# Strengthening National Forest Inventory and Satellite Land Monitoring System in support of REDD+ in Bangladesh

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# EXECUTIVE SUMAMRY

In Bangladesh, the state and trends of the forestry resources are not fully known. The existing information is not dated. It is mainly constrained by the lack of institutional capacity and financial inadequacy in carrying out the National Forest Inventory (NFI) and Satellite Land Monitoring System (SLMS). The Forest Department (FD) has identified a national forestry inventory and satellite forest monitoring system as the priority activities for the Forest Department under the Ministry of Environment and Forests.

The results of the NFI and SLMS are needed to support the national policy processes. Yet, the demand of the stakeholders in Bangladesh for data and information on the state of the forestry resources is continuously expanding. This project is planned to develop complete and sound updated information on the forest and tree resources, assist the FD to set up a specialised structure "National Forest Inventory Unit" and put in place a long term satellite monitoring system of the forestry ecosystems. It will also introduce policy relevant and holistic and integrated approach to forestry resources assessment that addresses all domestic needs of information as well as the international reporting requirements, thereby being able to provide data and information on the sub-sector to users (both local and international) on timely and regular basis.

**Justification of the project**

1. Sustainable management of the forest resources needs up to date and reliable data on the social, economic and environmental benefits of forests and trees outside forests.
2. Basic countrywide information on the current state of forests and other ecosystems is inadequate, fragmentary and outdated. The existing data on the forestry resources at national level is based 2005-07 assessment.
3. Reliable estimates of the forest and ecosystem resources, consumption rate and real economic potential are still lacking. Generally, the awareness on their values is low. The extent of forest ecosystems and their rate of change over time are largely unknown.
4. In spite of the many achievements in institutional and policy reforms in the forestry sector, FD shows insufficient capacity to respond to the growing need of information in the country.
5. The NFI and SLMS are efficient tools to contribute to and guide the planning and implementation of the forestry and natural resources related programmes and projects.
6. In the context of reducing emissions from deforestation and forest degradation under the United Nations Framework Convention on Climate Change (UNFCCC), the NFI and SLMS are two of the three pillars to allow acquisition of robust and transparent estimates of forest carbon stock and stock changes.
7. Through UN-REDD and with coordination and support from the FD, FAO has the responsibility to support GoB to develop a transparent National Forest Monitoring System (NFMS). The UN-REDD programme suggests the NFMS to be based on three pillars namely the NFI, the SLMS and the greenhouse gas (GHG) inventory.

8. The project is linked to national Poverty Reduction Strategy and the 7th goal of the Millennium Development Goals.
9. It will set up a specialised structure in FD for data collection, updating of information, training of inventory personnel, developing norms and methods of inventories and assessments, helping define government policy in the area of knowledge generation, management and dissemination, etc.
10. It will create new baseline information complete in scope and harmonised with existing information with the international reporting requirements.
11. The project is, therefore, consistent with the objectives and priority areas of the Government policy and strategies that support social programmes.

**Outcome:**

The outcome of the project is the strengthening of the National Forest Inventory and Satellite Land Monitoring System in support of REDD+ in Bangladesh. This contributes to both the REDD+ context, the production of data required for other international agreements, and support to national forest policy and land management. Project sustainability will be addressed through the strengthening of technical capacities and the establishment of an appropriate institutional framework.

**Specific Objectives:**

The project has the following immediate objectives:

1. Establish broad consensus at the national level on the process and approach to NFI and SLMS in Bangladesh, taking into account national users' information requirements for planning and sustainable management of the forestry resources and country's obligations of reporting to the international processes including GHG reporting and expected REDD+.
2. Strengthen the capability of FD to collect, analyse, update and manage the needed information on forests and Trees outside forests (TOF) for planning and sustainable management of the forestry resources and REDD+ MRV.
3. Develop a national database and information system on forests and TOF
4. Prepare national maps of forests and land uses based on harmonized classification and forest related definitions.
5. Undertake an NFI of the forest and TOF resources with the aim to create an information base according to national and international requirements and to set up a long term monitoring system of the resources.
6. Define long term satellite forest monitoring programme of the forestry resources, design multi-purpose forest inventory.
7. Develop tools and methods for integration of REDD+ MRV to NFI and SLMS methodology.

**Outputs:**

By the end of the project, it is expected to achieve the following outputs:

***Output 1: General conditions to implement the national forest inventory reinforced***

This output is crucial in order to ensure that the NFI and SLMS project will contribute to the national forest management plans and will contribute to the accomplishment of long terms strategic objectives. This output will be achieved through providing support to the establishment and strengthening of the NFI Unit, reinforcement of the National capacities in forest inventory and satellite monitoring, and the strengthening of forestry research programmes and harmonizing forest inventory information.

***Output 2: National forest monitoring strategy reinforced***

This will be achieved through setting up a clear participatory process to ensure adequate collaboration from different stakeholders, disseminating information to ensure the improvement of the current national system and to allow access to information to support the various policies related to forest and other natural resource management, rationalizing forest definition and a Land Cover Classification System, designing an appropriate multi-purpose NFI and SLMS forest inventory plan and successfully implementing the plan.

***Output 3: NFI and SLMS planned and implemented***

The main results from this output are the inventory plan to design and implement the NFI and SLMS. This will be achieved through the review of existing forest inventory designs, identifying multi-purpose NFI and SLMS objectives and reaching a consensus to approach and a method to develop and implement the multi-purpose NFI and SLMS. Output 3 will provide the necessary data to support forest policies, forest management planning and to take measures related to natural resource management, forest management and climate change reporting, and particularly will support the development of Emission Factors (EF) for the preparation of the GHG inventory.

***Output 4: Value of forest ecosystem goods and services estimated.***

Forest ecosystem goods and services have significant direct and indirect contributions to national economies and human welfare. The benefits people obtain from forests include forest goods, environmental services and sociocultural benefits. There has been no attempt to value these contributions of forest ecosystem goods and services in Bangladesh. As a result contribution of forestry sector is not well reflected in the national GDP. It is, therefore necessary to value forest ecosystem services and promote their inclusion in national economic accounts. This will also help to justify assessment of country's forest resources and sustainability of forest assessment and monitoring programme for future.

***Institutional Arrangement:***

The project will be anchored within a Project Management Unit (PMU) based at Forest Department of the Ministry of Environment and Forests. The Forest Department (FD) will be the lead counterpart institution for execution of the project activities through a National Project

Coordinator (NPC) who will be a senior official of the FD having expertise in NFI, will be the national focal point for the project and will have the overall responsibility for planning, managing, coordinating and supervising the project activities. In order to ensure the long term sustainability of this project's activities, the project will be set firmly within the institutional setting of the FD by creating a NFI Unit within the FD to sustain the continuous forest inventory and monitoring.

The FAO Representative in Bangladesh will be the budget holder. FAO will be responsible for the implementation of the project activities including the provision of technical assistance and procurement of goods and services according to the provision listed in the Funding Agreement signed with the USAID.

FAO will administer the technical assistance; provide operational and technical backstopping services from FAO Headquarters, Rome and RAP, Bangkok and Rome (FAO Headquarters) to ensure timely inputs to the project and smooth implementation at highest technical quality.

The project activities will be directly taken care by the Project Steering Committee (PSC) and a NFI Technical Committee where FAO will be represented.

The expertise and support of SilvaCarbon, a flagship program under United States fast start financing for REDD+, will be sought for the development and design of NFI and SLMS, including, but not limited to, capacity building programmes under the project.

***Partnership:*** The implementation process of the project will be structured, participatory and consultative while always emphasising the principles of partnership and collaboration in a multi-sectoral arena.

***Information Management and Knowledge Sharing***: Information generated from the NFI and Satellite Forest Monitoring System could be used to assist in formulation of policies, strategies and programmes related to Environment, Forestry and Climate Change, particularly REDD+ programmes and projects.

***Budget and sources of funding***
USAID: USD 6,552,137
Government of Bangladesh: In kind support
Project duration: 48 Months

# ACRONYMS

| | |
|---|---|
| ADB | Asian Development Bank |
| ADP | Annual Development Program |
| BBS | Bangladesh Bureau of Statistics |
| BCCRF | Bangladesh Climate Change Resilience Fund |
| BCCSAP | Bangladesh Climate Change Strategy and Action Plan |
| BCCT | Bangladesh Climate Change Trust |
| BFIDC | Bangladesh Forest Industries Development Corporation |
| BFRI | Bangladesh Forest Research Institute |
| BGDP | Bangladesh Green Development Programme |
| BNH | Bangladesh National Herbarium |
| CCF | Chief Conservator of Forests |
| CEGIS | Centre for Environmental and Geographic Information Services |
| CPF | Country Programming Framework |
| CSO | Civil Society Organizations |
| CTA | Chief Technical Adviser |
| CTF | Consultative Task Force |
| DFID | UK Department for International Development |
| DLRS | Directorate of Land Records and Survey |
| DPs | Development Partners |
| DG | Director General |
| DoE | Department of Environment |
| DP | Development Partners |
| EF | Emission Factor |
| EFCC | Environment, Forestry and Climate Change |
| EIA | Environmental Impact Assessment |
| ERD | Economic Relations Division |
| ETM | Enhanced Thematic Mapper |
| EU | European Union |
| FAO | Food and Agriculture Organization of the United Nations |
| FAOR | FAO Representative |
| FD | Forest Department |
| FOMR | FAO Forestry Department in Rome |
| FORESTAL | Forestry and Engineering International Ltd. |
| FRA | Forest Resources Assessment |
| GeoVis | Geographical Vector Interpretation System |
| GHG | Green House Gas |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GIZ | German Society for International Co-operation |
| GoB | Government of Bangladesh |

| | |
|---|---|
| GPS | Global Positioning System |
| HQ | Headquarter |
| IDMS | Improvement of Digital Mapping System |
| IMED | Implementation Monitoring and Evaluation Division |
| IPAC | Integrated Protected Area Co-Management |
| LCCS | Land Cover Classification System |
| LCG-CCE | Local Consultative Group for Climate Change and Environment |
| LTO | Lead Technical Officer in FAO RAP, Bangkok |
| LEAF | Lowering Emissions in Asia's Forests |
| LOA | Letter of Agreements |
| LTO | Lead Technical Officer |
| LTU | Lead Technical Unit in FAO HQ, Rome |
| LULUCF | Land Use, Land –Use Change and Forestry |
| MDG | Millennium Development Goals |
| M&E | Monitoring and Evaluation |
| MODIS | Moderate Resolution Imaging Spectro-radiometer |
| MoEF | Ministry of Environment and Forest |
| MRV | Measurement, Reporting and Verification |
| MTE | Mid-Term Evaluation |
| MTSAT | Multi-functional Transport Satellite |
| NAPA | National Adaptation Plan of Action to Climate Change |
| NFA | National Forest Assessment |
| NFAP | National Forestry Action Plan |
| NFI | National Forest Inventory |
| NFI Unit | National Forest Inventory Unit |
| NFMA | National Forest Monitoring & Assessment |
| NFMS | National Forest Monitoring System |
| NFP | National Focal Points |
| NGO | Non-Government Organization |
| NOAA | National Oceanic and Atmospheric Administration |
| NPC | National Project Coordinator |
| NPD | National Programme Document |
| NTE | Not –To-Exceed |
| NWFP | Non-Wood Forest Products |
| ODA | Overseas Development Administration |
| p/a | Per Annum |
| PCR | Project Completion Report |
| PMU | Project Management Unit |
| PPER | Project Performance Evaluation Report |
| PRODOC | Project Document |
| PSP | Permanent Sample Plots |
| PSC | Project Steering Committee |
| QA/QC | Quality Assessment/Quality Control |

| | |
|---|---|
| RAP | Regional Office for Asia and the Pacific – FAO |
| RPP | Readiness Preparedness Proposal |
| REDD | Reduced Emissions from Deforestation and Forest Degradation |
| REDD+ | REDD, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks |
| RIMS | Resource Information Management System |
| RS | Remote Sensing |
| RSS | Remote Sensing Survey |
| SFYP | Sixth Five Year Plan |
| SFM | Sustainable Forest Management |
| SLMS | Satellite Land Monitoring System |
| SoB | Survey of Bangladesh |
| SPARRSO | Space Research and Remote Sensing Organization |
| SRDI | Soil Resource Development Institute |
| SRF | Sundarban Reserve Forest |
| TCP | Technical Cooperation Programme |
| TWG | Technical Working Group |
| TAT | Technical Assistance Team |
| TM | Thematic Mapper |
| TOF | Tree Outside Forests |
| TOR | Terms of Reference |
| TS | Technical Support |
| TSS | Technical Support Services |
| UNDP | UN Development Program |
| UNDAF | United Nations Development Assistance Framework |
| UNDAF | United Nations Development Assistance Framework |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USAID | United States Agency for International Development |
| USFS | United States Forest Service |
| USD | United States Dollar |
| w/m | Worker Month |
| WS | Wildlife Sanctuary |

# SECTION 1 – RELEVANCE

## 1.1 Context

Global population is expected to increase to 9 billion by 2050; rural areas populations will decrease by 30% moving toward urban areas, food demand will rise, as will the pressure to convert agricultural land to other purposes. All of these facts add to societal concerns on issues like biodiversity conservation, climate change mitigation and adaptation. These pressures constitute a serious threat to forest sustainability, despite forest acting as a form of planetary life support system.

Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. As part of international climate change mitigation efforts and in the context of the Climate Change Convention (UNFCCC), developing countries are encouraged to undertake activities in the forestry sector to reduce carbon emissions, and conserve and enhance forest carbon stocks. Countries that would like to participate in the REDD+ efforts, are required to establish a National Forest Monitoring System of which a National Forest Inventory (NFI) and Satellite Land Monitoring System (SLMS) are two of the three key pillars (the third pillar is the land use, land use change and forestry (LULUCF) greenhouse gas (GHG) inventory.

Countries concerns on climate change have become a catalyst for the countries to re-discover their needs to account for reliable, transparent and coherent information about the state of their forests. Non Annex I countries had shown a strong interest in capacity building in Forest Resource Assessment as one of the approach to produce a well based accountability of their data. On the other hand the Annex I countries recognize that, good quality data from developing countries is the only chance for them to produce informed plans about future actions of mitigation with low uncertainty, i.e., reducing risks.

Bangladesh is one of the most vulnerable countries worldwide to the negative impacts of climate change and needs to develop its institutional competence to play a full role in international negotiations on climate change and in developing new mechanisms aimed at climate change adaptation and mitigation. The role of forests has expanded from production of timber and fuel wood to include a range of environmental services including mitigation of the impacts of climate change. There is increasing awareness of the role of forests in sustaining livelihoods and economic development and the institutions face new demands in ensuring forests increase their contribution to these goals.

“Climate change, environment and disaster risk reduction and response” is one of the seven pillars of the United Nations Development Assistance Framework (UNDAF) for Bangladesh (2012 to 2016) that would promote a balanced approach to ensure that key climate change, disaster risk reduction and environmental issues are anchored in national plans and strategies, and that greater awareness is created on environment, climate and social sustainability issues.

Forest resources in Bangladesh play an important role in country’s physical and socio-economic development and maintenance of environmental balance and sustainable land-based production system. The total area of forest land is 2.53 million hectares representing about 17.1% of the country’s area. Bangladesh Forest Department manages 1.53 million hectares of forest land. Following is a description of the forest area of Bangladesh and forest land managed by the Forest Department.

**Table 1: Forest Area of Bangladesh**

| Forest types | Area (m. ha.) | % with respect to country's area (14.757 m. ha.) |
|---|---|---|
| FD managed Forests | 1.53 | 10.37% |
| Un-classed State Forests | 0.73 | 4.95% |
| Village Forests (mainly homesteads). | 0.27 | 1.83% |
| Total | 2.53 | 17.15% |

**Table 2: FD Managed Forest Land**

| Forest Types | Area (m. ha.) | % with respect to country's area (14.757 m. ha.) |
|---|---|---|
| Hill Forests | 0.67 | 4.54% |
| Natural Mangrove Forests | 0.60 | 4.07% |
| Mangrove Plantations | 0.14 | 0.95% |
| Sal Forests | 0.12 | 0.81% |
| Total | 1.53 | 10.37% |

However, the National Forest and Tree Resources Assessment (2005-07) found that forest cover in the country was at 9.8 percent approx. (as per FAO's definition) distributed as follows:

**Table 3: Forest Land according to the National Forest and Tree Resources Assessment (2005-07)**

| Forest Types | Area (m. ha.) | % with respect to country's area (14.757 m. ha.) |
|---|---|---|
| Natural Forests (Hill forest, Sal forest, Mangrove forest, bamboo or mixed bamboo/broad-leaved forest) | 1.204 | 8.16% |
| Forest Plantations (LR, SR, Mangrove and Rubber Plantations) | 0.238 | 1.62% |
| Sub-total (Forest) | 1.442 | 9.78% |
| Other Wooded Land (Shrubs and Swamps with Shrubs) | 0.289 | 1.96% |
| Total | 1.732 | 11.74% |

These forests are under tremendous pressure. According to FAO, the country lost a yearly average 0.17% of its forest cover between 1990 and 2010 (MRV Action Plan, 2013). As part of its REDD-readiness activities, Bangladesh became a partner country of the UN-REDD Programme in 2010. The Readiness-Preparedness Proposal (R-PP) was approved in the policy board meeting held in December 2013 and National Programme Document (NPD) is under preparation. Measurement, Reporting and Verification (MRV) is an important component for REDD+ implementation. The R-PP has incorporated different activities to support the implementation of MRV through which GHG emissions and removals from the forestry sector will be measured, reported and verified for the country.

The Government of the People's Republic of Bangladesh has identified sustainable forest management and conservation as one of the key sectors for delivering country's climate change mitigation and adaptation goals under Bangladesh Climate Change Strategy and Action Plan (BCCSAP). These efforts also augur very well with the development objectives in the forestry sector as forests have now been identified as an important pathway in achieving the national development goals. The Vision 2021 which

aims at propelling Bangladesh towards middle income country status identifies forestry sector as one of the key sectors to save the country from the adverse effects of climate change and global warming leading to delivery of country's stable environment and making the country an ecologically attractive place.

National forest land use change monitoring is not conducted on a regular basis by the FD, although FD has performed this task in a limited scale with the assistance of the Centre for Environmental and Geographic Information Services (CEGIS). Forest carbon stock change monitoring data do not currently exist, although some tree volume data generated by the Bangladesh Forest Research Institute (BFRI) and FD could be converted to carbon equivalent using allometric equations or other conversion factors. Other existing volume data have several limitations: inconsistent data across the country; several data custodians; lack of data on some forest resources; lack of tools to accurately estimate carbon in standing trees; and lack of mechanisms for information dissemination sharing, networking. There is also no comprehensive up-to-date national forest information system in place. The Resource Information Management System (RIMS) unit of the FD has its own databases based on past inventories and systems. All this necessitates strengthening of existing national forest information systems based on up-to-date information.

The necessity for scientific management of country's forests has led to the undertaking of a number of forest inventories/assessments in different forest types of Bangladesh. Each inventory was designed to take care of a certain set of local condition and management requirement. Forest carbon stocks in six protected areas in Bangladesh were estimated through the USAID funded Integrated Protected Area Conservation (IPAC) project of FD in 2010. Carbon monitoring and measurement is also being conducted in 17 additional protected areas as part of the USAID funded Climate Resilient Ecosystems and Livelihoods (CREL) project of FD. Carbon stocks were also assessed during National Forest and Tree Resource Assessment 2005-2007.

For the monitoring of REDD+ activities, Bangladesh will define specific methods, criteria and indicators to reflect national circumstances. The NFMS is primarily a domestic tool to allow Bangladesh to improve management of forest resources and assess the results of REDD+ activities, as implemented by different stakeholders and institutions. The development of monitoring tools builds important experience and capacity in a country towards the establishment of a transparent, accurate, complete, consistent and comparable national GHG inventory for the LULUCF sector. In this way the development of the monitoring system will support assessing EF for REDD+. The development of modern remote sensing and computer technologies would, no doubt stimulate and assist the assessment and continuous monitoring of country's forest resources.

### 1.1.1 Rationale

#### *a. Gaps identified in the field of NFI and SLMS*

The Situation Analysis and Capacity Needs Assessment in the Ministry of Environment and Forests and its Agencies (MoEF-FAO, 2013) identified a number of gaps in the field of Forest Resource Assessment. These included: irregular NFI due to paucity of funds and technical manpower, lack of institutional arrangement, lack of institutional memory for the continuity of the inventory, lack of efficient systematic monitoring of forest changes on a sustainable basis and inadequate NFI network for transfer of knowledge, technology, methodologies, capacity building, etc;

#### *b. Improvement of inventory and monitoring technology for continuous assessment of country's forest resources.*

A complete understanding of the current status of forest resources is fundamental to policy and management analysis for the future. The diminishing pattern of forest resources has put forward questions before us concerning the dynamics of the forest: How have they changed? Why have they changed? How

will they change in the future? A broad knowledge on the forest and tree resources is needed for redefining the policy and strategy of Bangladesh Forest Department, for developing a comprehensive National Forestry Action Plan (NFAP) and for successful entry into REDD+. Thus, the development and establishment of suitable inventory and management systems or updating of existing data and developing appropriate information on change needs through improved inventory and monitoring technology is a priority. The FD, thus needs to develop or otherwise improve inventory and monitoring technology for continuous assessment of country's forest resources.

#### *c. Need for replacing project –based approach by Permanent NFI and SFM Unit*

Most of the forest resources assessment work was conducted through projects by the FD, which lacks pool of forest inventory experts and personnel. Within the FD, there currently doesn't exist any permanent NFI or SLMS infrastructure. There is a pressing need for the establishment of a permanent NFI and SLMS Unit, strengthening of RIMS Unit, Management Plan Divisions and Monitoring Unit in order to implement a transparent national forest monitoring system.

#### *d. Successful implementation of REDD+ programmes needs well established NFI and SLMS*

The development and implementation of REDD+ has an important bearing in the country as a part of its climate change mitigation and adaptation strategy. REDD+ has potential to deliver cost-effective climate change mitigation through sustainable means. To achieve this it is necessary to make accurate assessment of the forest carbon stocks and carbon stock changes. Changes in forest carbon stocks through time are monitored by a combination of remote sensing and field-based measurements.

#### *e. Need for Capacity Building in NFI and SLMS*

The FD needs to be strengthened to be able to conduct the NFI and SLMS, presentation of findings and management of information. The enhancement of capacity is necessary for REDD+ implementation including forest resource monitoring, verification and reporting in partnership with government, donors, and private sector. Capacity building in the form of training is, therefore, needed in the FD and collaborating agencies.

### 1.1.2. FAO's Comparative Advantage

FAO's comparative advantage is seen in the breadth of its technical experience in designing and guiding national forest inventories. FAO also draws from a pool of experts who are able to assist in the implementation of NFI and SLMS. FAO has more than six decades of experience, supporting countries in developing their NFI. The project also builds upon FAO's experience in Bangladesh in designing and implementing field-based technical assistance projects and programmes relating to Forestry. Expertise gained and lessons learned from those projects have been carefully considered and integrated in the project.

FAO successfully conducted FRA 2005-07 in Bangladesh under the overall technical supervision of FAO Forestry department in Rome (FOMR), who also provided technical assistance to the GoB to strengthen the capacities of the FD in the area of planning and implementing NFAs, including methodology development, sampling design, harmonization of land use classifications, mapping, field survey, data management and reporting. FAO has already conducted Global Forest Resources Assessment 2010 (FRA 2010) that included a global remote sensing survey (RSS) of forests. This survey was aimed at substantially improving the knowledge on land use change dynamics over time, including deforestation, afforestation and natural expansion of forests. The FRA 2010 Remote Sensing Survey builds on the experiences from the remote sensing surveys of the tropical region undertaken as part of previous global

forest resources assessments and on recent advances in methodologies and availability of imagery. This methodology could be used in filling the information gaps and prepare Bangladesh for REDD+ mechanism.

FAO has been engaged in the National Forest Monitoring & Assessment (NFMA) to enhance countries' forest monitoring and assessment through field surveys and database management. FAO has developed methodologies for satellite monitoring and GIS on forests such as LCCS (Land Cover Classification System designed to meet specific user requirements, and created for mapping exercises, independent of the scale or means used to map), GeoVis (Geographical Vector Interpretation System that facilitates and speeds up all mapping activities based on remote sensing data) and GeoNetwork that allows to easily share geographically referenced thematic information between different organizations. FAO has become the lead agency worldwide to support the development of tree models to assess volume, biomass and carbon stocks mainly through the Globallometree webplatform and capacity building activities. FAO has developed several Open Source software such as the Open Foris toolbox to support forest monitoring activities. FAO tools to support forest monitoring are designed to adapt to country national circumstances.

FAO also has a key normative role in forestry-related issues and can therefore serve the countries in building systems and methods that also serve international reporting and potential needs in the future. The NFI will be based on FAO's core competence in supporting member countries in establishing forest assessment and monitoring systems. FAO has, therefore, a clear comparative advantage all aspects of Forest Resource Inventory and Monitoring, in particular, as a source of forest related information and data, and because of its professional and multidisciplinary staff; it has enjoyed a long and stable partnership with. It also stresses responsible financial and administrative management.

FAO's comparative advantage also lies in capacity building programmes related to National Forest Monitoring Systems for REDD+ through close collaboration with the United States Government (USG). The successful organization of the UN-REDD Regional Lessons Learned Workshops on National Forest Monitoring Systems for REDD by FAO in partnership with two USAID-funded projects involved in building capacity for NFMS in Asia and the Pacific: the USG SilvaCarbon program and the Lowering Emissions in Asia's Forests (LEAF) project is a testimony to this collaboration.

FAO partners with UNEP and UNDP in the joint UN-REDD Programme which is executed alongside NFI and therefore, is able to ensure synergies between the activities.

### 1.1.3. Participants and Other Stakeholders

In course of NFI and SLMS process, all relevant stakeholders will be involved in the planning and implementation phases. The technical staff of the FD and other sister institutions involved in implementation of the project will be the direct beneficiaries.

Direct beneficiaries reached by the project will be the users of forest information in the forestry and related sectors, and also international partners. The entire Environment, Forestry and Climate Change (EFCC) Sectors, including a wide range of institutions will benefit from the availability of more accurate information for formulation and monitoring of policies, strategies and programmes.

The NFI and SLMS database will be used for research purposes by researchers in EFCC sectors, particularly by BFRI, Universities and other research agencies and projects concerned with natural resources. The capacity of the NFI and SLMS system will be utilised by several natural resources projects within the country. The Country's land management including afforestation projects will use maps from NFI and SLMS to identify land classes and possible project sites. NFI and SLMS's forest type/land use

maps will be useful to any Forest Management and Conservation Project. Many International and National Organizations dealing with natural resources will have a great interest in gaining access to the NFI and SLMS database. Bangladesh Bureau of Statistics (BBS) will use the NFI as official statistics for EFCC sectors.

The key identified stakeholders and targeted beneficiaries include:

1. Ministries (Ministry of Environment and Forests, Ministry of Planning, Ministry of Finance, Ministry of Agriculture, Ministry of Disaster Management, Ministry of Water Resources, Ministries of Fisheries and Livestock, etc.)
2. Departments / Bureaus / Corporations/Universities such as:
    a. Forest Department (FD)
    b. Department of Environment (DoE)
    c. Bangladesh Forest Research Institute (BFRI)
    d. Bangladesh Forest Industries Development Corporation (BFIDC)
    e. Bangladesh Forest Research Institute (BFRI)
    f. Bangladesh National Herbarium (BNH)
    g. Bangladesh Climate Change Trust (BCCT)
    h. Bangladesh Bureau of Statistics(BBS)
    i. Survey of Bangladesh (SoB)
    j. Directorate of Land Records & Survey (DLRS)
    k. Space Research and Remote Sensing Organization (SPARRSO)
    l. Bangladesh Soil Research Development Institute, etc.
3. National and International education and research institutes,
4. FAO and other DPs, NGOs and Civil Society Organisations,
5. Local and International Communities,
6. UN-REDD and other projects,
7. Non-Governmental Organisations, wood-based industries and various private sectors.

### 1.1.4. Lessons Learned from past and related work

The Project will benefit by way of lessons learned from past completed projects on Forest Resource Inventory. A number of forest inventories under the control of the FD were undertaken at various times in the past, especially for the preparation of Forest Management Plans. A snap-shot of past inventories is highlighted in Appendix 1.

The lessons learnt from past inventories suggest that the NFI and SLMS need to be carried out in consistent intervals to enable maintenance and development of competences with limited support from external sources. The value of the NFI and SLMS data will increase with every NFI and SLMS cycle in order to capture information on trends. To ensure the continuity of the NFI and SLMS it is important that it be institutionalised to maintain and strengthen the capacities of the NFI and SLMS team, maintain the NFI and SLMS database and the network of permanent sample plots (PSPs). Modern methods should be adopted to minimise recurring costs.

The past experience reflects that the project needs to build synergies with the MoEF, Development Partners' (DP), and other relevant organizations and projects (including REDD+) having interventions in NFI and SLMS. In this aspect, coordination and close interactions with SPARRSO, SoB, SRDI, DLRS, CEGIS and other relevant organizations will be useful.

The expertise and resources of SPARRSO can be utilized for applications of Remote Sensing and Geographic Information System (GIS) in FD and their advises in all matters relating to space technology applications, satellite data and information will greatly enhance project performance. The experience of SPARRSO gained through working jointly with the FD for mapping the coastal afforestation and national land use map preparation will be useful for the project. The research conducted by this organization on above-ground forest biomass and carbon stock estimation using optical, radar and terrestrial sample based inventory data will provide inputs for the project. A number of low to moderate resolution satellite data (Terra / Aqua MODIS, NOAA, MTSAT, FY-2) received by the SPARRSO and satellite data received from WINDS satellite receiving station established in SPARRSO will be added advantage for the project.

Survey of Bangladesh (SOB), the national mapping agency, initiated Improvement of Digital Mapping System (IDMS) project (2009-2016) aimed to produce detailed digital topographic maps and geospatial data for the users and stakeholders using very high resolution aerial photography for whole of Bangladesh. The project will benefit by establishing synergy with this project.

The past experience suggests that, the NFI and SLMS data should be used for the development of forest policies, forestry programs including REDD+ programmes, sustainable forest management and development, conservation of the resources, and may be used by various institutions to develop integrated national policies. The goals should be focussed to develop and strengthen the national capacities to collect, compile, and process and disseminate reliable and up-to-date information on forestry to national policy makers as well as to international organisations.

### 1.1.5 Links to National Development Goals, Policy and Legislation, and FAO's Strategic Objectives

The "National Strategy for Accelerated Poverty Reduction – Unlocking the Potential" (NSAPR II, 2009-2011) attaches high importance to issues of the environment and the sustainability of development, and clearly states that "no process of development and eradication of poverty can be conceived of without putting the environment and sustainable development at the centre-stage".

Considering the long-term consequences of environmental degradation to the country's ecosystem and citizen's welfare, GOB has set a number of National Development Goals in the Sixth Five Year Plan, 2011-2015 (SFYP) to attain a sustainable environment and to address fallout of climate change. SFYP has also spelled out clear objectives for forestry and environment subsectors. Similarly, SFYP has made significant policy commitment in the climate change sector. It has emphasized significantly the need for capacity building, streamlining policy and legislation, and actions contributing to resource mobilization to achieve the goals laid out in SFYP.

The "Outline Perspective Plan of Bangladesh (2010-2021): Making Vision 2021 A Reality", developed by the Government of Bangladesh to build a happy and prosperous nation, has set specific objectives for the protection and enhancement of the environment, effectively meeting the challenges arising from the intensifying climate change and addressing other environmental degradation issues.

The National Environmental Policy of 1992 and the National Forest Policy of 1994 are the main references for the country's aspirations for the sector. These policies are in the process of review and possible revision. In 1994, the National Forest Policy recognized for the first time the importance of people-oriented forestry programs. The National Environmental Policy is designed to maintain the ecological balance and overall development through environmental protection and improvement, protection from natural disasters, regulation of activities responsible for pollution and degradation of the environment, environmental

friendly development, and active participation in environment-related international efforts. Additional relevant policies and legislations are the Forest Act (1927, 1989 and 2000) and the Environmental Conservation Act (1995, 2000, 2002 and 2010) and the National Conservation Strategy (2005).

Of particular relevance to the proposal is the National Adaptation Plan of Action (NAPA) to Climate Change (2005) which orients the country's response to the adverse impacts of climate change. Coastal afforestation with community participation, capacity building and information sharing are among the top priorities identified in the NAPA. Relevant is also the Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2009) which identifies six thematic areas to address the challenges of climate change: (i) food security, social protection and health; (ii) comprehensive disaster management; (iii) infrastructure development; (iv) research and knowledge management; (v) mitigation and low-carbon development; and (vi) capacity building and institutional strengthening. Finally, the Climate Change Trust Fund Act (2010) provides the legislative framework for the use of the climate change trust fund.

"Food security and nutrition" and "climate change, environment and disaster risk reduction and response" are two of the seven pillars of the United Nations Development Assistance Framework (UNDAF) for Bangladesh (2012 to 2016). The UNDAF promotes an approach to ensure that climate change, disaster risk reduction and environmental issues are anchored in national plans and strategies. It also advocates for greater awareness on environment, climate and social sustainability issues. The framework identifies the needs for (a) strengthening and capacity development of government institutions, (b) supporting community-based approaches, (c) better co-ordination of programs, and (d) strong public-private partnerships as key components to achieve sustainable agriculture, environmental protection and climate change adaptability and mitigation. The UNDAF provides the main reference framework for the collaboration between the Food and Agriculture Organization of the United Nations (FAO) and the Government of Bangladesh.

The FAO Country Programming Framework (CPF) for Bangladesh (2010-2015) identifies: sustainable production intensification, and disaster risk reduction associated with the shocks from climate change, as two of its five main priorities poverty reduction and enhancing food security; increasing farm productivity and agricultural diversification; sustainable management of natural resources; disaster risk management, and building capacity to cope with climate change risks; and enhancing the capacity on knowledge generation and management among its priorities. FAO's New Strategic Framework (2013) includes Strategic Objective 2 to "Increase and improve provision of goods and services from agriculture, forestry and fisheries in a sustainable manner"; and FAO's regional priorities (C: enhancing equitable, productive and sustainable natural resource management and utilization, and E: coping with the impact of climate change on agriculture and food and nutritional security) are directly relevant as well.

Finally, this project contributes to various other national initiatives that aim to improve natural resource management and reduce the emission of greenhouse gases such as the National REDD+ Readiness Roadmap and the Bangladesh Green Development Programme (BGDP). The National REDD+ roadmap aims to support mitigations activities in the forestry sector while the BGDP aims to support the implementation of a green economy. In sum, national development plans and strategies all emphasize the critical importance of institutional strengthening and coordination in the MoEF.

## 1.2 Project Framework

The project has been designed in one phase that will include the design, the implementation of the National Forest Inventory and providing the necessary results in line with national objectives in terms of national forest management, including REDD+ programmes. Three years is a relatively short time to implement the design until ensuring the results are adequate to support the national forest management objectives. Therefore, the project will be implemented during a period of four years in three steps as described below.

### 1.2.1. STEP I: Capacity Building and Preparation

This step includes all the preliminary arrangements and preparatory work for the project: i) training of the supervisors and field crews for NFI and SLMS; ii) Design and Methodology for NFI and SLMS, iii) GIS boundary finalization of the forest area by digitization of the sheet maps iv) acquisition of equipment and satellite images and; v) recruitment of national and international personnel.

This phase of the project is a major capacity building phase. The NFI team in the FD will be familiarized with different techniques and methods to develop the NFI and SLMS, the forest and land use classification systems, and identification of forest, tree and land use attributes. The NFA approach of FAO will be the baseline for national discussions regarding the NFI. The sampling design and data collection model in the approach will be reviewed and adjusted to allow for proper integration with the SLMS. The configuration of the sampling tracts and the size, shape and spatial arrangements of the sample plots will be decided and sampling will be adapted to the national context and to the specificity of the forest and tree ecosystems in the country in stratification and sampling intensity. The sampling intensity and the stratification will be decided and adapted to meet the requirements of the NFI and SLMS approach in information, timeliness and cost. FAO is supporting the development of a national classification system that could be the basis for the harmonisation of existing land cover/use maps and for future mapping activities. The FAO Land Cover Classification System integrates data from multiple sources and allows the semantic interoperability, the inter-compare between thematic contents, the rationalization and links with field and remote sensing derived data, and new procedures of accuracy analysis of data. The consideration of existing legends, maps and their harmonization and integration within the national monitoring system was identified as a cost-efficient and adoptable approach. The list of biophysical, management and use variables will be thoroughly analysed and adjusted to include all parameters of national interest and to address the environmental, social and economic functions of the forests, trees and land use. The training will focus on the following topics:

- Information needs analysis
- Forest policy and planning needs
- General approach to forest assessment and monitoring
- Sampling design
- Mapping
- Land use/forest types classification
- Techniques of field data collection, including forest
- Remote sensing and Satellite Land Monitoring System
- GIS Boundary delineation of Forest areas
- Field navigation (GPS use)
- Database design and development
- Data processing and analysis
- Information management
- Reporting and results dissemination

The FD will secure deployment of the necessary technical staff to implement the office and field activities of the project. The training will be assured through workshops, courses and one study tour.

Implementation of activities related to remote sensing will be implemented within the RIMS unit of the FD. SPARRSO/CEGIS or any other competent technical organization/firm may be contracted to do mapping activities under the supervision of RIMS Unit. A national consultant, with short, medium, and/or long-term technical support from FAO-Rome, FAO-Bangkok, and/or SilvaCarbon experts, will be contracted to assist the RIMS unit to: (i) define the specifications of the satellite images and help procure them (if required); and (ii) participate in defining the harmonized land use classification.

An archive of high and medium resolution images will be made available directly by USAID and other United States Government agencies to FAO (and specified in the LoA).Other satellite imagery could be procured as needed to fill specific data gaps at the cost of the project.

### 1.2.2. STEP II: Data Collection through Field Survey

This phase will collect field data to be used in the NFI and SLMS. It will include materialization of the permanent sample sites in their field location, data collection from measurements of forest attributes, observations of forest and site attributes, field checking and validation of remote sensing analysis and interviews with local people and target groups as well as data entry and storage.

In this project, fieldwork is a crucial activity. The planned outputs will depend largely on it. Permanent sample plots will be established for long-term monitoring of the forest and tree resources all over the country and in all land use classes. GPS is a key instrument in locating plots with the help of latitude and longitude coordinates defined in advance on the topographic maps.

Measurements of forest and tree characteristics will be done in all land use classes (forest and non-forest lands). Observations of vegetation structure, health and spatial arrangements, and human activities will be recorded. Field inventory data and particularly land cover/use descriptors will be collected to calibrate and validate the remote sensing analysis done in step 1. Variables will be defined for this purpose at a workshop during the first phase of the project. Interviews with key informants from the local population, NGOs and entrepreneurs, etc. will be conducted in every sample site to identify major users of the resources (men, women, children and other groups), the products and services provided by the forest and trees, the way these are managed and used and for what end use.

Field crews will be trained properly and supervised to carry out the data collection. They will be prepared for future surveys and to maintain the established network of permanent sample plots. The national assessment team from the FD will also be trained in organization and supervision of the fieldwork.

On-the-job training will be continuous throughout the project implementation from planning the assessment to mapping, field survey, database development, data processing and analysis, and information management.

### 1.2.3. STEP III: Data Processing, Analysis and Reporting

The third phase includes development of the database storing cartographic and field data, training of the national staff in charge of the system, data entry, processing and analysis, reporting of project findings. Remote sensing validation data will be used to calibrate the national forest and land cover products. This information will be used to finalize and produce national atlas of forest cover and/or LULUCF in digital and hard copy formats.

The project will produce a considerable amount of data at national level. A functional information system will be designed, developed and established to structure and manage the collected inventory data, store it and process it to generate the needed information and expected outputs. The national forest monitoring information will be displayed on a national-owned web-platform.

The base for the information system will be a structured database, which will include various levels of internal relations. The system will permit storage of data from sequential surveys in order to detect and estimate changes and establish trends.

The field data will be progressively entered in the database and geo-referenced for integration and spatial representation of findings. Compatibility with other existing information systems and integration of existing datasets will be ensured.

A national workshop will be organized to review the project findings and provide recommendations on the entire image interpretation activities, including finalization and production of a national atlas of forest cover and LULUCF in digital format and hard copy.

## 1.3 Expected Results

### 1.3.1 Impact

The National Forest Inventory (NFI) and Satellite Land Monitoring System (SLMS) will provide reliable, current and consistent information on the extent and status of forests to enable sustainable management. This will help in monitoring carbon stocks and forest development activities, understanding the impacts of climate change on forest resources, deforestation and degradation, human pressure and economic activities and adopting necessary mitigation measures - one of the great challenges currently faced by foresters, conservationists and policy makers. This authoritative information on forest cover will support the development of necessary policy to address current needs as well as emerging challenges, such as climate change impacts and possible adaptive strategies.

### 1.3.2 Outcome

The outcome of the project is the strengthening of the National Forest Inventory and Satellite Land Monitoring System in support of REDD+ in Bangladesh. This contributes to both the REDD + context, the production of data required for international agreements, and support to national forest policy and land management. Bangladesh is one of the most vulnerable countries to climate change and forestry is identified as a crucial tool for mitigation and adaptation to climate change. Strengthening national capacities and the establishment of an appropriate institutional framework are priorities in this project because they determine the sustainability of activities to be implemented. In the context of international cooperation, the project is crucial to complement the UN-REDD programnme, support the national REDD+ Readiness Preparation Plan, and the project on capacity development of the Ministry of Environment and Forests. The project will aim at promoting modern methods and technologies while ensuring the necessary conditions for building innovations that are adapted, adopted and feasible.

### 1.3.3 Specific Objectives

- Establish broad consensus at the national level on the process and approach to NFI and SLMS in Bangladesh, taking into account national users' information requirements for planning and sustainable management of the forestry resources and country's obligations of reporting to the international processes including GHG reporting and expected REDD+ MRV.

- Strengthen the capability of FD to collect, analyse, update and manage the needed information on forests and TOF for planning and sustainable management of the forestry resources and REDD+ MRV.
- Develop a national database and information system on Forests and TOF.
- Prepare national maps of forests and land uses based on harmonized classification and forest related definitions.
- Undertake an NFI of the forest and TOF resources with the aim to create an information base according to national and international requirements and to set up a long term monitoring system of the resources.
- Define long term satellite forest monitoring programme of the forestry resources, design multi-purpose forest inventory.
- Develop Tools and methods for integration of REDD+ MRV to NFI and SLMS methodology.

### 1.3.4 Outputs

The project will produce three main outputs:

- **Output 1:** General conditions to implement the national forest inventory reinforced
- **Output 2:** NFI and SLMS strategy reinforced
- **Output 3:** NFI and SLMS implemented
- **Output 4:** Value of forest ecosystem goods and services estimated.

The details of four outputs along with activities are furnished below:

***Output 1: General conditions to implement the national forest inventory reinforced***

This output is crucial in order to ensure that the specific monitoring project will contribute to the national forest management plans and will contribute to the accomplishment of long terms strategic objectives.

***Activity 1.1: Institutionalization of the NFI and SLMS strengthened***

This activity will build on the assessment of the capacities of the MoEF and will provide specific recommendations in terms of reinforcement and modernization of the Institutional Framework. It will ultimately lead to establishment of a National Forest Inventory unit (NFIUnit). While the establishment of the NFIUnit rests with the Forest Department, its establishment will be directly and indirectly supported by several projects including the national RPP programme, the UN-REDD programme, and the project on Strengthening the Environment, Forestry and Climate Change Capacities of the Ministry of Environment and Forests and its Agencies ( GCP/BGD/053/USA).The NFI and SLMS needs to be coordinated with forest management plans and programmes in order to ensure that the monitoring systems provide the necessary information to improve management of forest resources.

Sub-activities include:

1.1.1 Support to legal preparedness

1.1.2 Enhancement of knowledge on international reporting (UNFCCC, CBD, FAO, etc)
1.1.3 Organization of regular meetings on NFI and SLMS (quarterly)

***Activity 1.2: National capacities in forest inventory and satellite monitoring reinforced***

This activity will focus on reinforcing the technical capacities of all entities involved in the implementation of the NFI and SLMS. The NFI and SLMS will be multi-purpose, and technical capacities will not focus exclusively on biomass assessment. Capacity building activities will consider monitoring of volume, biomass, carbon stocks, plant biodiversity, non-timber forestry resources, socio-economical aspects and remote sensing. Particular emphasis will be given to the remote sensing activities. National stakeholders will be strengthened with proper technical knowledge in data processing, capture, analysis and management. The decision on which tools to use will eventually be taken by GOB.

Sub-activities include:

1.2.1 Strengthening of FD forest inventory capability
1.2.2 Technical trainings (Local) (6 trainings) on SilvaCarbon & FAO tools for forest monitoring (this could include GIS, RS, forest inventory, data analysis, and/or forestry statistics)
1.2.3 Capacity of young professionals for forest monitoring tools (GIS, RS, forest inventory, etc.) reinforced
1.2. Capacity building on geospatial data processing and database management
1.2.5 Participation in short, medium and long-term trainings (including two Masters Programmes) related to forest inventories and satellite monitoring, and/or REDD + programmes)

***Activity 1.3: Forestry Research supported***

Research units are necessary for the implementation and the sustainability of the NFI and SLMS. A network of research institutions and actors will be developed in order to ensure adequate channel for dissemination of information. Several research activities will be implemented to support the different components of the NFI and SLMS (forest mapping, biomass modelling, sampling strategies, etc). One of the main research supports will be the development of biomass models and identification of innovative use of remote sensing technologies in the context of Bangladesh. Research will be conducted to support the development of tree models in order to assess volume, biomass and carbon stocks mainly through the Globallometree webplatform and capacity building activities.

Sub-activities include:

1.3.1 - Development of allometric equations for important species based on ecological regions
1.3.2 - Support remote sensing researches in forestry
1.3.3 - Enhancement of national capacities in volume, biomass and carbon stock calculation
1.3.4 - Strengthening of Spatial modeling expertise
1.3.5 - Development and Upgrading of existing NFA Tree Species Data Base

***Activity 1.4: Existing remote sensing and field data collected, harmonized and reviewed***

Many forest related services including climate change mitigation require an accurate assessment of forest variables. Despite the huge amount of data collected in the field and work done by several national institutions, weaknesses remain to ensure the forest inventory data, models and ancillary data are integrated and harmonized. Harmonization of the existing forest inventory information will consider: land cover/use

maps, the tree species list, allometric equations, biomass expansion factors, wood density, height measurements, carbon content, field inventory data etc. Data harmonization can be made only once the data become available. One of the methods to facilitate data accessibility is through the development of data sharing agreement. This particularly concerns the development of index maps for satellite images, clarification of ownership of the data. Once compiled and harmonized, it will be possible to review the existing data and provide recommendations on how to fill the gaps and consider the needs. One regional workshop could be organised to facilitate sharing of information between neighbouring countries which have similar capacities or technical constraints and consolidate the proposed technical options. Regional information sharing activities will consider forest monitoring related activities such as the Forest+ activities in India and the LEAF project.

Sub-activities include:

1.4.1 - National consultation on data sharing agreements implemented
1.4.2 - Development of land cover map index and satellite image database
1.4.3 - Research on very high spatial resolution satellite imagery for forest monitoring
1.4.4 - Archiving and documentation of all existing inventory data and development of a robust database management system
1.4.5 - Regional workshop on the use of remote sensing for monitoring deforestation and forest degradation in tropical countries

### *Output 2: NFI and SLMS strategy reinforced*

#### *Activity 2.1: Mandates and Funding clarified*

Under this activity, clear mandate is given to each Unit/Division/Institution for the implementation of the different activities. This includes: NFI and SLMS planning, satellite and forestry field data collection, data management and analysis, QA/QC, improvement plan, archiving and documentation, and uncertainty analysis. Forest monitoring between two successive inventories will mostly rely more heavily on analysis of satellite imagery and less on extensive field surveys.

Sub-activities include:

2.1.1 - International workshop on national forest inventory and monitoring systems (how the inventory planning, data collection, data management and analysis, QA/QC, etc. are performed in different countries)
2.1.2 - Identification of necessary resources for updating the NFI and SLMS
2.1.3 - Mandates to implement the NFI and SLMS clarified

#### *Activity 2.2: Participatory process developed and established*

It is important to set up a clear participatory process to ensure adequate collaboration from different stakeholders. However, this does not mean that all stakeholders have to participate in all activities. In order to adequately involve the different types of stakeholders, this activity starts with a stakeholder mapping process. The stakeholder mapping process will involve the different national institutions involved in forestry, civil society, forest communities and private sector. Then, depending on the results from the stakeholder mapping process, the participatory process will be defined. Particular attention will be given to young professionals. Sustainability of efforts to improve the national forest monitoring system essentially depends on young professionals. It is important to strengthen and reinforce the skills and capabilities of young professionals within the Departments. Firstly, the young professionals will be

identified and their technical background will be recorded. Secondly, in collaboration with the capacity development project, specific capacity support will be identified in order to reinforce their capacities and knowledge to achieve the daily tasks.

Sub-activities include:

2.2.1 - Stakeholder mapping involving different national institutions dealing in forestry, civil society, forest communities and private sector
2.2.2 - Participatory process defined
2.2.3 - Development of participatory tools for forest monitoring

***Activity 2.3: Communication and Public Relation system implemented***

Dissemination of information is crucial to ensure the improvement of the current national system and to allow access to information to support the various policies related to forest and other natural resource management. The four sub-activities: *Support to logistics, equipment and software needs for the forest information system; Documentation of methods and data collection for forest monitoring; Information system supported by adequate data management system and calculation process and Establishment of the Forest Management Information System (FMIS)"* originally planned under this activity has been incorporated in the UN REDD supported NPD. Thus, the activity 2.3 thus only includes support to communication and public relation system and development of a web based platform for data sharing among national stakeholders. *Moreover, provision has been made to address the gaps, if any, identified during establishment of FMIS through UN REDD programme.* One of the principles under the United Nations Framework Convention on Climate Change is transparency. This activity will facilitate transparency of information depending on their level of confidentiality.

Sub-activities include:

2.3.1 - Support to Communication and public relation system
2.3.2 - Development of a web based platform for data sharing among national Stakeholders
2.3.3 - Support to address the gaps (if any) identified during establishment of FMIS through UN-REDD programme.

***Activity 2.4: Common forest and land cover classification system/s agreed upon***

Several definitions and classification systems are being used in Bangladesh for different objectives. Using the meta-language systems allows integration of different classification systems and results from the different efforts. Under this activity, the national definition of forest and the forest classification will be reviewed, clarified and translated using the FAO land cover classification system in order to allow the integration of the national forest inventory results into broader national land cover/use activities. This is particularly crucial when preparing the national inventory for greenhouse gas but also to ensure the linkages between different sector policies. Experiences from other countries will be shared through the organization of an international workshop.

Sub-activities include:

2.4.1 - Rationalization of Land Cover Classification System
2.4.2 - International workshop on forest definition and land use representation system

***Output 3: NFI and SLMS implemented***

The main results from this output are the inventory plan to design and implement the National Forest Inventory. The inventory planning will provide the methods and responsibilities for designing and planning the inventory. Inventory Planning Checklist will be developed and field inventory will be planned in accordance with the inventory planning checklist. Implementation of output 3 closely depends on the outputs 1 and 2. Output 3 will provide the necessary data to support forest policies, forest management planning and to take measures related to natural resource management, forest management and climate change reporting, and particularly will provide Emission Factors (EF) for REDD+.

***Activity 3.1: Existing forest inventory designs reviewed, multipurpose NFI and SLMS objectives identified and consensus on approach and method to NFI and SLMS and long-term monitoring reached***

The NFI and SLMS plan depends on the objectives of the Government in terms of forest management and forestry related issues. It is vital for the NFI and SLMS plans to clearly identify the objectives taking into consideration national forest programme, forestry policy and legislation, etc. and to identify variables to be measured, scale of measurement, frequency etc.

Sub-activities include:

3.1.1 – Objectives of the NFI and SLMS identified
3.1.2 – National Seminar convened to inform all stakeholders about the scope, approach and timeframe of the project and exchange on ways of implementation to meet all users' needs.
3.1.3 – Review of existing inventory designs and provide recommendations for NFI and SLMS design
3.1.4 – National consensus on national list of forest and tree attributes from NFI established
3.1.5 – Validation of NFI and SLMS designs (NFI and SLMS design field verified and finalized)

***Activity 3.2: Multi-purpose NFI and SLMS designed***

The NFI and SLMS designs are an essential part of the preparatory activities for the NFI and SLMS implementation. At present, Bangladesh has implemented its first National Forest Assessment during 2005-07. In addition, a few pilot projects and experimental researches have undertaken field measurements using different methodologies and protocols. The NFI and SLMS designs will consider past efforts in order to optimize the design and it cost-effectiveness. The NFI and SLMS designs will be based on several components (1) the sampling strategy (based on remote sensing analysis, existing field inventory data, socio-economic parameters), (2) data integration (remote sensing, biophysical field data, socio-economic data, auxiliary data, models etc.); (3) estimation design, (4) quality assurance and quality control procedures and (5) information system design.

Sub-activities include:

3.2.1 – Assess the costs for carrying out the NFI and SLMS
3.2.2 – Design the field forms and field guides/manual describing the approach and Technique for data collection
3.2.3 – NFI Unit strengthened to be able conduct national forest inventories/ assessments and monitoring and Training Manuals developed
3.2.4 – Development of Guidelines for Quality Assurance Protocol
3.2.5 – Define the needs of equipment for the NFI and SLMS and field testing of equipment
3.2.6 – Produce a final draft of the NFI and SLMS compliant with REDD+

***Activity 3.3: Land use and/or land cover atlas developed***

Remote sensing became an essential technology to monitor forest cover in a cost effective way. Methods developed in activities 3.1 and 3.2 will be used to create national forest cover, forest cover change, land use and land use change products. Data from the NFI plot surveys, along with proxy data obtained from publicly available remote sensing imagery (very high, medium and low resolution imagery) will be used to train supervised classifications perform accuracy assessments and validate national remotely sensed forest cover and land use maps. Additionally, applications of remote sensing will be tested regarding the monitoring of REDD+ activities (essentially deforestation and degradation), fire detection, etc.

Sub-activities include:

3.3.1 – Design of a remote sensing based methodology for Forest and Forest change detection, tailored to the national context
3.3.2 – National atlas of forest cover and forest cover change developed
3.3.3 – National LULUCF atlas developed

***Activity 3.4: Field data collection, data recording and processing achieved***

This activity is one of the most costly and time-consuming inventory activities during the implementation of the NFI and SLMS. In order to ensure that the NFI and SLMS is as much as possible cost-efficient and robust, adequate planning and preparation are needed. This activity will particularly focus on building field inventory teams, operational planning & logistics, specific inventory protocol, training, data collection and data processing.

Sub-activities include:

3.4.1 – Support to logistics and equipment needs for field data collection for NFI and SLMS
3.4.2 – Field Data Collection
3.4.3 – Set up the monitoring system and establish permanent sample plots
3.4.4 – Forest area boundary delineation and/or digitization
3.4.5 – Forest plot data processing and laboratory analysis of samples soil/litter/plants samples for carbon estimation
3.4.6 –Ground-truthing data recorded and processed for use in forest cover and LULUCF validation and mapping

***Activity 3.5: Data analysis and reporting developed***

Calculation procedures require adequate preparation of the data. Generally, most of the time for data analysis is spent on preparation of the data for the analysis. In order to be as efficient as possible, an interoperable and performant data management system will be developed. Data management and quality control procedure will be operationalized. Data analysis system will be documented in order to ensure continuity and improvement of the system implemented. Results from the NFI and SLMS will be provided into a final report in addition to the manual, the field inventory protocol and the results that will be accessible in-country and on the FAO data warehouse. Results will be disseminated as appropriate to support decision makers and support national forest policies related to forest management, management of natural resources, and to mitigate the adverse effects of climate change.

***Output 4: Value of forest ecosystem goods and services estimated.***

Forest ecosystem goods and services have significant direct and indirect contributions to national economies and human welfare. The benefits people obtain from forests include forest goods, environmental services and sociocultural benefits. There has been no attempt to value these contributions of forest ecosystem goods and services in Bangladesh. As a result contribution of forestry sector is not well reflected in the national GDP. It is, therefore necessary to value forest ecosystem services and promote their inclusion in national economic accounts. This will also help to justify assessment of country's forest resources and sustainability of Forest assessment and monitoring programme for future.

**Project Management**

The NFI implementation will demand considerable human resources, effort and management flexibility. The PMU will be responsible for day-to-day management of the NFI project. Furthermore, it is responsible for the development and implementation of work plans and budgets and the organization of meetings, and maintains transparent and accessible records. Key staff members of the PMU include an international Staff, Chief Technical Advisor, a national Monitoring and Evaluation Consultant and national support staff (National Operation Assistant, National Communication Assistant, IT Assistant, Finance and Administrative Assistant, Secretary/Office Assistant and one Office Messenger). The costs related to project management have been put under the budget head "Project Management". The project management will ensure that the activities under three outputs are well coordinated and they contribute well to the project objectives.

# SECTION 2 – FEASIBILITY

## 2.1 Environmental impact assessment

This project falls under category C of the FAO EIA guidelines. The project activities do not envisage any physical construction, renovation of permanent structures or field activities that could lead to adverse environmental impact. The main goal of the project being capacity development for the environmental management, the sustainable forest management and the mitigation and adaptation of climate change influences, it will contribute positively for the protection of the environment.

A category C project does not require further environmental and/ or social analysis or assessment. However, provision of training of NGOs and local representatives in the techniques strengthening local ties and relationship, and minimizing social conflict is envisaged.

## 2.2 Assumptions and risk management

The project has been designed under the assumptions that:

- Government of Bangladesh remains committed to creating all the necessary conditions for the implementation of the NFI project and its sustainability in the long term. In particular GoB works to:
    - link the project to the national policy processes.
    - build legitimacy (partners and stakeholders acceptance) for NFI, through wide participation during planning and implementation of the project.
    - create synergies between the project and other related ongoing initiatives.

- ensure NFI is institutionalised and be part of the annual work and budget plan of the Government beyond the end of the project.
- engage in inter-sectoral policy dialogue.

- National stakeholders are engaged in the harmonization of the forest/land use classification and forest related information framework.

- FD coordinates and supervises project activities. Particularly FD works to ensure timely inputs from all partners and stakeholders, and cost-effectiveness of the project activities.

- Consensus is reached on a national list of forest and tree variables, assessment approach and methods that will help generate the needed information to all users.

There are a few risks with a Low to High probability of occurrence that the project team should be aware of and act to minimise them. Likely risks may include: Institutional Risks, Technical Risks, Financial Risks and Coordination Risks. These risks, their impact, probability of occurrence and mitigation measures are put in the following matrix. However, the project is built on FAO's extensive experience in Bangladesh in designing and implementing projects of similar nature. Expertise gained and lessons learned from those projects have been carefully considered and integrated in the project.

**Table 4: Assumption and risk management**

| Risks | Impact | Probability | Mitigation |
|---|---|---|---|
| **Institutional Risks** | | | |
| GoB's commitment to the project fades away | Sustainability of the project is not guarantee | Medium | GoB to clearly express its commitment for NFI beyond project cycle |
| Knowledge and skill deficiency: Staff skill / capacity may be poor / inadequate in FD to address NFI and satellite monitoring system. | Delivery of outputs may be affected | Medium | The project will have strong focus on capacity building within FD and other stakeholders. Structured technical training at first will be planned for mitigating this deficiency. |
| Brain drain of trained staff. | Delivery of outputs may be affected | Low | Trained staff can utilize acquired skills in their work. |
| Creating new posts for NFI Unit under revenue budget and retaintion of the trained staff after the termination of the project is a challenge. | Sustainability of the project will be affected | High | A continuing dialogue with the Ministry of Environment and Forests, Ministry of Public Administration and Ministry of Finnace is expected to mitigate this risk. |
| **Technical Risks** | | | |
| Limited capacities to use the equipment as intended. | Delivery of technical outputs will suffer | Medium | Provision of equipment will be complemented with training sessions on its use and maintenance. |
| **Financial Risks** | | | |
| Funds are not made available on-time and this effects to the progress and | Delivery of outputs will be delayed. | Low | The funds are delivered in time by the donor(USAID) to the |

| | | | |
|---|---|---|---|
| quality of the implementation process. | | | FAO and by the budget holder (FAOR) to the project. |
| **Coordination Risks** | | | |
| The project is not implemented through participation of all related stakeholders. | Benefits of the project are not maximised and generalised. Different initiatives are not synergised. | Low | Foresee mechanisms fo stakeholder and partner involvement. |

## 2.3 Implementation and management arrangements

### 2.3.1 Institutional Framework, Partnerships, Information Management and Knowledge Sharing, and Coordination

#### *a. Institutional Framework*

The NFI project will be implemented through Project Management Unit (PMU) which will be based at the FD. Because of its wide international knowledge and experience in forestry resources assessment and in forest development in general that are directly relevant to the development objective of this project, the Food and Agriculture Organization (FAO) of the United Nations (FAO) will be responsible for the implementation of the project activities (Outputs indicated in the Results Framework given in para 2.4.2.1) including the provision of technical assistance and procurement of goods and services according to the provision listed in the Funding Agreement signed with the USAID. It will provide the necessary expertise including national and international consultants for capacity building, forest assessment, remote sensing and mapping, information system development and data processing. Each consultant will provide in his/her area the technical inputs, monitor and evaluate the progress towards achieving the project objectives. FAO will administer the technical assistance; provide operational and technical backstopping services from FAO Headquarters, Rome and RAP, Bangkok to ensure timely inputs to the project and smooth implementation at highest technical quality. FAO will appoint a Chief Technical Adviser and Forest Assessment Expert who, under the overall supervision of the FAO Representative in Bangladesh, the technical supervision of the Lead Technical Officer (LTO) in Bangkok and Lead Technical Unit (LTU) at the FAO HQ and other relevant Divisions and services in FAO, and in consultation with relevant local authorities, will have overall responsibility to provide technical assistance for all project components. The technical officers from FAO will make regular backstopping and oversight missions to the project in the field to ensure that the project implementation is performed at highest technical standards. FAO will also facilitate the procurement of equipment and implementation of the training programme in collaboration with FD and in compliance with the FAO procedures.

The FAO Representative in Bangladesh will be the budget holder and will be responsible for the overall supervision of the project including administration and financial issues in accordance with the procedures of FAO. All activities listed in the project document will be implemented in direct partnership with the FD and other Implementing Partners in line with FAO standard procedures that are applied for Bangladesh. Specialised technical divisions of FAO's Headquarters and RAP will be mobilised to provide needed technical backstopping to project activities.

The project will be anchored within the Forest Department of the Ministry of Environment and Forests. Forest Department will be the lead counterpart institution for execution of the project activities through a National Project Coordinator (NPC) who will be a senior official of the FD having expertise in NFI. The

National Project Coordinator (NPC) will be the national focal point for the project and will be fully dedicated to the project and will have the overall responsibility for planning, managing, coordinating and supervising the project activities. The FD will collaborate with FAO in its capacity of implementing agency of the project and with the related international development partners (donors) and organizations. In order to ensure the long term sustainability of this project's activities, the project will be set firmly within the institutional setting of the Forest Department by creating NFI Unit within the FD to sustain the continuous forest inventory and monitoring. The Forest Department will have the responsibility of establishing a NFI Unit under its control at the inception of the project and ensuring that the Government strategy of setting up a permanent NFI Unit adequately manned and mandated is realised. The Project Steering Committee (PSC) will coordinate this vital issue with the Ministry of Environment and Forests, Ministry of Public Administration and the Ministry of Finance to create the permanent NFI Unit within the FD under revenue budget with regular annual financial provision. The NFI Unit will be headed by a Senior Officer of the Forest Department, having expertise in forest assessment and monitoring. Under the supervision of the NPC, the Head of the NFI Unit will be responsible of executing the project work plan and channelling the inputs to the activities. The NFI Unit will be will be assisted by four Technical Working Groups (TWGs): TWG – Forest Inventory, TWG-Mapping/GIS, TWG-Database Management and TWG-REDD+ Compliance. These TWGs will comprise international consultants, national consultants and their counterpart national personnel and supporting staff in the relevant field from the FD. These TWGs will be supported by technicians for data entry and database management and interpretation of satellite images. The NFI Unit will include also the general support staff. The NPC in consultation with the CTA and TWGs will arrange to provide the training, logistical support and supervision to the field (forest inventory) and office (mapping/GIS and database) personnel.

The project activities will be directly taken care by the Project Steering Committee (PSC) and a NFI Technical Committee where FAO will be represented. The importance of a PSC that cross-cut the sectors is indisputable for the project as it will ensure a general awareness about it and maximises its benefits to all users from the generated information and the capacity building. Under these supervisory instruments, the progress of the project will be reviewed and scrutinised, its achievements assessed against the planned outputs, its work plan for the next periods analysed, the actions to take in case of constraints identified and responsibilities assigned. At its discretion, the PSC may recommend to the Project Management that amendments be made to the content, location, timing and implementation arrangements of project activities but not to amend the development or immediate objectives of the project.

**SilvaCarbon Program Support:** SilvaCarbon is a flagship program under United States fast start financing for REDD+ and is a U.S. contribution to the Forest Carbon Tracking task of the intergovernmental Group on Earth Observations (GEO). SilvaCarbon taps expertise of the U.S. scientific and technical community particularly US government expertise from the US Forest Service, the US Geological Survey, the US Environmental Protection Agency, and NASA and works in partnership with developing countries in capacity enhancement for monitoring and managing forest and terrestrial carbon, data analysis, quality assurance and national level reporting.

The expert support of SilvaCarbon will be sought for the development, design, and implementation of the NFI and SLMS, including capacity building programmes under the project. A SilvaCarbon coordinator will be embedded within the FD during the life of this activity. The SilvaCarbon coordinator will play an important role in the implementation of this activity ensuring full and consistent SilvaCarbon short, medium, and long-term expert involvement. The SilvaCarbon coordinator will also serve as a member of the NFI technical committee.

SilvaCarbon support will be paid for in full through a separate grant agreement between USAID/Bangladesh and the SilvaCarbon program. The anticipated annual support provided via SilvaCarbon experts will be between $250,000 and $500,000 annually, pending the availability of funds.

It is required that project staff collaborates with the SilvaCarbon team, specifically the SilvaCarbon Country Coordinator, to ensure complementarity between the project and SilvaCarbon activities. See appendix 4 for an agreed upon list of sub-activities and responsibilities developed during the July 23-25, 2014 SilvaCarbon-FAO work planning session.

**Project Steering Committee (PSC):** The Bangladesh Forest Department (FD) will be the lead counterpart Department for implementing the project. A Project Steering Committee (PSC) chaired by Secretary, MoEF aand CCF as the Member Secretary/NPC as alternate member secretary will be established to provide overall guidance, co-ordination and facilitation to project implementation.

The Project Steering Committee (PSC) will be responsible for overseeing the project design and implementation, facilitating inputs to the project in all phases, ensuring wider dissemination of results and providing guidance to the FD as how it will ensure sustainability of the project outcomes at the long run. The PSC will be composed of representatives from the Ministry of Environment and Forests, Ministry of Land, Forest Department, Department of Environment representatives of Agriculture, Water Resource & Rural Institution Division, General Economics Division, Implementation, Monitoring and Evaluation Division, Programming Division under Planning Commission, ERD, BFRI, BFIDC, BCCT, SPARRSO, SoB, DLRS, SRDI, CEGIS, representatives from forest-related sectors, the USAID, FAO, UNDP and other partners and stakeholders. The MoEF will ensure wide representation of all concerned parties in the PSC. Adequate gender representation will be reflected in its composition.

### *b. Partnership*

The implementation process of the project will be structured, participatory and consultative while always emphasising the principles of partnership and collaboration in a multi-sectoral arena. The overall strategy of the project is to work in collaboration between FAO, the FD, the US Government (USAID and SilvaCarbon), and other Development Partners (donors) and organizations, to develop, promote and implement management tools to bridge the gap between knowledge generation and policy processes with emphasis on inter-sectoral coordination. This would help to improve sustainable forest management, to mainstream forestry within the national efforts to eradicate extreme poverty and hunger, achieve sustainable water and land use, mitigate climate change and achieve the MDGs.

The project formulation process has paid maximum possible attention to avoid duplication and ensure synergy between current and pipeline projects of similar nature funded or to be funded by other international development partners, including UN REDD. The Project's strategy is based on the transfer of knowledge to and strengthening the NFI and satellite forest monitoring capacity of the FD and partners through technical assistance, training and institutional changes. The project will closely consider the interactions between environmental and social factors in all of its outputs, ensuring that stakeholders are able to fully understand how environmental degradation, loss of forest cover and climate change affect livelihoods and influence poverty outcomes in Bangladesh. FAO will draw on its international expertise, along with the international expertise provided via SilvaCarbon, to provide technical support based on international best practices. Other development partners' involvement will be ensured through the LCG platform.

### *c. Information Management and Knowledge Sharing*

Information generated from the NFI and SLMS could be used to assist in formulation of policies, strategies and programmes related to Environment, Forestry and Climate Change, particularly REDD+ programmes and projects. In addition, the NFI and SLMS information could play an important role in policy monitoring especially since it is very much linked to land use/forest cover change detection within a specified period. The NFI and SLMS data will meet up national users' information requirements for planning and sustainable management of the forestry resources and country's obligations of reporting to the international processes including GHG reporting and expected REDD+.

The project is part of a global effort of FAO to build local capacity, assist in monitoring / assessing the forestry resources and generating/managing information that feeds into the national policy processes. Globally, the project will work towards enhancing a culture of knowledge generation and sharing within the countries and developing mechanisms to transfer knowledge to other countries to resolve practical problems based on users expectations and needs. The lessons learned from this project will find its way, through FAO to the networks of key partners around the world to assist in knowledge sharing and to provide guidance in similar projects.

The project will assist reviewing, clarifying and translating the national definition of forest and the forest classification using the FAO land cover classification system in order to allow the integration of the national forest inventory results into broader national land cover/use activities and to ensure the legends being used are harmonized and can be easily integrated and clustered into other categories such as the IPCC land categories. This will help in preparing the national inventory for greenhouse gas as well as ensuring the linkages between different sector policies. Experiences from other countries will be shared through the organization of an international workshop. The knowledge sharing importance of the PSC that crosscuts different sectors is indisputable for the project as it makes it known to all relevant institutions and maximises the benefits of the generated information to all users.

As a part of forestry research support, the project will assist in developing a network of research institutions and actors in order to ensure adequate channel for dissemination of information. The project will also use regular communication channels and activities comprising of international and Dhaka-based websites. The project will use FAO's established information management procedures to ensure that all relevant information is collected, analysed, disseminated and archived properly as well as being made available beyond the project cycle. All knowledge, products (publications, videos, presentation, images, etc.) in English and Bangla language will be shared and preserved in the RIMS Unit within the FD, in FAO repositories in Dhaka and Rome, and with USAID/Bangladesh and USAID/Washington as appropriate.

### *d. Coordination*

At the international level, the Food and Agriculture Organization of the United Nations (FAO) will undertake the overall responsibility for project coordination with support from the FAO Dhaka office and backstopping by the Lead Technical Officer in FAO's Regional Office for Asia and the Pacific (RAP) under the overall supervision of the FAO Representative in Bangladesh. At the national level, FAO Dhaka will use Local Consultative Group for Climate Change and Environment (LCG-CCE) as enabling platform to coordinate the project activities by presenting progress and issues on a regular basis.

The project will organise two major events. A seminar will be organised at the onset of the project to inform all stakeholders about its objectives and expected outputs and the parties involved and their responsibilities. The implementation of the project will be largely participative to ensure that it will address all pertinent issues; deliver the needed information at the suitable format that facilitates its uses in the

country and for international reporting and to adopt a nationally accepted approach that meets best the country's needs.

A workshop will be held towards the end of the project to present, discuss and validate the results and agree on the way forward to strengthen the sustainability of the actions done and results. In addition to these events, the NPC and CTA will report periodically on the performance of the project to the Chief Conservator of Forests, FAO, and USAID. The Chief Conservator of Forests will keep the NFI Project Steering Committee informed about progress and performance of the project. FAO will keep USAID and the Government informed of the progress and performance of the project.

### 2.3.2 Result Framework, Work Plan, Budget and Inputs of Partners

#### *a. Development Partners*

The USAID and FAO will sign a Funding Agreement for a total of USD 6.5 million (approx.) for implementation of the project. FAO will subcontract with relevant partners for the provision of specialized technical assistance to specific project activities. These include, among others, contract tools such as FAO's Letters of Agreement (LOA) with Dhaka-based relevant institutions will be used as much as possible as to strengthen country capacity. The project will be carried out over 4 years from the date specified in the Funding Agreement between FAO and the USAID. It is anticipated that the project will start on September 1, 2014 and extend until August 31, 2018. The result framework and its relation to RPP is depicted in the following table.

The Work Plan (Distribution of activities among different agencies) is given in Appendix 4.

**Table 5: The result framework**

| Result Framework | Contribution to RPP |
|---|---|
| **Output 1. General conditions to implement the national forest inventory reinforced** | |
| Activity 1. 1. Institutionalization of the NFI and SLMS strengthened | |
| sub-activity 1.1.1: Support to legal preparedness | Activity 4.a.1.3 |
| sub-activity 1.1.2. Enhancement of knowledge on international reporting (UNFCCC, CBD, FAO, etc.) | Activity 4.a.1.1 |
| sub-activity 1.1.3. Organization of regular meetings on NFI and SLMS (Quarterly) | Activity 4.a.1.2 |
| Activity 1. 2. Reinforcement of national capacities in forest inventory and satellite monitoring | |
| sub-activity 1.2.1. Strengthening of forest inventory capability of stakeholders | Activity 4.a.3.4 |
| sub-activity 1.2.2. Technical trainings (Local) on tools for forest monitoring (this includes GIS, RS, forest inventory, data analysis, forestry statistics) | Part activity 4.a.3.4 and 1.2.2 |
| Sub-activity 1.2.3: Capacity of young professionals for forest monitoring tools (GIS, RS, SLMS, etc.) reinforced | |
| sub-activity 1.2.4. Capacity building on geospatial data processing and database management | Activity 4.a.2.5 |
| Sub-activity 1.2.5 Participation in trainings abroad related to Forest Inventory and Satellite Forest Monitoring, REDD + programmes) | |
| Activity 1. 3. Forestry research supported | |
| sub-activity 1. 3.1. Development of allometric equations for important species based on ecological regions | Activity 4a.3.7 |
| sub-activity 1. 3.2. Support remote sensing researches in forestry | Activity 1.2.2 |
| sub-activity 1. 3.3. Enhancement of national capacities in volume, biomass and carbon stock calculation | Activity 4a.4.1 |
| sub-activity 1. 3.4. Strengthening of modeling expertise | Activity 4.a.4.2 |
| sub-activity 1. 3.6. Development and Upgrading of existing NFA Tree Species Data Base | Activity 4.a.3.4 |
| Activity 1. 4. Existing remote sensing and field data collected, harmonized and reviewed | |
| sub-activity 1. 4.1. National consultation on data sharing agreements implemented | Activity 4.a.6.3 |
| sub-activity 1. 4.2. Development of land cover map index and satellite image database | Activity 4a.2.1. |
| sub-activity 1.4.3 - Research on very high spatial resolution satellite imagery for forest monitoring | Activity 4a.2.2 |
| sub-activity 1. 4.4 Archiving and documentation of all existing inventory data and development of a robust database management system | Activity 4.a.3.1 |
| sub-activity 1. 4.5 Regional workshop on the use of remote sensing for monitoring deforestation and forest degradation in tropical countries | |

| | |
|---|---|
| **Output 2. NFI and SLMS strategy reinforced** | |
| Activity 2. 1. Mandates and funding clarified | |
| sub-activity 2. 1.1. International workshop on national forest inventory and monitoring systems (how the inventory planning, data collection, data management and analysis, QA/QC, etc. are performed in different countries) | Activity 4.a.2.4 |
| sub-activity 2. 1.2. Identification of necessary resources for updating the NFI and SLMS | Activity 4.a.1.3 |
| sub-activity 2. 1.3. Mandates to implement the national forest inventory and satellite forest monitoring clarified | Activity 4.a.1.3 |
| Activity 2. 2. Participatory process developed and established | |
| sub-activity 2. 2.1. Stakeholder Mapping involving different national institutions dealing in Forestry, civil society, forest communities and private sector | Activity 4.a.6 |
| sub-activity 2. 2.2. Participatory process defined | Activity 4.a.6 |
| sub-activity 2. 2.3. Development of participatory tools for forest monitoring | Activity 4.a.6 |
| Activity 2. 3. Communication and public relation system implemented | |
| sub-activity 2. 3.1. Support to Communication and public relation system | Activity 4.a.6 |
| sub-activity 2. 3.2 Development of a web based platform for data sharing among national Stakeholders | Activity 4.a.6.7 |
| sub-activity 2. 3.3 Support to address the gaps (if any) identified during establishment of FMIS through UN REDD programme. | Activity 4.a.6.8 |
| Activity 2. 4. Common forest and land cover classification system/s agreed upon | |
| sub-activity 2. 4.1. Rationalization of Land Cover Classification System | Activity 4.a.2.3 |
| sub-activity 2. 4.2. International workshop on forest definition and land use representation system | Activity 4.a.2.3 |
| **Output 3. NFI and SLMS implemented** | |
| Activity 3. 1. NFI and SLMS design prepared and consensus on approach and method to NFI,SLMS and long-term monitoring reached | |
| sub-activity 3.1.1 Objectives of the Multi-purpose National Forest Inventory identified | Activity 4.a.2.4 |
| sub-activity 3. 1.2. National Seminar convened to inform all stakeholders about the scope, approach and timeframe of the project and exchange on ways of implementation to meet all users' needs. | Activity 4.a.2.4 |
| sub-activity 3. 1.3. Review of existing inventory designs and provide recommendations for NFI design | Activity 4.a.3.2 |
| Sub-Activity 3.1.4 : National consensus on national list of forest and tree attributes from NFI established | |
| Sub-Activity 3.1.5 : Validation of NFI design (NFI design field verified and finalized) | |

| | |
|---|---|
| Activity 3. 2. Multi-purpose NFI and SLMS designed | |
| sub-activity 3. 2.1. Assess the costs for carrying out the NFI and SLMS | Activity 4.a.3 |
| sub-activity 3. 2.2. Design the field forms and field guides/manual describing the approach and technique for data collection | Activity 4.a.3 |
| sub-activity 3. 2.3 NFI Unit strengthened to be able conduct national forest inventories/assessments and monitoring and Training Manuals developed | Activity 4.a.3 |
| sub-activity 3. 2.4. Development of Guidelines for Quality Assurance Protocol | Activity 4.a.3 |
| Sub-Activity 3.2.5 : Define the needs of equipment for the NFI and SLMS and field testing of equipment | |
| sub-activity 3. 2.6 Produce a final draft of the multi-purpose NFI and SLMS design compliant with REDD+ | Activity 4.a.3 |
| Activity 3.3: Forest monitoring system reinforced by remote sensing applications | |
| Sub-Activity 3.3.1 Design of a remote sensing based methodology for Forest and Forest change detection, tailored to the national context | |
| Sub-Activity 3.3.2 : National Atlas of Forest Cover and Forest Cover Changes developed | |
| Sub-Activity 3.3.3 : National LULUCF Atlas developed | |
| Activity 3. 4. Field data collection and data processing achieved | Activity 4.1.3.5 |
| Sub-Activity 3.4.1 : Support to logistics and equipment needs for field data collection for NFI and SLMS | |
| Sub-Activity 3.4.2 : Field Data Collection | |
| Sub-Activity 3.4.3 : Set up the monitoring system and establish permanent sample plots | |
| Sub-Activity 3.4.4 : Forest boundary delineation | |
| Sub-Activity 3.4.5 : Forest plot data processing and laboratory analysis of samples soil/litter/plants samples for carbon estimation | |
| Activity 3.4.6 Ground-truthing data recorded and processed for use in forest cover and LULUCF validation and mapping | |
| **Output 4: Value of Forest Ecosystem goods and services estimated** | |
| **Project Management Unit** | |
| International Staff (CTA) -1 x 48 months | |
| National Consultant – 1 (M& E ) | |
| National Support Staff – 9 | |
| Travel | |
| Inception Workshop | |

| | |
|---|---|
| Non-Expendable Procurement (ICT Equipment, Vehicles -3, Other Equipment) | |
| Technical Advisory Services | |
| General Operating Expenses (Office supplies, fuel, Hiring of additional vehicles, Communication, different utilities, Security, etc.) | |
| Miscellaneous | |
| PMU will be supported by International and National Consultants under Outputs 1-4. A number of activities will be implemented through Letter of Agreement (LoA) | |

**Table 6: Budget Summary**

| Expenditure Head | Year Wise Break-Up: Costs (US $) | | | | Total costs (US $) | Percent of Total Cost (%) |
|---|---|---|---|---|---|---|
| | Y1 | Y2 | Y3 | Y4 | | |
| | 2015 | 2016 | 2017 | 2018 | | |
| | (12 months) | (12 months) | (12 months) | (12 months) | | |
| **Salaries - International Staff** | 198,684 | 198,684 | 198,684 | 198,684 | 794,736 | 12.31 |
| **Salaries - Consultants** | 639,000 | 616,000 | 222,000 | 150,000 | 1,627,000 | 25.20 |
| **Salaries - National Support Staff** | 81,600 | 81,600 | 81,600 | 81,600 | 326,400 | 5.06 |
| **Contracts** | 0 | 372,000 | 80,000 | 105,000 | 557,000 | 8.63 |
| **Travel** | 168,580 | 242,691 | 227,493 | 98,051 | 736,815 | 11.41 |
| **Training / Workshops / Seminars / Meetings** | 462,500 | 102,000 | 58,000 | 20,500 | 643,000 | 9.96 |
| **Expendable Procurement** | 4,000 | 10,000 | 0 | 9,000 | 23,000 | 0.36 |
| **Non-expendable Procurement** | 220,000 | 97,000 | 27,000 | 27,000 | 371,000 | 5.75 |
| **Technical Advisory Services** | 16,800 | 26,400 | 26,400 | 78,400 | 148,000 | 2.29 |
| **General Operating Expenses** | 90,350 | 190,350 | 90,350 | 90,350 | 461,400 | 7.15 |
| **Miscellaneous** | 2,500 | 7,500 | 7,500 | 7,500 | 25,000 | 0.38 |
| **Sub-Total** | **1,884,014** | **1,944,225** | **1,019,027** | **866,085** | **5,713,351** | **88.50** |
| **Support Costs (13%)** | 244,922 | 252,749 | 132,474 | 112,591 | 742,736 | 11.50 |
| **Total** | **2,128,936** | **2,196,974** | **1,151,501** | **978,676** | **6,456,087** | **100** |

## Budget Narrative:

1. The estimated budget in all budget lines are based on the FAO's standard corporate norms established and guided by the FAO Head Quarter through circulars.

2. The **level, daily/monthly/annual rates of salaries and emoluments** of the national and international consultants are based on responsibilities/types of duties of the incumbents. Their duration is also guided by the expected volume of work and corresponding to the each sub-activity and activities against each output.

3. **Travel budget** is also determined using standard UN rates and number of days and trips are based on responsibilities.

4. **Contracts budget** are determined by calculating volume of works and the rates are estimated based on FAO Dhaka's experience working with different consultants in large number of FAO projects and existing rates thereunder.

5. **The budget for training/workshops/seminars/ and meetings** are determined by working out details of each outputs and activities and cost norms are based on the FAO Dhaka's working experience in large number of country projects.

6. **The budget estimates of expendable and non-expendable equipment** are based on the FAO's experience in local procurement and international procurement.

7. **FAO's advisory services** are standard costs as per FAO manual.

8. **The budget for General Operation Costs (GoC)** is based on the experience of similar projects. **Support costs** continue to be calculated as 13% of the total direct costs. (A 13 percent FAO support cost is envisaged as in the case of all GCP projects).

9. Specific rates for **international staff(s), international and national consultants, technical support services** have been determined as below:

**Chief Technical Adviser (CTA) – P4**

The rates used for international staff are based on the *Pensionable Remuneration for Staff in the Professional and Higher Categories*. Accordingly, the rate for a P4 CTA is US$ 16557 per month. This is the only international staff post envisaged. Others are consultants.

**General Service FAO Project Staff**

The cost for this staff is calculated based on the *Revised Service Contract Remuneration Scale* circulated by UNDP on 28 February 2012. The rates against the individual posts are determined according to responsibilities.

**Consultants**

**International consultants:** The figures in the budget have been considered based on the assignments and outputs required. These rates are specific to each offer of appointment depending on the type of duties to be performed and the previous experience of the consultant/subscriber. The actual rate is determined by the personnel office recruiting the consultant in the relevant Regional Headquarter office of FAO.

**National consultants:** This is based on salary bands used for the project staffs above, and determined according to the same principles applied for the international consultants as are applicable (i.e. experience, type of duties, etc).

**Technical Support Costs**

These budget lines include secondment of FAO staff hired on FAO's Regular Programme. Secondment costs are calculated using the official rates. Since the grade of staff that the project will be mobilising may vary, these budget lines were calculated using a lumpsum per mission.

***b. Government***

It is assumed that the Government of Bangladesh, through the FD, would make the following in-kind contributions to project implementation:

- The FD will appoint a National Project Coordinator (NPC) who shall (i) coordinate interventions of the national institutions and individuals involved in the project, (ii) plan and facilitate training of the field team members, the mapping and database personnel, (iii) oversee fieldwork and mapping activities and secure timely logistical support to field teams, (iv) participate in and oversee the design and development of the database, processing of the field data, analysing the findings and reporting of project findings and (v) report to the PSC on the progress of the project activities and relay the recommendations of the PSC to the project team.
- The FD will designate counterparts to all international and national staff and consultants recruited by FAO to work with the project.
- The FD will provide functional office space to accommodate FAO's Technical Assistance Team (TAT) and the national counterpart staff at sub-professional and professional levels and will extend necessary support required from the Departments and other Institutions under it. The FD will ensure a sufficient and constant electrical power supply for the project office to carry out its activities without disruption.
- The FD will bear the salaries of national personnel deputed to NFI project and salaries of national personnel/staff participating in the fieldwork for forest and tree inventory, mapping, etc.
- The Government will identify and make available qualified government staff and professionals to participate in the project's proposed stakeholder workshops, meetings, study tours, training courses, etc.
- FD will act to set up and institutionalise the NFI and build its capacity for future updating of the NFI data and information management and monitoring of forest resources.
- FD will have the overall coordinating role of the project, including training of the national personnel, planning and implementation of the project.
- FD will ensure liaison with all government line departments involved with NFI project to make optimal use of existing knowledge and experience in this field.
- The Government should also provide a separate budget line for the operation and management of National Forest Inventory Unit in the FD not later than the start of the third year of the Project's timeframe. For sustaining the NFI at the long term, the Government will nominate a core of permanent personnel in the NFI Unit headed by an Officer.
- The Chief Conservator of Forests, with the support of the NPC, will oversee the work of the international experts, national consultants and the national personnel of the PTU; follow their progress and performances to ensure timely implementation of the project activities in order to make best use of the services provided by FAO and the Development partners for the implementation of the project activities.
- The Government will ensure payment of CD/VAT while transferring the vehicles to the Government after completion of the project.

### 2.4.3 Procurement

Procurement and delivery of inputs in technical assistance projects will follow FAO's rules and regulations for the procurement of supplies, equipment and services (available in the FAO Procurement Intranet page, Manual Sections 502 and 507). All the non-expendable equipment purchased under this project will be transferred to the Government after the completion of the project. The bulk of non-expendable procurement in the project will involve Inventory, ICT and Data Processing and office equipment.

### 2.4.4 Technical and Operational Support

#### *a. FAO's Technical Support Arrangement*

FAO will be responsible for overall project implementation and the provision of technical assistance of the Project. The FAO Representative in Bangladesh will be FAO budget holder for the Project (under the advice and assistance of CTA) and will be responsible for the overall supervision of the project including administration and financial issues in accordance with the procedures of FAO. FAO will receive funds from the USAID and disburse them in accordance with the Financing Agreements signed between the USAID and FAO and according to the approved annual operational plans, including funds for training, as detailed in this Project Document. For Outputs indicated in the Results Framework, FAO will deliver services to FD and other Implementing Partners in line with FAO standard procedures that are applied for Bangladesh. All activities listed in the project document will be implemented in direct partnership with FD and other Implementing Partners. The technical assistance will be provided by FAO technical staff, international and national technical specialists/consultants and specialists from relevant partner organisations and institutions.

At the international level, the Food and Agriculture Organization of the United Nations (FAO) will undertake the overall responsibility for project implementation and coordination with support from the FAO Dhaka office and backstopping by the Lead Technical Unit at the FAO HQ in Rome and the Lead Technical Officer in FAO's Regional Office for Asia and the Pacific (RAP) under the overall supervision of the FAO Representative in Bangladesh. FAO will, therefore, be responsible for the quality of the technical assistance that is provided by the Project and for ensuring that it is provided in a timely manner. Experts from Silva Carbon will extend capacity building support in the process of planning, designing and implementing NFI.

At the national level, the project will utilize expertise of FD and other specialized institutions (BFRI, SPARRSO, SoB, CEGIS, etc) related to NFI activities to coordinate and implement the project activities. A National Forest Inventory Unit will be established in the FD and this unit will coordinate NFI activities through coordination with RIMS and Management Plan Divisions in the FD and will be responsible for presenting progress to and discuss issues with PSC on a regular basis. This will ensure better coordination in the implementation of NFI activities.

#### *b. FAO's Operational and Administrative Support Arrangements*

FAO will be responsible for the administration, co-ordination, implementation/technical execution and supervision of project activities including programme planning and report preparation as well as management of funds as stipulated in its Financing Agreement with the USAID including the provision of technical assistance and the procurement of physical inputs, consultancy services and small civil works. Under the overall supervision of the FAO Representative in Bangladesh, the Project will be managed by a full-time international Chief Technical Advisor and Forest Assessment Expert (CTA) recruited by FAO who will be responsible for the overall co-ordination, supervision, management, disbursement of the

project's financial resources effective delivery of project outputs and reporting of project activities and evaluation of project interventions.

FAO CTA will be assisted by a National Project Co-ordinator (Senior Forest Official appointed by the Government) and the personnel of the PTU. The CTA will work closely with NPC in streamlining necessary policy, administrative and technical support and enhancing government ownership and engagement in project execution. Through the NPC, the CTA will ensure the closest liaison with other Government departments and agencies that deal with the land use resources and can provide advisory/technical inputs to the project and assist in the implementation of its activities according to the norms and standards that meet all users' needs of information.

FAO shall be responsible for the recruitment, national and international travel, salaries and emoluments of the international and national members of the technical assistance team, including Project's support staff. Recruitment of consultants and support staff will follow FAO procedures. The Government/FD will appoint counterpart staff to International and National Consultants in order to support implementation of relevant activities under their domain. The international consultants assigned to the project, under the general supervision of the FAO Representative in Bangladesh and the respective Technical Division in FAO headquarters and RAP will ensure high quality of technical assistance and advice. The CTA and NPC shall coordinate with FAO Representative in Bangladesh, FAO HQ and RAP to maintain standards of technical excellence in the work of the project.

## 2.5 Monitoring and reporting

### 2.5.1 Monitoring

Project monitoring and reporting will be conducted in accordance with established procedures of FAO, the Government of Bangladesh and the donor (USAID). The progress of project interventions will be measured against a series of indicators (Table 7).

The FAO Representation, the Lead Technical Unit of the project at FAO HQs in Rome and the Lead Technical Officer in FAO's Regional Office for Asia and the Pacific (RAP) in cooperation with FD shall be the focal point for monitoring project performance and assisting in meeting its implementation requirements. The Chief Technical Advisor will monitor the technical aspects of the project implementation with support from NPC. Furthermore, FAO will ensure the monitoring of the project on yearly basis through visits by its technical backstopping personnel from the Headquarters and the RAP. The NPC will be the responsible for continuous monitoring of the project and reporting on its progress, achievements and constraints to the Chief Conservator of Forests and the NFI Project Steering Committee. The NPC will also interact with the FD Technical Working Groups on more frequent basis on the running of the project. The NPC will also receive information on the progress of the project from the different national and international experts and consultants serving for the project. In his monitoring of the project and reporting on its progress, the NPC will be assisted by the Project CTA. The Project Steering Committee (PSC) comprising wide range of stakeholders including development partners (USAID and FAO) that meets periodically every three months or more frequently when needed will monitor the NFI activities.

**Table 7: Monitoring framework**

| Results Chain | Indicators | Baseline | Target | Means of Verification | Assumption |
|---|---|---|---|---|---|
| Impact: Improved REDD+ MRV capacities, data production for international agreements and support to national forest policy and land management | Better informed, up-to-date, data on extent, status and trends of forests available at the national level. | Data on forest extent and status at the national level are 10-years-old, based on irregular NFI, with lack of institutional arrangement and lack of an efficient monitoring system. | Data on forests extent and status are updated every 5 years, based on robust, accurate, transparent, coherent and complete NFMS. | Data reported to FRA, UNFCCC, and other international conventions based on NFI and SLMS data. | Continuity of Government commitment in support of this initiative and adequate resources are made available.<br>Continuity of Donor support.<br>Enabling Policy Environment<br>Ownership by the Government and the stakeholders.<br>Adequate level of Government resources allocated to the NFI unit for Continuous Forest Inventory and Monitoring.<br>No global and national level recession ensuring Increased financing in support of investment programs.<br>Data are adequately shared between national institutions to undertake the activities. |
| Outcome: Strengthened technical capacities and institutional framework for the National Forest Inventory and Satellite Land Monitoring System in support of REDD+ in Bangladesh. | NFI formally exists and produces data. | The RIMS unit of the FD has its own databases based on past inventories and systems. | NFI Unit is established under RIMS and is functional. | Official workshop held to announce NFI Consultants are hired | Buy in of the NFI SLMS by FD.<br>The MoEF institutionalize NFI in FD and provide it with financial and human resources to continue its mission beyond the project term.<br>Continuity of Government commitment and ownership in support of this initiative.<br>FD assigns the necessary staff on permanent basis to execute |
| | SLMS formally exists and produces data. | Links between and roles of SPARRSO, SoB, SRDI, DLRS, CEGIS not clearly defined. | SLMS is constituted under RIMS and coordinates the activities undertaken by the partners. | Activity report. | |

| Results Chain | Indicators | Baseline | Target | Means of Verification | Assumption |
|---|---|---|---|---|---|
| | | | | | NFI and SLMS and operate the forest and tree data base. |
| ***Output 1:*** General conditions to implement the national forest inventory and satellite land monitoring system are reinforced | Organization of meetings on NFI and SLMS. | Public consultations have been held to design NFI and SLMS for restricted audiences. | Quarterly information sessions are held with a large audience of stakeholders and results made public. | Minutes of sessions. | Competent consultants are recruited.<br>Data sharing agreement signed. |
| | No. of Technical trainings organized and number and level of national personnel/stakeholders trained and skills developed in forest resource monitoring, assessment and information/data management. | Capacities are scattered, trainees with good skills get attracted by other institutions / projects. | 20 in-country trainings for 300 personnel and 15 short/medium term trainings abroad for 75 personnel. | Project report about training courses and number of people having been trained and staying within the FD in duties related to NFI and SLMS activities | |
| | All inventory data are archived and accessible through a robust database management system. | Data are in different formats, with different legends, for different years. | One database enables to access all historical data | Archives in the database and number of queries to the database | |
| | Allometric equations are developed and tested. | Regional default values are used. | Specific national equations available by most common species & forest type. | Number of equations inserted in GAT. | |
| ***Output 2:*** NFI and SLMS strategy are reinforced | Mandates to implement NFI and SLMS are clear | NFI and SLMS don't exist. | NFI and SLMS mandate are accepted by all FD actors concerned by the national REDD+ process. | NFI and SLMS action regularly communicated (newsletter, FD bulletin). | Adequate institutional, procedural and legal arrangement to support data sharing and information flows.<br>Broad participation of stakeholders. |

| Results Chain | Indicators | Baseline | Target | Means of Verification | Assumption |
|---|---|---|---|---|---|
| | Participatory tools for forest monitoring are available. | 9 multi-stakeholder workshops held for the RPP submission >700 individuals consulted. | Participatory process ensuring regular consultation of all stakeholders and on-going buy-in. | Minutes of sessions. | FD works along project requirements and conduct a participatory process to reach a national consensus on NFI and SLMS approach and attaining project activities.<br>FD broadens participation of partners and stakeholders in development of NFI and SLMS process and reaching a stable approach to long term forestry resources monitoring.<br>Partners and Stakeholders work with FD to reach/develop a consensual approach and process for NFI and SLMS. |
| | Common Land Cover Classification system is adopted. | Several definitions and classification systems are being used in Bangladesh for different objectives. | One meta-language system allows integration and comparison of different classification schemes. | Number of definitions compliant to international processes that are integrated (set of rules) in the classification system. | |
| ***Output 3:*** NFI and SLMS are implemented | Multi-purpose NFI and SLMS designed. | One NFI was designed in 2005-2006 / RS products are usually sub-contracted to CEGIS/SPARRSO. | A long term, multi-purpose NFI, compliant with IPCC requirements is field validated and on-going / RIMS coordinates all activities of the SLMS. | NFI and SLMS designs published in a scientific journal. | Continuity of Government and donor's commitment in support of this initiative.<br>2. Adequate technical and computer skills.<br>3. Adequate participation and motivation from the participants.<br>4. Ownership by the Government and the stakeholders.<br>5. Enabling Policy Environment.<br>6. Competent consultants are recruited. |
| | LC / LU maps produced | FD performed National forest land use change monitoring in a limited scale with CEGIS. | LULUCF maps systematically produced by NFI / SLMS unit in cooperation with relevant technical entities. | Atlas exists, is publicly shared and activity data reported to UNFCCC are based on the atlas | |

| Results Chain | Indicators | Baseline | Target | Means of Verification | Assumption |
|---|---|---|---|---|---|
| | Field data collected and analysed. | Data collected for the 2005/2007 NFI, mangrove field data collected in 2010. | Data is collected, analysed and regularly updated on the web platform. | Number of plots visited<br>Field forms received with field data<br>Number of sample analysis done<br>Database recording<br>Final report of the Project results and findings. | 7. Adequate capacities build, ownership and permanency of staff for the preparation of the project proposal Trained manpower remain in the sector for a longer period of time so that sustainability does not erode.<br>8. FD personnel involved in the analysis of the results.<br>9 Logistical support provided and supervision done in systematic way as to harmonize data collection among field crews. |

### 2.5.2 Reporting

***Project Inception Report:*** It will be prepared by an FAO Inception Mission, in consultation with the FD, MoEF, other key stakeholders and implementing partners, and the donor (USAID), within one month of project effectiveness. The draft Inception Report will be shared with and reviewed by a stakeholder inception workshop, which will be followed by the first PSC meeting to endorse the First Annual Work Plan and Budget.

***Semi-annual Monitoring/Progress Report:*** During the Project's implementation period, CTA will prepare detailed Semi-annual Monitoring/Progress Reports using the agreed FAO format for donor-funded projects. The draft semi-annual progress reports will be circulated to project stakeholders for comment and review at the appropriate PSC meetings. The semi-annual monitoring/ progress reports will be finalised by CTA in consultation with NPC and submitted to the FAO Representation in Bangladesh, FAO/LTU, Rome and FAO/LT, RAP, Bangkok for approval. The approved Semi-annual Monitoring/Progress Report will be circulated to the MoEF, CCF and the donor (USAID).

***Terminal Report***: In the concluding month of the project, CTA will prepare a draft Terminal Report in consultation with NPC. The Terminal Report will be finalised by the FAO Representation in Bangladesh and LTU, and submitted to the Government of Bangladesh and the donor (USAID). Upon completion of the project, NPC will also prepare Project Completion Report (PCR) in IMED Format and will submit it to the CCF for onward transmission to the MoEF and IMED.

## 2.6 Communication

In accordance with the relevant provisions of the Financing Agreement between FAO and the donor (USAID), visibility and communication actions for the Project will be developed following firstly, the guidelines of the Government of Bangladesh and the donor and secondly, the communication strategies of FAO and its implementing partners.

## 2.7 Provision for evaluation

In-depth project evaluation is scheduled twice (Mid-term Evaluation and Final Evaluation) are for this project. The National Project Coordinator in coordination with the CTA will prepare and submit a Project Performance Evaluation Report (PPER) to FAO, the donor and the Government of Bangladesh at least one month in advance of each evaluation. Additional PPERs may be requested, if necessary, during the project implementation.

### *2.7.1 Mid-term Evaluation Report*

The Mid-term Evaluation (MTE) of the project will focus on progress, project impacts, assessment of compliance with the Financing Agreement between FAO and USAID, and MoUs/LoAs between FAO and implementing partners/service providers; identification of problems and constraints, formulation of appropriate recommendations for corrective actions and development of revised project implementation schedule for effective implementation of the interventions, etc.

This Mid-Term Evaluation will be undertaken when delivery will reach 50% of the initial total budget and/or mid-point of scheduled project duration, to review efficiency and effectiveness of implementation in terms of achieving project objective, outcomes and delivering outputs. The MTE will be instrumental for contributing through operational and strategic recommendations to improved implementation for the remaining period of the project's life which will include an assessment of SilvaCarbon support to date.

### *2.7.2 Final Evaluation Report*

An independent Final Evaluation will be completed within six months prior to the actual NTE date of the project. It will aim at identifying project outcomes, their sustainability and actual or potential impacts. It will also have the purpose of indicating future actions needed to assure continuity of the process developed through project activities.

### *2.7.3 Project Completion Report*

It will be prepared by FAO and the MoEF within six months of project completion for final submission to the Government of Bangladesh and the donor (USAID).

# SECTION 3: SUSTAINABILITY OF RESULTS

The project focuses on assisting the GoB to develop a national database and information system on Forests and TOF and promises to strengthen the capability of FD to collect, analyse, update and manage the forestry resource information for planning and sustainable management of the forestry resources and REDD+ MRV. It will further help in meeting country's obligations of reporting to the international processes including GHG reporting and expected REDD+ MRV and linking NFI results to the national policy and planning processes.

In order to ensure the sustainability of the project results in the future, FD will work to develop, consolidate and expand its programme of continuous forest inventory, assessment and monitoring. Under this project and with the help of the international assistance, FD will work to develop an innovative approach for resources assessment and monitoring and to introduce new concepts and technologies. FD will work to set up a permanent specialised NFI Unit and lasting programme of resources monitoring and information management on the basis of the nationally accepted approach and the developed capacity. The NFI Unit will be established during the first year of the project. The organization will ensure that the trained personnel will remain under the programme and continue to receive the necessary technical and financial support from the Government.

Briefly, it is envisaged that the project will yield sustainable results because the root causes of FD's weak NFI and SLMS capacity are addressed at the individual level, through a capacity development programme and at the organizational level, through provision of support to creation of NFI Unit and establishment of Satellite Forest Monitoring process in the RIMS Unit of the FD. These areas of interventions, as they relate to sustainability, are more fully described below.

## 3.1. Capacity building at individual level

Sustainability of NFI and SLMS results depends on systematic capacity building of the individuals holding technical positions within the FD and other partners' organization. Individuals working in newly proposed NFI Unit, RIMS Unit and Management Plan Divisions, Inventory Division of BFRI, SPARRSO, Research Organizations, Survey Organizations, etc. fall under this stream, and the nature of their work is primarily

technical. They will contribute the most even after the project resources are discontinued since the trained staff will remain in their respective positions for extended period of their assignments.

The second group of beneficiaries represents field level staff working during NFI at the different divisions within the FD. They are expected to remain in the FD for longer period of time and contribute significantly during the life of the project and beyond.

The third group represents the senior officials at policy level who benefit from short-term training and participation in workshops, seminars, meetings, etc. related to forest Assessment and monitoring. They will contribute significantly towards organizational policy and strategy required for the improvement NFI and monitoring system.

Individuals/stakeholders of the entire Environment, Forestry and Climate Change Sectors will accrue benefit from exposure through project-sponsored workshops, training and special studies, and their future involvement will contribute to sustainability of results. Individual capacity development will be focused on those who are likely to remain with the technical arms of the FD in the medium to long terms. All individual capacity development issues will take account of any existing gender inequalities and attempt to ensure an appropriate gender balance.

## 3.2. Organizational strengthening

Experience reveals that support to the new NFI Unit in the FD, RIMS Unit, and MP Divisions could face difficulties after the project inputs cease since GoB approval to convert project posts into revenue posts may take some time. However, in the case of this project there is better chance of sustainability of reforms since it will contribute significantly to generate information for planning and sustainable management of the forest resources, contributing to climate change sector by providing data support for REDD+ interventions in the country and meeting country's obligations of reporting to the international processes including GHG reporting and expected REDD+ MRV.

It is in the interest of the GoB to sustain the NFI Unit with improved and efficient management structure in order to generate quality information on forest resources that will help to bring investment support from development partners to the EFCC sectors, particularly the forestry sector. The project design envisages a built-in mechanism to facilitate a continuous dialogue between donor, FD officials, MoEF officials and other stakeholders through the provision of regular PSC meetings, consultations/workshops to deliberate on the NFI process for which the FD's strong leadership is warranted. The provision of a Project Steering Committee chaired by the Secretary of the MoEF is another mechanism envisaged in the project to ensure sustainability of key organizational reforms in support of permanent NFI Unit in the FD.

## 3.3. Transfer of appropriate technology

The transfer of an appropriate NFI technology and Satellite Forest Monitoring will be sustained as it falls under clearly expressed priority needs of the FD. The support to strengthen digital database infrastructure are twinned with adequate training of staff and technical advisory services Therefore, it is in the interest of the FD to sustain the system and associated technical capacities developed through the project support after the termination of the project.

Adequate provisions for different levels of training have been built into the project design to ensure sustainability of transferred technology. Partnership with training and research institutions through Letter of Agreement/Memorandum of Understanding are expected to reinforce country capacity to sustain local training and research in the future.

Activities contributing to the institutionalization of knowledge are key measures to ensure the sustainability of the outcomes of this project. The establishment of long-term linkages and development of partnerships with international and/or regional institutions to provide technical support and exchange of knowledge should enhance sustainability of the training program.

In particular, it is envisioned that addressing the requirements for the new NFI Unit, reinforced RIMS Unit and Management Plan Divisions for continuous forest inventory and monitoring, information management and documentation will require a consistent effort that will last beyond the project period.

# APPENDICES

## Appendix 1: A snap-shot of past inventories in Bangladesh

**Sundarban Reserved Forests:** The Sundarban Reserved Forest (SRF) is considered as the largest contiguous mangrove of the world. Inventories of SRF resources have been made since 1931 under different projects and programmes. Messrs. Ritchie, Richards and Martain carried out the first survey of the Sundarbans, during 1769-1773. In 1821-23, Lt. Prinsep surveyed the boundary between the forest and cultivated areas from the Hoogly to the Jamuna Rivers. Between 1905 and 1908, the Sundarbans was surveyed in detail by the Survey Department of the province of Bengal. FORESTAL (Forestry and Engineering International Ltd. Canada) initiated the inventory survey in January 1958, based on new aerial photography, photogrammetric techniques and statistically controlled ground sampling. Overseas Development Administration (ODA), Land Resources Development Centre, England carried out an inventory of the Sundarbans during 1983-84. An assessment of the land cover changes for SRF was also done using the Landsat TM and ETM imagery of the year 1989, 1999 and 2009 under USAID-funded Integrated Protected Area Co-management (IPAC) project. An assessment and monitoring of the SRF using Geo Eye imagery of 2010-11 was done by Resources Information Management System (RIMS) Unit of Forest Department during 2012-13 under the Climate Change Trust Fund assisted Forest Information Generation and Networking System project

**Coastal Plantations:** The FD has been establishing mangrove plantations since 1961 along the coast and in the off-shore islands. In 1986 an inventory was carried out of the maturing mangrove plantations (established prior 1980) of the coastal afforestation project. Landsat imagery of 1984, 1986, 1988; SPOT imagery of 1989 and infrared coloured aerial photographs of 1990 was used for assessment and mapping with assistance of SPARRSO under the World Bank funded *Second Forestry Project* (SPARRSO 1993). Hard copy maps later were subsequently digitised by RIMS Unit and archived. An inventory on the mangrove plantations was conducted in 1996 using the aerial photo of 1994 under a World Bank funded FRMP project. Rapid Eye imagery of 2010-11 was used for the assessment and monitoring of coastal plantations under the Forest Information Generation and Networking System project of *Climate Change Trust Fund* of the Government.

**Sal (*Shorea robusta*) Forests:** This type of forest located in the central and north-western parts of Bangladesh) was inventoried during the period from November 1999 to May 2000 under ADB funded Forestry Sector Project. SPOT 4 images of 1999 were procured during 2000 to assess the forest areas but the assessment work was not completed due to lack of FD's capacity to process those imageries. The current state of the forest was assessed in 2012 with the help of Geo Eye imagery of 2010 -11 by the RIMS Unit of FD under *Climate Change Trust Fund financed* Forest Information Generation and Networking System project.

**Hill Forests:** FORESTAL (Forestry and Engineering International Ltd.) of Vancouver, Canada carried out an inventory of the Kassalong, Rankhiang and Sangu-Matamuhuri Reserved forests in Chittagong Hill Tracts was conducted during 1961-63 by use of aerial 1958 aerial photographs.

In 1983 - 84 the ***Kassalong and Rankhiang Reserved Forests*** were re-evaluated under FAO/UNDP Project BGD/79/017 "Assistance to the Forestry Sector of Bangladesh" with the help of 1:15,000 aerial photographs taken in January-February, 1984.

An evaluation of the ***Sangu-Matamuhuri Reserved Forests*** was carried out with the help of 1984 aerial photographs in the 1: 50,000 scale under UNDP/FAO project BGD/79/017.

***The Sitapahar Reserved Forest*** was inventoried under FAO/UNDP Project BGD/79/017 in 1983 - 84.

Forest Inventory Division of the Bangladesh Forest Research Institute, Chittagong carried out an inventory of ***Pulpwood Plantations (1974-1981), Kaptai*** during 1981-82.

In 1983 an inventory was carried out of the mixed hardwood/teak plantations in Chittagong and Cox' Bazar forest divisions with the help of aerial photographs, taken in January-February 1982. During the period

from August 1984 to July 1985 an inventory was carried out of the high forest in these two divisions with the help of 1982 - 1: 50,000 aerial photographs. In 1986-1987 an inventory was carried out of the forest resources in the southern part of Sylhet Forest Division with the help of 1984 limited aerial-photographs in the scale of 1:50000 and 1987 - SPOT satellite imageries. Aerial photography of 1995 was used for the assessment and inventory of these forest areas during 1996-97 under Forest Resources Management Project. GIS maps and management plans were prepared at that time. SPOT imagery of 1996 was used to identify the areas and land use classes for the Hill forest of greater Sylhet district under FRMP. In 2012, the hill forests in Chittagong and Cox's Bazar was assessed and land cover map was prepared by use of Geo Eye imagery and similar activities were implemented for forests in Chittagong Hill Tracts and Sylhet by use of Rapid Eye imagery under Forest Information Generation and Networking System project of the Forest Department.

**National Forest and Tree Resources Assessment:** FAO, at the request of its member countries, regularly monitors the world's forests and their management and uses through the Forest Resources Assessment Programme. Under the auspices of Global Forest Resources Assessment (GFRA), Bangladesh Forest Department implemented a technical cooperation project namely "Strengthening Capacity to Generate Quality Information on Forest Resources (TCP/BGD/3001)" during 2005-2007 with the technical and financial assistance from FAO of the UN. Under this project, the first National Forest Assessment (NFA) was conducted both in forests and Trees Outside Forests (TOF) areas whereby earlier management inventories were confined within the designated forest reserves only. Topographical sheets of 1: 50,000 scale maps produced by the Survey of Bangladesh were used to delineate the tracts. A globally harmonised classification system was developed and five major land use classes were identified for the inventory. Bangladesh Space Research and Remote Sensing Organization (SPARRSO), responsible for the remote sensing survey, employed Landsat TM data from 2005 for mapping the land uses and forest types. The overall technical supervision of the NFA implementation was provided by FAO Forestry Department in Rome (FOMR), who also provided technical assistance to the GoB to strengthen the capacities of the Forest Department in the area of planning and implementing NFAs, including methodology development, sampling design, harmonization of land use classifications, mapping, field survey, data management and reporting. The NFA was guided by remote sensing analysis as well as ground inventory with 296 sampling plots all over the country. Further, the inventory enumerated national land use area, growing stock, biodiversity and regeneration, social and economic aspects of forests and trees and biomass and carbon as per guidelines of FAO.

Till the launching of this NFA program, no inventory was carried out at a time all over the whole country with the same methodological approach to capture data on all the various land use patterns. The NFA approach is basically tagged with the land use aspects, with special emphasis to collect information on forests and tree resources, their uses and users, irrespective of its ownership, public or private. Thus for the foresters in Bangladesh this is a new approach.

The FRA 2010 of Bangladesh was conducted based primarily on the 'National Forest and Tree Resources Assessment 2005-2007' and supplemented with national data generated by the Forest Department

**Forest Carbon inventory for the natural mangrove:** FD has an experience on carbon inventory on SRF under the USAID-funded IPAC project during 2010. The carbon inventory methodology followed a similar sampling design and data collection methodology that was used in forest inventory of 1995 for the forest. FD staffs and other team members were trained in field data collection, data recording, standardized measurement procedure/techniques, field plot layout, soil sample collection by the project prior to starting the inventory. The result on total carbon and carbon per hectare was derived from the conversion of aboveground biomass to carbon, based on the assumption that 50% of the tree biomass is comprised of carbon. All these figures need to be verified by more detailed assessment of carbon stock and detailed analysis of past data. The detailed assessment and analysis of carbon stock will be required during NFI to develop a credible national baseline.

**Chunoti Wildlife Sanctuary (WS) Carbon Inventory:** Chunoti WS carbon inventory was conducted during 2008 by Inventory Division of BFRI. Soil organic carbon, above-ground biomass, below-ground biomass, and on-ground biomass were measured for the WS. The forest inventory data was analyzed for estimating growing stock in terms of volume, biomass and carbon stock changes in baseline and mitigation scenario for different reforestation technologies.

**Forest Carbon Inventory for Protected Areas (PAs):** The USAID funded IPAC project of FD conducted Carbon inventory for six PAs (Medakchapia NP, Fashiakhali WS, Dudpukuria-Dhopachari WS, Inani NP, Sitakunda Eco-park and Teknaf (WS).

**Village Forest Inventory:** Village Forest Inventory was conducted in 1980-81 under FAO/UNDP Project BGD/78/020 "Village Forest Inventory". Re-measurement was carried out in 26 villages during April-August 1984 under UNDP/FAO Project "Assistance to the Forestry Sector". Forestry Master Plan Team made a survey in order to cross-check the previous results.

Beside assessment of different forest areas by the FD, there are other government, autonomous and private or trustee organisations such as SPARRSO, SoB, BWDB, CEGIS, BCAS etc. are engaged in mapping the land uses by the application of remote sensing.

## Appendix 2: Terms of Reference

### Chief Technical Advisor (P-4)

A national forestry Inventory and satellite forest monitoring project has been designed with the support from FAO for implementation with funding by the USAID and in-kind contributions from the Government of Bangladesh.
Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, in coordination with the NPC from FD, the CTA will lead the implementation of the project and provide the lead technical assistance and support to FD in the areas of capacity building, institutional strengthening, planning and implementation of the project. The main tasks of the CTA will be to:

- Assist in the recruitment of the national and international consultant/staff and their deployment within the project and oversee their activities.
- Prepare, in collaboration with the NPC, an updated detailed work plan for the project and submit it to the PSC for review.
- Work closely with the NPC and the other national counterpart personnel to implement the project activities as planned.
- Work closely with the SilvaCarbon Country Coordinator to ensure complementarity between the project and SilvaCarbon activities.
- Work closely with the NPC to refine the approach to national forest and tree resources assessment based on the FAO approach to NFAs and taking into consideration the forest inventory methods applied in Bangladesh.
- Assist the NPC and the other national counterpart personnel in elaborating a training programme to the national staff assigned for the implementation of the office and in field activities.
- Assist the national counterpart personnel and other national and international personnel to strengthen FD for future monitoring of the resources and information management.
- Assist FD in planning, running and servicing the workshops and seminars/training planned in the project (informative seminar , workshops on the NFA approach, information and capacity building needs, land use classification system, project findings, etc).
- Assist in securing wide consultation to establish national consensus on the NFA approach and long term monitoring process.
- Assist in selecting and procuring equipment and supplies for the forest inventory component of the project.
- Assist in organising and supervising the fieldwork for timely implementation of the activities.
- Assist in supervising the mapping activities and deployment of the needed resources.
- Assist in developing and setting up the national database and deployment of the resources.
- Provide supervision to the field crews during the survey and provide technical guidance as to homonise data collection and interpretation of variables and definitions. All teams will be closely followed during the start of the fieldwork.
- Prepare in collaboration with the NPC periodic progress reports project for submission to FAO and the Government of Bangladesh as well as the Terminal report of the project.

- Assist in any other tasks under the project at the instruction/advice of the FAOR/CCF/Project Steering Committee.

**Duration**: 48 months
**Duty Station**: Dhaka, Bangladesh and travel inside the country
**Qualification**: The Expert should have advanced University Degree in Forestry or related field, at least 15 years of relevant experience in the field of forest resources monitoring and assessment, relevant experience in developing countries, strong background in remote sensing, forest inventory design and planning and in forestry policies. He/She must be competent in satellite forest monitoring, forest information system development and information management and have confirmed experience in capacity building and project implementation.
**Language**: English

## International Consultant: Forest Inventory and Carbon Assessment

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, in coordination with the NPC from FD, the international consultantwill provide the technical assistance and support to the FD in the areas of planning of NFI, volume, biomass and carbon assessment, capacity building, institutional strengthening and mapping. The main tasks of the consultant will be to:

- Work with the national team from the FD and related NFI Institutions to contribute in review of the inventory methodology, vegetation classification, and biophysical and socio-economic variables.
- Assist in supervising interpretation of satellite imagery using the harmonised vegetation classification and the production of the landscape maps of the selected sites.
- Review the methods and protocols used for the national forest assessment 2003-2004 and provide recommendations on improving the national forest inventory design and field measurement methods.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- In collaboration with the NFI Institutions, support the implementation of a national consultation on the objectives of the national forest inventory.
- In collaboration with the NFI Institutions and the international REDD+ consultant, identify the parameters and variables to be considered and identify their priorities.
- Propose options for national sampling design taking into consideration costs, ecological zones, accessibility and accuracy aspects, possible comparability to past data, and reporting requirements under the UNFCCC.
- To provide recommendations on the basis of stakeholder discussions on findings and design considerations.
- To complete the Multipurpose NFI Design for Bangladesh as part of national forest monitoring system and the future forest carbon stocks and stock changes assessment in accordance with the guidelines under the UNFCCC.
- In collaboration with the national and international consultants, prepare field manual protocols and data collection procedures.
- Assist in supervising interpretation of satellite imagery and the production of the necessary maps/Atlas.
- Prepare in collaboration with the national consultants and Backstopping experts from FAO, a training programme for the field personnel involved in the project and assist the CTA/FD in implementing it.
- Participate in implementing the training programme to the field crews and database personnel through the planned workshops and courses.
- Assist FAO and FD in purchasing, installing and using the equipment and supplies planned for the project.
- In close collaboration with the national consultants, prepare a plan of the project activities
- and identify timely inputs from the project and the Government.
- Provide supervision to the field crews during the survey and provide technical guidance.
- Prepare quality assurance methods.

- Homogenise data collection and best interpretation of variables and definitions.
- Frequent visits to all crews must be carried out throughout the assignment of the expert;
- Work closely with the International and national data base consultant to develop and set up a database.
- Assist in encoding, validating and storing the field data; prepare functions for data processing and initiate data processing together with the Biometrician.
  Assist in data analysis, reporting of findings and elaboration of the project terminal statement.
- Assist in carrying out forest volume, biomass and carbon assessment activities prepare a terminal report at the end of the recruitment period describing all the works performed.
- Assist in any other tasks under the project at the instruction of the FAOR, CTA and NPC.

**Duration:** 24 months
**Duty Station:** Dhaka, Bangladesh with frequent field trips
**Qualifications:** The Expert should have advanced University Degree in Forestry or related field, at least 5 years of relevant experience in the field of national forest resources monitoring and assessment and volume, biomass and carbon assessment. The Consultant should have a strong background in remote sensing, forest inventory design and planning in developing countries. The consultant must be competent in forest information system development and information management and have confirmed experience in capacity building and project implementation.
**Language**: English

## International Consultant: REDD+

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, in coordination with the NPC from FD, the international consultantwill provide the technical assistance and support to the FD in the areas of planning of NFI, volume, biomass and carbon assessment, capacity building, institutional strengthening and mapping. The main tasks of the consultant will be to:

- In close colalboration with the national team from the FD, related NFI Institutions, SilvaCarbon, the UN-REDD programme, provide technical guidance and advice on the development and implementation of the national forest inventory to support the national forest monitoring system and reference emission level(s) for components of national REDD+ Roadmap;
- Provide support to the training activities on international conventions and particularly on REDD+ requirements under the UNFCCC;
- Support technical decisions on issues related to national definitions of forest, land cover/use classifications, mapping of national forest and forest stratification;
- Ensure that the National Forest Inventory activities and outputs contribute to the preparation of the GHG inventory for the LULUCF/AFOLU sector;
- In collaboration with NFI institutions, supervise the preparation of the necessary methods for the assessment of country-specific emission factors;
- Provide options for the national forest inventory to provide information on the REDD+ safeguards;
- Provide recommendations for the sustainability and transparency of the national forest monitoring system;
- Provide technical support on the development of a functional satellite forest monitoring system based on available satellite imagery and national technical, financial and human resources;
- Support national and subnational consultations with relevant stakeholders on NFMS development and implementation;
- Facilitate and support government officials in the organization and delivery of training of national staff involved in the national forest monitoring system (MRV, IPCC, National Forest Inventory, GHG Inventory, Forest Monitoring System);
- In close collaboration with Silvacarbon and the UN-REDD programme, support the design and deliver stakeholder awareness raising and communications materials on the national forest inventory, MRV and RELs/RLs development and implementation;
- Organize meetings and consultations with relevant stakeholders;
- Work closely with partners in Bangladesh and elsewhere to ensure coordination and complementarities in the implementation of the UN-REDD National Programme, in synergy with regional and international initiatives;
- Perform other technical and operational duties, as necessary.

**Duration:** 20 months
**Duty Station:** Dhaka, Bangladesh with frequent field trips
**Qualifications:**
The Expert should have a post graduate degree in Forestry, Environmental Science or a closely related field, at least 5 years of work experience on forest inventory, forest monitoring and/or forest management

in developing countries, Excellent knowledge of climate change negotiations, REDD+, MRV procedures and methodologies under the UNFCCC, proven experience relating to forest inventory, remote sensing and GIS in developing countries, proven track record of supporting, advising and collaborating with government institutions in developing countries, proficiency in both spoken and written English, and strong inter-personal skills and excellent oral communication skills.
**Language**: English

## International Consultant: Database Management Specialist

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, in coordination with the NPC from FD, the Database Management Specialist will provide the training to the national personnel, planning and implementing the activities in connection with the creation of the Forest Inventory Information System (FIIS). The main tasks of the Consultant will be to:

- Prepare an inception report.
- Collect and review comprehensively all existing forms of record keeping systems and relevant documents.
- Examine the existing data base systems, information management systems and computer facilities within FD and other relevant institutions if needed, etc, and propose actions for a unified functional and practical system integrating the information produced by the different institutions involved in the project.
- Assist in specifying and procuring equipment and supplies for the Forest Inventory Information System (FIIS).
- In close collaboration with the national counterpart personnel, design a preliminary database structure and present it for review and comments by concerned parties (professionals from forestry and other concerned institutions).
- Finalise the FIIS structure on the basis of comments/recommendations of reviewers.
- Set up a functional database and FIIS and train the national personnel on its design, operation and maintenance.
- Prepare a descriptive paper of the structure and functions of the database and the FIIS.
- Work closely with the Forest Inventory Consultant and the Biometrician to review existing volume tables/allometric Equations and other functions for computation in the database.
- Provide trainings to national staff on data management and database development to ensure the sustainability of the system.
- Prepare and submit end of consultancy report.
  Assist in any other tasks under the project at the instruction of the FAO Representative, the LTO,The CTA and the NPC.

**Duration:** 3 months
**Duty Station:** Dhaka
**Qualifications:** The consultant should have at least M.Sc. in information technology and a minimum of 5 years' experience in database development and information management. The consultant should be conversant with the knowledge of forest inventory data management, forest statistics, management of GIS and remote sensing data. Experience in developing countries is a strong asset.
**Languages:** English

## National Project Coordinator

A national forestry resources monitoring and assessment project has been designed with the support from FAO for implementation with funding by the USAID and in-kind contributions from the Government of Bangladesh.

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts,the National Project Coordinator (NPC) will assume managerial responsibility of the project, facilitate its smooth implementation and will report to CTA and coordinate the project activities with the CTA and CCF, FD. The main tasks of the NPC will be to:

- Promote, liaise and maintain close working relationships with the national institutions administrative Offices of the Conservator of Forests/Divisional Forest Officers to ensure wide participation of the implementation of the project activities.
- Prepare and update in conjunction with the CTA a detailed annual and quarterly work plan for project implementation. The preparation of workplans will be subject to consultations with the Project Steering Committee and the CCF, FD, or if required by FAO, MoEF or the Donor.
- Implement the work plans in accordance with the project requirements. In close coordination with the CTA, the LTO at Bangkok and the FAO/Dhaka, ensure timely delivery of equipment, recruitment, placement of consultants and reporting by them, selection of personnel wit the adequate technical preparation and skills for training courses, study tours and other training activities, arrangement and fieldwork activities and project reporting.
- Facilitate the nomination of the national counterpart professionals to the international experts.Supervise, guide and monitor all personnel, including experts and consultants, in the project implementation.
- Monitor the progress of establishing a NFI Unit and ensure that the development is on track, proper papers are being filed and Government strategy of setting up a permanent NFI Unit adequately manned and mandated is realised.
- Ensure that all reports, manuals and other documentation prepared by experts and their counterpart are of high quality.
- Plan and supervise the planning, implementation and monitoring processes of project activities.
- Monitor the progress of the training of the national counterpart professionals.
  Ensure that all Government facilities and inputs to the project (e.g. office accommodation andadministrative assistance, equipment, training and personnel) are available when required and are used by the project.
  Facilitate the preparation and finalization of data sharing agreement if necessary.
- Arrange the travel and coordination arrangements for international training and study tours.
- Arrange internal travel in Bangladesh for international experts and their counterparts to the regions in accordance with the project needs.
  Liaise with other projects that are active in the implementation of the national forestrydevelopment programme.
- Arrange and supervise all workshops, training courses, seminars and fieldwork that are required for project implementation.

- Assume responsibility for the submission of all project reports to CTA and CCF, FD in a timely manner.
- Prepare periodic reports for the Project Steering Steering Committee, Project Review Missions, MoEF and FAO as required by the Project Document, including a terminal report.
- Assist in any other tasks under the project at the instruction of the FAOR, CTA and NPC.
- Assist in project and SilvaCarbon coordination.

**Duration:** 4 years.
**Duty Station:** Dhaka with travels in the country.
**Qualifications:** A university degree, preferably at Masters Level, in Forestry with experience of at least 15 years of practical experience in Bangladesh in forest management, forest assessment/inventory, project management. The NPC must have an extensive knowledge of forestry and project management/administration.
**Language:** English.
**Appointment:** The National Project Coordinator will be selected and appointed by the Government and will work Full Time on the Project

## National Consultant: Forest Inventory and Carbon Assessment Expert

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, in coordination with the NPC, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, the National Forest Inventory Expert will provide the technical assistance and support to FD in the areas of capacity building, institutional strengthening, planning and implementation of NFI project. The main tasks of the Expert will be to:

- Prepare an inception report and submit it to CTA and NPC.
- Work with the national team from FD, NPC and CTA to set up the NFI Unit for which the mandate, organisation and needs will be defined. The mandate of the NFI Unit includes wide range of tasks e.g. updating information, initiating NFIs, disseminating information to users, training national staff, defining inventory norms, and methods, helping in defining government policy in information generation, resources monitoring, knowledge management, etc.
- Work closely with the CTA and the NPC to prepare work-plans for implementation of the project activities following the participatory approach where professionals, scientists, and stakeholders from the different sectors must be involved.
- Work closely with the national personnel and international experts and provide inputs for the elaboration of the training programme to be given to the national staff involved in the project and assist FD in implementing it.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- Participate in implementing the training programme to the field crews and database personnel through the planned workshops and courses.
- Assist FD in planning and servicing the workshops throughout the project and securing wide participation of stakeholders from the different sectors.
- Work with the professionals from the different sectors and scientists, and in close collaboration with the NPC, CTA and consultants, to reach a consensus on the NFI approach and long term monitoring.
- Assist in coordinating the efforts of FD to define the information needs and harmonise the land use classification.
- Assist FD in purchasing, installing and using the equipment and supplies foreseen for the project.
- Organise the fieldwork including composition of the field crews, their assignment to their sampling.areas with the transport, field equipment, field forms, etc, and provide the necessary logistical support.
- Provide supervision to the field crews during the survey and provide technical guidance as to homogenise data collection and best interpretation of variables and definitions. All teams should be closely followed during the start of the fieldwork.
- Assist in organizing and filing field crew outputs.
- In close collaboration with NPC and CTA, assist in developing the national forest database, entering/storing the field data, preparing functions for data processing and be part of the data processing together with the Biometrician.
- Carry out Carbon assessment
- Assist in data analysis and reporting of findings. Participate in preparing the project progress reports.
- Assist in any other tasks under the project at the instruction of the NPC and CTA.

**Duration:** 24 months
**Duty Station:** Dhaka, with frequent travels inside the country
**Qualification:** The Expert should have advanced University Degree in Forestry or related field, at least 10 years of relevant experience in the field of forest resources monitoring and assessment, carbon assessment, strong background in forest inventory design and planning. He must be competent in forest information system development and information management and have confirmed experience incapacity building and project implementation.
**Languages**: English

## National Consultant: Biometrician and Data Processing Expert

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, in coordination with the NPC, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, the Biometrician and Data Processing Consultant will provide the technical assistance and support to FD in the areas of capacity building, institutional strengthening, and data processing and analysis. The main tasks of the consultant will be to:

- Prepare an inception report.
- Conduct analysis of information needs for Bangladesh for transparent, accurate, consistent, complete and comparable forest estimates, in line with the guidelines of the Intergovernmental Panel on Climate Change.
- Conduct analysis of gaps in biometric information.
- Prepare a work plan with prioritization of actions.
- In co-operation with international experts and national institutes, design and conduct studies aiming to fill in gaps in information to meet the reporting requirements of IPCC. The topics cover the subjects but not limited to: tree species list, wood density, allometric equations, biomass expansion factors, root /shoot ratios, carbon conversion factors for country's native tree species by ecological zones.
- Sort, process, analyse and validate the collected data in coordination with the NPC and National Forest Inventory and Carbon Assessment Consultant.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- Analyse the forest inventory data in accordance with the agreed strategy for producing results and statistical calculations and store the findings in an easily retrievable format.
- Refine the analysed data and compile the relevant sections of the report for submission to the Government and to FAO and the donor. This work will be done on the basis of the recommendations from the workshop on the project findings.
- Assist the national staff in sorting and processing the collected data to meet the needs of the FD and generate the expected results. Ensure that the FD counterpart personnel fully understands all the work processes related to extracting, sorting, processing and analysing the collected data so that future repetitions will be possible with the FD's own capacity.
- Support the preparation of country specific emission factors and accuracy assessment.
- Develop a manual for data processing and analysis emphasizing on harmonizing project results in the country and with international information requirements.
- Assist FD in the areas of capacity building, institutional strengthening, and data processing and analysis.
- Provide trainings to the national team in data processing and analysis.
- Report any technical problems related to the data and the Information System/Database to the FD counterpart and to FAO.
- Describe all the work performed in the form of a terminal report at the end of the recruitment period. The report should contain: i) ample descriptions of the methods used to validate and process the field data to allow for accurate future repetitions of the work; and (ii) recommendations for possible

improvements of the database application including a description of any technical problems and any 'bugs' encountered during the work.

Assist in any other tasks under the project at the instruction of the FAO Representative, the LTO, the CTA and the NPC.

**Duration:** 4 months.
**Duty station:** Dhaka
**Qualifications:** At least M.Sc. level in Forestry, Biology, or Natural Sciences. The consultant should have a strong background in biometry, information system development, database management, statistical analysis, forest inventory and be familiar with MS Access database application at an advanced level. At least 10 years of relevant working experience is required.
**Language**: English

## National Consultant: Remote Sensing and GIS

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, in coordination with the NPC, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, the consultant for GIS and Remote Sensing will provide the technical assistance and support to the Forest Department in Bangladesh in the areas of GIS, mapping and Remote Sensing analysis. The consultant will participate in the training of the project personnel and supervise project activities in connection with forest/land mapping and remote sensing. He/she will participate in the development of methodology for mapping, supervise the classification and interpretation processes of the satellite images, supervise field checking and validation of the interpretation, and will ensure that the interpretation team has the necessary logistical support. The main tasks of the consultant will be to:

- Prepare the inception report
- Depending on their availability and data sharing agreements, collect available RS materials and organize archiving and safety copies of materials in FD.
- Support the preparation of an index map of available satellite images in Bangladesh.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- Examine the existing thematic maps on forestry and other land uses and assess their quality in terms of thematic details, dates of production, methods of production, and precision.
- Provide recommendations on their use in the context of a transparent national forest monitoring system.
- Participate in defining the harmonized land use classification.
- Define the specifications of the land cover/use map to be produced and methodology to be applied.
- Define the specifications of the remote sensing data needed and help their procurement. Use should be made of existing data and resort to purchase only if the existing data is judged not suitable or incomplete.
- Assist in planning and organizing satellite image classification and interpretation including field checking and validation.
- Provide training to the national personnel in forest/land cover/use mapping and change detection.
- Oversee the entire image interpretation activities including field checking and finalization of the interpretation.
- Support the preparation of manual for acquisiton of field calibration and validation data.
- Validate the interpretation results, produce a final map based on the harmonized legend and generate statistical results on areas of the different land use units.
- In close collaboration with International NFI Expert, the National Forest Inventory and Carbon Assessment Consultant, CTA and NPC, prepare mapping storage system.
- Work with the relevant International and National consultants to reinforce the FD in in strengthening the specialized RS and GIS Unit for resources monitoring and information management.
- Prepare and submit final consultancy report describing the planned activities, the method followed for land use mapping, training programme and beneficiaries and results of the mapping work and the results achieved.
- Assist in any other tasks under the project at the instruction of the FAO Representative, the LTO, the CTA and the NPC.

**Duration:** 6 months.
**Duty Station:** Dhaka with frequent travel inside the country.
**Qualifications:** The consultant should have at least M.Sc. in RS/GIS techniques. The consultant should have at least 10 years of experience in forest mapping related activities by using RS/GIS techniques. The consultant should be conversant with the knowledge of forest inventory, Remote Sensing (RS), Geographic Information Systems (GIS), Mapping and Remote Sensing.
**Language:** English.

## National Consultant: Capacity Building in Forest Inventory

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, in coordination with the NPC, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, the consultant, in collaboration with the national authorities and with national consultants and personnel, will provide the technical assistance and support to the FD for the training of national personnel, planning and implementing the project activities. The main tasks of the consultant will be to:

- Prepare, in collaboration with the international and national consultants and Forest Department (FD) Experts, a training programme for the national personnel involved in the project and assists the FD in implementing it.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- Participate in implementing the training programmes to the national personnel including the team of supervisors, the field crews and database personnel through the planned workshops and training courses.
- Assist the FAO and FD in purchasing, installing and using the equipment and supplies planned for the project.
- Work with the national personnel and the international and national consultants to reinforce the FD in strengthening the specialised National Forest Inventory Unit for resources monitoring and information management.
- In close collaboration with the national and international consultants, prepare a plan of the project training activities and identify timely inputs from the project and the Government.
- Provide supervision to the field crews during the survey and provide technical guidance to homogenize data collection and best interpretation of variables and definitions. Frequent visits to all crews must be carried out throughout the assignment of the expert.
- Work closely with the national data base management specialist to chalk out and implement a training programme how to develop and set up a database, how to enter, validate and store the field data, prepare functions for data processing and initiate data processing.
- Prepare and submit final consultancy report describing the planned training activities, the method followed for training programme and beneficiaries and results achieved.
- Assist in any other tasks under the project at the instruction of the FAO Representative, the LTO, the CTA and the NPC.

**Duration:** 18 months.
**Duty Station:** Dhaka with frequent field trips.
**Qualifications:** The Consultant should have a strong background in GIS/ remote sensing, forest inventory design and planning. The consultant must be competent in forest information system development and information management and have confirmed experience in capacity building and project implementation.
**Language:** English

## National Consultant: Communication and Public Relation

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, in coordination with the NPC, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, the the consultant will provide the technical assistance and mass communication and public relation support to the Forest Department in the areas of capacity building, National Forest Inventory Web Portal development, dissemination of information and data sharing. The main tasks of the Expert are to:

- Review of existing Forest Inventory materials (data, reports, maps, photos, etc).
- Processing of materials (photos, maps, documents, statistics, and other materials) for the
- Information CD and Web Portal in co-operation with the international experts and a local ICT Service Provider.
- Prepare communication materials to inform the local stakeholders on the national forest inventory.
- Processing of materials to be printed (posters, leaflets, etc).
- In consultation with CTA and NPC, prepare a complete "Information Dissemination Plan" which contains identification of potential recipients and beneficiaries of Inventory materials in ministries, organisations, Forest Circles/Divisions and institutions (e.g. schools, NGOs), budget, and timetable.
- Assist the FD, in co-operation with the International experts to design visually attractive and functional user interface and content forForest Inventory Portal and for Inventory Information CD/DVD (also a cover page for Inventory CD/DVD).
- Co-operate with the technical ICT Service Provider in all technical matters concerning the development of the portal and multimedia-CD/DVD.
- To provide guidance and training to the staff in FD, and to the project stakeholders.
- assist in any other tasks under the project at the instruction of the FAO Representative, the LTO, the CTA and the NPC.

**Duration:** 24 months.
**Duty station:** Dhaka.
**Qualifications:** At least B.Sc. level in Information Technology/Computer Science/Mass Communication. The consultant should have a proven experience in mass communication and public relation, digital publishing, Web page visual design with an applicable software, and be familiar with HTML, CSS, and preferably also with PHP, JavaScript and MySQL. At least 5 years of relevant working experience is required.
**Language:** English.

## National Consultant: Database Management Expert

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, in coordination with the NPC, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, the the Database Management Expert will provide the technical assistance and support to the FD in the areas of capacity building, multi-user database development, data sharing and data processing. The main tasks of the Specialist are to:

- Review the existing Inventory database structure and develop multiuser database for web portal compatible with it.
- Provide recommendations on a functional database management system.
- Review existing data sharing standards.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- Provide training to the national team in the development and maintenance of the database and formulating SQL queries.
- Prepare a database maintenance manual to ensure the sustainability of the forest data information and archiving systems
- Report any technical problems related to the data and database to the CTA and the NPC.
- Describe all work performed in the form of a terminal report at the end of the recruitment period — to be submitted to the CTA for technical clearance. The report should contain: 1. an ample descriptions of data processing to facilitate future repetitions of the work and; 2. recommendations for possible improvements of the database application including a description of any technical problems and any 'bugs' encountered during the work.
- Assist in any other tasks under the project at the instruction of the FAO Representative, the LTO, the CTA and the NPC.

**Duration**: 8 months
**Duty station:** Dhaka.
**Qualifications:** At least M.Sc. in Information Technology or Computer Science. The consultant should have a strong background in information system development, database management, and statistical analysis and be familiar with MS Access and MySQL database applications. At least 15 years of relevant working experience is required.
**Language:** English.

## International Consultant, Forest Statistician

Under the overall managerial administrative leadership of the FAO Representative in Bangladesh, direct supervision of the Chief Technical Advisor, in coordination with the NPC, guidance provided by the Lead Technical Officer (LTO) at FAO Bangkok, the technical backstopping of the Forestry Department and FAO forestry experts, the the consultant will:

- Undertake trainings in forest statistics for FD personnel and other project stakeholders.
- Develop adequate training materials to support Bangladesh' circumstances and different levels.
- Provide recommendations for data management, data analysis, model development, and in particular assessment of forest carbon stock and stock changes and related accuracy.
- Provide recommendations on the calculation of the emission factor calculation.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- Assist in any other tasks under the project at the instruction of the FAO Representative, the LTO, the CTA and the NPC.

**Duration**: 2 months
**Duty station:** Dhaka
**Qualification :** University degree (Master or PhD) in statistics; At least Three years of relevant experience in statistics and Statistical analysis of forestry data; The consultant should have should have strong background and experience in statistical analysis of forest inventory data, particularly in developing countries; Experience in the field of forestry and natural resources;

**Language:** English.

## National Consultant: Forest Statistician

Under the direct supervision of the FAO Representative in Bangladesh as budget holder and guidance provided by the Lead Technical Officer (LTO) at FAO RAP, Bangkok, in coordination with the CTA and NPC, the incumbent will:

- Assist the InternationalForest Statistician consultant to undertake trainings in forest statistics for FD personnel and other project stakeholders.
- Assist the International Consultant to develop adequate training materials to support Bangladesh' circumstances and different levels.
- Work closely with the SilvaCarbon Country Coordinator and relevant SilvaCarbon technical specialists to ensure complementarity between the project and SilvaCarbon activities.
- Undertake an overview of existing statistical methods used for analysing tree allometric equations, forest inventory and land use change information in partner and pilot countries of the UN-REDD programme.
- Support and improve statistical approach for accuracy assessment of forest carbon stock and stock change assessment.
- Provide recommendations on improving the approach to assess volume, biomass and carbon stock assessment.
- Support the analysis of Height/diameter relationships in all forest types.
- Support the assessment of country specific emission factors.
- Support mapping accuracy assessment.
- Assist in any other tasks under the project at the instruction of the FAO Representative, the LTO, the CTA and the NPC.

**Duration**: 2 months
**Duty station:** Dhaka

**Qualification :** University degree (Master or PhD) in statistics; At least Three years of relevant experience in statistics and Statistical analysis of forestry data; The consultant should have should have strong background and experience in statistical analysis of forest inventory data, particularly in developing countries;• Experience in the field of forestry and natural resources;

**Language:** English.

## Appendix 3: Advisory Technical Services from FAO

### Four missions for a total of six weeks from FOM

Under the supervision and technical direction of the Forest Resources Development Service (FOMR) and in collaboration with the national authorities, the officers will support the project as foreseen in the work plan. The officers will also provide technical assistance and guidance to the CTA, National Project Coordinator and international/national consultants on aspects in connection with:

- Putting in place the organization of the project at the national level.
- Assisting in setting up Steering Committee for the project and coordinating their work and inputs.
- Integrated national forest and tree assessment methodology development including sampling design, classification system harmonization and variables, forest type and land use mapping.
- Training of the national forestry personnel in the areas of national forest and tree assessment and information management, field survey for data collection on forest and tree resources, data processing, information system development and reporting with focus on forest and tree data.
- Supervise and interact with international staff on the local training courses;
- Overall technical supervision of project implementation and delivery at the national level;
- Support the integration of forestry resources in policy analysis on the basis of the project findings.
- Undertake technical editing and clearance of project reports including the terminal statement.

### Six missions for a total of twelve weeks from the FAO RAP, Bangkok

Under the supervision and technical direction of FOMR and in collaboration with the national authorities, the backstopping officer, from RAP, will undertake two missions in support to the project as foreseen in the work plan. The backstopping officer will also provide technical assistance and guidance to the CTA and National Project Coordinator on aspects in connection with:

- Reviewing and assisting in putting in place the organization of the project at the national and sub-national levels.
- Assisting in setting up a National Team (NT) for the project.
- Support launching the project.
- Assisting in setting up a Steering Committee for the project.

- Finalizing the work plan of the project identifying necessary inputs from the Government and the FAO (technical staff, equipment, transport, supervision).
- Identifying and selecting national and international consultants.
- Reviewing the list of technical staff for field activities and the training programme;
- Attending workshops/ training programmes, etc and providing necessary inputs.
- Advising on dissemination to and use of information by all users.

## Appendix 4: Work Plan (Distribution of activities among different agencies)

| **Output 1. General conditions to implement the national forest inventory reinforced** | **YR 1** | **YR 2** | **YR 3** | **YR 4** | **FAO** | **USFS** | **UMD** | **NASA** | **other** | **comments** |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Activity 1. 1. Institutionalization of the NFI and SLMS strengthed*** | | | | | | | | | | |
| sub-activity 1.1.1: Support to legal preparedness | x | | | | X | x | | | | Through SilvaCarbon liaison |
| sub-activity 1.1.2. Enhancement of knowledge on international reporting (UNFCCC, CBD, FAO, etc.) | x | | | | x | X | x | x | x | Other is ongoing EPA involvement with GHG inventory |
| sub-activity 1.1.3. Organization of regular meetings on NFI and SLMS (Quarterly) | x | | | | X | | | | | |
| ***Activity 1. 2. Reinforcement of national capacities in forest inventory and satellite monitoring*** | | | | | | | | | | |
| sub-activity 1.2.1. Strengthening of forest inventory capability of stakeholders | x | | | | X | x | x | x | | |
| sub-activity 1.2.2. Technical trainings (Local) (6 trainings) on SilvaCarbon tools for forest monitoring (this includes GIS, RS, forest inventory, data analysis, forestry statistics) | x | x | x | x | x | X | X | | | SilvaCarbon will do > 75%, |
| Sub-activity 1.2.3: Capacity of young professionals for forest monitoring tools (GIS, RS, SLMS, etc.) reinforced | x | x | x | x | x | x | x | x | | |
| sub-activity 1.2.4. Capacity building on geospatial data processing and database management | x | x | x | x | X | x | | | | |
| Sub-activity 1.2.5 Participation in international events including Short and Medium trainings related to Forest Inventory and Satellite Forest Monitoring, REDD + programmes | x | x | x | x | x | x | x | x | x | other is SilvaCarbon Regional Program out of Bangkok |
| ***Activity 1. 3. Forestry research supported*** | | | | | | | | | | |
| sub-activity 1. 3.1. Development of allometric equations for important species based on ecological regions | x | x | | | X | | | | | |
| sub-activity 1. 3.2. Support remote sensing researches in forestry | x | x | x | x | | | x | X | | All SilvaCarbon |
| sub-activity 1. 3.3. Enhancement of national capacities in volume, biomass and carbon stock calculation | x | x | x | x | x | x | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| sub-activity 1. 3.4. Strengthening of modeling expertise | | x | x | | x | x | | | | |
| sub-activity 1. 3.5. Development and Upgrading of existing NFA Tree Species Data Base | x | | | | X | (x) | | | | This could involve remote assistance from USFS |
| ***Activity 1. 4. Existing remote sensing and field data collected, harmonized and reviewed*** | | | | | | | | | | |
| sub-activity 1. 4.1. National consultation on data sharing agreements implemented | x | | | | X | | | | | |
| sub-activity 1. 4.2. Development of land cover map index and satellite image database | | x | x | | X | | | | | |
| sub-activity 1. 4.3. Research in very high resolution data sets | x | x | x | | | | X | x | | All SilvaCarbon |
| sub-activity 1. 4.4 Archiving and documentation of all existing inventory data and development of a robust database management system | x | x | x | x | X | | | | | |
| sub-activity 1. 4.5 Regional workshop on the use of remote sensing for monitoring deforestation and forest degradation in tropical countries | | x | x | | X | x | x | x | x | Other is SilvaCarbon Regional Program out of Bangkok |
| | | | | | | | | | | |
| **Output 2. NFI and SLMS strategy reinforced** | | | | | | | | | | |
| ***Activity 2. 1. Mandates and funding clarified*** | | | | | | | | | | |
| sub-activity 2. 1.1. International workshop on national forest inventory and monitoring systems (how the inventory planning, data collection, data management and analysis, QA/QC, etc. are performed in different countries) | x | x | | | X | | | | | |
| sub-activity 2. 1.2. Identification of necessary resources for updating the NFI and SLMS | x | x | | | X | | | | | |
| sub-activity 2. 1.3. Mandates to implement the national forest inventory and satellite forest monitoring clarified | x | | | | X | | | | | |
| ***Activity 2. 2. Participatory process developed and established*** | | | | | | | | | | |
| sub-activity 2. 2.1. Stakeholder Mapping involving different national institutions dealing in Forestry, civil society, forest communities and private sector | x | | | | X | | | | | |
| sub-activity 2. 2.2. Participatory process defined | x | | | | X | | | | | |
| sub-activity 2. 2.3. Development of participatory tools for forest monitoring | | x | | | X | x | | | | |

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| ***Activity 2. 3. Communication and public relation system implemented*** | | | | | | | | | | |
| sub-activity 2. 3.1. Support to Communication and public relation system | | x | | | X | | | | | |
| sub-activity 2. 3.2 Development of a web based platform for data sharing among national Stakeholders | | x | x | | X | | | | | |
| sub-activity 2. 3.3 Support to address the gaps (if any) identified during establishment of FMIS through UN REDD programme. | | x | x | | X | | | | | |
| ***Activity 2. 4. Common forest and land cover classification system/s agreed upon*** | | | | | | | | | | |
| sub-activity 2. 4.1. Rationalization of Land Cover Classification System | x | | | | X | | | | | |
| sub-activity 2. 4.2. International workshop on forest definition and land use representation system | x | | | | X | | | | | |
| **Output 3. NFI and SLMS implemented** | | | | | | | | | | |
| ***Activity 3. 1. NFI and SLMS design prepared and consensus on approach and method to NFI,SLMS and long-term monitoring reached*** | | | | | | | | | | |
| sub-activity 3.1.1 Objectives of the Multi-purpose National Forest Inventory identified | x | | | | X | X | x | x | | |
| sub-activity 3. 1.2. National Seminar convened to inform all stakeholders about the scope, approach and timeframe of the project and exchange on ways of implementation to meet all users needs. | x | | | | X | | | | | |
| sub-activity 3. 1.3. Review of existing inventory designs and provide recommendations for NFI design | x | x | | | x | X | | | | |
| Sub-Activity 3.1.4 : National consensus on national list of forest and tree attributes from NFI established | | x | | | x | X | | | | |
| Sub-Activity 3.1.5 : Validation of NFI design (NFI design field verified and finalized) | x | | | | x | x | | | | |
| ***Activity 3. 2. Multi-purpose NFI and SLMS designed*** | | | | | | | | | | |
| sub-activity 3. 2.1. Assess the costs for carrying out the NFI and SLMS | x | | | | X | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| sub-activity 3. 2.2. Design the field forms and field guides/manual describing the approach and technique for data collection | | x | | | x | X | | | | |
| sub-activity 3. 2.3 NFI Unit strengthened to be able conduct national forest inventories/assessments and monitoring and Training Manuals developed | | x | | | x | X | | | | |
| sub-activity 3. 2.4. Development of Guidelines for Quality Assurance Protocol and Training to follow the guidelines | x | x | x | x | X | | | | | |
| Sub-Actvity 3.2.5 : Define the needs of equipment for the NFI and SLMS and field testing of equipments | x | | | | X | x | x | | | |
| sub-activity 3. 2.6 Produce a final draft of the NFI and SLMS compliant with REDD+ | | x | | | X | | | | | |
| ***Activity 3.3: Forest monitoring system reinforced by remote sensing applications*** | | | | | | | | | | |
| Sub-Activity 3.3 .1 : National Atlas of Forest Cover and Forest Cover Changes developed | x | x | | | x | | X | X | | |
| Sub-Activity 3.3 .2 : National LULUCF Atlas developed | | | x | | x | | x | | | |
| ***Activity 3. 4. Field data collection and data processing achieved*** | | | | | | | | | | |
| Sub-Activity 3.4.1 : Support to logistics and equipment needs for field data collection for NFI and SLMS | x | x | | | X | | x | | | |
| Sub-Activity 3.4.2 : Field data collection and recording | | x | x | | X | | | | | |
| Sub-Activity 3.4.3 : Set up the monitoring system and establish permanent sample plots | | x | x | x | X | | | | | |
| Sub-Activity 3.4.4 : Forest boundary digitization and delineation | | x | x | | X | | | | | |
| Sub-Activity 3.4.5 : Forest plot data processing and laboratory analysis of samples soil/litter/plants samples for carbon estimation | | x | x | x | X | | | | | |
| Activity 3.4 6. Ground-truthing data recorded and processed for us in forest cover and LULUCF validation and mapping | | x | x | x | X | x | x | | | |
| ***3.5 Data Analysis and Reporting*** | | | ***x*** | ***x*** | ***X*** | ***x*** | ***x*** | | | |
| **Output 4: Value of Forest Ecosystem goods and services estimated** | | | | | **X** | | | | | |

"X" denotes that the respective FAO or SilvaCarbon partner will provided leadership in the proposed sub-activity; a "x" denotes a support role.