

Project Design Document

Lowering Emissions, Enhancing Forests (LEEF) in Nagaon, Assam



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**Assam Project on Forest and Biodiversity Conservation
&
IORA Ecological Solutions**

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ABBREVIATION

AACP	Assam Agricultural Competitiveness Project
AEDA	Assam Energy Development Agency
AFOLU	Agriculture, Forestry and Other Land Use
ANR	Assisted Natural Regeneration
APFBCS	Assam Project on Forest and Biodiversity Conservation Society
ASTRA	Application of Science and Technology for Rural Areas
BMC	Biodiversity Management Committee
BSM	Benefit Sharing Mechanism
CAMPA	Compensatory Afforestation Management and Planning Authority
CBD	Convention on Biological Diversity
CBOs	Community Based Organizations
CDM	Clean Development Mechanism
CH ₄	Methane
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO ₂	Carbon di Oxide
CPT	Cattle Proof Trenches
DDC	District Development Committee
DFO	Divisional Forest Officer
DoAHDF	Department of Animal Husbandry, Dairying and Fisheries
DoEF	Department of Environment and Forests, Government of Assam
EDC	Eco-Development Committee
EE	Executive Entity
EPT	Elephant Proof Trenches
FAO	Food and Agriculture Organization of the United Nations
FDA	French Development Agency
FGD	Focused Group Discussion
FSI	Forest Survey of India
GCF	Green Climate Fund
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIM	Green India Mission
GMO	Genetically Modified Organism
GOI	Government of India
GPS	Global Positioning System
GWP	Global warming potential
HCV	High Conservation Value
HOFF	Head of Forest Force
ICAR	Indian Council for Agricultural Research
IPCC	Intergovernmental Panel on Climate Change
ISFR	Indian State Forest Report
IWDP	Integrated Watershed Development Programme

JFMC	Joint Forest Management Committee
JICA	Japan International Cooperation Agency
LEEF	Lowering Emission Enhancing Forests
LULC	Land Use Land Cover
LULUCF	Land use, land-use change and forestry
MAB	UNESCO's Man and Biosphere
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MNRE	The Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment Forests and Climate Change
MRV	Monitoring, Reporting and Verifying
NAEB	National Afforestation and Eco-Development Board
NAP	National Afforestation Programme
NaRMIL	Natural Resource Management and Integrated Livelihood”
NBMMP	National Biogas and Manure Management Programme
NDC	Nationally Determined Contributions
NER	Net Emission Reductions
NGO	Non-Governmental Organization
NRDWP	National Rural Drinking Water Programme
NRLM	Aajeevika National Rural Livelihoods Mission
NRSC	National Remote Sensing Agency
NTFP	Non Timber Forest Produce
PA	Project Area
PCCF	Principal Chief Conservator of Forests
PPP	Public Private Partnership
PWD	Public Works Department
QA/QC	Quality Assurance and Quality Control (QA/QC)
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RS/GIS	Remote Sensing and Geographical Information System
SAPCC	State Action Plans on Climate Change
SES	Social and Environmental Safeguards
SHG	Self Help Groups
SIS	Safeguard Information System
SOP	Standard Operating Procedures
SVEP	Start-up Village Entrepreneurship Development Programme
TPP	Twenty Point Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
USAID	United States Agency for International Development
VCS	Verified Carbon Standard
WTO	World Trade Organization

EXECUTIVE SUMMARY

Assam Project on Forest and Biodiversity Conservation (APFBC) under the Department of Environment and Forests (DoEF), Government of Assam, with the help of the French Development Agency (AFD) has initiated the project **Lowering Emissions, Enhancing Forests (LEEF)** in State's Nagaon district to mitigate climate change in the forestry sector through REDD+ actions. The aim of the project is to avail intended benefits of the REDD+ mechanism which includes carbon and non-carbon benefits. The GHG emission reduction from forests can also contribute to India's commitments under its Nationally Determined Contributions (NDC) under the United Nations Framework Convention on Climate Change (UNFCCC) agreement. India has planned to create an additional carbon sink of 2.5 to 3 billion tons of CO₂ from forestry sector by 2030. The project will also help in achieving the Assam-specific Sustainable Development Goals (SDGs), which have been developed as the first State-level SDGs in India.

Reducing Emissions from Deforestation and Forest Degradation (REDD) is an international 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 for sustainable development. Jurisdictional REDD+ is a recent innovation in REDD+, where a government is closely involved in, or may actually lead a REDD+ initiative in areas that lie under its jurisdiction. The advantage is that this enables better integration of the multiple sectors involved in climate change action. In practical terms, this approach blends local action with public policy more efficiently, and is effective in bringing a synergy between project goals and governance elements.

The AFD has been working closely with the APFBC (Govt. of Assam) to develop a Jurisdictional REDD+ model within Assam's Nagaon district. The project demands great technical capacity to analyse the effects of forest and non-forest policy and non-forest economic activities on forests as part of a jurisdictional REDD+ intervention strategy. The key areas of intervention under the Jurisdictional REDD+ Project in Nagaon includes:

- Baseline development for REDD+ in Nagaon
- Training and capacity building of various stakeholder groups in Nagaon
- Identification of drivers of deforestation and forest degradation in the district
- Developing tools, techniques, and methods for forest carbon measurement
- Developing specific convergence models which will be helpful for leveraging funds for implementation of REDD+ activities in Nagaon

The project will achieve its objective through multi-layered planning, the stakeholders of which will also include the forest-dependent communities in the region. Studies have shown that there are several agents and drivers responsible for deforestation and forest degradation in the Nagaon district of Assam.

A thorough socio-economic survey across Nagaon's 7 ranges, including 58 villages and 567 households, was carried out to identify drivers of deforestation and forest degradation. The households surveyed were representative of large, medium and small farmers, and landless households. The driver identification process also resulted in a participatory identification of interventions. Unsustainable extraction of forest produces has been reported to be a major cause of forest degradation.

Thorough analysis of satellite images of four years (2000, 2006, 2010, and 2015) was undertaken with the help of advanced RS/GIS techniques to assess land-use change dynamics and deforestation and forest degradation in the district over the years. The six IPCC LULC classes, namely Forestland, Cropland, Grassland, Wetland, Settlement and Other Land have been distinguished and the area under each classification has been detailed. The LULC classes have been further sub-divided into forest strata, to achieve the goal of defining classes that are homogeneous in forest Carbon stock density. These forests have been further sub-divided based on canopy densities, so as to accurately pinpoint forest degradation. Land transitions within the same forest types have been mapped between different density classes and between forest classes and non-forest classes, so as to estimate rates of forest degradation and deforestation. The annual average rate of change in Carbon stocks is -1.44%, which will lead to emissions of emissions of 97,990 tCO₂e/year. This flags a caution to act upon these drivers immediately through innovative intervention actions on ground.

The proposed LEEF project not only aims to reduce Greenhouse Gas (GHG) emissions, but also yields co-benefits such as biodiversity conservation, access to cleaner cooking devices, improved standard of living, better options for livelihood, enhanced climate resilience etc., which are also an integral part of the REDD+ mechanism. By linking the climate change mitigation benefits, and the social and environmental co-benefits, the State of Assam is attempting to access national and/or international incentive mechanisms on climate change. These benefits, can either be monetary or be in other forms (e.g., direct transfer of cooking devices), and it is the prerogative of the project developer to design a functional benefit sharing mechanism.

A detailed safeguards information system (SIS) was developed with the officers of the Assam Forest Department. Identified parameters will be monitored over the life of the project, and the results will be analysed and fed to the SIS to ensure no social or biological harm is brought about by the actions under the REDD+ project. A transparent benefit sharing mechanism has also been designed under the LEEF project, where the DoEF will oversee incentives being channelized to the community through JFMCs. The safeguards information system and the benefit sharing mechanism were formulated in accordance with Cancun Safeguards agreed to under the UNFCCC.

DRAFT

1 Introduction

1.1 Background and overview

It has been established irrefutably that there is a gradual change in the global climatic patterns, and these changes are ascribed to anthropogenic emissions resulting in increased concentration of Greenhouse Gases (GHG) in the atmosphere, which then leads to global warming. The evidences are detailed in the Fifth Assessment Report (AR5) by the Inter-governmental Panel on Climate Change (IPCC), where the extent of the rise in terrestrial and oceanic surface temperature, sea level rise and decrease in glacial & arctic sea-ice content are detailed¹. Scientists have given substantial evidences to prove that the changing climate and its impact is real (O'Brien K. L., 2000) (O'Brien K. e., 2004).

A global scientific consensus has been reached that in order to limit the ill effects of the on-going climate change, emissions must be reduced so that by the end of the 21st Century, the global mean temperature does not increase by more than 2°C from pre-industrialization levels. Delaying in the high-impact and resilient climate change mitigation actions before 2030, will require substantially higher rates of emission reductions from 2030 – 2050 for limiting warming over the 21st Century to below 2°C. The United Nations Framework Convention on Climate Change (UNFCCC) estimates that beyond this level it will become too difficult to stabilize the global mean temperature.

Forests, being a major carbon sink, play a major role in combating climate change as they contribute towards both climate change mitigation and adaptation efforts. Forests cover one-third of the earth's total land surface², and play a major role in the carbon cycle by acting as carbon sinks as well as a major source of carbon stock. Land-use is one of the major sectors responsible for around 24% of the total emissions, globally the largest emitting sector after energy³. The conversion of forest land into other land-use categories result in greenhouse gas (GHG) emissions into the atmosphere.

¹Climate Change 2014, Synthesis Report (http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_LONGERREPORT.pdf)

² FAO Global Forest Resource Assessment 2010. (pg no 20)

³ Ibid 1

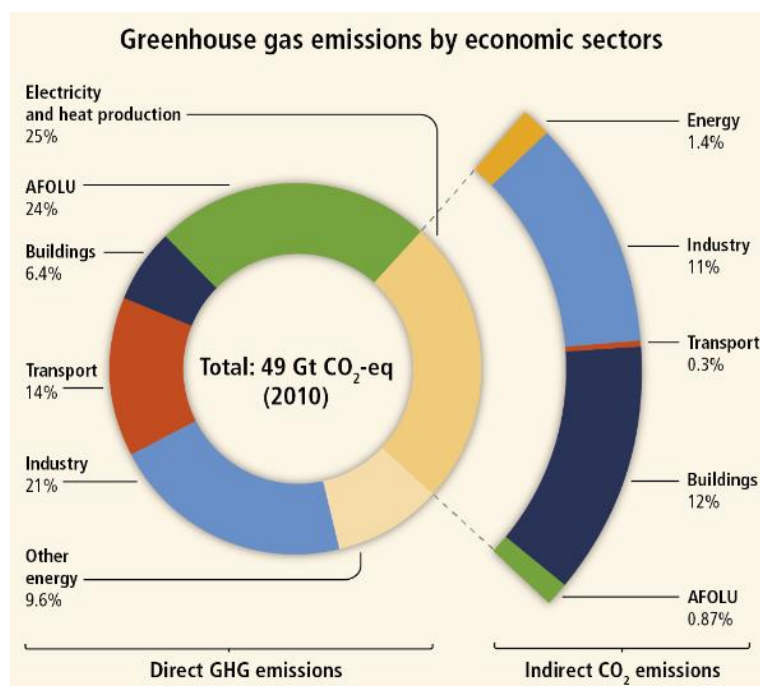


FIGURE 1: AFOLU REPRESENTS LARGEST EMITTING SECTOR AFTER ENERGY (SOURCE: ADAPTED FROM IPCC AR5)

Global assessments have shown that forest ecosystems will be extremely vulnerable to the impacts of climate change. In India, analysis of climate models and climate projections suggest that forests are expected to undergo significant changes, including shifts in forest types. Under the IPCC's A2 and B2 climate scenarios⁴, 77% and 68% of the forested grids in India are vulnerable to such effects⁵. Apart from GHG emissions, forest loss also impacts biodiversity and socio-economic well-being.

The forests of Nagaon district are among the most biodiversity rich in India and are part of the Eastern Himalaya biodiversity hotspot; containing a National Park which is also a World Heritage Site and a Wildlife Sanctuary, home to species such as the One-Horned Rhinoceros and the Tiger.

Climate change will intensify drought and floods in the State of Assam (DoEF, 2015)⁶, which will lead to loss of forest and may increase the impacts on other crucial sectors on which the people are dependent. In Nagaon, Very Dense Forest (VDF) account for only 5% while Open Forest (OF) is 51% of the total forest area. The cause for this is mainly degradation in forest quality and quantity, encroachments, fuel wood extraction, etc. The Assam State Action Plan for Climate Change (SAPCC) states, "If mechanisms could be created to provide payments for mitigation benefits, these could add 5% to 10% to forestry GDP, based on the relative value of net carbon sequestration, compared with commercial benefits from forestry".

In order to ensure sustainable forest management, biodiversity conservation, and to explore livelihood alternatives of the forest dependent communities in Assam, the State Government with the help of the French Development Agency (AFD) has initiated a Project on Forest and Biodiversity Conservation (APFBC). The project will achieve its objective through multi-layer integrative planning involving stakeholders including the forest-dependent communities. This Project Design Document (PDD) details the *Lowering Emissions, Enhancing Forests (LEEF)* project in the Nagaon District. LEEF has been developed under the APFBC, as a district level Jurisdictional REDD+ project in Assam. The Department of Environment and Forests (DoEF) is the Executive Entity (EE) of the project.

⁴ IPCC Special Report Emissions Scenarios 2000

⁵ Ravindranath, H.R., Joshi, N.V., Sukumar, R., and Saxena, A. (2006); Impact of Climate Change on Forests in India; Current Science 90(3). (pg no 1)

⁶ Assam SAPCC, 2015, <http://www.moef.gov.in/sites/default/files/Final%20draft%20ASAPCC%20document.pdf>

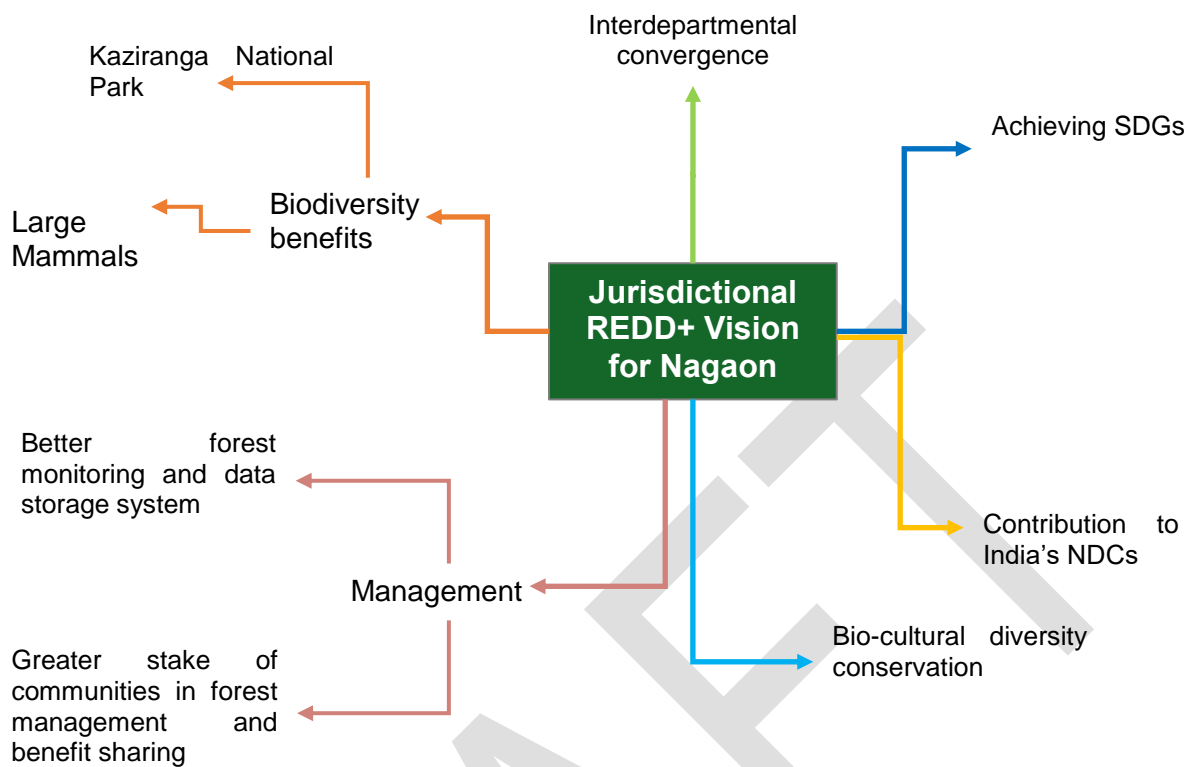


FIGURE 2: LEEF VISION

1.1.1 Jurisdictional REDD+ and Nagaon

As per the Forest Survey of India (FSI) assessment, negative change in forest cover was recorded during 1999-2001 and 2003-05 in Nagaon. Overall the forest cover has decreased slightly in the sixteen years from 1999 to 2015 (Figure 3).

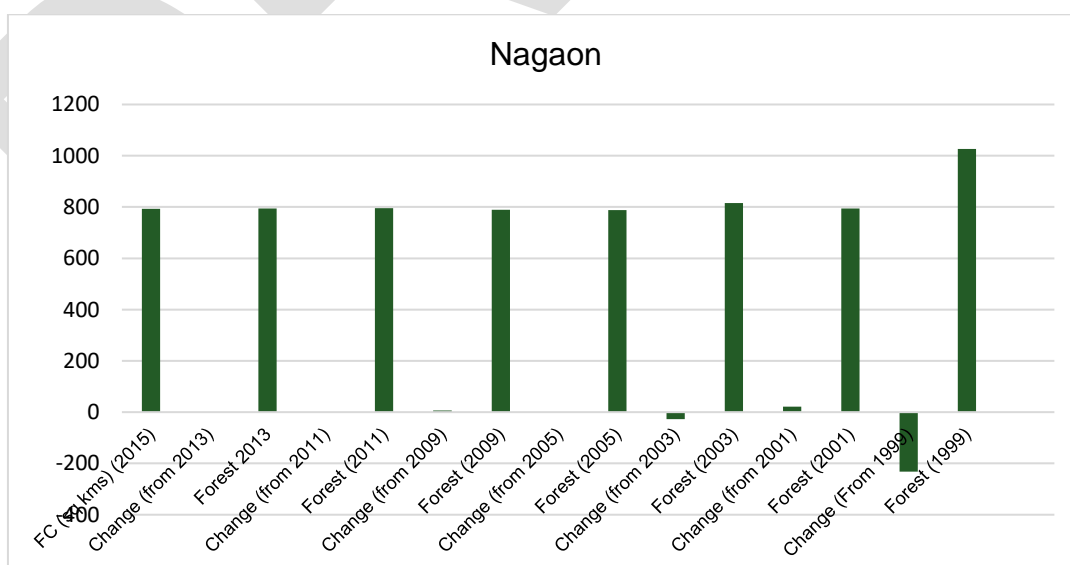


FIGURE 3: CHANGE IN NAGAON FOREST COVER FROM 1999 – 2015 AS PER FSI OF INDIA

National Remote Sensing Centre (NRSC) data also showed slight decrease in forest cover from 2005 to 2011 (Figure 4). Increase in grassland and settlement area was recorded during these periods.

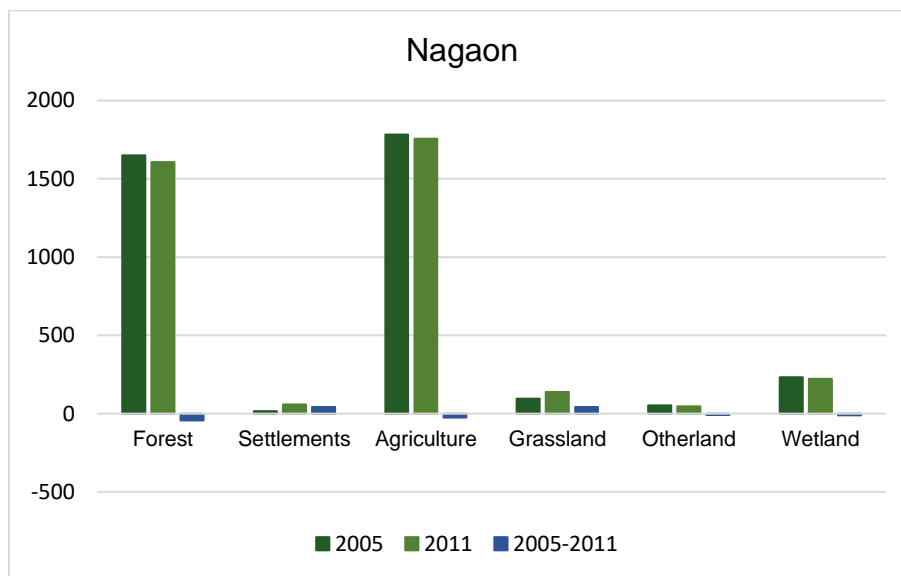


FIGURE 4: CHANGE IN AREA OF SIX IPCC LAND CATEGORIES IN NAGAON FROM 2005 - 2011 AS PER NRSC

There are 21 Reserve Forests in the district covering a total of 69,414 ha of land. As per records available, an area of 3,155 ha is under encroachment in different RFs/PRFs of Nagaon district. The district forest is facing social, political, natural and anthropogenic pressure which results in depletion of quality and quantity of forests. As per the surveys conducted in the district, the major causes of forest loss in Nagaon are⁷ :

- Forest fires
- Floods
- Illegal felling
- Encroachment
- Increased timber demand
- Increase in human-animal conflict
- Political interference

Being a part of national heritage of the country, there is an urgent need to carry out a landscape-level strategy to ensure protection and enhancement of forests and biodiversity of Nagaon District.

The Government of Assam has predominant authority over the forestry sector. Hence, it would be easy to align policies with the forest conservation goals of REDD+, bringing different departments together for convergence to achieve the project goal and enforcing the management practices. Also, there is demonstrable change in forest cover in the last 20 years for which many active drivers are also recorded. Owing to the large area available (around 85% of the total forest area) under Medium Dense Forest (MDF) and Open Forest (OF), there is high potential for new plantations in the District. The rich and threatened biodiversity needs conservation measures. The REDD+ will also bring high co-benefits to the community and biodiversity in the region. Hence, the project will be apt for the situation and will be beneficial overall.

1.1.2 Overview of the Project

Nagaon district of Assam, part of a Biodiversity Hotspot, comprises a UNESCO World Heritage Site and is home to several flagship species including Great Indian one-horned Rhinoceros (*Rhinoceros unicornis*), Royal Bengal Tiger (*Panthera tigris*), Asiatic Elephant (*Elephas maximus*), Eastern Swamp Deer (*Rucervus*

⁷ Working Plan of Nagaon Forest Division

duvauceli) and the Asiatic Wild Buffalo (*Bubalus arnee*). 20.7% of the total geographical area of the district is covered by forests⁸. There is a decrease in the forest cover compared to assessments made in 2013 to 2015 due to encroachment of forest land, biotic pressure, rotational felling in tea garden, and shifting cultivation⁹.

TABLE 1: NAGAON FOREST COVER (FSI ISFR 2015)

Geographic area	VDF	MDF	OF	Total area under forest cover	% of geographical area
3,831 km ²	40 km ²	351 km ²	402 km ²	793 km ²	20.7%

The District has one National Park (Kaziranga National Park) and one Wildlife Sanctuary (Lowkhowa Wildlife Sanctuary). Agriculture is the principal occupation and income generating activity of the District. However, forestry is a vital sector in the District and a sizeable population is dependent on it and its resources for their sustenance and livelihood.

As per the FSI's India State of Forests Report (ISFR) 2015, there is a decrease in the forest cover, compared to the assessments made in 2013 to 2015 due to encroachment of forest land, biotic pressure, rotational felling in tea gardens and shifting cultivation. The outstanding range of flora and fauna of the district are facing incidents of biotic pressure, which is affecting the overall State forests and biodiversity.

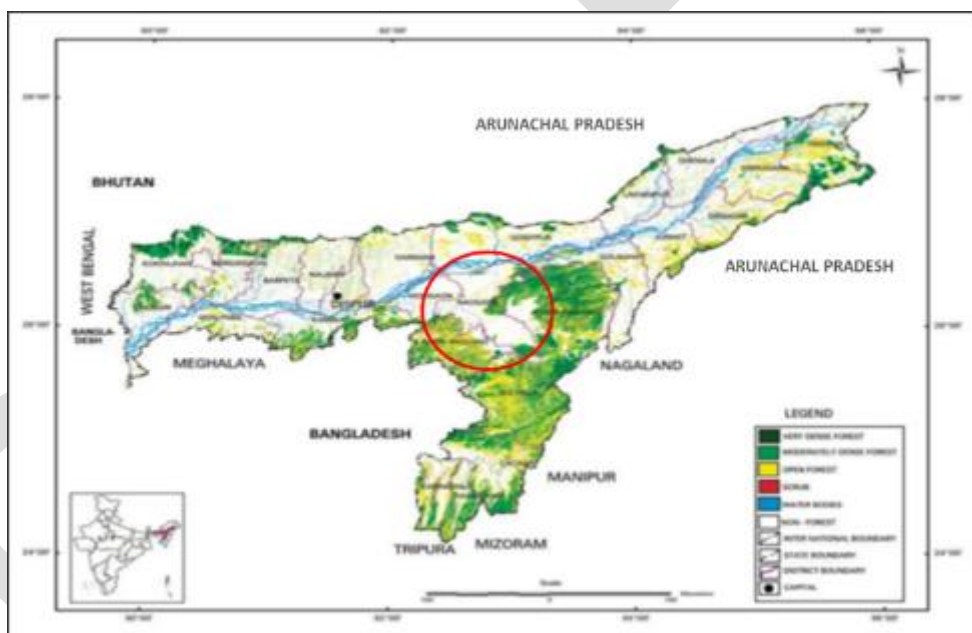


FIGURE 5: FOREST COVER MAP OF ASSAM. CIRCLED PORTION REPRESENTS NAGAON.⁹

To ensure protection, restoration and conservation of the forests and biodiversity of the District, DoEF with the support from French Development Agency - AFD, is implementing the LEEF project in Nagaon under the Assam Project on Forest and Biodiversity Conservation (APFBC) Project. The aim of the project is to avail intended benefits of REDD+ mechanism which includes carbon and non-carbon benefits from forestry and allied sectors such as biodiversity conservation, organic farming and ecosystem services which are integral to REDD+ implementation according to the National Policy¹⁰. The project will assist the State of Assam in conserving and enhancing its forest carbon stock and developing capacity in utilization of national

⁸ FSI ISFR 2015

⁹ <http://fsi.nic.in/isfr-2015/isfr-2015-forest-and-tree-resources-in-states-and-union-territories.pdf> (pg no 16 and 17)

¹⁰ Draft National Policy and Strategy on REDD+:

<http://envfor.nic.in/sites/default/files/Draft%20National%20Policy%20&%20Strategy%20on%20REDD.pdf>

and/or international incentive mechanisms on climate change and forestry through a REDD+ pilot project; the co-benefits being the environmental and social benefits. This will also help in achieving the Assam Sustainable Development Goals, 2030 targets and will also add to India's Nationally Determined Contributions (NDCs) under the UNFCCC agreement¹¹.

To estimate the reduction of CO₂ emission from LEEF project, a reference baseline for Nagaon district has been developed, taking into account average deforestation and forest degradation rates over the last 15 years. Project monitoring of emission levels would similarly be developed to estimate Green House Gas (GHG) emissions reductions over the project lifetime.

To separate the drivers and agents of deforestation and forest degradation, as well as to better understand ground scenario, several meetings with local stakeholders, key informant interviews, geospatial analysis, social and ecological surveys in the district have been conducted. After evaluating the outcomes of surveys and studies, it is clear that there exists considerable anthropogenic pressure on forests of Nagaon. These issues need to be addressed as early as possible to avoid further loss of forest cover and emissions from deforestation and forest degradation.

To bring down forest loss and related emissions, intervention activities have been planned as a part of project activities. These interventions will be implemented across the District.

DRAFT

¹¹ India First NDC: <http://www4.unfccc.int/ndcregistry/PublishedDocuments/India%20First/INDIA%20iNDC%20TO%20UNFCCC.pdf>

Potential benefits of LEEF in Nagaon

Reduced forest loss

Enhanced forest and tree cover

Reduced biodiversity loss

Reduced forest and habitat fragmentation

Conservation of natural and intact forests

Conservation of rare and threatened flora and faunal species

Enhanced ecosystem resilience

Protection of water resources

Reduced soil erosion and restoration of soils in degraded land

Sustainable livelihood and contribution to economic upliftment of marginal and indigenous communities

Actions towards combating climate change

Help in sustainable production and consumption of resources

Help achieving food security

Promote agroforestry

Help in maintaining ecosystem services

Promote livestock management

Promote use of renewable energy

Conservation of traditional and indigenous knowledge

Development of robust MRV and forest management system

Development of robust and transparent benefit sharing mechanism and safeguards information system

1.2 Objective

The primary objective of the project is to develop a pilot jurisdictional REDD+ project in Nagaon district of Assam, India.

1.3 Executive Entity

The Executive Entity (EE) for this project is the Department of Environment and Forests (DoEF), Government of Assam. The DoEF is the custodian of forests in the State and is responsible for protection and improvement of the forests and wildlife of the State. It is responsible for project development, implementation, monitoring, ensuring the equitable distribution of benefits arising from the project, and safeguarding biodiversity and communities. The Department will serve as the nodal agency for dissemination of information from the project.

Organization name	Department of Environment and Forests (DoEF), Assam
Contact person	Sri Bikash Brahma, IFS PCCF (HoFF), Assam, Basistha, Guwahati Sri A.K. Johari, IFS PCCF (B&CC), O/o the PCCF & HoFF, Assam
Address	Aranya Bhavan, Panjabari, Guwahati - 781037 Assam
Telephone	0361-2730337
Email	pccf.assam@gmail.com

1.4 Start Date

The start date for project is to be determined based on the actual emissions saving activities on ground. Expected date is 15/09/2017.

1.5 Project Lifetime

20 years

1.6 Baseline Reassessment

The project baseline will be reassessed every 10 years from the start date of the project

1.7 Project climate, community and biodiversity benefits

The Executing Entity (EE) considers the forest communities as guardians of the forest and is keen on involving them in different activities proposed under the project. As mentioned in the above section, the main objective of the project is achieved by avoiding drivers of deforestation and degradation of forests and

enhancing forest cover in the PA through various intervention activities. Sections below provide details of benefits on climate, community and biodiversity of the District, due to the implementation of this project.

1.7.1 Climate Benefits

Lifetime of the project activity is 20 years, it is expected to produce substantial GHG emissions from forests annually. The impacts on climate are determined by the ex-ante estimates of GHG emissions reductions, expected to be generated due to reduced deforestation and forest degradation, and enhanced forest cover in the project area (PA). Detailed study was carried out in the PA to identify potential drivers responsible for forest cover loss. Data on drivers of deforestation and forest degradation and their possible interventions were collected using socioeconomic survey, focus group discussions (FGDs) with the village communities and forest range level, and are validated by Assam forest officers.

The project activities are aimed at reducing pressure on forests by deploying the intervention activities, improving governance, technology-driven community-based monitoring and forest management practices, and capacity building of the communities as well as department officials through proper training.

1.7.2 Community benefits

Communities in the PA are rural and most of the population is dependent on agricultural sector. Communities don't have good access to clean energy and to new methods and technologies to utilize forest resources. People extract timber, NTFPs, green leaves, firewood, etc. in an unsustainable manner. This project will build awareness among the communities and knowledge of sustainable utilization of the forest resources through its capacity building programs. Also, the project respects and acknowledges the significance of communities' traditional knowledge and practices of forest conservation and considers them as important criteria for measuring the project success.

TABLE 2: COMMUNITY BENEFITS FROM THE PROJECT

Activities	Benefits
Short- and long-term net positive well-being benefits to the community members	Changes in well-being due to project activity like knowledge and capacity building, alternative livelihood opportunities, climate change adaptation, health and empowerment (participation in decision making and management of natural resources for future)
Communities participation	The direct involvement of JFMCs/EDCs is to enable a participatory process, enabling communities from even the lower socio-economic strata to participate in the decision making process.
Participation of women in decision making process	Women participation as members of the management committee. As per the JFM guidelines issued by MoEFCC ¹² - <ul style="list-style-type: none"> • At least 50% members of the JFM general body should be women. • Presence of at least 50% women members is compulsory for holding the general body meeting • At least 33% of the membership in the JFM Executive Committee/ Management Committee should be filled by women
Benefit sharing mechanisms	Community members have full and effective participation in defining the decision-making process and distribution mechanism for benefit sharing process.

¹² <http://www.moef.nic.in/sites/default/files/jfm/jfm/html/strength.htm>

Project's governance and implementation structure	The project governance and implementation will follow the guidelines of JFM practices of Assam, which promotes and enables effective participation of communities in project decision-making and implementation.
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1.7.3 Biodiversity benefits

The project activities aim to conserve and harness the existing biodiversity in the Project Area (PA). No biodiversity related High Conservation Value (HCV) species will be affected through programme activities. The project design promotes conservation of HCV species. The project will minimize encroachment and grazing; hence will increase the faunal and floral diversity of the region. In addition, the project strives to reduce deforestation and forest degradation, thus helping to reduce forest fragmentation and increase forest health.

The species identified for plantations will be finalized after expert consultations. No non-native species will be used for plantation activities. No genetically modified organisms (GMOs) will be used to generate GHG emissions reductions or removals.

Since project activities are primarily designed to reduce levels of deforestation and forest degradation in the PA, the estimation of biodiversity impact is primarily linked to changes in measurable forest vegetation cover conditions. This strategy is consistent with the view that biodiversity change correlates strongly to changes in vegetation cover, and that the size and connectedness of forest ecosystems correlate with levels of natural ecological function. (Pitman 2011, Richards and Panfil, 2011).

Pitman notes that implementation of biodiversity-focussed project activities as prescribed, in parallel with a credible demonstration of a greater extent or quality of natural vegetation, the demonstration of reduced anthropogenic impact, and the maintenance of HCVs, is sufficient to confirm a net positive biodiversity impact for carbon projects.

Man-animal conflict is a major issue in Assam. Several deaths of animals as well as humans are reported every year due to conflict. The conflicts largely involve elephants. From 1980 to 2003, more than 1,150 humans and 370 elephants have died as a result of these conflicts (Choudhury, 2004). From 2012 to 2016, around 99 elephants and 426 humans were killed in the State due to man-animal conflict¹³. Around 36 leopards too were killed in Assam from 2012 to 2016, of which 27 deaths were due to animals that had entered human habitations.¹⁴

TABLE 3: DEATH OF ELEPHANTS AND HUMANS DUE TO MAN-ANIMAL CONFLICT

Elephant death due to man-animal conflict from 1980 to 2003 (24 years)	370
Elephant death due to man-animal conflict from 2012 to 2016 (5 years)	99
Human death due to man-animal conflict from 1980 to 2003 (24 years)	1150
Human death due to man-animal conflict from 2012 to 2016 (5 years)	426

From several studies it is clear that the man-animal conflict in Assam is mainly due to habitat loss, fragmentation of habitat and food shortage. Indirectly, poaching is also a source of conflict in Nagaon; injured animals often retaliate by damaging properties and killing humans. Infrastructure development activities like construction of roads and railways leads to habitat loss for wild animals and fragmentation of forest land. This blocks the migration route of animals and also facilitates encroachment in the forest area¹⁵.

Elephants are protected under Schedule I of Indian Wildlife Protection Act, 1972 and are also listed as an endangered species by the IUCN, 2008 (based on a reduction in its area of occupancy and the quality of its

¹³ <http://indianexpress.com/article/india/assam-four-national-parks-under-encroachment-99-elephants-killed-in-5-years-4503948/>

¹⁴ *ibid*

¹⁵ On December 5, 2016 three elephants including two pregnant females were killed in the PA by a speeding train. <http://www.asianage.com/india/all-india/051216/assam-speeding-train-hits-elephants-kill-3-including-2-pregnant-females.html>

habitat)¹⁶. As part of forest management, the Assam Forest Act, 2004 also says “*To strengthen Elephant Reserves to ensure peaceful co-existence of man and elephant through ecological restoration, scientific and planned management of natural habitat and migratory routes in order to maintain viable population of Wild Asiatic Elephants in the State*”. The Assam Government has also undertaken several measures to resolve man-animal conflicts¹⁷. However, in spite of several laws and regulations many deaths of elephants and humans are reported every year in the PA.

The objective of the LEEF project is to create more protected areas, enhance forest cover, help in habitat restoration of wild animals and establish a robust monitoring system to record and report the issues in the PA, which will help in reducing man-animal conflict.

The project area is a part of Eastern Himalayas which is one of the biodiversity hotspots and it is very important that such landscapes are conserved and protected from any biodiversity loss. It is anticipated that this project shall help in conservation of biodiversity in the Eastern Himalayan region.

TABLE 4: DETAILS OF BIODIVERSITY BENEFITS ACCRUING FROM THE PROJECT

Positive impact	Impact “with project scenario”	Impact “without project scenario”	Indicators	Methodologies to estimate the impact
Increased flora and fauna species population	Nagaon is a part of one of the biodiversity hotspots of India, harbouring a large number of floral and faunal species. Proposed activities within the project will help conserve as well as enhance biodiversity in the PA.	In absence of the project scenario, deforestation and forest conservation will continue which may lead to disappearance of native floral and faunal species	<ul style="list-style-type: none"> No. of protected area inside the PA No. of threatened, rare and endangered species in the PA Increased heterogeneity and complexity of PA Rate of forest conversion to other land use 	Social survey tools, published/peer reviewed literature and expert inputs
Conservation of native plant species	Conservation of the proposed forest area will help in conserving the native species	In absence of the project scenario, deforestation and forest conservation will continue which will then lead to disappearance of native vegetation	Conservation status of PA	Social survey tools, published/peer reviewed literature and expert inputs

¹⁶ <http://www.iucnredlist.org/details/7140/0>

¹⁷ http://www.assamforest.in/forestGlance/assamForest_glance.php

Positive impact	Impact “with project scenario”	Impact “without project scenario”	Indicators	Methodologies to estimate the impact
Improved ecosystem services	The proposed project is based on a holistic approach that not only addresses forest loss but also helps in improving ecosystem services.	In absence of the project scenario there will be loss in biodiversity which will lead to loss of ecosystem services	Conservation status of PA	Social survey tools, published/peer reviewed literature and expert inputs
Improved habitat structure and forest health	Conservation, enhancement and effective management of forest in the project landscape will improve the forest health, habitat structure and habitat connectivity of large number of organisms. Owing to increased size and quality, more faunal and floral species could be found	Continuation of baseline scenario will lead to degraded forest quality and fragmentation. This will effect large number of native and exotic species of flora, fauna and microorganisms and ultimately end with their extinction	<ul style="list-style-type: none"> • Increased heterogeneity and complexity of PA • Conservation status of PA • Increased canopy density 	Social survey tools, published/peer reviewed literature and expert inputs
Protection of indigenous communities	The project design has been developed for the best interest and welfare of forest communities. The project design emphasizes generating	Continuation of baseline scenario in the long run will lead to extinction of the indigenous communities. Since, they completely depend on the forest for their survival and extinction of	<ul style="list-style-type: none"> • Numbers of indigenous and local community representatives participating in official meetings • Finance spent to support indigenous and pro-poor communities 	Social survey tools, published/peer reviewed literature and expert inputs

Positive impact	Impact “with project scenario”	Impact “without project scenario”	Indicators	Methodologies to estimate the impact
	<p>benefits for forest dependent communities. Their rights and effective participation has been ensured. The project promotes protection and involvement of indigenous communities and will not lead to eviction of any indigenous communities</p>	<p>forest might lead to their extinction.</p>		

1.8 Management of Risks beyond Project Lifetime

The project life is 20 years and the project longevity is expected to last far beyond this timeframe. The project is taking measures to enhance the climate, community, and biodiversity benefits of the project beyond the project lifetime by implementing the following activities in the longevity period:

1. Institutionalising multi-tiered framework under the office of the Chief Secretary of Assam to monitor the REDD+ projects. The REDD+ Task Force will manage the day to day affairs of the REDD+ project and the district based REDD+ Committee will ensure convergence and sustainability of the actions.
2. Awareness creation and capacity building during the project lifetime will sensitize communities towards sustainably managing and utilizing forest resources, maintaining the various interventions such as energy efficient devices and adapting an overall approach that is less GHG intensive.
3. The baseline will be updated after 10 years, taking into account any changes and other issues as per the requirements of REDD+ project.
4. The EE and the communities will be continuing to develop and implement sustainable forest and land use management plans based on current priorities for sustainable land use.
5. Developing alternative livelihoods so that a sustainable use of spare-time is ensured (opportunity cost from not having to go to forest to collect fuelwood).

2 Scope of the Project

2.1 Geographical Scope

2.1.1 Administrative arrangement

The Nagaon district was carved out of Morigaon district and formed as a new district in the year 1989. At present Nagaon has geographical area of 2,523.46 sq. km consisting of 10 revenue circles¹⁸. The total number of revenue villages in the district is about 1,396. There are 18 development blocks in the district with 3 administrative sub-divisions, namely Nagaon, Kaliabor and Hojai. In August 2015, Nagaon was further divided to form a new district Hojai, comprising 3 Tehsils of Nagaon namely, Hojai, Doboka and Lanka.

Total PA = 2523.46 sq.km or 252346.53 ha

2.2 Physical Features of Nagaon

2.2.1 Location

Nagaon district falls between 26^o-45' North Latitude and 92^o-33'-6" East Latitude¹⁹. The district is bounded by Sonitpur district and the river Brahmaputra in the north, West Karbi Anglong and North Cachar Hills in the south and East Karbi Anglong and Golaghat district in the east. Nagaon is the main access strip to upper Assam districts. The Project Area (PA) for this Jurisdictional REDD+ project is Nagaon District of Assam. Nagaon spreads across thousands of square kilometres of fertile alluvial soils, Brahmaputra river plains, and densely forested hills.

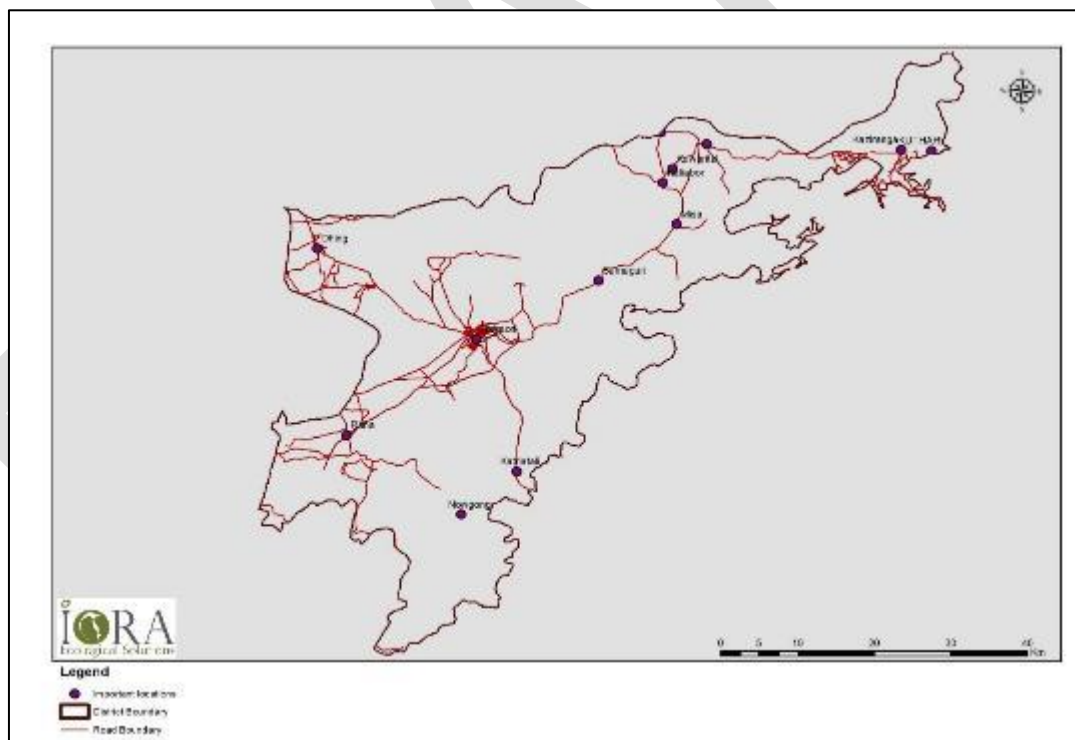


FIGURE 6: DISTRICT MAP OF NAGAON²⁰

¹⁸ <http://nagaon.gov.in/glance.html>

¹⁹ <http://nagaon.nic.in/geog.html>

²⁰ <http://www.nagaon.assampanchayat.gov.in/documents/7788737/0/nagaon-district-map.jpg?t=1370331895011>

2.2.2 Climate

The PA climate is very extreme compared to other parts of Assam. Nagaon experiences humid subtropical climatic conditions.²¹ The District is under the Agro-Ecological Sub Region (ICAR) of Assam and Bengal Plain, hot sub-humid to humid Eco-Region (15.2) Agro-Climatic Zone (Planning Commission), Eastern Himalayan Region (II) Agro Climatic Zone (NARP), Central Brahmaputra Valley Zone (AS-3). The annual average maximum temperature is 30.4° Celsius and the minimum is 19.8° Celsius. The average altitude of the district is 60.6 m²².

December and January are the coldest months of the year with minimum temperature from 11.2°C to 12.7°C. From March to middle of November, the temperature is fairly high, July & August generally being the hottest months. The maximum temperature on an average rises up to 30.75°C.

MONTH WISE AVERAGE TEMPERATURE DATA (In °C)

Station: Assam Agricultural University, Regional Agricultural Research Station, Shillongani, Nagaon.

Parameter: Monthly Average Temperature (°C)

Period: 01/01/2007 to 31/07/2016

TABLE 5: YEAR AND MONTHWISE TEMPERATURE DATA

Year Months	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan.	16.70	17.20	18.40	16.90	16.20	16.20	16.85	17.75	18.00	16.65
Feb.	18.20	17.80	20.75	19.70	19.50	19.50	20.40	18.20	19.20	20.20
Mar	22.35	22.40	22.75	23.40	23.20	23.20	23.70	22.60	23.50	23.05
Apr	24.05	24.55	25.50	25.05	25.10	25.10	25.20	26.10	23.90	24.90
May	27.95	27.95	27.50	26.65	27.40	27.40	26.90	27.20	26.60	26.45
Jun	23.05	28.95	28.05	27.85	29.20	29.20	29.90	29.25	28.05	28.75
Jul	29.35	29.60	29.85	29.35	29.40	30.10	29.60	29.50	29.40	28.35
Aug.	29.55	28.95	29.30	29.35	29.45	29.85	29.50	28.55	27.85	
Sep.	28.10	28.60	29.65	28.55	29.75	28.55	29.15	28.25	28.80	
Oct.	26.90	26.65	27.40	27.45	27.75	27.10	26.65	27.30	27.00	
Nov.	23.05	22.25	22.55	23.60	21.00	22.80	21.65	23.45	22.55	
Dec.	18.50	20.15	19.00	18.60	19.25	18.90	18.55	18.95	18.20	

2.2.3 Rainfall

Rainfall increases towards the east and the west of Assam from this district. The annual rainfall, on an average varies from 2.96 mm to 341.62 mm. A comparatively dry zone with average rainfall between 50 to 60 inches exists around Dhing (Brahmaputra plains). Over the past few year, rainfall pattern has been observed to have changed. This can be due to deforestation, El-Nino effect and urbanisation²³. During the socio-economic survey, people also admitted there is paradigm shift in raining pattern of the district. People

²¹ http://www.icarzcu3.gov.in/Dist_Agri_Inventory/Nagaon.pdf (pg no 8)

²² <http://dcmsme.gov.in/dips/Nagaon.pdf> (pg no 4)

²³ <http://nagaon.nic.in/geog.html>

recollected that they used to get very good rain spread across few months but now they are receiving same amount of rains for only few days.

MONTH WISE RAINFALL (IN mm) (Total)

Station: Assam Agricultural University, Regional Agricultural Research Station, Shillongani, Nagaon

Parameter: Monthly total rainfall in MM

Period: 01/01/2007 to 31/07/2016

TABLE 6: MONTH WISE RAINFALL (IN MM) FROM 2007 – 2016

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
2007	0.00	77.60	8.20	220.80	175.40	163.60	401.00	262.80	399.60	109.80	20.80	0.00	1839.60
2008	16.40	3.60	80.80	126.80	94.20	163.60	498.80	367.40	104.80	87.80	0.00	0.00	1544.20
2009	1.60	0.00	29.80	62.80	198.40	88.40	233.80	346.90	184.00	59.80	1.00	1.00	1207.50
2010	0.40	1.20	92.20	273.40	255.80	540.40	281.60	264.20	236.40	92.80	1.20	3.40	2043.00
2011	3.60	2.80	73.20	42.80	315.20	179.80	395.80	328.00	119.60	42.60	65.00	8.20	1576.60
2012	11.80	0.80	11.60	225.60	111.60	278.40	427.40	223.60	330.80	180.80	0.00	0.00	1802.40
2013	0.00	7.00	51.20	39.00	221.50	191.10	480.10	391.40	178.80	48.80	0.00	6.40	1615.30
2014	1.00	19.50	27.90	74.20	183.90	203.60	329.10	259.60	349.90	22.70	0.00	0.00	1471.40
2015	1.00	12.60	16.70	175.90	207.40	284.40	264.60	354.20	160.10	78.30	19.00	30.20	1604.40
2016	33.90	0.40	60.40	262.00	157.20	227.40	495.90						1237.20

Station: Assam Agricultural University, Regional Agricultural Research Station, Shillongani, Nagaon

Parameter: Monthly Maximum Temperature (°C)

Period: 01/01/2007 to 31/07/2016

TABLE 7: MONTHLY MAXIMUM TEMPERATURE (°C) FROM 2007 – 2016

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	24.00	23.50	25.00	23.60	22.40	22.40	24.10	24.20	24.70	22.10
Feb	24.00	24.10	27.40	26.90	26.20	26.20	28.20	24.00	25.80	25.40
Mar	28.90	27.80	30.00	29.80	29.30	29.30	30.30	28.50	29.80	28.40
Apr	29.20	29.60	30.40	29.40	30.30	30.30	31.20	32.60	28.60	29.10
May	32.80	33.00	32.20	31.00	32.10	32.10	30.70	31.60	30.70	30.00
Jun	28.40	33.40	34.00	31.30	33.10	33.10	34.00	32.70	31.10	32.20
July	33.20	33.60	34.20	32.70	33.00	34.40	33.10	33.00	33.10	31.10
Aug	33.40	32.50	33.00	33.00	33.00	33.40	33.10	31.10	30.40	
Sep	31.60	32.70	33.70	32.00	33.60	32.30	32.60	31.40	31.90	
Oct	30.80	31.40	31.80	31.20	32.80	31.80	30.50	31.50	31.30	
Nov	28.70	29.00	28.50	28.90	26.70	28.80	27.70	28.70	27.80	
Dec	25.40	26.50	24.90	24.80	26.10	25.00	24.30	24.90	23.70	
Total	29.20	29.80	30.40	29.60	29.90	29.90	30.00	29.50	29.10	

Station: Assam Agricultural University, Regional Agricultural Research Station, Shillongani, Nagaon

Parameter: Monthly Minimum Temperature (°C)

Period: 01/01/2007 to 31/07/2016

TABLE 8: MONTHLY MINIMUM TEMPERATURE (°C) FROM 2007 – 2016

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan.	9.40	10.90	11.80	10.20	10.00	10.00	9.60	11.30	11.30	11.20
Feb.	12.40	11.50	14.10	12.50	12.80	12.80	12.60	12.40	12.60	15.00
March	15.80	17.00	15.50	17.00	17.10	17.10	17.10	16.70	17.20	17.70
April	18.90	19.50	20.60	20.70	19.90	19.90	19.20	19.60	19.20	20.70
May	23.10	22.90	22.80	22.30	22.70	22.70	23.10	22.80	22.50	22.90
June	17.70	24.50	25.10	24.40	25.30	25.30	25.80	25.80	25.00	25.30
July	25.50	25.60	25.50	26.00	25.80	25.80	26.10	26.00	25.70	25.60
August	25.70	25.40	25.60	25.70	25.90	26.30	25.90	26.00	25.30	
Sept.	24.60	24.50	25.60	25.10	25.90	24.80	25.70	25.10	25.70	
Oct.	23.00	21.90	23.00	23.70	22.70	22.40	22.80	23.10	22.70	
Nov.	17.40	15.50	16.60	18.30	15.30	16.80	15.60	18.20	17.30	
Dec.	11.60	13.80	13.10	12.40	12.40	12.80	12.80	13.00	12.70	
Total	18.80	19.40	19.90	19.90	19.70	19.70	19.70	20.00	19.80	

2.2.4 Rock and Soil

The project area is flat alluvial terrain with hills on its southern part. Most of the North Karbi-Anglong hills are composed of massive gneiss or foliated granite. The gneiss is composed mostly of quartz feldspar with magnetic hornblende and mica. The area consists of combined formations belonging to Pre-Cambrian Groups of rocks²⁴, Semi-consolidated Formations of Tertiary age²⁵ and overlain by Unconsolidated Alluvial sediments of Quaternary age²⁶.

The major soil type of the district is alluvial loamy which consists of a mixture of clay and sand in varying proportions. Low-lying areas are mainly marshy soil which are black in colour. The foot hills and hill slopes mainly contain red soil which is good and suitable for forest growth.²⁷

²⁴ <https://www.britannica.com/science/Precambrian-time>

²⁵ <http://wrmin.nic.in/writereaddata/WatertheResource/tab17562984991.pdf>

²⁶ <http://wrmin.nic.in/writereaddata/WatertheResource/tab17562984991.pdf>

²⁷ http://www.cgwb.gov.in/District_Profile/Assam/Nagaon.pdf

Sl.No	Name of the block	Clay		Clayloam		Alluvial Soil		Sandy Soil		Sandy loam	
		Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
1	Bajiagaon	2893	24.04	5250	43.62	1118	9.29	1250	10.39	1525	41.67
2	Barhampur	3800	30.24	2368	18.84	400	3.18	900	7.16	5100	40.58
3	Batadrava	327	3.25	5820	57.90	3280	32.63	72	0.72	553	5.5
4	Binakandi	4483	17.30	10461	40.38	7970	30.76	498	1.92	2496	9.63
5	Dholpukhuri	4430	29.31	4320	28.59	3930	26.01	112	0.74	2320	15.35
6	Dolongghat	1530	14.68	2500	23.99	520	4.99	250	2.40	5620	53.93
7	Jugijan	-	-	6492	62.00	523	4.99	1361	13.00	2095	20.00
8	Juria	974	6.72	2012	13.88	1738	11.99	1550	10.69	8218	56.68
9	Kaliabor	724	5.73	362	2.87	4227	33.48	1131	8.96	6181	52.69
10	Paschim Kaliabor	4466	18.55	2560	10.63	2870	11.92	12500	51.91	1683	6.99
11	Kathiatoli	3969	14.98	11500	43.42	1000	3.78	18	0.06	10000	37.75
12	Khagarijan	450	5.55	941	11.61	5582	68.88	146	1.80	985	12.15
13	Laokhowa	-	-	140	1.53	1800	19.69	2700	29.54	4500	48.96
14	Lumding	-	-	625	11.67	512	9.56	420	7.84	3798	70.92
15	Pakhimoria	505	6.82	2210	29.86	919	12.42	485	6.55	3283	44.35
16	Raha	1230	4.51	4772	17.51	9631	35.34	2852	10.47	8767	32.17
17	Rupahihat	-	-	-	-	930	9.93	944	10.07	7495	80.00
18	Udali	7500	16.30	16300	35.43	1500	3.26	1200	2.61	19500	42.39
Total		37281	13.00	78633	27.41	48450	16.89	28389	19.90	94119	33.28

FIGURE 7: SOIL RESOURCES OF THE DISTRICT²⁸

2.2.5 Flora and Fauna

Forests cover 20.7% of Nagaon's total geographical area with 793 sq.km under forest. This includes 40 sq.km of very dense forest, 351 sq.km of moderately dense forest and 402 sq.km of open forests. There is a decrease in the forest cover compared to the assessments made in 2013 to 2015, due to encroachment of forest land, biotic pressure, and rotational felling in tea garden²⁹.

The Nagaon district is home to the world-famous One-horned Rhinoceroses and has a World Heritage site. The PA is also home to the Royal Bengal Tiger, Asiatic Elephant, Eastern Swamp Deer and the Asiatic Wild Buffalo. The PA has also a wildlife sanctuary called Laokhowa Wildlife Sanctuary which is situated on the southern bank of Brahmaputra River having an area of 70.13 sq.km. Forests of Nagaon district vary from Evergreen to Dry Deciduous type and are dominated by Sal species. Also the forests are classified into two classes namely Reserved forests and unclassified state forests.

²⁸ http://www.icarzc3.gov.in/Dist_Agri_Inventory/Nagaon.pdf

²⁹ <http://fsi.nic.in/isfr-2015/isfr-2015-forest-and-tree-resources-in-states-and-union-territories.pdf> (pg no 16 and 17)

2.3 Socio-economic Profile of Nagaon

Detailed socio-economic study was conducted in Nagaon district in order to ascertain the present agents and drivers responsible for deforestation and forest degradation. The study implemented most commonly used tools for collection of socio-economic information such as in–depth interviews of individuals (household survey), focus group discussions (FGDs) with communities, dialogues, and personal observation. Major data was collected using in–depth interviews of individuals (household survey). A detailed questionnaire was designed and field-tested before implementing large scale data collection. In total 567 households were surveyed in 58 villages of the 7 forest ranges in the Nagaon district. Since this is a Jurisdictional REDD+ project activity, the villages were selected within the administrative boundaries of Nagaon district. The households surveyed were representative of large, medium and small farmers, and landless households. The survey was conducted between the months of December 2016 and January 2017. The following Table 9 gives the names of Forest Ranges and Villages and also the number of households surveyed during the study.

TABLE 9: LIST OF VILLAGES AND NUMBER OF HOUSEHOLDS VISITED FOR SURVEY

Range	Village	No. of HHs	Range	Village	No. of HHs
Dhania	1 No. Bhurbandha	10	Kathiatoli	2 No. Pilkhana Bongaon	2
	3 No. Bhagamukh	10		Borkacharigaon	11
	3 No. Bhurbandha	10		Garogaon	10
	5 No. Bhagamukh	9		Garubandha	8
	6 No. Bhagamukh	1		Manuhargaon	8
	7 No. Bhagamukh	1		Rengbeng	4
	Sutirpar Chitalmari	11		Sarupathar	4
Dharamtul	Amsoi Gaon	10	Nagaon Sadar	Tetelisara	10
	Balikuchi	11		Adarsha Gaon	12
	Burha rajagaon	10		Alitangani	13
	Ganeshguri	10		Bejorgaon	12
	Gashpara	10		Dagaon	12
	Niz sahari	10		Fuhaniati	13
Garajan	Barunguri Bongaon	10	Salona	Ghugar gaon	14
	Kaliyadangia Tongia gaon	12		Rowmari	13
	LalungGaon	10		Uriagaon	15
	Lawkhuwa Bongaon	8		Baghekhaiti	1
	Nalkata Bongaon	13		Balijuri Karbigaon	11
	Salpara Bongaon	10		Bolhula karbi gaon	15
	Senimari Bil	10		Bonbahoni	2
	Sunsahar Bongaon	14		Hatimurah	15
Sutirpar Bongaon	10	Nalbari Kacharigaon	10		
Kampur	1 No. Kuhimari	3		Namkamakhya	12
	2 No. Kuhimari	7		Samdhara	10
	9 no Kheroni (Tongia gaon)	18		Sunarigaon	12
	Atigaon	7		Uttar Borghat	10

Range	Village	No. of HHs	Range	Village	No. of HHs
	Dakhin Jor Bagan	11	Grand Total		567
	Jadupathar	12			
	Kuhimari	2			
	Lutumari Tapakuchi	9			
	Natun Garukhunda (Pilkhana1)	16			
	Sitalmari	13			



FIGURE 8: GLIMPSES OF SURVEY

2.3.1 Demographic details

As per Census 2011, the PA has a total population of 28,26,006 with decadal growth of 22.09%³⁰. Population density of the PA is 711 persons per sq. km. which higher compared to the State's population density of 398 persons per sq. km. 86.97% of the total population of the PA lives in rural areas. The district historically comprises diverse ethnic groups. Major population of the district is from the Muslim community followed by the Hindu and Christian communities.

³⁰ <http://nagaon.nic.in/cen2011assam.xls>

TABLE 10: POPULATION DATA (CENSUS 2011) OF NAGAON DISTRICT

Population		
Total	Rural	Urban
28,26,006	24,57,906	3,68,100
Percentage Decadal Growth (Persons)		
Total	Rural	Urban
22.09	20.70	32.27
Sex Ratio (No. of Females per 1000 Males)		
Total	Rural	Urban
962	962	963

2.3.2 Livelihood

Agriculture is the principal occupation and income generating activity of the district. Besides that handloom and weaving are two major economic activities of the communities. Rice, sugarcane, mustard, jute, coconuts, bananas and vegetable are the major crops grown in the district³¹. Total cropped area of the district is 3,54,801 ha and net sown area is 2,34,633 ha. With Paddy being the principle crop in the district, about 78% of the total population is dependent on agriculture³².

2.3.3 Household size

As of Census 2011, the average household size is 6 members, with 4 adults and 2 children. The average adult equivalent of a family is 4.47³³. Analysis revealed that the male to female ratio is 1000:956³⁴.

2.3.4 Census Classification

The project area (PA) is a part of the State of Assam, in the North-Eastern (NE) region of India. Assam is a tribal state and from the survey (refer Figure 10) it is evident that majority of the people (35%) belong to scheduled tribe (ST) followed by other backward classes (OBC), General, scheduled caste (SC), and More Other Backward Classes (MOBC).

³¹ <http://pmgsy.nic.in/pas128.asp>

³² <http://nagaon.nic.in/econ.html>

³³ Adult equivalent- Male – 1; Female – 0.85 and Children – 0.5

³⁴ <http://www.census2011.co.in/census/state/assam.html>

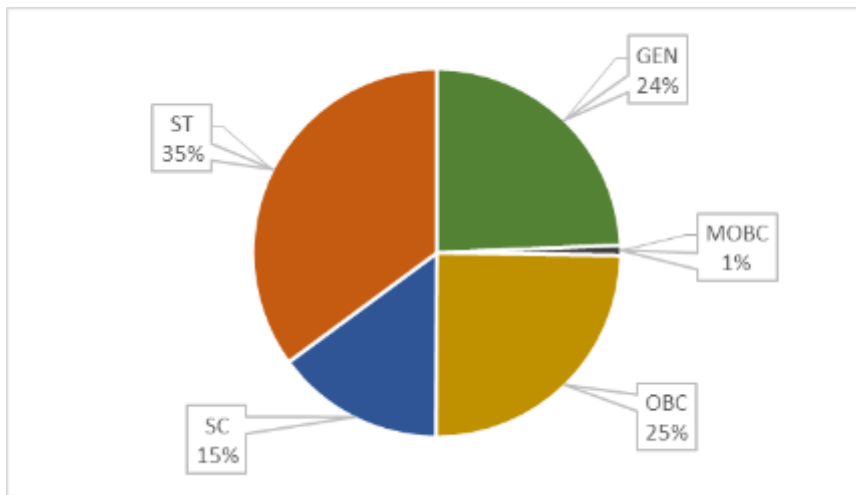


FIGURE 9: CENSUS CLASSIFICATION

2.3.5 Literacy Status

Literacy plays an important role in livelihoods of communities. It determines the analytical capacities and decision making capacities of people. This is an important indicator of human development. As per 2011 census survey, the PA literacy rate stands at 72.37%³⁵. The survey conducted in the PA revealed that 29% of respondents are uneducated, only 4% of the respondents have completed graduation, and more than 38% of the people have completed primary and high school.

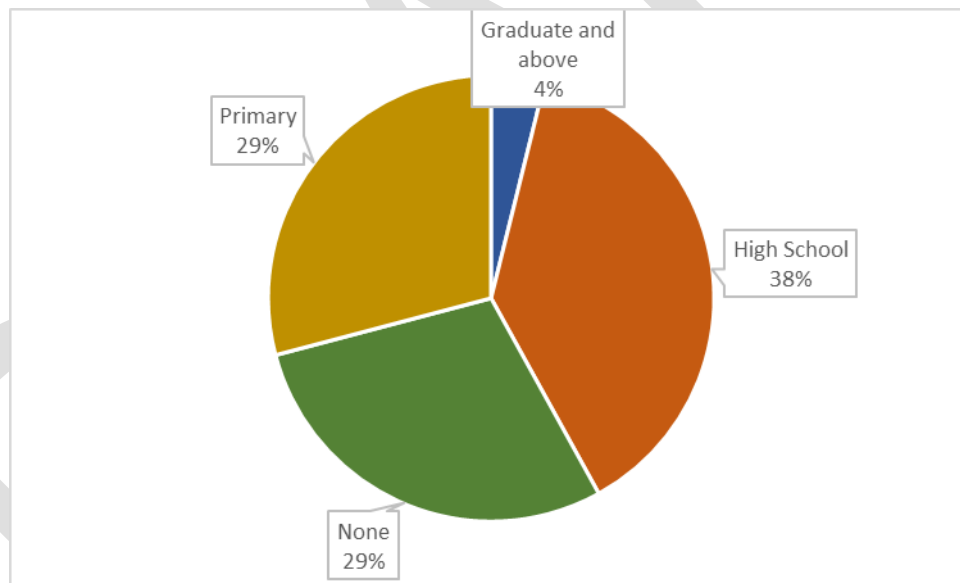


FIGURE 10: LITERACY STATUS

2.3.6 Dwelling units

The PA, being a part of north-eastern India, is prone to natural calamities like heavy rainfall, earthquakes, etc. Thus, communities prefer to build houses which are climate resilient. Traditional Assamese houses use light materials such as Bamboo, Ikra (locally available reed) to build houses. Traditional house construction is based on several factors ranging from socio-cultural, economic to physical factors. The type of dwelling unit defines the requirement of timber for household construction and regular maintenance. Majority of the roofs of the dwelling units are covered with metal sheets (83%). This type of house construction requires

³⁵ http://www.censusindia.gov.in/2011census/dchb/1806_PART_B_DCHB_NAGAON.pdf

supporting beams to hold the sheets intact. These beams are made up of either timber or bamboo, which is collected locally from the forests³⁶.

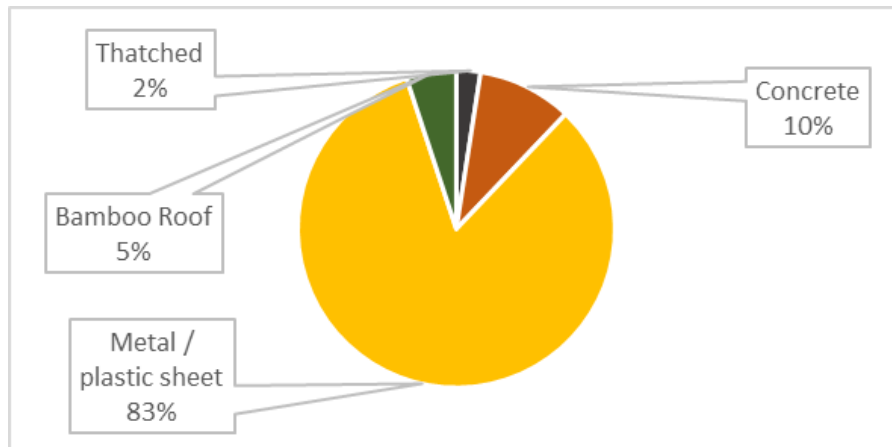


FIGURE 11: HOUSE TYPE



FIGURE 12: NORMAL HOUSE TYPES IN NAGAON

2.3.7 Land holdings

In general, land holdings determine the poverty status of communities. There is strong evidence of high correlation between rural poverty and land holding size of the communities. Poverty is very high in those communities that do not possess any land compared to those which do. Greater the land holding lesser the poverty.

³⁶ http://www.censusindia.gov.in/2011census/dchb/DCHB_A/18/1806_PART_A_DCHB_NAGAON.pdf (page no24)

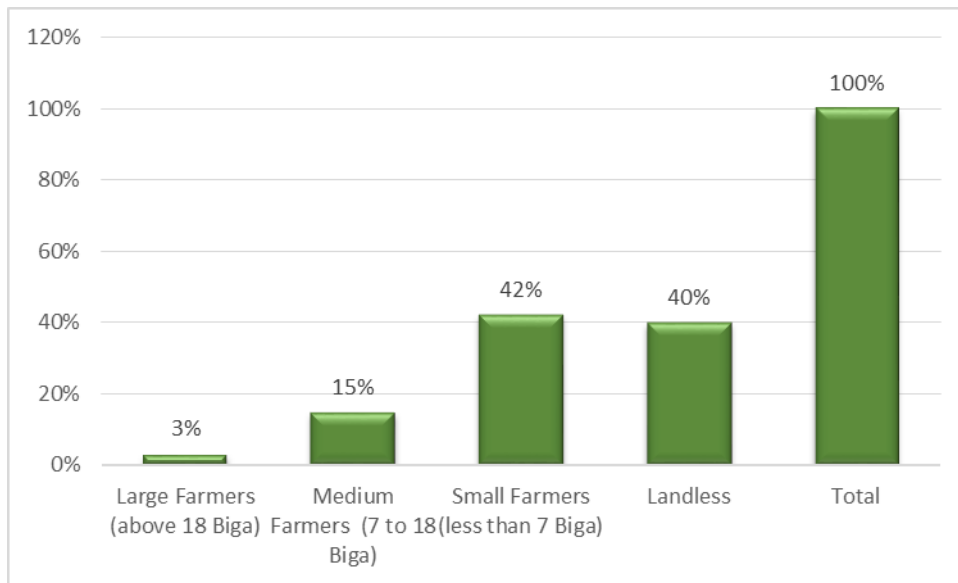


FIGURE 13: LAND HOLDING PATTERN

Figure 14 above shows the land holding pattern of the survey area conducted by the project entity for the project. Majority of the population (40%) is landless population. 42% of the surveyed households have land holdings of less than 7 biga³⁷ land. This indicates people have to look for freely available resources for sustenance. Consequently, forests cater to the needs of landless and small farmers, especially energy needs in the project area.

2.3.8 Occupation

Nagaon is an agrarian district. 42% of the surveyed households' primary occupation is agriculture followed by casual labour (32%) in agriculture related activities. Households with less land holding also take up casual labour as their secondary occupation. Other occupation involves carpenters, teachers, ex-servicemen, etc.

³⁷ 1 Acre=2.5 biga

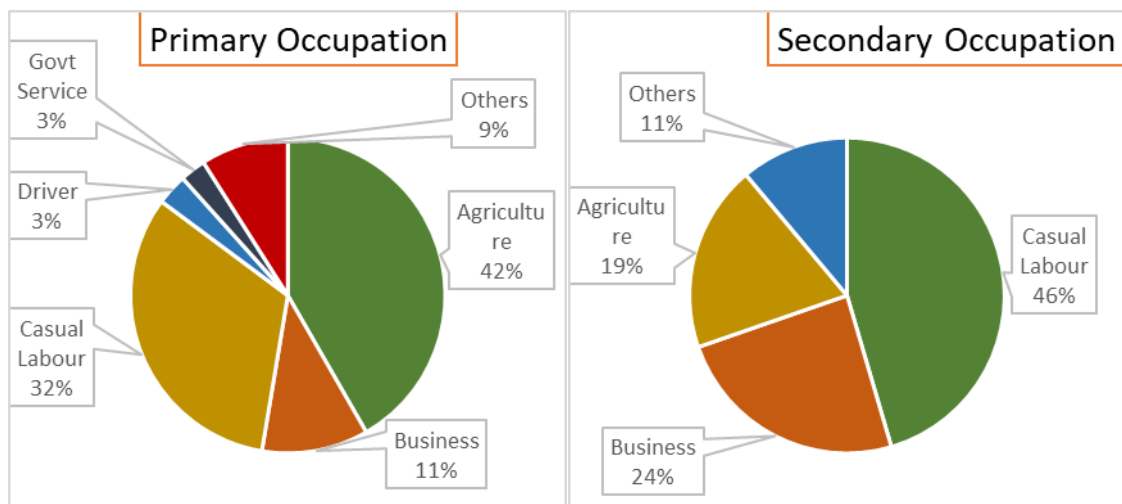


FIGURE 14: PRIMARY AND SECONDARY OCCUPATION

The survey revealed that primary occupation of 3% of the respondents is driving commercial vehicles. People also have local wine making business in which they consume fuelwood to process the wine. The processed wine is sold in local weekly markets of nearby villages.

2.3.9 Land under Cultivation

Nagaon is known as the rice bowl of Assam. Nearly 89% of people cultivate paddy as their primary crop and it is grown all over the year. Jute is grown as a secondary crop in the district. Vegetables like Brinjal and Potato are commonly grown and most of the produce is consumed by the household itself. Surplus production of paddy is sold to nearby agents and markets. Community fishing is also practiced in certain areas. Water is available in abundance for cultivation. Nearly 50% of land is irrigated from streams, wetlands and small ponds next to the farmers' lands using either diesel or electrified pumps.

SL.No	Crop	Area (ha)*	Production (MT)*	Productivity (MT/ha)*
1	Winter rice	157685	441688	2.73
2	Summer rice	59562	262600	3.44
3	Autumn rice	28426	91748	2.68
4	Wheat	6121	7980	1.12
5	Maize	2731	2346	0.86
6	Jute	13507	30313	2.63
7	Mesta	283	199	0.71
8	Sugarcane	4686	221647	47.30
9	Green gram	2314	3806	0.66
10	Black gram	4347	2739	0.63
11	Rajmah	260	148	0.57
12	Pea	3130	2316	0.74
13	Lentil	1657	961	0.58
14	Khesari dal	988	889.5	0.46
15	Toria	19058	16390	0.86
16	Sesamum	1439	762	0.53
17	Linseed	210	109	0.52
18	Nizer	102	55	0.54
19	Groundnut	254	660	2.6
20	Gram	96	50	0.52
21	Arhar	980	951	0.97

FIGURE 15: AREA, PRODUCTION AND PRODUCTIVITY OF MAJOR CROPS FOR 2011-12³⁸

2.3.10 Livestock

Cattle plays an important role in livelihood generation of Indian rural population through milk, manure and as part of the agricultural activities like ploughing, transporting, etc. Nowadays, mechanisation of agricultural activities has reduced the burden of livestock utilisation as well as native breed cattle rearing. On the contrary, the survey revealed that native breed dominates the cattle population in Nagaon district. Table 11 summarises the number of cattle present in the PA surveyed households.

TABLE 11: CATTLE POPULATION

Cows		Buffalo		Ox, Bulls	
Native	Cross Breed	Native	Cross Breed	Native	Cross Breed
816	11	4	0	91	0

Also Sheep, Pig, Chicken and Geese are reared in most of the households and used for meat purposes. Around 68% of surveyed households rear cattle, with an average of 3 cows present per family.

2.4 Forest dependency

Recently in Rajya Sabha, it has been conveyed that 31.98% of Assam population lives below poverty line (BPL)³⁹. Also, as per the survey, nearly 40% of the families are landless and 42% of families are small and marginal farmers with less than 2 acre of land. Along with poverty, increase in population has increased the demand for forest products, thereby increasing the pressure on forests which leads to deforestation and degradation. Since time immemorial, forests are the common resource and service provider for human beings as well as wild creatures. Assam forests are rich in resources and at present these forests are catering services to the needs of the people. Studies conducted in the area has revealed that majority of the people depend on forests to lead their daily life. People depend on forests mainly for fuelwood, small timber and NTFP products. Detailed discussion on forest dependency of the communities is discussed in section 6 of this document. Unsustainable and unplanned extraction of forest produces has degraded the forests considerably. There are instances where communities have encroached forest lands and converted into agriculture lands. This has resulted in deforestation in the district.

³⁸ http://www.icarzc3.gov.in/Dist_Agri_Inventory/Nagaon.pdf

³⁹ https://www.telegraphindia.com/1170411/jsp/northeast/story_145661.jsp#.WQMIAcYIHU

2.5 Project Chronology/milestones

The start date of the project is 10/01/2015. The start date for project crediting period is 01/01/2017. The program-crediting period is 20 years. Baseline will be re-validated and updated after every 10 years.

TABLE 12: MAJOR MILESTONES DURING PROJECT DEVELOPMENT

Milestone	Date
Inception report	June 2016
Constitution of REDD+ Task Force	25 July 2016
REDD+ Cell: Pre-formation meeting	04 August 2016
Jurisdictional REDD+ Project Road Map	04 August 2016
Assam REDD+ meeting on the concepts and the potential landscapes	04 August 2016
Meeting with the Principal Secretary, DoEF on REDD+	16 September 2016
Constitution of REDD+ Cell in Assam	23 September 2016
Draft Safeguards Information System report	September 2016
Draft Benefit Sharing Mechanism report	September 2016
Finalization of project sites	23 October 2016
Launch of the projects by the Chief Secretary	16 November 2017
Launch of project at DDC meetings in and workshops, meetings with departments apart from forest department	December 2016
Report on stakeholder mapping	December 2016
Notification for nomination of Nodal officer and submitting details of two schemes/ programmes with high potential of convergence with LEEF	6 December 2016
Socio-economic survey in Nagaon	February 2017
RS/GIS analysis: procurement of layers, classification	January onwards
Working Plan – REDD+ convergence	April 2017
Launch of communication hoardings	22 March 2017
Draft presentation of findings of Nagaon socio-economic survey	21 March 2017
Validation of drivers and classification with officers from Nagaon landscape	22 April 2017
Meeting with the DFO on the subsequent actions, meeting with ADC on district boundary	26 April 2017
Presentation of the project at the DDC meeting	05 July 2017

3 Project Boundary

3.1 Carbon Pools

A rigorous assessment of the Carbon stock of the PA forests has been undertaken through spatial analysis and extensive field surveys. The Carbon pools considered as part of Carbon stock assessment and baseline development, along with their justification, has been given below.

TABLE 13: CARBON POOLS CONSIDERED FOR JURISDICTIONAL BASELINE

Carbon pools/ sources	Gas	Included	Justification/Explanation
Aboveground tree or woody biomass	CO ₂	Yes	Major carbon pool affected by project activities
Aboveground non-tree or non-woody biomass	CO ₂	No	Time and resource limitations
Belowground biomass	CO ₂	Yes	Major carbon pool affected by project activities
Litter	CO ₂	Yes	Carbon pool affected by Project activity
Dead wood	CO ₂	No	Dead wood contribution to the Carbon pool is negligible (1% approx.) ⁴⁰ .
Soil organic carbon	CO ₂	Yes	Major carbon pool affected by project activities

3.2 Baseline Sources and Project Sources of GHG

Source	Gas	Included?	Justification/Explanation
Baseline Deforestation and Forest Degradation	CO ₂	Yes	Emissions are related to changes in carbon pools.
	CH ₄	Yes	Included only in the case of certain intervention activities such as cook stove and fuel efficiency activities (CFE). In baseline if biomass is burnt during land preparation in the case of ARR, CH ₄ is included. In baseline if grazing and animal management is involved, CH ₄ is not counted for reasons of conservativeness.
	N ₂ O	Yes	Included as cook stove and fuel efficiency activities (CFE) are involved. In baseline or project if biomass is burnt, N ₂ O is included. If baseline involves application of fertilizers N ₂ O is not considered for reasons of conservativeness.
Baseline Afforestation, Reforestation and Revegetation (ARR)	CO ₂	Yes	Emissions are related to changes in carbon pools.
	CH ₄	No	Emissions are expected to be negligible. Hence excluded.
	N ₂ O	No	Emissions are expected to be negligible. Hence excluded.

⁴⁰ Carbon Stock in India's Forests, Forest Survey of India 2009

Source		Gas	Included?	Justification/Explanation
Project	Biomass burning from unplanned large and small scale fires and biomass burnt in cook stoves	CO ₂	No	Emissions are excluded as they are a part of the changes in carbon pools.
		CH ₄	Yes	CH ₄ emissions of burning woody biomass from unplanned fires are to be accounted. If the fires are catastrophic, CH ₄ emissions must be estimated and demonstrated negligible or otherwise accounted for.
		N ₂ O	Yes	N ₂ O emissions of burning woody biomass from unplanned fires are to be accounted, If the fires are catastrophic, N ₂ O emissions must be estimated and demonstrated negligible, or otherwise accounted for.
	Fossil fuel used during operations	CO ₂	No	Emissions from fossil fuel combustion is considered <i>de minimis</i> for REDD and ARR. Excluded.
		CH ₄	No	Insignificant
		N ₂ O	No	Insignificant
	Removal of woody biomass during assisted natural regeneration (ANR and ARR) activities	CO ₂	Yes	Emissions related to changes in carbon pools are taken into account. But woody biomass will not be removed during assisted natural regeneration activities.
		CH ₄	Yes	CH ₄ emissions from removal of woody biomass are significant when fire is used in preparing the land for ANR activities. But woody biomass will not be removed during assisted natural regeneration activities.
		N ₂ O	No	N ₂ O emissions from burning woody biomass during ANR activities are assumed negligible and conservatively excluded.
	Fertilizer used during enrichment planting for assisting natural regeneration and ARR	CO ₂	No	Assumed negligible
		CH ₄	No	Assumed negligible
		N ₂ O	No	Assumed negligible
	Increased fertilizer use	CO ₂	No	Not Applicable
		CH ₄	No	Not Applicable
		N ₂ O	No	N ₂ O emissions related to increased fertilizer use are <i>de minimis</i> .

Data Source	Main Use of Data	Information about data collected
(If different sources of remote sensing data are used, a formal comparison of the sensors should be added to the monitoring report to ensure consistency)		Landsat multi-spectral sensor with a spatial resolution of 23.5 m, operating in the visible, near infra-red bands and 70.5 m resolution in the shortwave infra-red band, with a swath of 141 km. Landsat multi-spectral sensor with a spatial resolution of 23.5 m, operating in the visible, near infra-red bands and shortwave infra-red band, with a swath of 141 Km.
Minimum Mapping Unit (ha)	Training of classification procedures Independent verification of the analysis of historical images	≥1 hectare
Description of method used to produce these data		The LULC maps for historical baseline are classified using supervised approach with Maximum Likelihood Classifier (MLC).
Descriptions of the LULC classes and/or LULC-change categories		The LULC classes or categories described are as follows: App. Kamrup Sal Forest (AKS) East Himalayan Mixed Deciduous Forest (EMMD) Cachar Semi Evergreen Forest (CSE) Bamboo Brakes Cropland Waterbodies Grassland Other Land Settlements

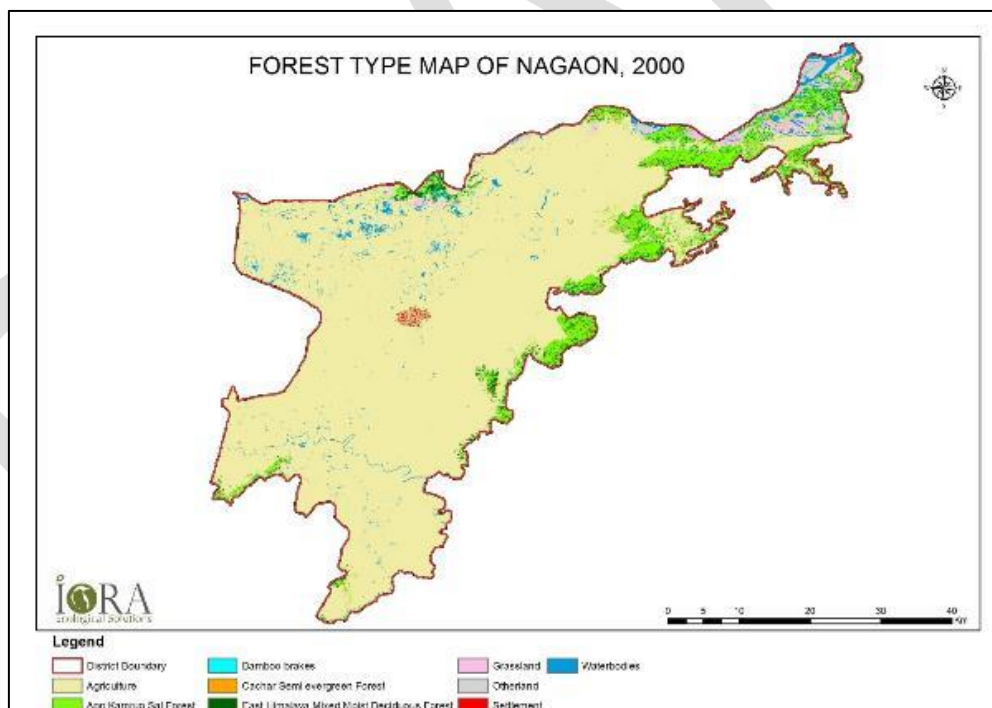


FIGURE 16: FOREST TYPE MAP NAGAON, 2000

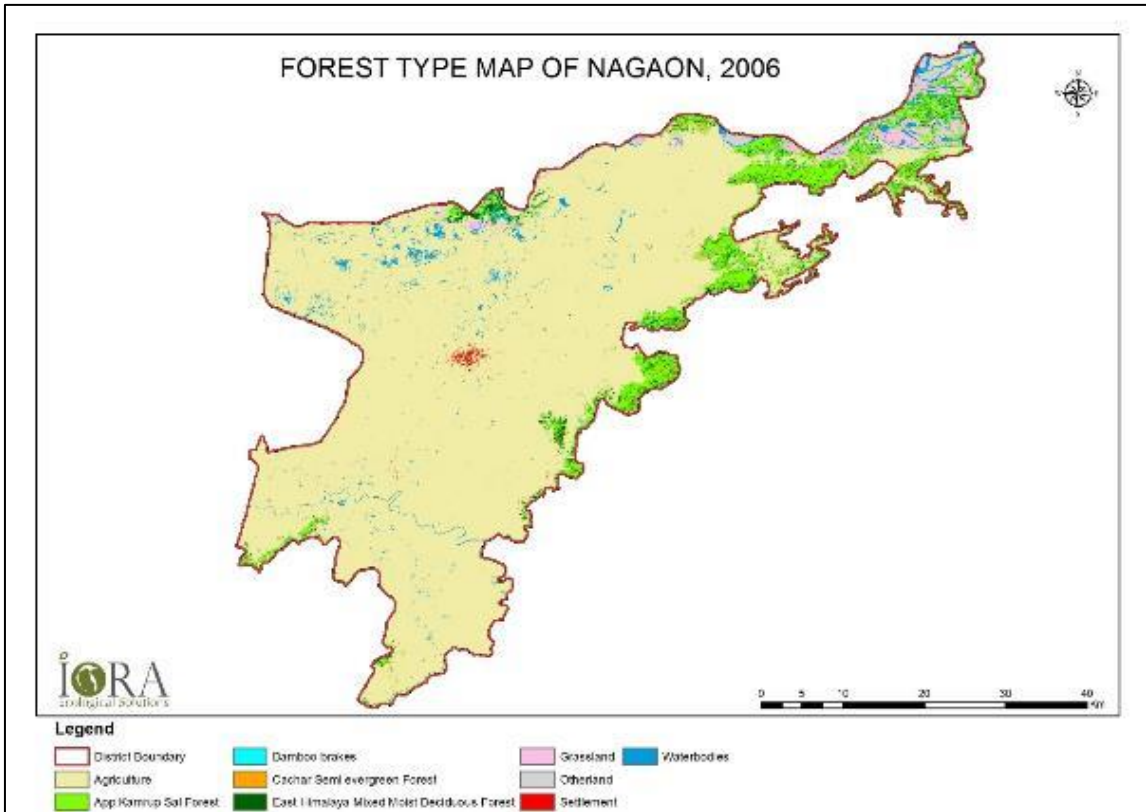


FIGURE 17: FOREST TYPE MAP NAGAON, 2006

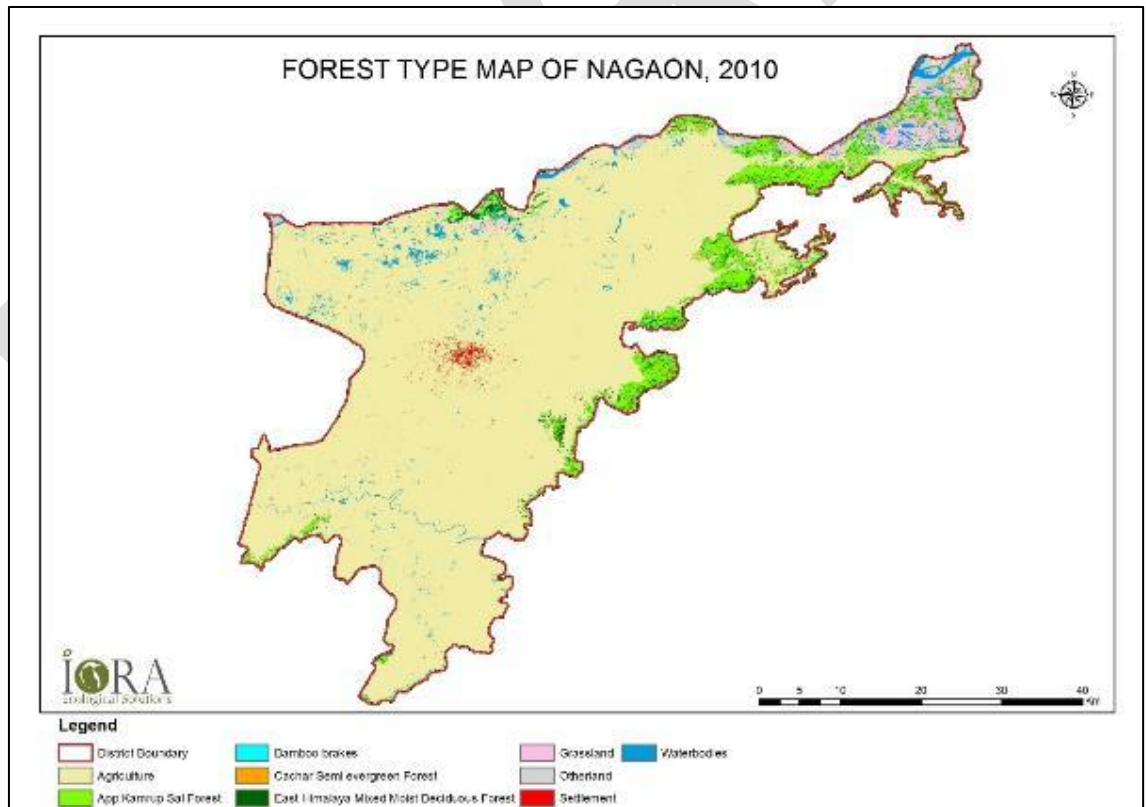


FIGURE 18: FOREST TYPE MAP NAGAON, 2010

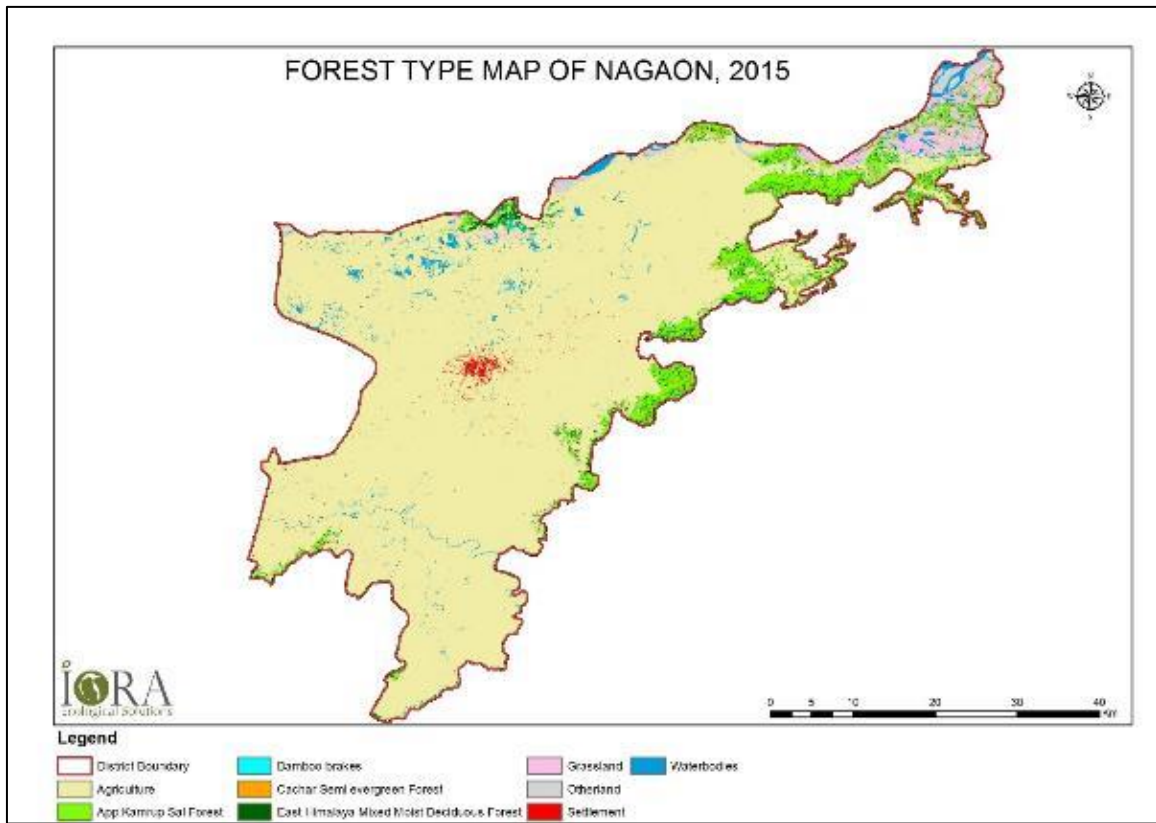


FIGURE 19: FOREST TYPE MAP NAGAON, 2015

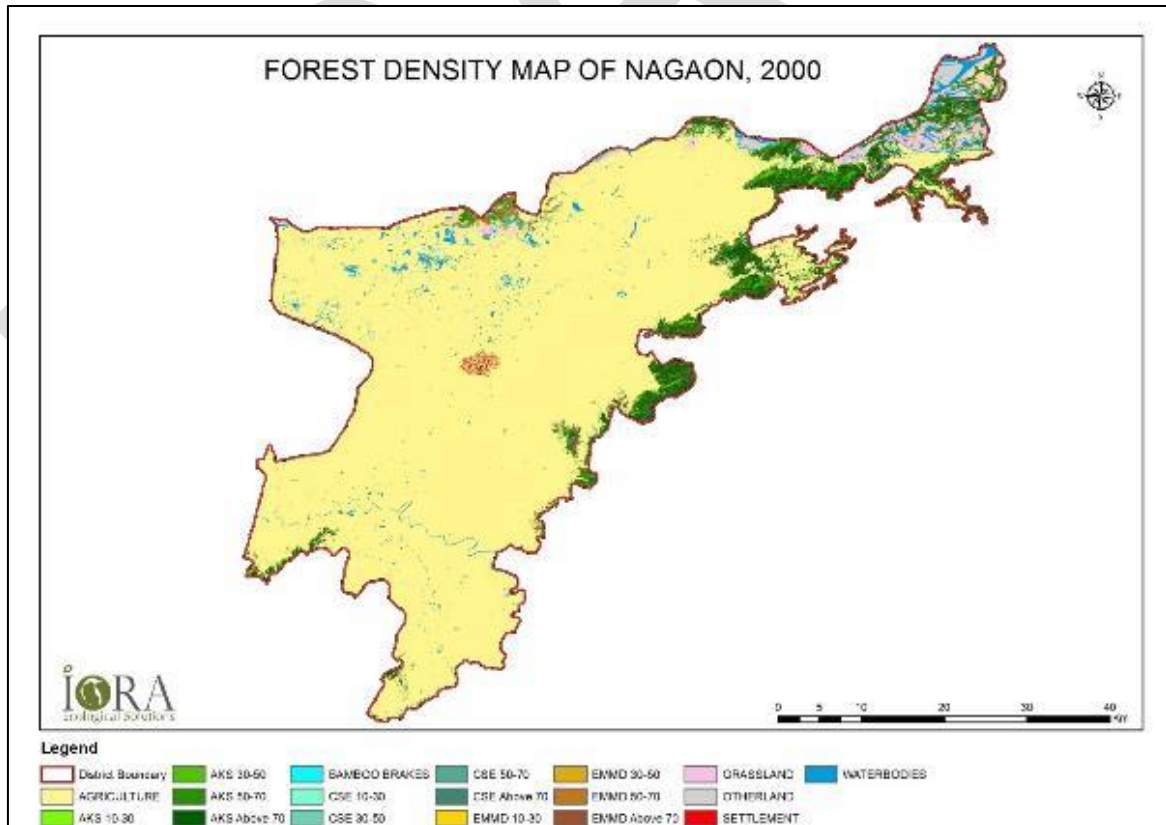


FIGURE 20: FOREST DENSITY MAP OF NAGAON, 2000

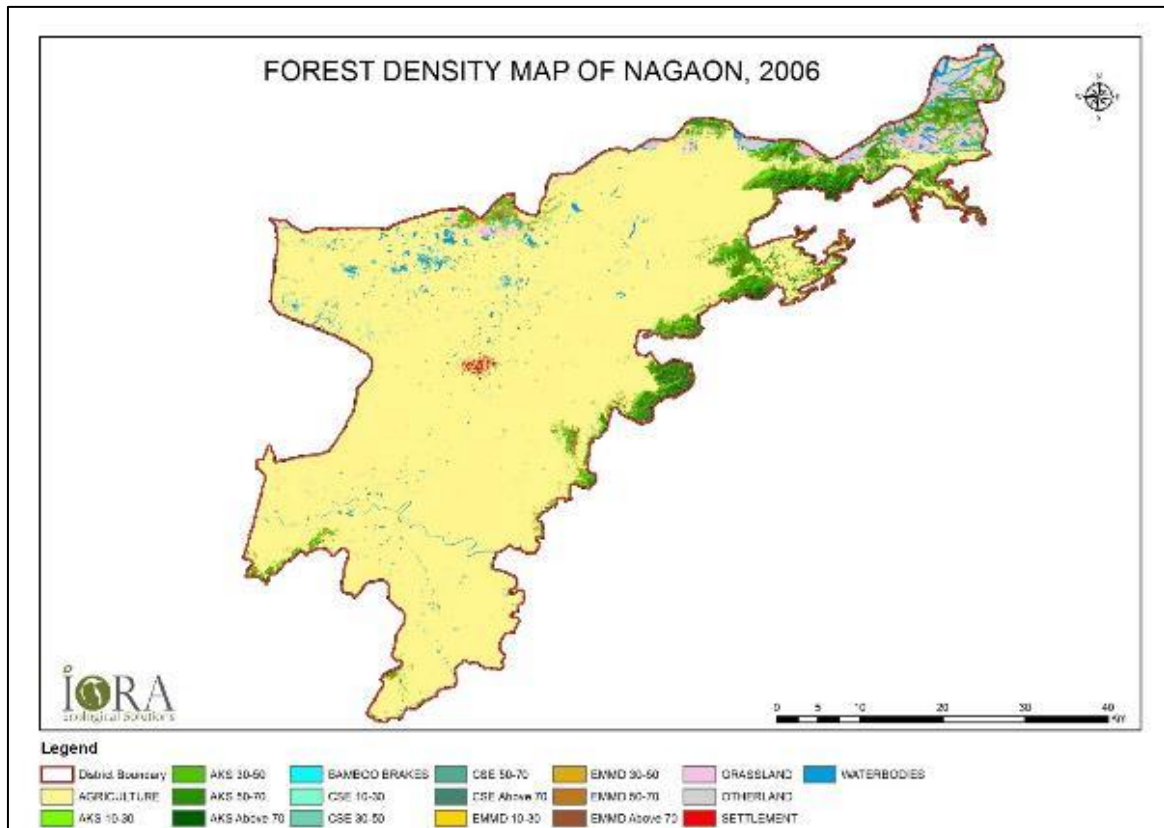


FIGURE 21: FOREST DENSITY MAP NAGAON, 2006

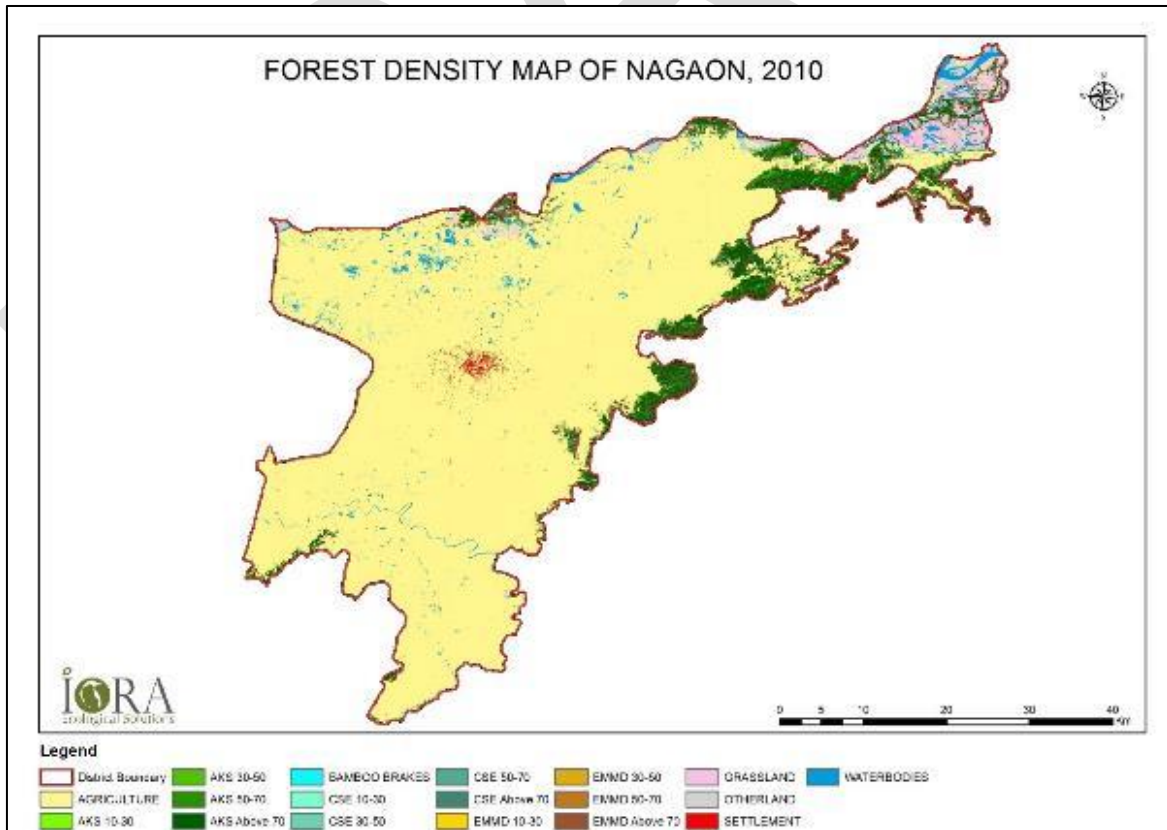


FIGURE 22: FOREST DENSITY MAP NAGAON, 2010

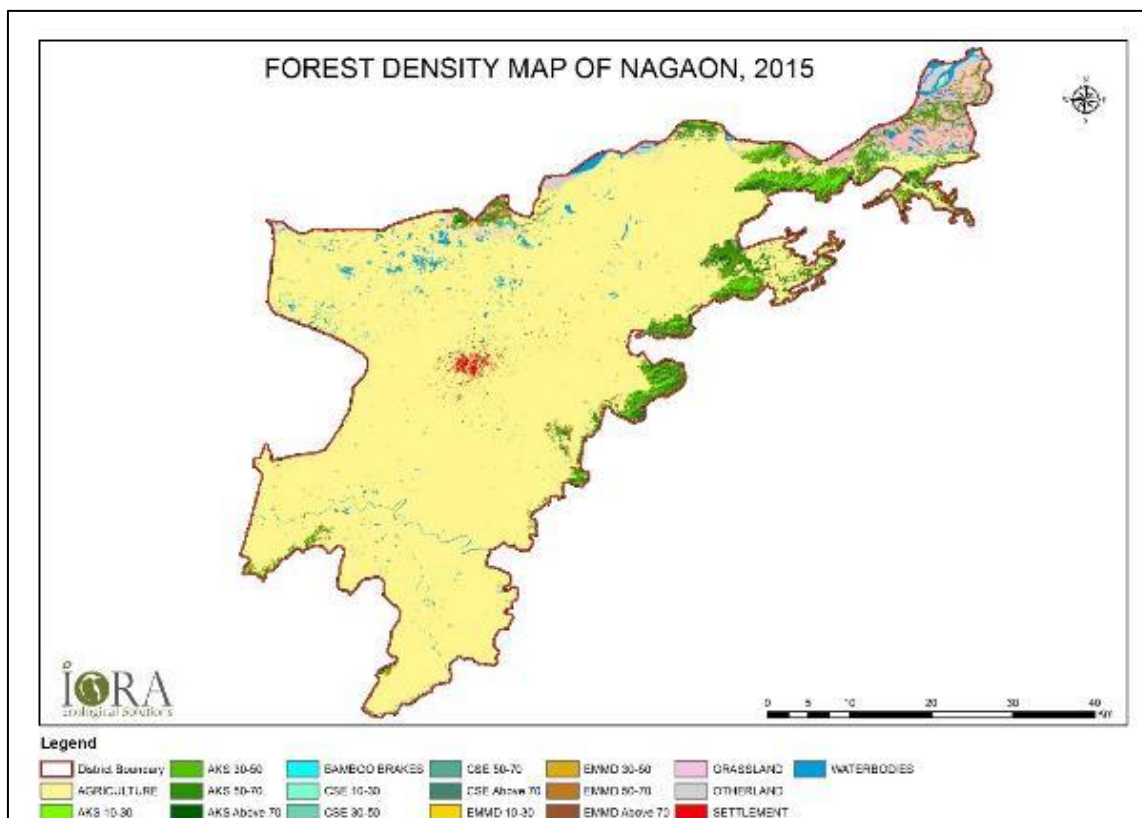


FIGURE 23: FOREST DENSITY MAP NAGAON, 2015

4.4 Ancillary Data

Ancillary data such as ground-truthing information, Working Plans, Forest Circle and Range Boundaries maps, Administrative Boundary maps, Slope maps, Elevation maps, etc. have been used where available.

4.5 Pre-processing of remote sensing data

Pre-processing includes radiometric and geometric correction and handling image data loss due to cloud cover. Geometric correction ensures that images in a time series overlay properly to each other and to other GIS maps used in the analysis (i.e. for post-classification stratification). The average location error between two images (RMSE) must be less than or equal to one pixel.

A Forest Benchmark map was generated to show forest cover status in the project area. The final LULC map in the historic series was used as the forest benchmark map, however missing values within the project area due to clouds and cloud shadow was filled with remotely sensed data acquired within three years before the start of the crediting period to be eligible.

Calculation of GHG benefits in the project area after the project start will include only cloud-free imagery. When clouds and cloud shadows are present, calculation of the GHG benefits from these areas will be postponed until cloud-free remote sensing data is available in a subsequent monitoring period. These temporarily halted NERs may be added to the NERs generated in the subsequent monitoring period. This is only allowed on areas for which the forest status was unambiguously demonstrated at the beginning of the crediting period.

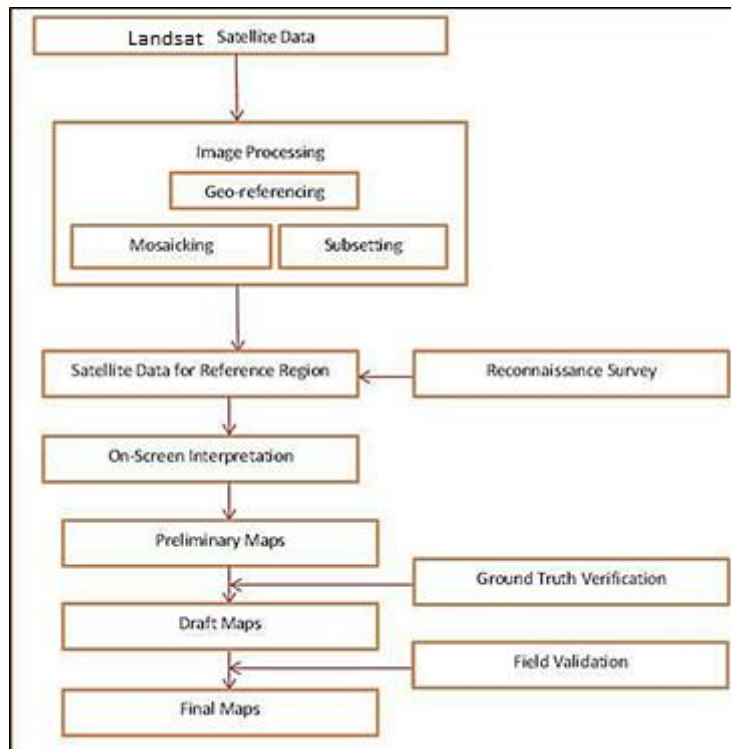


FIGURE 24: DETAILED METHODOLOGY FOR ANALYSIS OF SATELLITE IMAGERY

The satellite imagery was subjected to radiometric and geometric corrections to get a clear image in real world coordinates. The images and layers are maintained in a common system, which are as follows:

Projection Type	UTM
Spheroid Name	WGS 84
Datum Name	WGS 84

Reconnaissance survey was conducted to acquaint with the general patterns of vegetation of the area, main vegetation types and variation and tonal patterns which were observed on existing imageries and maps. The landscape was traversed along roads, major drainages and hilltops for collecting ground truth information. Global Positioning System (GPS) readings were taken representing various land use classes and Forest types. In addition, existing literature like Working Plans and Annual Reports were consulted.

Classification of land cover using remotely sensed data was done by digital classification algorithms, which allows for automated grouping of spectrally similar pixels in order to classify different features of the landscape.

4.6 Analysis and Results

The six IPCC LULC classes, namely Forest Land, Crop Land, Grassland, Wetlands, Settlements, and Other Lands, were distinguished as per the IPCC's Good Practice Guidance for Land Use, Land-Use Change and Forestry 2003 (IPCC GPG-LULCF 2003).

To achieve the goal of defining classes that are homogeneous in carbon stock density, the forest LULC class was further sub-divided into forest strata. The preliminary LULC Classes along with Forest Strata and their areas for the 4 time periods are as follows:

Forest lands have been further divided into three major forest types - App. Kamrup Sal Forest, Cachar Semi Evergreen Forest and East Himalayan Mixed Moist Deciduous (Champion and Seth, 1968⁴¹), and each forest type has been further divided into 4 forest density sub-stratums to estimate forest carbon with high accuracy.. The five other LULC types: Croplands, Waterbodies, Settlements, Grasslands and Other Lands, have also been detailed. Forest type maps for previous years in the reference period have also been included to account for relevant changes.

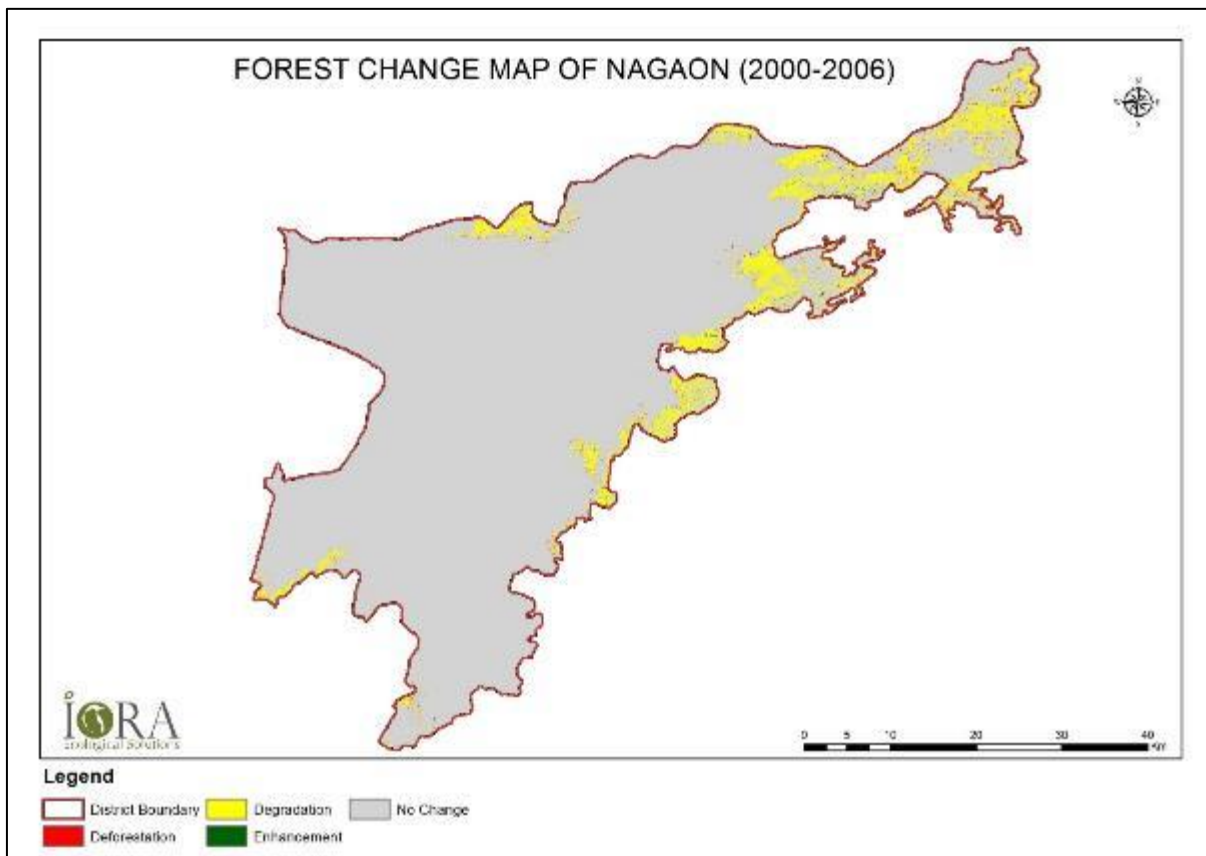


FIGURE 25: FOREST CHANGE MAP OF NAGAON, 2000 – 2006

⁴¹ Champion, S. H., & Seth, S. K. (1968). A revised survey of the forest types of India. *A revised survey of the forest types of India*.

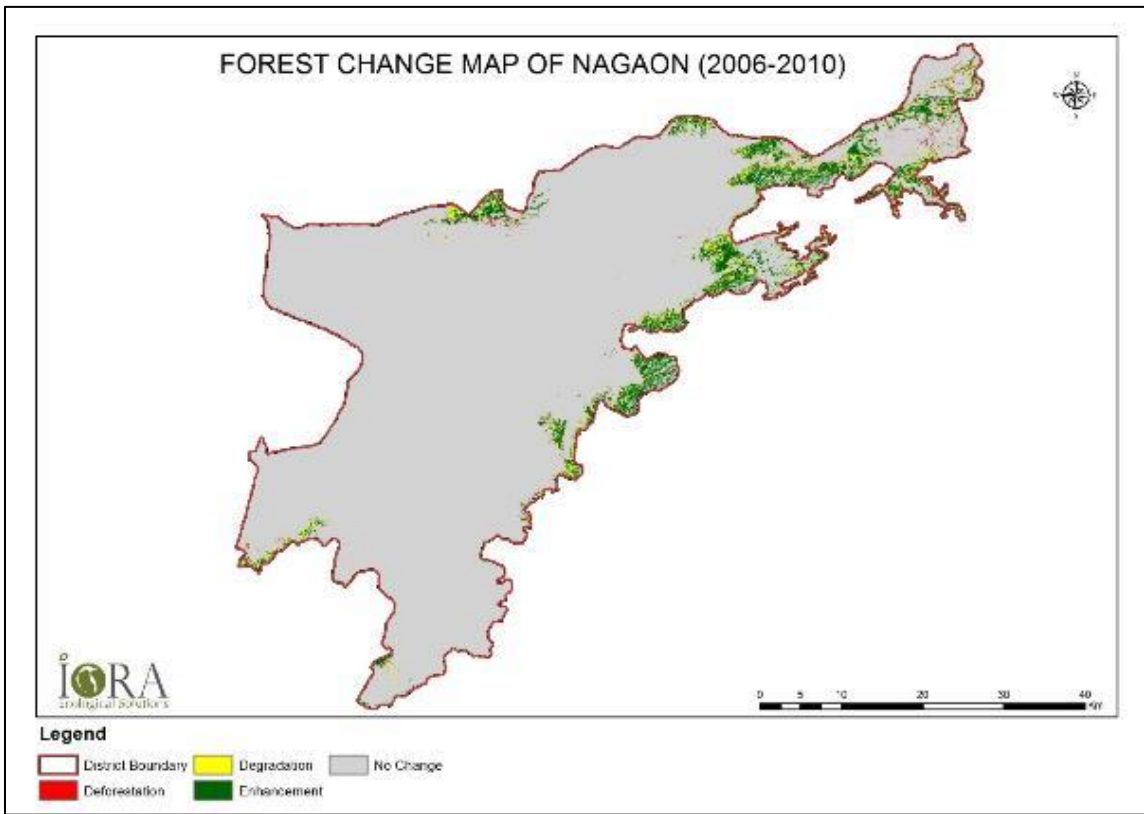


FIGURE 26: FOREST CHANGE MAP OF NAGAON, 2006 - 2010

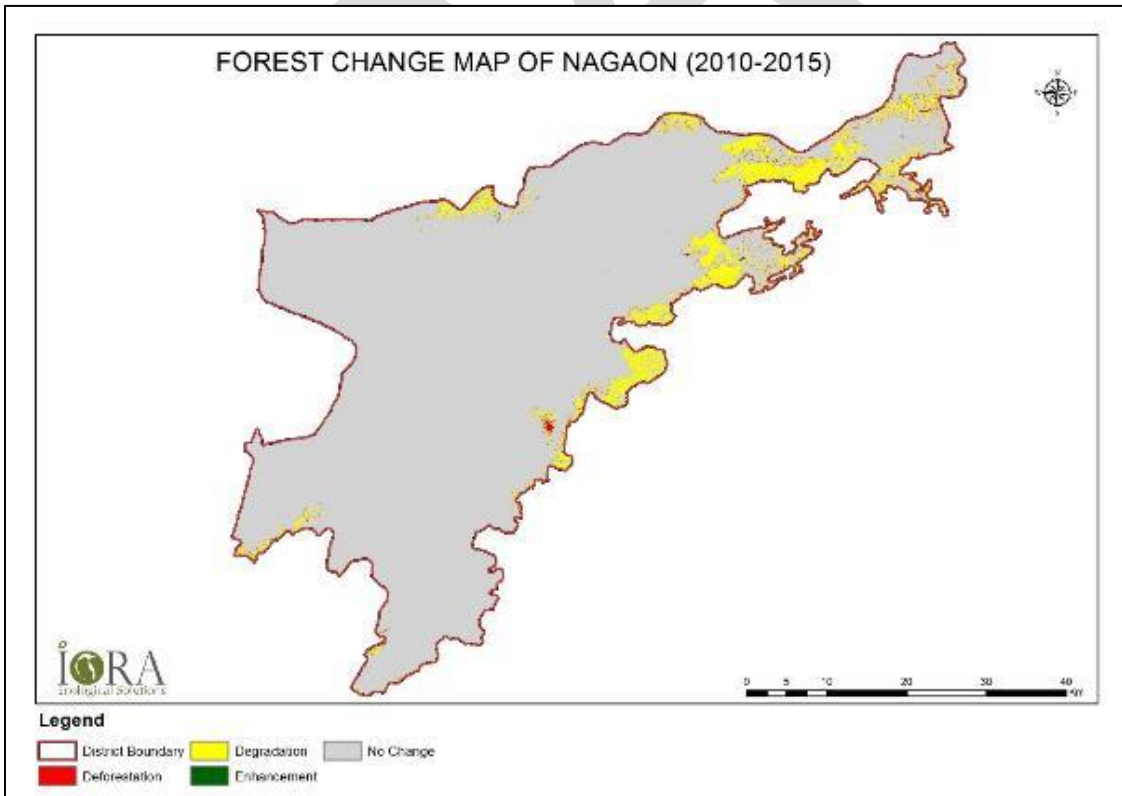


FIGURE 27: FOREST CHANGE MAP OF NAGAON, 2010 - 2015

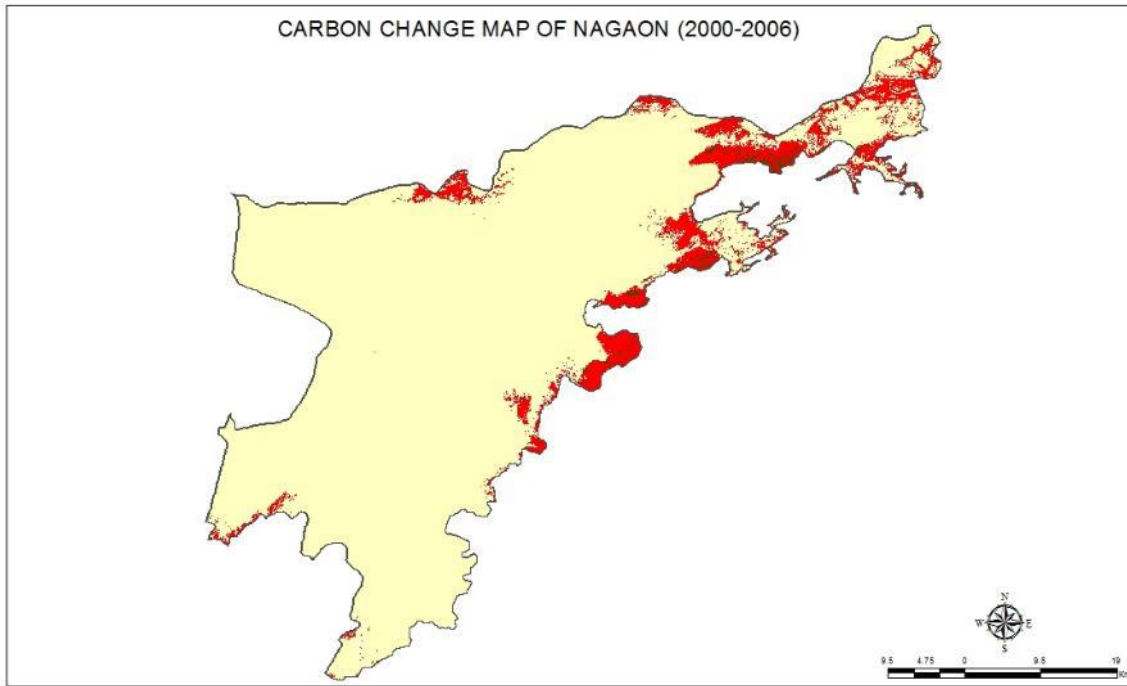
Ecological data has been sourced from the data collected from the landscapes for the preparation of forest working plans. In total 57 plots, each of 1 ha were laid in Nagaon, Hojai and Moregaon districts. We considered ecological data from Hojai and Moregaon also since the bio-geographic characters of these neighboring regions are very similar; and can be used to develop the carbon mapping of Nagaon to a higher accuracy. Since SOC was not collected from these 57 plots, we have not considered SOC in our estimates; and it includes only Above Ground Biomass (AGB) and Below Ground Biomass (BGB). During preparation of working plans the department had laid 4 more validation plots, each of 0.1 ha in Nagaon division, which was also considered in our estimates. Using the carbon content of the plots, we developed regression equations against canopy density for conducting a full field analysis of Nagaon district. This will give Carbon content of each pixel of the scene for the district. Based on this we again calculated the Carbon content for four years in each of the forest stratum to study the dynamics, and also map the overall shift in forest carbon stock. It is discovered that there is a net decrease of 1.44% every year in carbon content on an average in the historical time period 2000-2015. Since the average annual change in carbon stock in each time period (2000 to 2006, 2006-2010 and 2010-2015) was considered, any biasness owing to sudden shifts have been weeded out. This baseline is also conservative against a compounded annual decrease rate of -2.94% for years 2000 to 2015. Table below explains the Carbon content in each forest stratum over the historical time period and changes.

TABLE 15: ORGANIC CARBON CONTENT IN VARIOUS FOREST STRATUM

Forest Stratum	Carbon content in 2000 (tC)	Carbon content in 2006 (tC)	Carbon content in 2010 (tC)	Carbon content in 2015 (tC)
AKS 10-30	1810	29747	40864	50022
AKS 30-50	33412	190973	230143	143396
AKS 50-70	792612	621996	517565	558565
AKS Above 70	736273	296166	355247	365660
EMMD 10-30	138	1816	3985	790
EMMD 30-50	1599	56272	79594	11193
EMMD 50-70	203580	228725	239683	313935
EMMD Above 70	766431	119601	249458	180007
CSE 10-30	10	44	168	29
CSE 30-50	417	520	1081	457
CSE 50-70	15694	9847	17535	16080
CSE Above 70	237423	109142	180470	165738
BAMBOO BRAKES	117601	42157	24244	51841
Total	2906999	1707007	1940036	1857712

Net change in total forest carbon stocks between 2000 and 2006 is found to be -1199992 tC or -41.28%. For the time periods of 2006-10 and 2010-15 this is respectively 233030 tC and -82324 tC or 13.65% and -4.24%. Annual change in percentage is computed for each of the time period, which is -6.88%, 3.41%, -0.85% respectively. An average of these three values gives the annual average change in AGB and BGB forest carbon stock in Nagaon district, which is -1.44%.

The images below details the change in carbon stock in each time period.

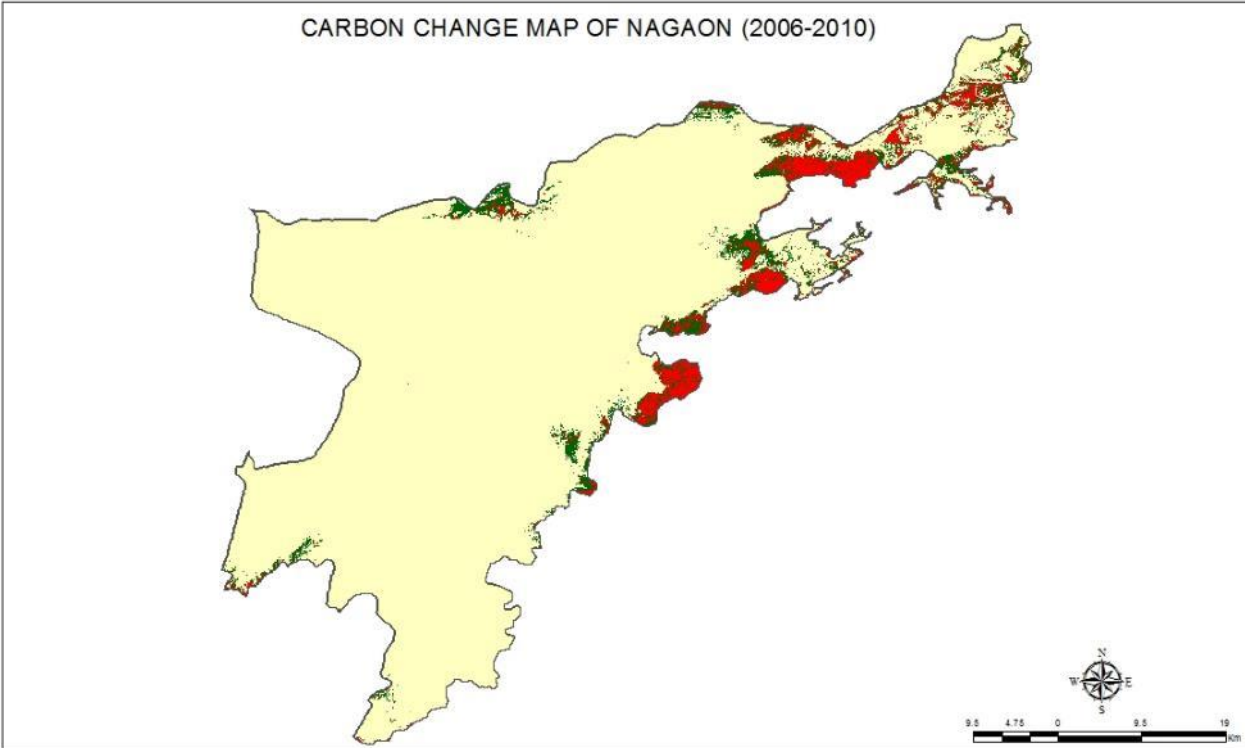


Legend

- District Boundary
- Non-Forest
- Negative Change
- No Change
- Positive Change

FIGURE 28: FOREST CHANGE MAP OF NAGAON, 2000 – 2006

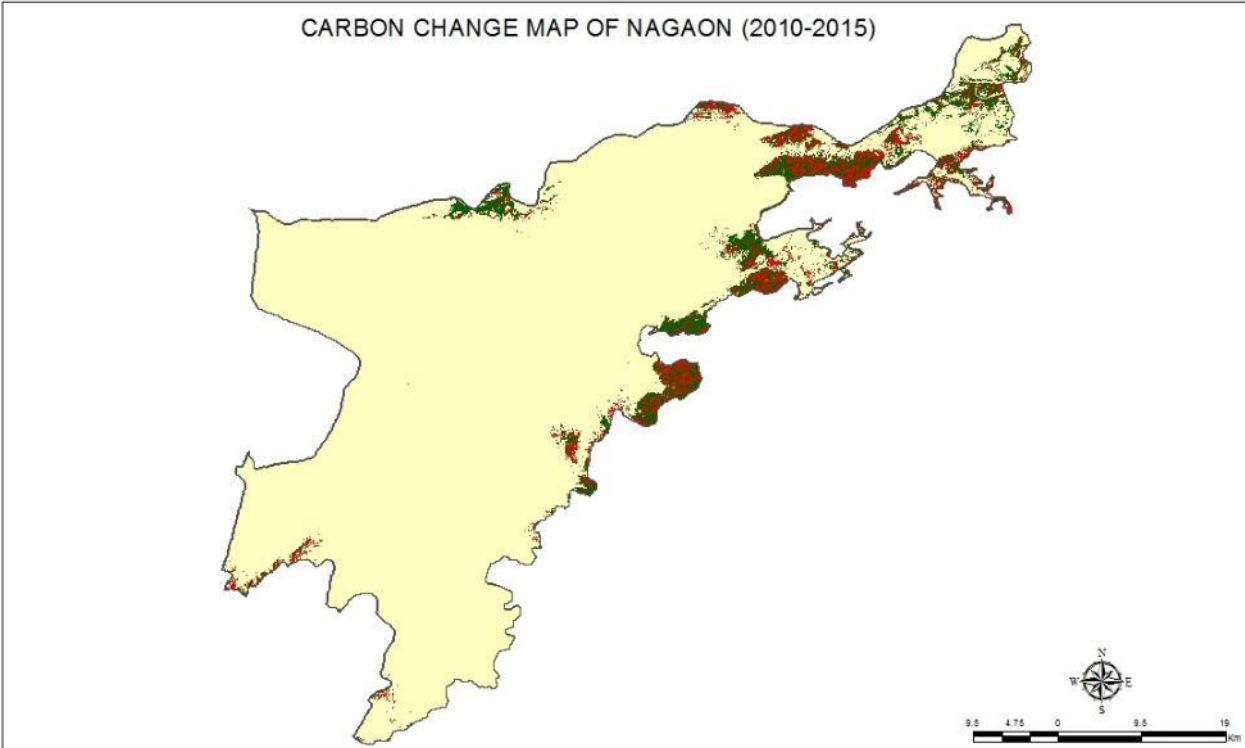
DRAFT



- Legend**
- District Boundary
 - Non-Forest
 - No Change
 - Positive Change
 - Negative Change

FIGURE 29: FOREST CHANGE MAP OF NAGAON, 2006 – 2010

DRAFT



- Legend**
- District Boundary
 - Non-Forest
 - Negative Change
 - No Change
 - Positive Change

FIGURE 30: FOREST CHANGE MAP OF NAGAON, 2010 - 2015

DRAFT

5 Drivers of Forest Change

There is no evidence to suggest that the deforestation observed in the last 15 years, before the Project start, will not continue in the future, given the number of drivers of deforestation and forest degradation identified.. Therefore, the most likely scenario is that the historical deforestation rate and dynamics of deforestation will continue in the future leading to a deforested landscape in the PA. No new economically attractive course of action is expected in the future, which can reduce the identified pressures on the forests of the PA. The net GHG sources and sinks under the baseline scenario is estimated ex-ante and the baseline shall be updated every 10 years.

5.1 Classification of Stakeholders

Every project has its own unique influence on its stakeholders. To ensure project success, it is important to assess roles, responsibilities, dependencies and impacts of each stakeholder. Hence, it is imperative that the LEEF project being developed in Nagaon take cognizance of this, and map out all plausible stakeholders who may directly or indirectly affect the project or be affected by the project. Therefore, all potential stakeholders in the project landscape in Nagaon have been mapped. The mapping has been conducted in multiple phases, and is validated after consultations with various thought-leaders in the sector as well as with the DoEF and other stakeholders in the Nagaon district.

Mapping of stakeholders was done for Nagaon district after analysis of multiple criteria, enabling a clear understanding of their influence on implementing the REDD+ project in the district. The stakeholders have been categorized as Veto, Key, Primary, and Secondary stakeholders based on their extent of influence, assessed using secondary literature study and expert consultations. The categorization is described as under:

Veto stakeholders — Principal stakeholders with decision making powers having a direct impact on the REDD+ project, with authority to define the direction of the project.

Key stakeholders — Stakeholders that directly affect demand-supply scenarios of forest resources or have a strong influence on forestry project activities. They contribute significantly through their direct participation in the REDD+ project, and are expected to be involved with the project throughout. Their support is crucial in achieving the objectives of the project.

Primary stakeholders — Stakeholders that may be affected by project outcomes or are directly influenced by project activities.

Secondary stakeholders — Stakeholders who are temporarily involved or have an indirect interest in the actual project activities. Their actions may have an impact on the REDD+ project. They are involved in research activities, capacity building and training, and other forestry extension activities. These usually are organizations with technical know-how, but are not directly affected by the project activities. The dissemination of knowledge regarding the aspects of REDD+ is a very important operation performed by the secondary stakeholders.

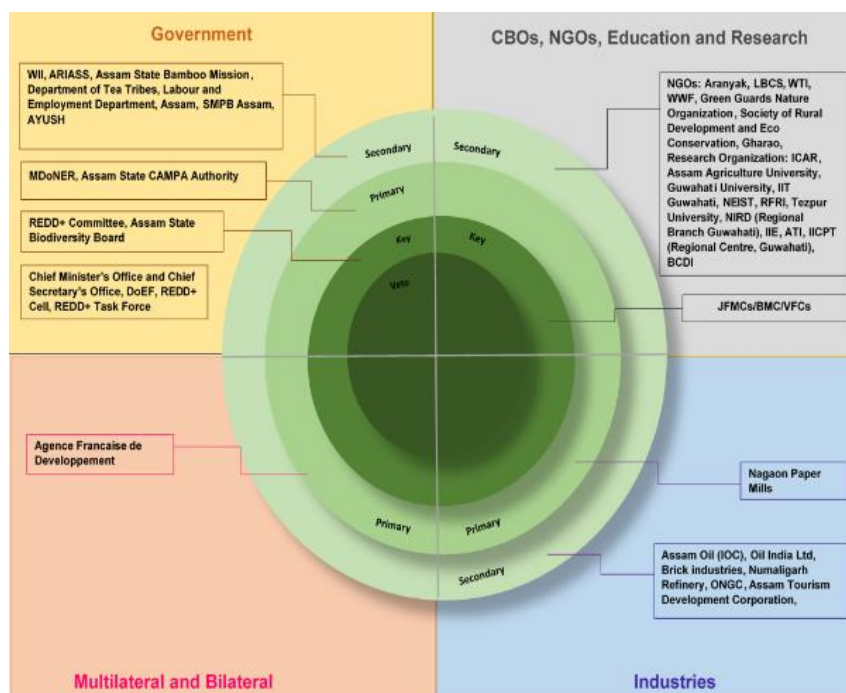


FIGURE 31: STAKEHOLDER ONION DIAGRAM FOR NAGAON DISTRICT

5.2 Drivers of Forest Change

5.2.1 Introduction

Nagaon district has a high population density of 711 persons per sq. km, compared to the State population density of 398 persons per sq.km. Moreover, 86% of the total population lives in rural parts of the District. Thus, the District population exerts considerable pressure on forest resources to meet their day to day needs.

As seen from the socioeconomic survey undertaken in the sampled villages, nearly 40% of the families are landless and 42% of families are marginal farmers with less than 2 acre of land. Rising population has also increased the demand for forest products and thereby increasing the pressure on forests which is leading to deforestation and forest degradation in the district.

From local to national or on a global scale, forests are vital in providing ecosystem services such as water cycle and flow management, watershed management, rainfall generation, nutrient cycling, and carbon sequestration⁴². Forests also provide provisioning services in the form of non-timber forest produce (NTFPs) and are an integral part of culture of many forest communities.

Deforestation, as defined in the Marrakech Accords (Decision 11/CP.7, 2001⁴³) is direct human-induced conversion of forested land to non-forested land. Whereas, forest degradation is defined as the changes within the forest that negatively affect the structure or function of the forest stand or site, which lower the capacity of the forest to supply products and/or services.

The dynamics and causes of deforestation and forest degradation are multifaceted, complex and vary from place to place. They are an interplay of demographic, economic, technological, institutional, and socio-cultural factors (Geist and Lambin, 2002⁴⁴)

⁴² The process of increasing the carbon content of a carbon pool other than the atmosphere.

⁴³ Decision 11/CP.7, 2001. Land use, land-use change and forestry. FCCC/CP/2001/13/Add.1, Marrakesh Accords

Geist, H.J., Lambin, E.F., 2002. Proximate causes and underlying driving forces of tropical deforestation. *Bioscience* 52, 143–150

Drivers of deforestation and forest degradation fall in two categories - first, those which are **planned** and projected in accordance with policies, legal framework and management plans, etc. and second, that are **unplanned** and spontaneous, beyond government and management control.

Planned and unplanned withdrawals of forest resources from forests affect the forest carbon stock (i.e. deforestation and forest degradation). Thus, it requires proper understanding and management tools including transparent governance, effective enforcement and appropriate mitigation actions to counter these drivers. Both categories of drivers relevant to India are listed below in *Table 14* as identified in India's submission to the UNFCCC's Subsidiary Body of Scientific and Technological Advice (SBSTA) on REDD+.

In order to minimize the impacts of planned drivers, appropriate interventions need to be implemented. These interventions encompass policy instruments and management options such as effective legal framework and site-specific mitigation measures. Unplanned drivers and activities are mainly a direct outcome of local people's dependence on the adjoining forest areas to meet their livelihood and subsistence needs of firewood, grazing, fodder, and food supplements, etc. To a small extent, illegal mining activities within forest is also an unplanned driver of forest change.

Weaning the local communities away from such livelihood related practices will require sizable investment in providing alternatives for the forest products that the communities have been deriving from the forests traditionally, but not necessarily in a sustainable manner. Many of these people dependent on forests are poor, with little land and limited options for sustaining livelihood.

5.2.2 Fuelwood

Due to lack of awareness and unavailability of clean energy sources such as LPG, kerosene, etc. in the region, communities resort to using fuelwood as their major energy source for cooking, heating water, cattle food preparation, etc., creating significant pressure on forests. Being a major source of energy in forest fringe villages, fuelwood is extracted daily by the communities for their day-to-day purposes.

5.2.2.1 Source of energy for cooking and heating

Fuelwood is the major source of energy for cooking. Around 96% of the sampled areas responded that wood is their main energy source for cooking as well as heating water. Only 25% of respondents said that they use LPG, that too for hospitality purposes such as preparing tea and coffee. From the below Figure 17 it is evident that fuelwood is the common energy source used for cooking and heating water. According to the survey, an average of **3.22 tons** of fuelwood is required per family per year in the PA. According to Census 2011, 81.37%⁴⁵ of the rural households of Nagaon district predominantly use firewood for cooking. Rural LPG penetration is less than 10%³¹.

⁴⁵ http://www.censusindia.gov.in/2011census/dchb/1806_PART_B_DCHB_NAGAON.pdf (page no 341 and 342)

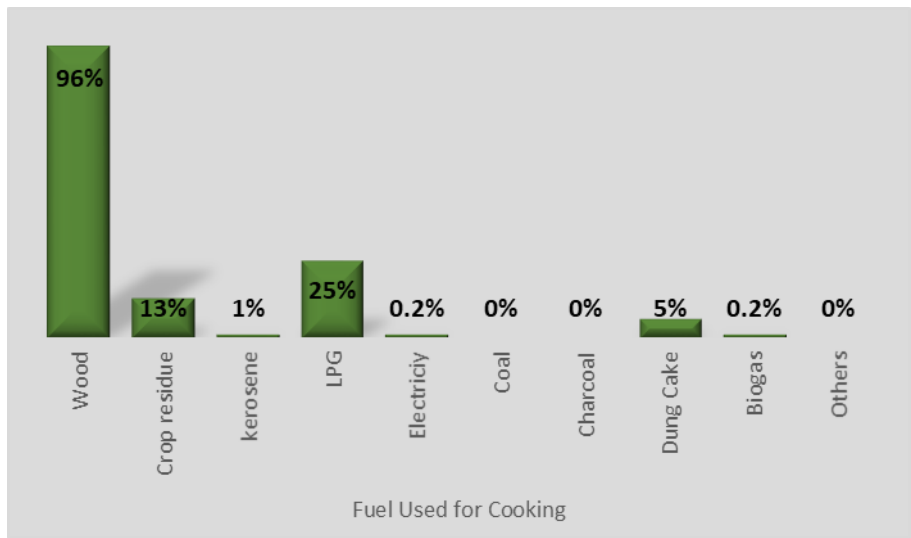


FIGURE 32: SOURCE OF ENERGY FOR COOKING





FIGURE 33: FUELWOOD COLLECTION IN THE STUDY AREA

5.2.2.2 Mode of fuelwood collection

Majority of the fuelwood collected from forest is transported either as headloads or cartloads. As per the socio-economic survey, 90% of respondents said they collect fuelwood as headloads and only 9% use carts to transport fuelwood.

TABLE 16: MODE OF FUELWOOD TRANSPORTATION

Mode of transport	Head Load	Cart Load or cycle	Tractor Load
Number of HHs	393	41	4
% of HHs	90%	9%	1%

5.2.2.3 Source of fuelwood

Forest is the main source of fuelwood for the communities in the project area. Communities also buy fuelwood from the local sellers within the village and these sellers collect fuelwood from the forests. From the Figure 19 below it is evident that 59% (28%+31%) of fuelwood is collected from the forests. Communities have also planted some trees next to their agricultural fields. 23% of the respondents collect wood from their own agricultural lands.

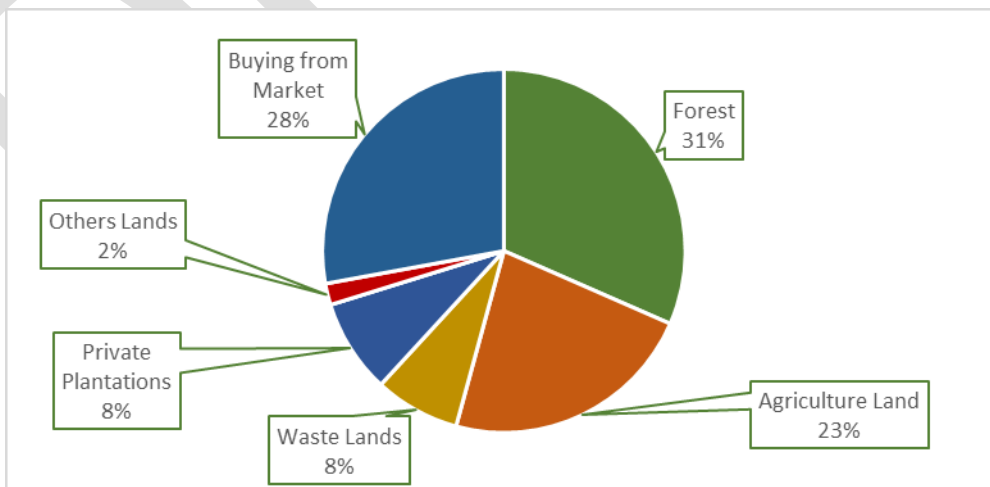


FIGURE 34: SOURCE OF FUELWOOD

Source of Fuelwood (% of HHS)					
Range	Forest	Agriculture Land	Waste Lands	Private Plantations	Buying from Market
Dhania	27%	40%	29%	25%	33%
Dharamtul	87%	11%	0%	13%	28%
Garajan	29%	32%	13%	3%	54%
Kampur	26%	61%	5%	1%	39%
Kathiatoli	47%	42%	14%	26%	40%
Nagaon Sadar	26%	26%	12%	16%	46%
Salona	77%	9%	7%	9%	26%

FIGURE 35: RANGE WISE SOURCE OF FUELWOOD

The following are the common tree species collected as fuelwood in the study area.

TABLE 17: COMMON TREE SPECIES COLLECTED AS FUELWOOD IN THE STUDY AREA

Species Name	Vernacular Name
<i>Mangifera indica,</i>	Mango
<i>Ficus religiosa,</i>	Peepal
<i>Lagerstoemia flosreginae,</i>	Queen Crape Myrtle
<i>Dillenia pentagyna Roxb,</i>	Oua
<i>Spondias magnifera,</i>	wild mango
<i>Myristica kingie,</i>	Nutmeg
<i>Bambusa vulgaris,</i>	Bamboo
<i>Trewia nudiflora,</i>	False white teak
<i>Tetrameles nudiflora,</i>	False Hemp Tree
<i>Zizyphus jujube,</i>	Jujube
<i>Zanthoxylum budrunga</i>	Indian Prickly Ash
<i>Alstonia scholaris,</i>	Scholar Tree
<i>Holarrhena antidysenterica,</i>	Bitter Oleander
<i>Holarrhena pubescens Wall,</i>	Indrajao
<i>Ficus glomerata,</i>	Cluster Fig
<i>Wrightia tomentosa,</i>	Sweet Indrajao
<i>Pisidium guyava,</i>	Guava
<i>Gmelina arborea,</i>	Gamhar
<i>Bombax Ceiba,</i>	Silk Cotton Tree
<i>Cassia fistula,</i>	Amaltas
<i>Syzygium cuminii,</i>	Jamun
<i>Eupatorium odoratum,</i>	Bitter Bush
<i>Garuga pinnata,</i>	Pama
<i>Corchorus capsularis,</i>	White Jute
<i>Saccharum spontaenum,</i>	Kans grass
<i>Ipomoea aquatic,</i>	Water Morning Glory
<i>Bauhini spp,</i>	Butterfly tree
<i>Anthoccephalus cadamba,</i>	Kadam
<i>Kayea floribunda,</i>	
<i>Artocarpus heterophyllus,</i>	Jackfruit
<i>Walsura robusta,</i>	
<i>Erythrina variegata,</i>	Lenten tree
<i>Zea mays,</i>	Maize
<i>Albizia lucida,</i>	Potka siris
<i>Pterospermum acerifolium,</i>	Karnikara tree

Species Name	Vernacular Name
<i>Azadirachta indica,</i>	Neem tree
<i>Stereospermum chelonoides,</i>	Padal
<i>Toona ciliata,</i>	Mahogany tree
<i>Shorea robusta,</i>	Sal tree
<i>Tectona grandis,</i>	Teak
<i>Sapium baccatum,</i>	Sapium
<i>Lagerstroemia parviflora</i>	Small flowered Crape Myrtle
<i>Bombax ceiba</i>	Simbal
<i>Cassia fistula</i>	Amaltas
<i>Areca catechu</i>	Betel palm
<i>Gynandropsis pentaphylla</i>	Jakhiya

5.2.2.4 Frequency of collection

Communities collect fuelwood from different sources depending upon their consumption. The following Figure 21 depicts the frequency of collection of fuelwood in general. 57% of the surveyed households said they collect fuelwood on weekly basis and 24% collect fuelwood on monthly basis.

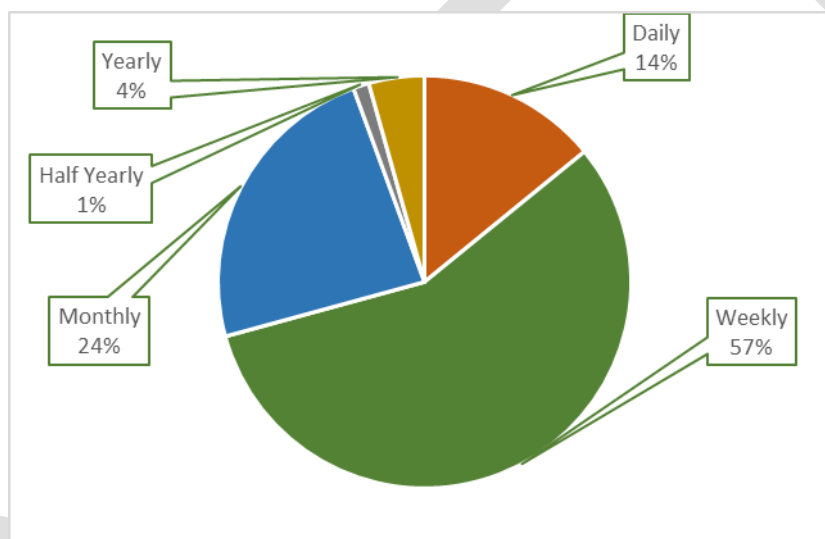


FIGURE 36: FREQUENCY OF FUELWOOD COLLECTION

The following Table 17 summarises the average distance travelled by the households to collect fuelwood in each range.

TABLE 18: AVERAGE DISTANCE TRAVELLED TO COLLECT FUELWOOD

Range	Forest Distance (km)	Agriculture land Distance (km)
Dhania	0.4	0.3
Dharamtul	2.3	0.2
Garajan	0.7	0.3
Kampur	0.5	1
Kathiatoli	1.2	0.6
Nagaon Sadar	0.5	0.4

Salona	2.2	0.1
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5.2.2.5 Cooking device

Cooking devices used by the communities are traditional and have very low efficiency. These are built using local available materials such as mud and sand. These stoves do not have any chimneys to vent out the smoke produced during wood burning. The figure below lists the cooking devices used by the communities in the study area. It is evident that 91% of the cooking devices are made out of mud/clay/cement by traditional method.

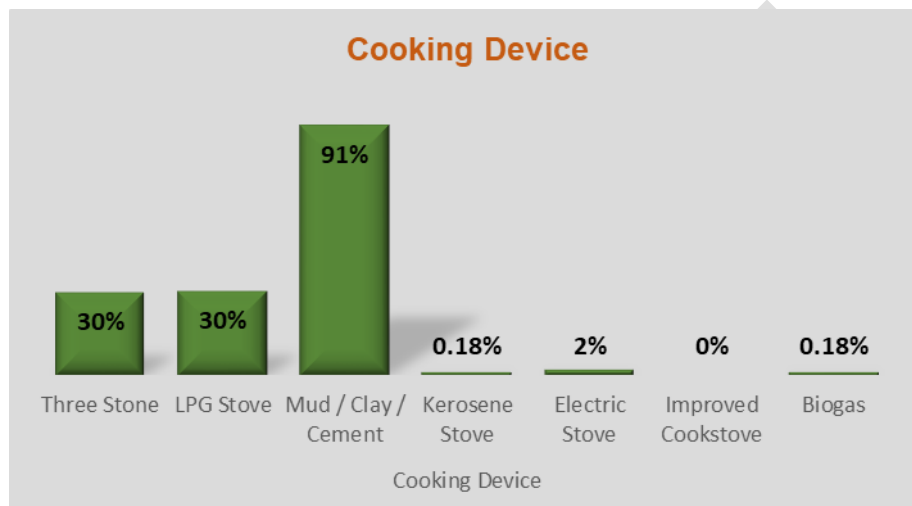


FIGURE 37: COOKING DEVICES USED IN THE STUDY AREA

Traditional stoves are relatively inefficient and consume a lot of fuelwood as compared to improved cook stoves (ICS). Respondents were unaware of the alternative technologies or models available to replace the traditional stoves, except for LPG. LPG is penetrating the villages gradually. Poor supply chain and cost involved in procuring and refilling LPG cylinders discourage people from using LPG. At present, fuelwood is available free of cost and only a few households buy it from market. Culturally also people prefer to use fuelwood to prepare food. Awareness creation introducing ICS among the communities will help in reducing fuelwood consumption, thereby reducing deforestation and forest degradation.





FIGURE 38: TRADITIONAL STOVES USED IN STUDY AREA

5.2.3 Cattle grazing and lopping for fodder

Cattle in the study area is majorly native breed. Cow, suitable to the area's climatic condition, is the dominant species in the PA. Presence of buffalos and ox or bulls is negligible. Cows are left for grazing in open by their owners. Thus, the cattle mainly moves to forests and open agricultural lands for grazing purposes. Grazing (83%) is the most common practice of cattle feeding in the area. For stall feeding of cattle, fodder is collected from forests and agricultural lands. 22% of the surveyed households reported collecting fodder from forest and 58% from different sources including roadside area, nearby ponds, agriculture fields, etc. Cattle are able to enter forests easily due to absence of Cattle Proof Trenches (CPT) along the forest boundary. This type of grazing inside the forest hinders regeneration⁴⁶ of forests as younger saplings are also fed upon. Therefore, the need is felt to construct CPTs or EPTs (Elephant Proof Trenches) along the forest boundary. EPTs prevent wild elephants entering villages thereby reducing man-animal conflicts.

⁴⁶ <https://www.roij.com/open-access/concern-and-conservation-perspective-in-laokhowa-wildlife-sanctuary-of-nagaon-district-assam-india-.php?aid=48148> , <http://www.assamforest.in/knp-osc/linkpages.php?u=hr>

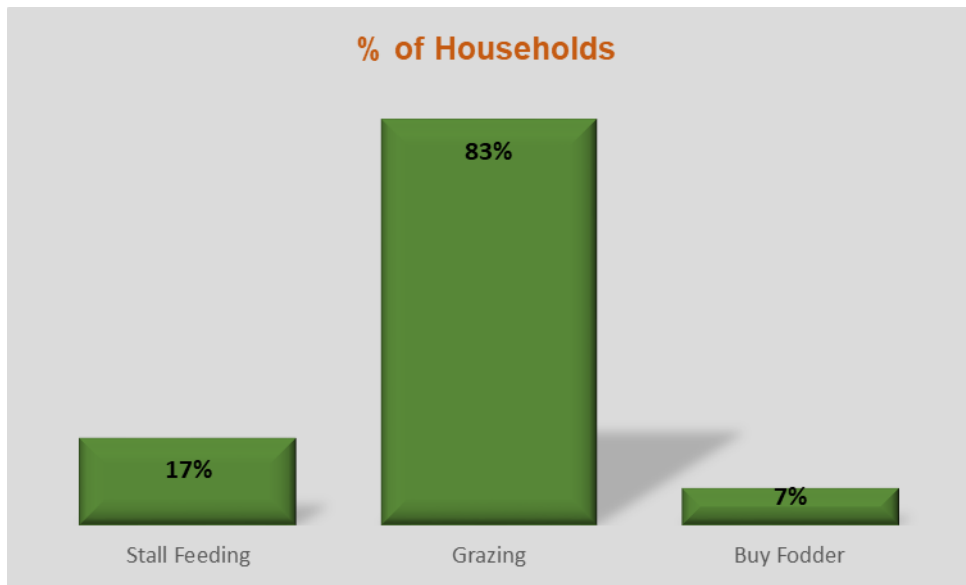


FIGURE 39: CATTLE FEEDING



FIGURE 40: FODDER COLLECTION



FIGURE 41: CATTLE GRAZING INSIDE THE FOREST AREA

5.2.4 Timber and Small timber

The main dwelling units of the communities in the area use metal sheets to cover the roof. 83% of the respondent households have roof made up of metal sheets. To hold these metal sheets, beams are required, which are made up of either timber or bamboo. People collect timber from forests for house construction and regular maintenance of houses. Apart from these uses, some people use timber for fencing their agricultural lands and house surroundings, making furniture, etc. The main source of timber is forest and local markets. The following table describes the use and source of the timber with the percentage of positive respondents.

TABLE 19: USE OF TIMBER AND SOURCE

Use of Timber	Major source of Timber	% of HHS
Agriculture Fencing	Forest	4%
Fencing around residential area	Buying from market	3%
Fuelwood- commercial	Forest	1%
Furniture	Agricultural land	1%
House construction	Buying from market	55%
	Agricultural land	18%
	Forest	9%
	Purchase from market- local vendor	4%
	From the forest dept. depot	3%
	Buying from forest through illegal harvester	2%
Fuelwood for cooking	Buying from market	1%

Teak (*Tectona grandis*), Neem (*Azadirachta Indica*), Jamoon (*Syzygium Cumini*), Mango (*Mangifera Indica*), Sal (*Shorea Robusta*), and Gamhar (*Gmelina arborea*) among others are the common timber species collected from forests in the area. Small timber, especially bamboo, is also collected from the forests. People grow bamboo locally too. Locally grown bamboos are mainly used for maintenance and fencing purposes.



FIGURE 42: TIMBER COLLECTION FROM FORESTS



FIGURE 43: SMALL TIMBER USED FOR FENCING AND AGRICULTURE ACTIVITIES

5.2.5 Non Timber Forest Produce (NTFP)

The forests of Nagaon Division are rich in flora and fauna biodiversity and proliferate across different ecosystems. Natural herbs and shrubs are also present in the forests. The following are the list of NTFPs available in the Nagaon Forest Division⁴⁷.

Considerable amount of NTFP is collected by communities from these forests. The communities employ traditional practices for extraction and collection of NTFPs, which are unsustainable and cause considerable amount of loss to the forest cover.

TABLE 20: LIST OF NTFP SPECIES

Local Name	English Name	Scientific name
Bon Naharu	Garlic chives	<i>Allium tuberosum</i> Rottl. Ex Spreng
Bagh Asura	Ragi	<i>Caesalpinia cuculata</i> Roxb.

⁴⁷ Nagaon Working Plan

Bontulasi	Basil	<i>Ocimum basilicum L</i>
Dhekia	Vegetable fern	<i>Diplazium esculentum</i>
Kochu	Taro	<i>Colocasia esculenta L</i>
Kolmou	Meia	<i>Ipomea aquatic Frosk</i>
Mati Kanduri		<i>Alternanthera sessilis L</i>
Pippali	Indian Long Pepper	<i>Piper longum L</i>
Pok Mou, Lach Kachi		<i>Solanum nigrum L</i>
Tora	Galingale	<i>Alpinia allughas</i>

TABLE 21: LIST OF HERBS AND SHRUBS

Local Name	English Name	Local Name	English Name
Abu-Tenga	<i>Antidesma acidum Retz</i>	Helochi	<i>Enhydra fluctuans Lour</i>
Agora	<i>Triumfetta rhomboidea Jacq</i>	Jhau	<i>Tamarix dioica</i>
Assam lota	<i>Eupatorium odoratum</i>	Jamlakhuti	<i>Costus speciosus Sm</i>
Akan	<i>Calotropis gigante & Calotropis acia</i>	Jatiar	<i>Phalaris arudinacea Linn</i>
Bagh-ashora	<i>Polygonus glabrum</i>	Kana-ximalu	<i>Commelina duffusa Barun F</i>
Bogi tora	<i>Alpinia molluccensis</i>	Kaupat	<i>Phrynium species</i>
Bhat-tita	<i>Solanum torvum Swartz</i>	Kauri thengia	<i>Leea crispa Willd</i>
Bhedelilata	<i>Hedyotis scandens</i>	Khutura	<i>Amaranthus virdis Linn</i>
Bhekuri	<i>Solanum indicum</i>	Kuchia-kota	<i>Mimosa rubicaulis Lam</i>
Bhotua Xak	<i>Chenopodium album Linn</i>	Lajuki lota	<i>Mimosa pudica Linn</i>
Bor Manimuni	<i>Hydrocotyle asiatica Linn</i>	Lekluru	<i>Coffea bengalensis</i>
Bondhonia	<i>Ranunculus sceleratus Linn</i>	Mati-kaduri	<i>Altermanthera sessils (L) Br</i>
Bor-barial	<i>Sida rohmbifolia Linn</i>	Makhi-loti	<i>Flemingia strobilifera</i>
Chawl dhowl	<i>Ardisia humilis Vahl</i>	Mechaki	<i>Debregeasia species</i>
Dam deuka	<i>Impatiens jurpia Hk.f&Th</i>	Moin	<i>Catuna regam spinoisa Tiruv</i>
Dhudhi Bon	<i>Eubhorbia hitra Linn</i>	Patidoi	<i>Clinogyne dichotoma</i>
Dhopa tita	<i>Phlogocanthus curviflorus</i>	Phutuka	<i>Melastoma malabathricum</i>
Durun xak	<i>Leacus lanata</i>	Sorat-goch	<i>Laportea crenulata</i>
Dighlati	<i>Litsea Salicifolia</i>	Ikora	<i>Phragmites kakra (Retz) Trin</i>
Erra goch	<i>Ricinus communis L</i>	Tengesi	<i>Marsilea qudrifolia</i>
Gahoti-bon	<i>Ageratum conyzoides Linn</i>	Tita-phul	<i>Phlogocanthus thyrsiflorus</i>
Go-naharu	<i>Crinum amoenum Roxb</i>	Xal-pan	<i>Desmodium gangeticum Dc</i>
Hat-thenga	<i>Senna occidentalis (L) Link</i>	Xaru-manimuni	<i>Hydrocotyle sibthorpioides Limk</i>
Habida-cha	<i>Polyathia suberosa</i>	Xaru-moin	<i>Fagerlemdia fasciculate Tiruv</i>
Han-boka	<i>Olox acuminara</i>	Xaru-barial	<i>Sida carpanifolia Linn</i>

TABLE 22: LIST OF CANES AND PALMS

Local Name	Scientific Name
Bon-tal	<i>Licuala peltata</i>
Geruga-tamul	<i>Pinanga gracillis</i>
Jai-bet	<i>Calamus tenuis</i>
Hauka-bet	<i>Calamus latifolius</i>
Raidang-bet	<i>Calamus flagellum</i>
Rongkeli-bet	<i>Calamus loptospadix</i>

Tita-bet	<i>Calamus tenuis</i>
Toko-pat	<i>Livistonia jenkinsiana</i>

TABLE 23: LIST OF GRASSES

Local Name	Scientific Name
Ikra (Ekra)	<i>Erinthus ravaneae</i>
Jarmaniban	<i>Eupatorium odoratum</i>
Kush	<i>Saccharum spontaneum</i>
Meghela	<i>Saccharum arundinaceum</i>
Nal	<i>Phragmites karka</i>
Sau	<i>Pollinia ciliate</i>
Sungress	<i>Imperata arundinacea</i>

TABLE 24: LIST OF BAMBOOS

Local Name	Scientific Name
Bojal	<i>Pseudostachym polymorphum</i>
Dalu	<i>Teinostacoa sp.</i>
Hill-jati	<i>Bambusa pallida</i>
Kako	<i>Dendrocalamus hamiltonii</i>
Kanta	<i>Bambusa arundinaceae</i>
Muli	<i>Melocanna bambusoides</i>

TABLE 25: LIST OF CIMABERS

Local Name	English Name	Local Name	English Name
Amrolio-lota	<i>Tapiria hirsute</i>	Kata-ghoh	<i>Dalbergia rimosa</i>
Arkeng-lota	<i>Combretum species</i>	Kerek-lota	<i>Hiptage madablota</i>
Baghasora	<i>Mezoneurum cucullatum</i>	Kota-har	<i>Capparis tenera</i>
Bokul-lota	<i>Embelia ribes</i>	Kochai-lota	<i>Acacia pennata</i>
Barkhi-lota	<i>Uncaria macrophylla</i>	Laleng-chhali	<i>Dalbergia tamarindifolia</i>
Bel-lota	<i>Willoughbeia edulis</i>	Lota-dimoru	<i>Ficus scandens</i>
Bhedali-lota	<i>Paederia foetida</i>	Lota-guti	<i>Caesalpinia crista</i>
Boga-lota	<i>Strychnos laurina</i>	Lota-mahudi	<i>Croton caudatus</i>
Bokal-bhi	<i>Derris elliptica</i>	Madhu-malati	<i>Roydsia suaveolens</i>
Bon-boguri	<i>Ziziohus rugosa</i>	Mamci-lota	<i>Gnetum montanum</i>
Cham-lota	<i>Conocephalus suaveolens</i>	Mouhilika	<i>Bridelia stipularis</i>
Chonge-lota	<i>Thunbergia coccinea</i>	Nigoni-bual	<i>Eryciba paniculata</i>
Dat-bijla	<i>Dalbergia stipulacea</i>	Ou-lota	<i>Delima sarmentosa</i>
Deo-bhi	<i>Linostoma decandrum</i>	Paduri-lota	<i>Paederia foetida</i>
Dhekia-lota	<i>Stenochleana palustre</i>	Pan-lota	<i>Spatholobus roxburghii</i>
Dhobai-lota	<i>Heptapleurum venulosum</i>	Pani-lota	<i>Vitis latifolia</i>
Gahora-lota	<i>Myxopyrum smilacifolium</i>	Pani-leteku	<i>Vitis pedata</i>
Ghilo-lota	<i>Entada scandens</i>	Pichola-lota	<i>Hibiscus fragrans</i>
Gulanca	<i>Tinospora cordifolia</i>	Pahari-lota	<i>Dalhousiea bracteata</i>
Hollock-lota	<i>Combretum dasystachyum</i>	Tabaki-lota	<i>Cissampelos pareire</i>
Hoguni-lota	<i>Tinospora cordifolia</i>	Tikoni-borua	<i>Buettneria aspera</i>

Jetelu-poka	<i>Rubus ellipticus</i>	Wakmi	<i>Mucuma bracteata</i>
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According to the survey, 24% of the households collect NTFPs from forests, mostly for personal consumption. The list of NTFPs collected per year in the study area and their quantity is tabulated below.

TABLE 26: NTFP COLLECTED IN THE STUDY AREA

NTFP name	Quantity collected per year (kg)	NTFP name	Quantity collected per year (kg)
Kachu	181	Bagori	4
Dhekia	153	Amlakhi	4
Bogori	30	Vebeli lata	4
Fish	27	Kolphul	4
Amla	18	Pipali	3
Botatenga	15	Lai sak	3
Tita phul	14	Forn	2.5
Bota tenga	10	Mehek pat	2
Bamboo shoot	9	Kaldil	2
Samsori pat	8	Toragojali	1
Masolanga	6	Mengsoring pat	1
Bhebelilata	5	Koinamari pat	1
Kolmou saak	4.5	Gaztenga	1
Hanthu pat	1		

Since the techniques used for NTFP collection are primitive and unsustainable, there is a need for creating awareness and educating the locals on sustainable harvesting techniques.



FIGURE 44: NTFP DEKIA (FERN) AND TUBER

5.2.6 Supari Industries and Fuelwood Sellers

Rupohi and Sunaribali are the two major places in Nagaon district where raw Arecanut is processed. Processed supari is marketed in South India especially in Karnataka and Tamil Nadu. There are nearly 150 Arecanut processing industries in Rupohi and 50 in Sunaribali. These industries consume considerable amount of fuelwood to process raw Arecanut.





FIGURE 45: RAW ARECANUT PROCESSING

These industries run during the months of November to April and raw Arecanut is procured from nearby villages. Majority of the procurement is done from upper-Assam districts. The fuelwood requirement in the raw Arecanut processing is for extracting fruit from shell, boiling the fruit and drying. Sun-drying is also practiced but is limited since the demand for supari dried using fuelwood is very high. The following table throws light on the fuelwood consumption by an average Arecanut industry

TABLE 27: ESTIMATION OF FUELWOOD REQUIRED FOR ONE ARECANUT INDUSTRY

Supari processed per Month	1000	Kg
FW required to process 1Q of raw Arecanut	80	Kg
Total Fuelwood required	80000	Kg
Total Fuelwood required	80	Tons/Month
Operation months	5	
Total Fuelwood required per season	400	Tons per Year

The industries buy fuelwood from the local market or agents. The agents procure fuelwood from different parts of the district and supply it to industries, as per demand. Since the supari industries do not have any preference of wood species for Arecanut processing, they do not face any issues in procuring fuelwood.



FIGURE 46: FUELWOOD COLLECTED IN ARECANUT INDUSTRIES

Supari industry owners lack awareness on better and energy efficient technologies to process Arecanut. It is essential to educate them about the consequences of using high amounts fuelwood. Awareness is needed on moving towards implementing sustainable technologies in Arecanut industries such as dryers, improved boilers, etc.

5.2.7 Conclusion

With the use of socio-economic data, it is possible to establish different causes of deforestation and forest degradation and relate these to observed forest cover changes. Several drivers are at play leading to deforestation and forest degradation in the area. A summary of these drivers based on the socio-economic survey is presented in the table below.

Structured questionnaires were used to collect data from both the approaches. Questions were asked at both, the village and the household levels, to list the drivers for deforestation and forest degradation. The following figure gives the responses given at village level FGDs.

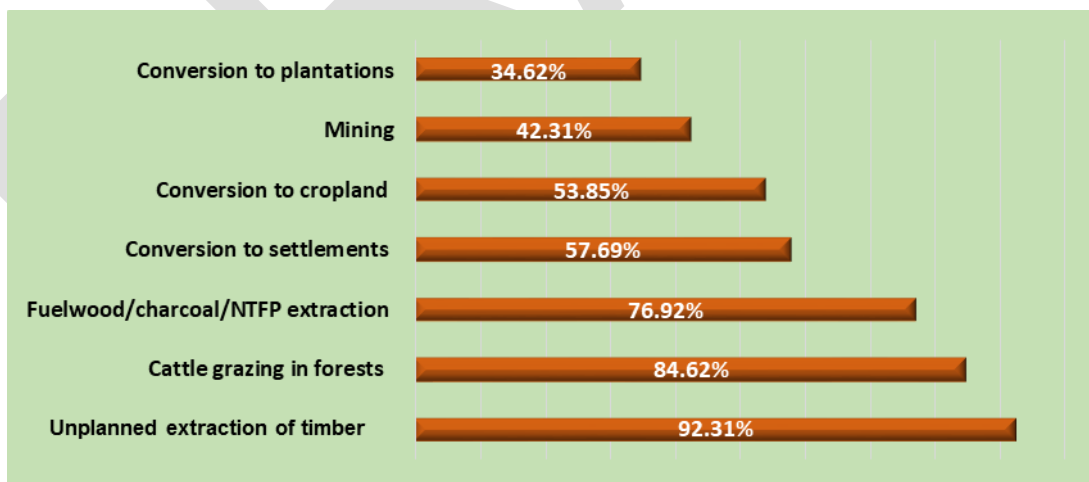


FIGURE 47: RESPONSES ON DRIVERS DURING FOCUS GROUP DISCUSSIONS

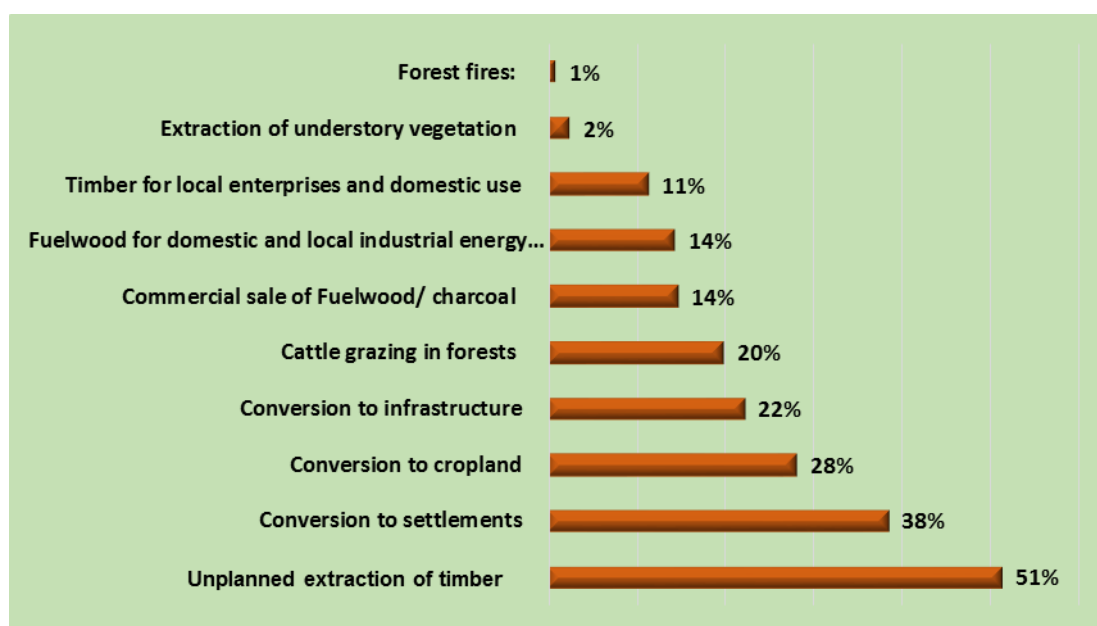


FIGURE 48: HOUSEHOLD RESPONSES ON DRIVERS

Unplanned timber collection was found to be the major driver responsible for deforestation and degradation in Nagaon. The survey analysis also shows that the other two major drivers after timber are fuelwood collection and grazing.

Based on the responses from 67 villages, the drivers have been ranked. This is based on consolidated responses from all the villages. Accordingly, conversion to cropland is the dominant driver followed by extraction of timber for domestic use and fuelwood for domestic and industrial use.

Range	No of Respondents said "Yes"										
	Conversion to cropland	Conversion to settlements	Conversion to infrastructure	Timber for commercial sale	Timber for local enterprises and domestic use	Commercial sale of Fuelwood/ charcoal	Fuelwood for domestic and local industrial energy needs	Cattle grazing in forests	Extraction of understory vegetation	Forest fires:	Destructive harvesting of NTFP:
Dhania	26	28	23	25	5	7	1	18	0	0	0
Dharamtul	20	28	8	41	6	12	12	19	1	1	0
Garajan	33	33	20	42	22	16	3	13	3	0	0
Kampur	20	40	5	31	4	2	21	9	2	0	0
Kathiatoli	13	17	17	30	9	16	5	17	3	2	1
Nagaon Sadar	31	42	27	63	8	14	20	21	2	0	0
Salona	15	29	25	58	9	15	18	14	1	0	0
Total	158	217	125	290	63	82	80	111	12	3	1
% of HHS	27.9%	38.3%	22.0%	51.1%	11.1%	14.5%	14.1%	19.6%	2.1%	0.5%	0.2%

FIGURE 49: RANGE WISE RESPONSES ON DRIVERS

Encroachment is prevailing in all ranges. Unplanned and unsustainable timber extraction is a major driver responsible for deforestation and forest degradation which follows the encroachment of forest land for cultivation. Population increase is putting a lot of pressure on forests by creating new settlements and meeting the ever-growing demand for energy.

Planned and unplanned withdrawals of forest resources leads to forest cover loss and decreased carbon sequestration capacity. Thus, it requires proper understanding and management tools including transparent governance, effective enforcement and appropriate mitigation actions to counter these drivers. Hence, from the above analysis both categories of drivers are listed as follows.

Unplanned drivers	Illegal encroachment for cropland and settlements	Planned driver	Infrastructure development
	Unplanned and illegal timber harvesting		
	Fuelwood for domestic and commercial use		
	Grazing and fodder collection from forests		

FIGURE 50: LIST OF PLANNED AND UNPLANNED DRIVERS OF NAGAON

DRAFT

6 Driver Intervention Matrix

6.1 Introduction

Based on primary and secondary studies as well as consultations held with the stakeholders in the PA, a number of potential interventions were identified as a part of this project. These interventions are broadly classified into the following categories – forest management, improved fodder technologies, and clean energy solutions as fuelwood alternatives. During the survey, communities were asked to list out the intervention activities which communities think possible in their area. The following tables summarise the interventions activities suggested by various households across the ranges.

TABLE 28: INTERVENTION ACTIVITIES TO REDUCE FUELWOOD CONSUMPTION

Range	Dhania	Dharamtul	Garajan	Kampur	Kathiatoli	Nagaon Sadar	Salona
Intervention Activities	No of HHS						
LPG	38	21	54	55	25	33	43
ICS	0	0	1	14	4	4	1
Electric Stove	1	2	10	4	1	7	2
Biogas	2	1	0	0	1	1	6
Create Awareness	0	1	0	0	2	0	4
FD should take strict action	3	0	0	2	6	1	1
Government should help us	1	0	5	2	2	6	3
People should grow more trees	1	1	1	3	1	5	0

Majority of households surveyed suggested LPG is an alternative solution to reduce fuelwood consumption followed by electric stoves. Very few suggested Biogas and improved cook stove (ICS) as alternatives due to lack of awareness about these solutions. This can be overcome by constant awareness creation programs among communities by the Forest Department.



FIGURE 51: INTERVENTION ACTIVITIES TO REDUCE FUELWOOD CONSUMPTION⁴⁸

TABLE 29: INTERVENTION ACTIVITIES TO REDUCE FODDER COLLECTION

Range	Dhania	Dharamtul	Garajan	Kampur	Kathiatoli	Nagaon Sadar	Salona
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⁴⁸ Details of the each intervention activity will discussed separately in the following sections

Intervention Activities	No of HHs						
Create awareness to grow more fodder in own lands	2	0	2	4	4	0	0
Govt. should act towards improving fodder availability	8	0	14	7	7	0	11

TABLE 30: INTERVENTION ACTIVITIES TO REDUCE TIMBER CONSUMPTION

Range	Dhania	Dharamtul	Garajan	Kampur	Kathiatoli	Nagaon Sadar	Salona
Intervention Activities	No of HHs						
Plantations in own land	15	0	0	0	0	0	1
increase in tree planation	1	0	0	0	0	2	0
Iron poles	0	3	6	5	1	5	3
Govt. should take strict action	0	1	1	0	0	5	4
Govt. should help us in constructing the houses	0	3	12	3	0	8	6
RCC houses	0	1	0	3	0	4	0
Awareness creation	0	0	0	0	0	0	1

From the above tables it is evident that households suggested to create awareness amongst communities to grow more fodder species and timber species on their own lands. It was also indicated that government should take strict actions on those who collect timber from the forest. Along with strict actions, it was suggested to provide assistance to communities to build houses.

In the following tables, all the intervention activities planned for the PA have been detailed out describing the problems, solutions, and their implementation plans, among others. Each intervention activity to address deforestation and forest degradation has specific objectives to serve. The objectives could be better forest management, capacity building, governance, clean energy solutions like solar, ICS, etc. All the intervention activities have been classified into different categories and details of the same are given below.

6.2 Selection of Target Villages

The villages shortlisted for implementing the proposed interventions are forest fringe villages located within 1 km buffer of the forest area. This is because the residents of these villages are the most dependent on forest resources for their sustenance. The villages have been categorised according to their household size and population, based on which each of the interventions will be scaled. The selected villages, their household size, and respective populations have been tabulated below.

TABLE 31: FOREST FRINGE VILLAGES SELECTED FOR INTERVENTIONS

HH Size	Village	Total Population
1-50	Pub-Deopani	297
	Krogaon	236
	Raja Pahar No.2	233
	Kathalguri	232
	Kamar Gaon	215
	Joysagar No.2	211
	Kamarpha No.2	198

HH Size	Village	Total Population
	Silphata No.2 (Silghata No.2)	186
	Hatimura No.2	167
51 - 100	Hatimura No.1	298
	Palkhowa	380
	Deopani	480
	Kanchanjuri (Kachanjuri)	425
101 - 150	Sonari Gaon	511
	Bandar Dubi	1009
	Harmoti No.2	756
	Harmati No.1	904
	Baghmari	670
151 - 200	Dakhin Pat	750
	Bagari	986
	Silghat Gaon	969
201 - 500	Sutirpar	1675
	Bhakuwamari	1621
	Kamakhya	1153
	Najangaon	1604
	Nalbari (Sagunbahi Gaon)	1693
	Garaimari (Bogamukh No.2)	2298
	Pachim Salpara (Sonajuri No.2)	2559
501 and above	Kachari Gaon (Silphata No.1)	2525
	Sonaribali (Naharbari No.2)	5346
	Bakula Guri (Dakhinjar Bagan)	5158
Total	31 Villages	35745

6.3 Intervention Plan

The following tables explain the various drivers and problems identified and the respective interventions planned for them.

TABLE 32: LIST OF INTERVENTIONS PLANNED FOR NAGAON UNDER THE LEEF PROJECT

S. No.	Name of Intervention	Drivers Addressed
1	Alternative energy cooking system in households (ICS, LPG, biogas)	Unsustainable fuelwood extraction from forests for cooking and heating purposes
2	Efficient fuelwood-based driers for arecanut processing in arecanut industries in Nagaon	
3	Efficient fuelwood-based boilers for Arecanut boiling in Arecanut industries in Nagaon	
4	Retrofitting existing brick kilns / Introducing new brick manufacturing technologies, for fuel efficient brickmaking	

S. No.	Name of Intervention	Drivers Addressed
5	Smokeless Biomass briquettes as a fuelwood substitute	
6	Smart patrolling to check unplanned extraction of forest resources and unplanned mining within forest land	Encroachment, unplanned felling
7	Construction of CPTs and EPTs for better defined boundaries to reduce encroachments	Grazing, illegal transport of forest produce, encroachment
8	Bio-fencing to reduce encroachment, illegal felling and man-animal conflicts	Encroachment, unsustainable fuelwood and NTFP extraction, man-animal conflicts
9	Plantation activities: 1) Afforestation and Reforestation in non-forest lands for tree cover. 2) Assisted Natural Regeneration in forests to stop degradation	Unsustainable extraction of fuelwood
10	Promoting agro-forestry in large scale in non-forest lands	Unsustainable extraction of fuelwood and timber
11	Cultivation of medicinal plants as a measure of alternative livelihood and income enhancement	Over-dependence on forest resources
12	Sustainable grazing and livestock management 1) Silvi-pastoral and Horti-pastoral models 2) Fodder densification and stall feeding 3) Vaccination of livestock	Unsustainable fuelwood extraction from forests and overgrazing in forest lands

Driver-Intervention Matrix

1. Alternative Energy for Households

Name of the Intervention	Alternative energy cooking system in households (ICS, LPG, biogas)
Code	FW-ICSLPG-HH
Description of the problem	Extraction of fuelwood is the major driver in the Nagaon forest division. 96% of the surveyed households use fuelwood for cooking and water heating purposes. 25% households use LPG, but only for hospitality purposes like preparing tea and coffee. An average of 3.22 tons of fuelwood is required per family per year. According to 2011 census, 81.37% ⁴⁹ of the rural households of Nagaon district predominantly use firewood for cooking. 57% of the households said they collect fuelwood on a weekly basis. Rural LPG penetration is less than 10% ⁴⁹ . So fuelwood is the main energy source available for the communities.
Description of the solution	Deployment of a mix of alternative energy solutions for rural households to regulate fuelwood requirements and ease pressures on forests for fuelwood. This mix would involve provision of ICS, biogas plants and solar cookers tailored towards specific requirements of each Range in Nagaon District. These measures are backed up by

⁴⁹ http://www.censusindia.gov.in/2011census/dchb/1806_PART_B_DCHB_NAGAON.pdf (page no 341 and 342)

	<p>government commitments towards clean energy deployment in rural households across India.</p> <p>Under the Union Budget 2016-17, there are plans to extend cleaner energy solutions to 5 crore families in India over the next 3 years, with further plans to development induction cook stoves as well into this basket to enable cleaner cooking. Electric cook plates can also make use of solar power in remote rural areas of Assam, where LPG penetration may be low and solar energy be easier to provide⁵⁰.</p> <p>In addition, biogas is a proven alternative renewable clean energy technology that can play a huge role in decreasing fuelwood demand. Biogas is a clean and renewable energy solution which completely replaces the non-renewable biomass by introducing a system for utilizing cattle dung and organic matter to provide a clean gaseous fuel for cooking and lighting⁵¹.</p> <p>The distribution of LPG cylinders can be undertaken under the Pradhan Mantri Ujjwala Yojna (PMUY) where priority will be given to forest fringe villages.</p>																				
<p>Detailed description of the technology</p>	<p>1. ICS</p> <p>The Ministry of New and Renewable Energy (MNRE) has approved some improved biomass cookstoves for widespread use across the country, as part of the Central Government-sponsored Unnat Chulha Abhiyan. Some of these are⁵²:</p> <table border="1" data-bbox="405 913 1281 1382"> <thead> <tr> <th>Model</th> <th>Manufacturer</th> <th>Power output (kW)</th> <th>Thermal efficiency (%)</th> </tr> </thead> <tbody> <tr> <td>Harsha Multi-Fuel Cookstove</td> <td>Unicus Engineering Pvt Ltd, Bhubaneswar (Odisha)</td> <td>2.0</td> <td>28.6</td> </tr> <tr> <td>Vikram Bio Super Chulha Top</td> <td>Vikram Stoves and Fabricators, Osmanabad (Maharashtra)</td> <td>2.77</td> <td>31.95</td> </tr> <tr> <td>Oorja K3 Dlx</td> <td>First Energy Pvt Ltd, Pune (Maharashtra)</td> <td>1.51</td> <td>37.26</td> </tr> <tr> <td>TERI SPT-0610</td> <td>The Energy and Resources Institute (TERI), New Delhi</td> <td>1.08</td> <td>36.84</td> </tr> </tbody> </table>	Model	Manufacturer	Power output (kW)	Thermal efficiency (%)	Harsha Multi-Fuel Cookstove	Unicus Engineering Pvt Ltd, Bhubaneswar (Odisha)	2.0	28.6	Vikram Bio Super Chulha Top	Vikram Stoves and Fabricators, Osmanabad (Maharashtra)	2.77	31.95	Oorja K3 Dlx	First Energy Pvt Ltd, Pune (Maharashtra)	1.51	37.26	TERI SPT-0610	The Energy and Resources Institute (TERI), New Delhi	1.08	36.84
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⁵⁰ Panagariya, A., and Jain, A.K. (2016); Electricity and Clean Cooking Strategy for India; NITI Aayog, Government of India.

⁵¹ National Biogas and Manure Management Programme (NBMMMP), Section 3, Technology. <http://www.mnre.gov.in/schemes/decentralized-systems/schems-2>

⁵² Approved Models of Portable Improved Biomass Cookstoves, Ministry of New and Renewable Energy.



2. Biogas

A typical family type biogas plant generates biogas from organic substances such as cattle –dung, and other bio-degradable materials such as biomass from farms, gardens, kitchens and night soil wastes etc. The process of biogas generation is called anaerobic digestion (AD). Such plants are ideal for households with livestock towards becoming self-dependent for the provision of cooking gas and enriched bio-manure.

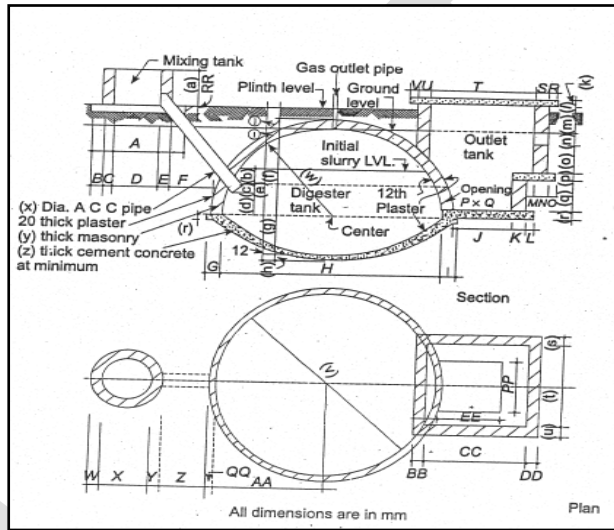
Biogas is a mixture of methane (CH_4) and carbon dioxide (CO_2), and is generated by fermentation of cellulose-rich organic matter under anaerobic conditions. The optimum utilization depends upon the successful physical installations, which in turn depend upon plant design and its selection. The basic conversion principle is that when a non-ligneous biomass is kept in a closed chamber for a few days, it ferments and produces an inflammable gas. The anaerobic digestion consists of three stages: Hydrolysis; Acid Formation and Methane Fermentation.

Under the National Biogas and Manure Management Programme (NBMMP), the MNRE provides subsidies for fixed-dome Deenbandhu type models for use in households. The model is well-known in India and is known for effective methane recovery and combustion⁵³. Its technical specifications are as follows⁵⁴

⁵³ National Biogas and Manure Management Programme (NBMMP), Section 3, Technology. <http://www.mnre.gov.in/schemes/decentralized-systems/schems-2>

⁵⁴ B.T. Nijaguna. 2002. Biogas Technology, New Age International Publishers, New Delhi.

Specification	Value
Capacity	2 m ³
Mixing Proportion (Water: Dung)	1:1
Feed Material	Cattle Dung
Flow rate	0.47 m ³ /hr
Number and size of burners	2 burners of 4" size





3) Liquefied Petroleum Gas (LPG)

Provision of LPG connections and electric cookplates under relevant schemes and programs of the central and state governments in selected households in every district will be explored.

Institutional Partners

1. Social Forestry Wing, DoEF (Nodal agency for NBMMP)
2. Panchayat and Rural Development Department
3. AEDA
4. Planning and Development Department
5. Science and Technology Department
6. Gram Panchayats and VFCs

Identified Barriers	<ol style="list-style-type: none"> 1. Lack of awareness about deleterious effects of fuelwood combustion 2. Lack of awareness about alternate efficient sources of cooking 3. Cultural barriers to accepting new systems 4. Lack of capacity towards installation and maintenance of biogas plants and solar cookers 5. Lack of a delivery network for installing/galvanize LPG cylinders, supply chain of LPG cylinders.
How will these be overcome through REDD+ project	<ol style="list-style-type: none"> 1. Undertaking communication campaigns to sensitize communities towards alternative cooking systems and the ill-effects of fuelwood combustion 2. Assisting in delivery mechanisms for uptake and installation and maintenance of ICS, biogas plants and solar cookers by convergence under government schemes 3. Demonstration and monitoring of the maintenance of biogas plants 4. Creation of an enabling environment to facilitate distribution of ICS 5. Assisting in delivery mechanisms for uptake of LPG by convergence under government schemes 6. Creation of an enabling environment to facilitate distribution of induction cookplates. 7. Monitoring and evaluation of the identified interventions in all districts, overseen by the REDD+ Cell.
Implementation Plan	<ol style="list-style-type: none"> 1. Using a scientific and objective decision support system to identify locations of maximum benefit for rollout of these activities. 2. Calculation of benefits (in CO₂ eq.) and costs (in INR), and presentation to the DoEF and Government of Assam 3. Development of community-level biogas plants, in coordination with local Gram Panchayats and VFCs 4. Facilitating distribution of solar cookers and ICS with Gram Panchayats and VFCs 5. Development of an Action Plan for the administration and monitoring of these interventions, together with the identified institutional partners and the DoEF, and coordinated by the REDD+ Cell.
Co-benefits	Better health of women and children, decrease in indoor pollution, contribution to SDGs, decrease drudgery in collection of fuelwood, economic benefit as more time will be available for other income generation activities, skill development, better education as children will be freed from collection of fuelwood, improved standard of living
Potential convergence	Pradhan Mantri Ujjwala Yojana, Unnat Chulha Yojana

2. Efficient fuelwood-based driers for arecanut processing

Name of the Intervention	Efficient fuelwood-based driers for arecanut processing in arecanut industries in Nagaon
Code	FW-DRY-AREC
Description of the problem	India is one of the world's largest producers of arecanut, with the maximum output from Karnataka, Kerala and Assam. In Assam in 2015-16, total area under arecanut cultivation was 77,000 Ha, with a production of more than 74,000 tons of arecanut, giving an average yield of 973 kg/Ha ⁵⁵ . Nagaon district is one of the leading producers of arecanut in Assam, and is a major source of employment for households in Nagaon.

⁵⁵ Directorate of Arecanut and Spices Development, Ministry of Agriculture, Government of India. www.dasd.gov.in/index.php/statistics.html

	<p>There are an estimated 200 arecanut producing industries in Rupahi and Sunaribali areas of Nagaon district. Nut bearing usually starts 4-5 years after planting. After the kernel is taken out from the harvested arecanut, they are immediately boiled at a high temperature for a minimum of 12 hours⁵⁶. From the results of the socio-economic survey conducted in Nagaon, it has been observed that significant amounts of fuelwood is utilized for drying of arecanut.</p> <p style="text-align: center;">Table 2.1: Estimation of fuelwood required by 1 Arecanut Industry</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Supari processed per Month</td> <td>1,000</td> <td>KG</td> </tr> <tr> <td>FW required to process 1Q of raw Arecanut</td> <td>80</td> <td>KG</td> </tr> <tr> <td>Total Fuelwood required</td> <td>80,000</td> <td>KG</td> </tr> <tr> <td>Total Fuelwood required</td> <td>80</td> <td>Tons/Month</td> </tr> <tr> <td>Operation months</td> <td>5</td> <td></td> </tr> <tr> <td>Total Fuelwood required per season</td> <td>400</td> <td>Tons per Year</td> </tr> </table> <p>Table 2.1 shows that approximately 400 tons of fuelwood is consumed by 1 arecanut industry in one season. This translates to over 80,000 tons of fuelwood being consumed by the arecanut industry in Nagaon every year. Conventional driers used for processing result in a large amount of thermal energy loss, leading to increased fuelwood requirements from all sources, primarily forests. This places pressure on local forests and leads towards deforestation and forest degradation – fuelwood efficient driers would bring down the pressure on forests for drying of arecanut and help maintain the forest carbon stocks in Nagaon.</p>	Supari processed per Month	1,000	KG	FW required to process 1Q of raw Arecanut	80	KG	Total Fuelwood required	80,000	KG	Total Fuelwood required	80	Tons/Month	Operation months	5		Total Fuelwood required per season	400	Tons per Year
Supari processed per Month	1,000	KG																	
FW required to process 1Q of raw Arecanut	80	KG																	
Total Fuelwood required	80,000	KG																	
Total Fuelwood required	80	Tons/Month																	
Operation months	5																		
Total Fuelwood required per season	400	Tons per Year																	
<p>Description of the solution</p>	<p>Fuelwood efficient driers for arecanut to bring down considerable fuelwood demand and provide environmental and social benefits to supari industries.</p>																		
<p>Detailed description of the technology</p>	<p>Fuelwood-efficient driers utilize significantly less fuelwood, reduce the curing period and associated pollution. One of the most famous such biomass driers is the ASTRA drier, which is a clean and efficient biomass-fired device, which saves fuelwood utilization and does not expose the operator to smoke. Drying is done in the ASTRA drier in the temperature range of 60-70°C using hot air, but can also be operated at temperatures in the vicinity of 100°C, if necessary⁵⁷.</p> <p>Use of solar-biomass hybrid driers will also be explored for undertaking this activity.</p>																		
<p>Institutional Partners</p>	<ol style="list-style-type: none"> 1. Agriculture Department 2. Horticulture and Food Processing Department 3. Panchayat and Rural Development Department 4. Science and Technology Department 5. AEDA 6. Centre for Sustainable Technologies, Indian Institute of Science (Bangalore). 7. Gram Panchayats and VFCs 																		
<p>Identified Barriers</p>	<ol style="list-style-type: none"> 1. Lack of awareness about new techniques of arecanut drying 2. Insufficient supply chains and delivery mechanisms of new drying technologies. 3. Lack of production capacity to meet demand. 																		


⁵⁶ www.gmgroupp.in/arecanut-processing.html

⁵⁷ astra.iisc.ernet.in/Pages/Faculty/somu/p2.html

How will these be overcome through REDD+ project	<ol style="list-style-type: none"> 1. Undertaking communication campaigns to sensitize cultivators towards the ill-effects of fuelwood combustion and the benefits of adopting efficient driers for their crop. 2. Installation and monitoring of efficient driers with selected beneficiaries through convergence with relevant Departments, and with coordination from local Gram Panchayats and VFCs 3. Mobilization of adequate funding for the procurement, demonstration and deployment of these driers.
Implementation Plan	<ol style="list-style-type: none"> 1. Selection of beneficiaries in Nagaon based on objective criteria 2. Facilitating distribution and sale of efficient driers in coordination with the VFCs and CST. 3. Calculation of benefits (in CO₂ eq.) and costs (in INR), and presentation to the DoEF and Government of Assam 4. Development of an Action Plan for administration and monitoring of driers, in coordination with DoEF and other Departments, overseen by the REDD+ Cell
Co-benefits	Better price for good quality cardamom, economical benefit as less amount of fuelwood used.
Potential convergence	Schemes under horticulture and agriculture departments to promote energy efficient driers.

3. Efficient fuelwood based boilers for arecanut boiling

Name of the Intervention	Efficient FW based boilers for arecanut boiling in arecanut industries in Nagaon
Code	FW-BOI-AREC
Description of the problem	As discussed in above table before drying arecanut either under sun or using FW, raw arecanut has to be boiled thoroughly for few hours. This boiling is under using traditional inefficient stoves which consumes lots of fuelwood.
Description of the solution	Fuelwood efficient boilers for arecanut to bring down considerable fuelwood demand and provide environmental and social benefits to supari industries.
Detailed description of the technology	Improved and efficient boilers or stoves are developed by TIDE technologies has very good thermal efficiency with 40% fuel savings compared to traditional stoves. The stoves are made from prefabricated ferro-concrete components that are transported to the user site and then assembled on site. Consistency in design and performance is obtained by use of production centre assembled prefabricated components. Three pan stove dimensions are 425cm x 111cm x 116cm. Burning rate of the stove is 30 kg/hr. Two pan stove dimensions are 300cm x 111cm x 116cm. Burning rate of the stove is 25.8 kg/hr. Single pan stove dimensions are 96 cm diameter and 103 cm height. Fuel burning rate of the stove is 19.23 kg/hr. The three/two/single pan arecanut cooking stoves have the potential to conserve up to 60% of biofuels as compared to conventional devices.

	 <p>Use of solar-biomass hybrid boilers will also be explored for undertaking this activity.</p>
Institutional Partners	<ol style="list-style-type: none"> 1. Agriculture Department 2. Horticulture and Food Processing Department 3. Panchayat and Rural Development Department 4. Science and Technology Department 5. AEDA 6. Centre for Sustainable Technologies, Indian Institute of Science (Bangalore). 7. Gram Panchayats and VFCs
Identified Barriers	<ol style="list-style-type: none"> 1. Lack of awareness about new techniques of arecanut boiling 2. Insufficient supply chains and delivery mechanisms of new boiling technologies. 3. Lack of production capacity to meet demand.
How will these be overcome through REDD+ project	<ol style="list-style-type: none"> 1. Undertaking communication campaigns to sensitize cultivators towards the ill-effects of fuelwood combustion and the benefits of adopting efficient boilers for their crop. 2. Installation and monitoring of efficient boilers with selected beneficiaries through convergence with relevant Departments, and with coordination from local Gram Panchayats and VFCs 3. Mobilization of adequate funding for the procurement, demonstration and deployment of these boilers.
Implementation Plan	<ol style="list-style-type: none"> 1. Selection of beneficiaries in Nagaon based on objective criteria 2. Facilitating distribution and sale of efficient boilers in coordination with the VFCs and CST. 3. Calculation of benefits (in CO₂ eq.) and costs (in INR), and presentation to the DoEF and Government of Assam 4. Development of an Action Plan for administration and monitoring of boilers, in coordination with DoEF and other Departments, overseen by the REDD+ Cell
Co-benefits	<p>Better price for good quality cardamom, economical benefit as less amount of fuelwood used.</p>
Potential convergence	<p>Schemes under horticulture and agriculture departments to promote energy efficient boilers.</p>

4. Fuel efficient brick kilns

Name of the intervention:	Retrofitting existing brick kilns / Introducing new brick manufacturing technologies, for fuel efficient brickmaking
Code:	ALT-AFW-BRK
Description of the problem	Brick factories in the district consume a lot of fuelwood. On an average around 10 tons of fuelwood is used per kiln in a year for initial firing purpose. (FAO, 1988) There are around 300 brick kilns in Nagaon district (Sentinel Assam, May 2017), consuming more than 3,000 tons of fuelwood in a year.
Description of the solution	Introduction of alternate household fuels like efficient burners and driers. Retrofitting existing brick factories to make them more fuel efficient.
Description of the technology	Zig-zag kiln: <ul style="list-style-type: none"> • 15-20% reduction in Specific Energy Consumption (SEC) • Upto 75% reduction in SPM emissions over FC-BTK • A higher percentage of Class I bricks are produced as compared to FC-BTK (80-85% Class I bricks as compared to 55-60% in FC-BTK) • Option for easy retrofit of FC-BTK to natural draught zig-zag kiln. • Like FC-BTK, zig-zag kilns also require solid fuels for firing. • Some of the fuels currently being used are saw dust, low and high grade coal, pet coke, agricultural residue etc. As zig-zag kiln is an energy efficient technology, it requires less fuel than FC-BTK.
Institutional partners	TARA, Development Alternatives, Shakti Foundation, Core Support Programme (Science and Society Division, Dept. of Science and Technology)
Identified barriers	<ul style="list-style-type: none"> • Lack of awareness of other technologies – Knowledge barrier • Lack of finances to invest in clean technologies – Financial barrier • Untrained labour – Technical barrier
How will these be overcome through REDD+ project?	<ul style="list-style-type: none"> • Organising workshops for brick kiln workers on efficient fuels and kiln retrofiting • Training workshops for kiln workers (e.g. for honeycomb layering of bricks, optimal size of bricks, etc) • Development of a financing mechanism for retrofiting existing kilns.
Implementation plan	<ul style="list-style-type: none"> • Adoption of improved feeding, firing and operating practices in existing Fixed Chimney Bull's Trench Kilns (FCBTKs) • Retrofitting of kiln and converting into High Draft Kiln/ Fixed Chimney Bull's Trench Kiln with zig-zag firing. • Extensive Capacity Building Program • Effective policies and regulations required for implementing energy efficient technologies like Tunnel Kiln, Hoffman Kilns, TARA Eco Kiln, TARA BrickMek, etc. • Need for establishing the demand/market for resource efficient products like hollow and perforated bricks, and limiting the production of solid bricks in phases. • The technologies being capital intensive, requires mechanism for financial support before its replication on large scale.
Co-benefits	Economic benefit as less amount of fuelwood used. Improved health of brick kiln workers due to proper training and less pollution.
Potential convergence	Initiatives by the Pollution Control Board of Assam (PCBA)

5. Smokeless Biomass briquettes as a fuelwood substitute

Name of the intervention:	Smokeless Biomass briquettes as a fuelwood substitute
Code	ENE-BRQ-FW
Description of the problem	Unsustainable fuelwood extraction from forests (for household use, for fodder preparation and for use in small enterprises) to support rural communities is a major cause of deforestation and forest degradation in Nagaon. Illegal felling of fuelwood is reported in almost all ranges in Nagaon.
Description of the solution	Introduction of smokeless bio-briquettes using waste biomass and invasive species will help reduce fuelwood consumption, leading to the conservation and enhancement of Nagaon's forest carbon stocks. In addition, they will lead to the following benefits: <ul style="list-style-type: none"> - Check the breakout of invasive species causing deterioration of forest health - Provide an outlet for disposal of agricultural and animal feed wastes - Make available organic fertilizer and opportunities for non-farm based livelihoods - Reduce health hazards from smoke and high emissions from burning fuelwood and biomass
Detailed description of the technology	About 400-500 gm of biodegradable waste is utilized for the production of 1 bio-briquette – 40-50 bio-briquettes can be manufactured per day. The processes involved in making bio-briquettes: <ul style="list-style-type: none"> - Collection and drying of bio-degradable waste and burning in a pit to make active charcoal. - Production of biochar by leaving the charcoal overnight and airtight upto 12 hours. - Mixing biochar with fine mud in 3:1 ratio, and adding water to make a paste - Putting biochar-mud mixture in the briquette moulding frame and drying.
Identified barriers	<ol style="list-style-type: none"> 1. Lack of awareness about deleterious effects of fuelwood combustion 2. Lack of awareness about alternate efficient sources of cooking 3. Lack of established bio-briquettes manufacturing and delivery systems 4. Lack of rural infrastructure to support bio-briquettes manufacturing 5. Lack of data on availability of invasive species as well as agricultural and animal feed wastes 6. Cultural barriers for take-up of alternative systems
How will these be overcome through REDD+ project?	<ol style="list-style-type: none"> 1. Building on existing communication campaigns to popularize the use of bio-briquettes across the state 2. Assisting in procuring equipment, providing training and setting up of small enterprises focused on manufacturing and use of bio-briquettes 3. Building on linkages and convergence with the government, public sector (NABARD) and private sector
Implementation plan	<ol style="list-style-type: none"> 1. Training and awareness campaigns on bio-briquettes shall be organised in all the districts in such a way that at least 4 representatives from each village attend the training program. 2. One mould will be given to each village, the SHGs/JFMCs in each village can procure more moulds from wherever they prefer. 3. A market chain will be established to market the bio-briquettes.
Co-benefits	<ul style="list-style-type: none"> • Better health of women and children, decrease in indoor pollution, contribution to SDGs, decrease drudgery in collection of fuelwood, economical benefit as more time will be available for any income generation activity, skill development, better education as children will be freed from collection of fuelwood, improved standard of living • There is employment generation as well where SHGs can form a group together and market bio-briquettes.
Potential convergence	Pradhan Mantri Ujjwala Yojana, Unnat Chulha Yojana

6. Smart patrolling to check unplanned extraction of forest resources and unplanned mining within forest land

Name of the intervention:	Smart patrolling to check unplanned extraction of forest resources and unplanned mining within forest land
Code:	FML-PAT-MIN
Description of the problem	Few village communities extract small rocks from the forests and break them into small pieces (gravel) and sell. Over a period of time, this practice affects the forest soil and leads to forest degradation.
Description of the solution	Regular patrolling by forest personnel will discourage encroachers to illegally retrieve rocks from forests.
Institutional partners	Forest Department, Horticulture Department, National Horticulture Mission, Social Forestry Wing (Dept. of Environment & Forests, Govt. of Assam)
Identified barriers	<ul style="list-style-type: none"> • Lack of capacity in JFMCs • Neglecting the need of local community while focusing on timber-only forestry could threaten the sustainability (ecological and social) of sal forests.
How will these be overcome through REDD+ project?	<ul style="list-style-type: none"> • Integrating NTFPs could create the opportunity for local people to participate in forest management. • Increasing NTFP production like pepper & betel vine may contribute towards the economic opportunities and ultimately lead to the economic prosperity of local communities.
Implementation plan	<ul style="list-style-type: none"> • Constitution of JFMCs and preparation of micro plans. • Nursery raising by JFMCs for creation of plantation and simultaneous raising of another people's nursery by each JFMC for income generation from sale of seedlings. • Entry Point Activities like repairing of village road, construction of community hall, providing safe drinking water facility etc. • Training and capacity building of JFM communities as well as forest personnel. • Plantation over degraded forest by JFMCs. • Infrastructure Development of Forest Department for better service delivery • Exposure visit to other states. • Support to JFMCs for Medicinal and Aromatic Plantation on PPP mode.

7. Construction of CPTs and EPTs for better defined boundaries to reduce encroachments

Name of the intervention:	Construction of CPTs and EPTs for better defined boundaries to reduce encroachments
Code:	FML-DBN-ENC
Description of the problem	The lack of artificial boundaries of a number of reserve forests leads to encroachment and regular felling and extraction of resources from the forest reserves. Ecological and social surveys conducted in the landscape indicate that Reserved Forests in Nagaon suffer from illegal encroachments due to lack of proper demarcation, unauthorized cattle grazing and lack of soil conservation leading to riverine and gully formations. Except for the Nagaon Sadar range, all ranges in Nagaon witness man-animal conflicts on a regular basis. Most of these incidents involve elephants.
Description of the solution	The need for strict vigilance through watchtowers to manage the boundary line of the reserve forests is there and proper demarcation with fixing of pillars in the division. Construction of CPTs and EPTs, as well as other relevant measures, to counter the multi-faceted challenges that RFs face in the Nagaon Division. These CPTs and EPTs

	are multi-purpose and useful towards forest management, utilizing least amount of resources for maintenance and construction. These can be constructed under MGNREGA funds through convergence with other state government departments by looking at various models practiced in different landscapes across India.
Description of the technology	<p>A watchtower is simply a structure with a platform a few meters high that can support one or two people and from which the surrounding area can be observed. It can be either be on a tree or as a stand-alone structure.</p> <p>For CPTs and EPTs: Common dimensions of such trenches are 3m wide at the top, 1m wide at the bottom and 2m deep. The design of the CPTs and EPTs may also depend on the challenge that needs to be addressed :</p> <ul style="list-style-type: none"> - For cattle grazing, trench size of at least 4ft depth and 4ft width. - For encroachment, trench size of 3ft height and 3ft width. - For erosion control, trench size of 3ft height and 3ft width <p>These trenches are constructed after identification of vulnerable areas on the forest fringes where encroachment activities, man-animal conflicts and other issues have been repeatedly observed.</p> <p>Other relevant measures that can be considered include the utilization of used rail tracks sourced from the Indian Railways for fencing purposes. This has already been tried on an experimental basis in Assam.</p>
Institutional partners	Department of Environment and Forests (DoEF), JFMCs
Identified barriers	<ul style="list-style-type: none"> • Lack of properly defined boundaries in reserve forests. • Lack of awareness among communities regarding reserve forests. • Lack of capacity among the JFMCs. • There are reports that animals get injured in tea garden areas after falling into the deep trenches, dug within the garden areas for drainage of water. • Lack of funding towards construction of trenches • Lack of participation of local communities and VFCs towards construction • Defective construction and lack of maintenance
How will these be overcome through REDD+ project?	<ul style="list-style-type: none"> • Regular surveillance will check encroachment. • Training campaign among communities regarding the importance of reserve forests. • CPTs and EPTs will make sure animals are not injured and man-animal conflicts are reduced.
Implementation plan	<ol style="list-style-type: none"> 1) Proper demarcation of reserve forests with help of the Forest Dept. 2) Creating awareness among JFMCs and concerned forest communities regarding management of reserve forests. 3) Construction of watch towers & posting of staff on 24 hours duty during most vulnerable periods. 4) Vaccination of cattle near the fringe villages needs to be done regularly and awareness camp & animal health camps needs to be conducted with the help of veterinary doctors regularly. 5) Elephant depredation hot spots needs to be identified. 6) JFMC's (or) EDC's needs to be activated & awareness to be given on protection to wildlife. 7) Provision of funds to public for construction of stone wall/solar electric fencing around agricultural fields. 8) Live/bio-fencing 9) Construction of watchtowers & posting of staff on 24 hours duty during most vulnerable periods. 10) Identification of vulnerable areas with need for fencing based on objective criteria 11) Exploring various models of trench construction

8. Bio-fencing to counter encroachment

Name of the intervention:	Bio-fencing to reduce encroachment, illegal felling and man-animal conflicts
Code:	FM-BRDR-PLANT
Description of the problem	Encroachment and illegal felling is one of the many causes of deforestation and forest degradation. Further, in areas where agricultural fields are situated adjacent to forestlands, there are frequent man-animal conflicts.
Description of the solution	Development of biological barriers such as agave plantation can stop the felling and transport of local timber, while also acting as a barricade against animal incursion. These natural barriers would supplement existing efforts undertaken by the DoEF, like surveillance through watchtowers and procurement of night-vision glasses, to check these illegal activities. In addition, such vegetative barriers restrict animals from foraging on agricultural produce and causing crop damages.
Description of technology	Agave plantations have been used across various states in India for live fencing due to its low maintenance requirements, growth of marginal lands and its soil binding properties. Agave leaves are thick and fleshy, and its tips are full of spines ⁵⁸ . Rows of agave plantations would help check illegal encroachment, felling and transport of timber, as well as man-animal conflicts, by acting as a natural barrier. Other types of vegetation can also be explored to act as bio-fencing towards restricting these activities.
Identified barriers	<ol style="list-style-type: none"> 1. Lack of protection and maintenance of these bio-fencing techniques 2. Lack of capacity and training of local DoEF personnel and communities towards bio fencing 3. Destruction of such fences by encroachers
How will these be overcome through REDD+ project?	<ol style="list-style-type: none"> 1. Undertaking communication campaigns on the benefits of natural barriers to restrict these activities. 2. Training and capacity building of JFMCs and local communities, in addition to convergence of central and state funds and schemes, on the plantation and maintenance of these bio-fences. 3. Distribution of saplings (e.g. agave or other thorny species) of plants which can be used for live fences.
Implementation plan	<ol style="list-style-type: none"> 1. Training of DoEF personnel, JFMCs and local communities on the construction and maintenance of live fences 2. Identification of areas which are priority plantations to take up agave plantation, geo-tagging them. 3. Ground reconnaissance, raising agave, planting them in the prescribed manner. 4. Development of strategies to converge the objectives of this intervention with other DoEF initiatives to check illegal felling and transport.
Co-benefits	Decrease man-animal conflict, encroachment, and smuggling.
Potential schemes	Existing DoEF schemes

9. Afforestation/Reforestation and ANR activities

Name of the intervention:	Plantation activities: <ol style="list-style-type: none"> 1. Afforestation and Reforestation in non-forest lands for tree cover. 2. Assisted Natural Regeneration in forests to stop degradation
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⁵⁸ biogov.in/article/agave-a-multipurpose-dryland-plant/


Code:	FM-ANR-AFD
Description of the problem	REDD+ interventions strives to decrease degradation and deforestation and associated emissions. Through LULC change mapping, it is observed that there are pockets of degradation and deforestation in Nagaon, which leads to emissions.
Description of the solution	Plantation activities in identified degraded pockets through Assisted Natural Regeneration (ANR) and gap plantation and identified non-forest pockets prone to deforestation (afforestation and reforestation) will help in enhancement of forest stock and increase forest and tree cover.
Detailed description of the technology	Afforestation and reforestation both refer to establishment of trees on lands not currently having trees. Reforestation refers to establishment of forest on land that had recent tree cover, whereas afforestation refers to land that has been without forest for much longer ⁵⁹ . For such activities, it is stipulated that the identified land at the time of commencement of plantation is not a forest, and woody vegetation on the land is below the forest thresholds as decided for the national GHG inventory; which is a crown cover of 10%. ANR is a method for enhancing the establishment of secondary forest from degraded grassland and shrub vegetation by protecting and nurturing the mother trees and their wildlings inherently present in the area ⁶⁰ . ANR activities are focused on lands currently classified as forests (and which meet the minimum eligibility criteria for forests mentioned above), but which may not remain one in the future due to anthropogenic pressures from the drivers of forest change identified in the socio-economic surveys conducted in the landscape. Depending on the existing condition and canopy cover of the identified area, the appropriate techniques and methods for plantations and development of the degraded landscape will be employed towards regenerating forest cover through selection of appropriate tree species, forest management, protection and monitoring.
Institutional partners	JFMCs/EDCs
Identified barriers	<ol style="list-style-type: none"> 1. Non-availability of degraded areas on a suitable scale. 2. Lack of sufficient funds to undertake plantation activities across Nagaon. 3. Lack of technology-driven cost effective monitoring of these plantations.
How will these be overcome through REDD+ project?	<ol style="list-style-type: none"> 1. Training of DoEF personnel and JFMCs on undertaking best land regeneration practices through trainings planned under REDD+. 2. Undertaking communication campaigns focusing on the benefits of forest conservation and enhancement 3. Distribution of native tree species seeds and saplings for plantation to JFMCs and EDCs under an appropriate scheme. 4. Convergence of funds and schemes for better regeneration of degraded forest and non-forest land
Implementation plan	<ol style="list-style-type: none"> 1. Identification and demarcation of degraded forest and non-forest land, its extent of degradation and suitability for A/R and ANR activities. 2. Selection of suitable native species to be used for regeneration of forest through consultations within DoEF. 3. Convergence of schemes and funds for implementing the plantation activities on the degraded lands. 4. Expert consultations to identify, and attempt to overcome, expected challenges (environmental, ecological, and financial) for carrying out the regeneration of the degraded land. 5. Development of an Action Plan for administration and monitoring of the intervention with JFMCs and DoEF. 6. Year 3 onwards, further ANR to increase the forest stocks in a phased manner.


⁵⁹ ipcc.ch/ipccreports/sres/land_use/index.php?idp=47

⁶⁰ fao.org/forestry/anr/en/

Co-benefits	Access to timber, fuelwood and fodder, increase the forest cover and health, provide labour to people in plantation and site preparation activities, decrease incidents of landslides.
Potential schemes	All existing schemes and programs on afforestation, reforestation in the sites <ul style="list-style-type: none"> • National Afforestation Policy (NAP), NAEB (MoEFCC) [State Implementing Agency: State Forest Development Agency, Assam] • State Compensatory Afforestation Fund Management and Planning Authority (CAMPA) • Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) [State Implementing Agency: Panchayat and Rural Development Department]

10. Promoting agro-forestry in large scale in non-forest lands

Name of the intervention:	Promoting agro-forestry in large scale in non-forest lands
Code:	FM-AGF-AFD/AGD/HORT
Description of the problem	REDD+ interventions strives to decrease degradation and deforestation and associated emissions. Through LULC change mapping, it is observed that there are pockets of degradation and deforestation in Nagaon, which leads to emissions.
Description of the solution	Agro-forestry will be promoted with a mix of fuelwood and other native fodder, fruit trees to address fuel, fodder and other livelihood needs of the communities
Detailed description of the technology	<p>Promoting horticulture species such as mangoes, jack fruit, jamoon, etc. not only increases tree cover but also provide livelihoods to communities. Fruit processing industries will be promoted with proper market linkages. Farmer producing companies will be integrated with existing JFMCs which will have active participation of all stakeholders.</p> <p>Dedicated fuelwood plantations will be raised and managed sustainably to address fuelwood needs of the community. The species will be decided after consulting local communities with the help of forest department.</p>  <p style="text-align: center;">FIGURE 52: MANGO PLANTATION</p>

	 <p style="text-align: center;">FIGURE 53: JACKFRUIT PLANTATION</p>
Institutional partners	JFMCs/EDCs
Identified barriers	<ol style="list-style-type: none"> 1. Non-availability of degraded areas on a suitable scale. 2. Lack of sufficient funds to undertake plantation activities across Nagaon. 3. Lack of technology-driven cost effective monitoring of these plantations.
How will these be overcome through REDD+ project?	<ol style="list-style-type: none"> 1. Training of DoEF personnel and JFMCs on undertaking best land regeneration practices through trainings planned under REDD+. 2. Undertaking communication campaigns focusing on the benefits of forest conservation and enhancement 3. Distribution of native tree species seeds and saplings for plantation to JFMCs and EDCs under an appropriate scheme. 4. Convergence of funds and schemes for better regeneration of degraded forest and non-forest land
Implementation plan	<ol style="list-style-type: none"> 1. Identification and demarcation of non-forest land which belongs to local farmer 2. Selection of suitable native species to be used through consultations within DoEF. 3. Convergence of schemes and funds for implementing the plantation activities on the agriculture lands. 4. Expert consultations to identify, and attempt to overcome, expected challenges. 5. Development of an Action Plan for administration and monitoring of the intervention with JFMCs and DoEF. 6. Year 3 onwards, further ANR to increase the forest stocks in a phased manner.
Co-benefits	Source of fodder, timber and increased source of income through multi-tiered agriculture.
Potential schemes	<ul style="list-style-type: none"> • Awareness schemes under agriculture department and agro-forestry promotion • Sub-Mission on Agroforestry (SMAF), National Mission for Sustainable Agriculture (NMSA), Govt. of India

11. Cultivation of medicinal plants

Name of the intervention:	Cultivation of medicinal plants as a measure of alternative livelihood and income enhancement
Code:	FM-MED-PLANT
Description of the problem	Around 24% of the surveyed households revealed they collect NTFPs, including herbs like Abu-Tenga (<i>Antidesma acidum</i> Retz), Agora (<i>Triumfetta rhomboidea</i> Jacq), Bagh-ashora (<i>Polygonus glabrum</i>), etc. Most of the households collect these NTFPs for personal consumption, which does not translate into monetary gains through NTFPs for the households.

Description of the solution	Plantation and collection of medicinal plants and linking it with herbal markets like the upcoming Food Park by Patanjali Ayurved will help the farmers by financially including them into the mainstream market. Patanjali is investing Rs 1300 crore for its Herbal and Mega Foodpark in Ballipara, Assam. This is estimated to give direct employment to 5000 people and benefit 1,00,000 farmers all across the state.
Detailed description of the technology	The Balipara unit of Patanjali will produce Rs 20,000 crore annual production with an annual production capacity of around 12 lakh MT. The unit will manufacture wide range of consumer products such as cosmetics, nutritional foods and kitchen essentials among others. The plant will produce rice bran oil from the remains of rice husks. (Patanjali Ayurved Ltd., November 2016)
Partner institutions	1. DoEF 2. JFMCs/EDCs/SHGs and Gram Panchayats 3. Patanjali Ayurved Ltd. 4. Horticulture Mission, Agriculture Department (Ayush Programme for cultivation of medicinal plants)
Identified barriers	1. Lack of awareness and knowledge of market potential of medicinal plants 2. Lack of resources and capacity of local communities towards the development and monitoring of medicinal plantations 3. Lack of coordination among institutions for the deployment of this intervention, along with other financial and technical towards adoption of these modern techniques
How will these be overcome through REDD+ project?	1. Undertaking communication campaigns on benefits from medicinal plants. 2. Training and capacity building on plantation techniques 3. Financial, technical and institutional support to overcome the barriers of medicinal plantation activities.
Implementation plan	1. Identification and selection of suitable lands for plantation activities. 2. Training, capacity-building and promotion of medicinal plantations. 3. Facilitating distribution of seeds of ecologically adaptive and agro-climatically suitable species 4. Convergence of public funds and schemes for promoting and implementing medicinal plantations 5. Development of an Action Plan for administration and monitoring of the intervention with Gram Panchayats, JFMCs, and DoEF.
Co-benefits	Increased income through alternative options. Reduced dependence on forest resources leading to less extraction and exploitation of forest resources.
Potential convergence	Horticulture Mission, Agriculture Department (Ayush Programme for cultivation of medicinal plants)

12. Sustainable grazing and livestock management:

1. Silvi-pastoral and Horti-pastoral models
2. Fodder densification and stall feeding
3. Vaccination of livestock

12.1 Silvi-pastoral and Horti-pastoral Models

Name of the intervention:	Silvi-pastoral and Horti-pastoral practices for sustainable grazing
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Code:	FM-SILV-HORT
Description of the problem	Around 68% of surveyed households have cattle in their houses. An average of 3 cows is present per family. It is estimated that there are 2,087,631 livestock (NER databank) in the district, which require a constant supply of fodder and pasturelands. Poultry, Duckery, Goatery and Piggery are major backyard activities of the rural households for food and nutrition. Pig rearing is taken as a subsidiary occupation by the small and marginal farmers and the agricultural labourers of the tribal community. ⁶¹ According to the socio-economic survey, sheep, pig, chicken and geese are reared in most of the households and used for meat purposes. There are 480,208 rural households in Nagaon (Census 2011), with average of 4 livestock per household. From the socio-economic survey conducted in the landscape, it was found that 83% of the cattle goes for open grazing. And around 22% of the surveyed households revealed they collect fodder from forests. This leads to pressures on existing lands to provide fodder and pastures.
Description of the solution	Development of silvi-pastoral models to meet the pasture demands of local livestock and to provide for the cultivation of trees for fuelwood purposes.
Detailed description of the technology	Silvi-pastoral systems advocate the cultivation of trees simultaneously with the cultivation of grasses and forage. In this system, the space between individual tree specimens in silvi-pastoral and horti-pastoral systems will be utilized for cultivation of grasses and forage for livestock. In-situ grazing will be provided for livestock throughout the year (in silvi-pastoral systems) and for a period of 3-4 months during fruiting season (in horti-pastoral systems). In addition, foliage to be made available for livestock consumption.
Partner institutions	<ol style="list-style-type: none"> 1. DoEF 2. JFMCs/EDCs/SHGs and Gram Panchayats 3. Horticulture Mission, Agriculture Department
Identified barriers	<ol style="list-style-type: none"> 1. Lack of awareness and knowledge of silvi-pastoral and horti-pastoral practices and their benefits 2. Lack of resources and capacity of local communities towards the development and monitoring of silvi-pastoral landscapes. 3. Lack of coordination among institutions for the deployment of this intervention, along with other financial and technical towards adoption of these modern techniques
How will these be overcome through REDD+ project?	<ol style="list-style-type: none"> 1. Undertaking communication campaigns on benefit of forest conservation, importance of silvipastoral and hortipastoral practices 2. Training and capacity building on silvipastoral and hortipastoral practices 3. Distribution of ecologically adaptive and agro-climatically suitable tree species seeds and saplings for silvi-pastoral and horti-pastoral plantations 4. Financial, technical and institutional support to overcome the barriers of silvipastoral and hortipastoral practices
Implementation plan	<ol style="list-style-type: none"> 1. Identification and selection of suitable lands for adoption of silvi-pastoral activities 2. Designing of silvi-pastoral and horti-pastoral activities in consultation with experts and institutions and agencies like local NGOs, SHGs and others. 3. Training, capacity-building and promotion of silvi-pastoral and horti-pastoral activities 4. Facilitating distribution of seeds of ecologically adaptive and agro-climatically suitable species 5. Convergence of public funds and schemes for promoting and implementing silvi-pastoral and horti-pastoral practices 6. Development of an Action Plan for administration and monitoring of the intervention with Gram Panchayats, JFMCs, and DoEF.


⁶¹ District Report: Nagaon, Baseline Survey of Minority Concentrated Districts, OKDISCD – Guwahati (Ministry of Minority Affairs, Govt. of India)

Co-benefits	Source of fodder and decrease in soil erosion.
Potential schemes	<ul style="list-style-type: none"> • Sub-Mission on Fodder and Feed Development, National Livestock Mission (Government of India) • Accelerated Fodder Development Programme, Department of Agriculture (Government of India)

12.2 Fodder Densification and stall feeding

Name of the intervention:	Fodder densification and stall feeding
Code:	ALM-FODD-FD
Description of the problem	<p>Due to climate variations, sustenance of livestock production is at threat due to scarcity of fodder during drought periods. Also, for a majority of illiterate and semi-literate farmers to compute a balanced feed for animals.</p> <p>State Animal Husbandry Department sources say the present requirement of green fodder for cross-bred animals is 2.3 million MT but what's available is a mere 85,633 MT.⁶² Crop residues, which are otherwise suitable for animal feeding are quite often burnt in the paddy fields or destroyed gradually without in utility, especially in Assam. (District Animal Husbandry and Veterinary Department, Nagaon)</p>
Description of the solution	<p>Densification of roughages and waste crop residues in compact blocks is an effective solution for livestock feed management. The digestibility of crop residues and other low quality forages can be increased through the action of rumen microbes by strategically mixing nitrogen and minerals that are deficient in these feed resources.</p> <p>The increase in digestibility of crop residues and low quality forages, in turn also increases their intake. Both these phenomena enhance the efficiency of nutrient utilization from these feed resources in animal food chains. Fodder densification machines are based on the formation of a complete diet in the form of densified feed blocks or pellets from straws mixed with minerals, oil seed cakes and other agro-industrial by-products.</p> <p>This technology will enhance income of farmers, decrease environmental pollution and help alleviate shortage of good quality seeds in tropical countries. In addition, the feed produced in the densified form as blocks or pellets could also provide complete feed to livestock in emergency situations. This will also enable efficient and cost-effective transport of fodder upon its densification into fodder blocks where up to 10 tons of feed block can be easily transported in a truck as against 4 ton loose fodder. (DAH&VD, Nagaon)</p> <p>Fodder Cultivation Scheme for production of oat grass was not very popular, hence it was discontinued 2 years earlier. It can be started on a pilot basis in one or two villages.</p> <p>Absence of feed mill in the district the main cause of lack of quality feed for cattle which is the main obstacle for promoting stall feeding. Quality fodder and feed production can be promoted in some of the fringe villages of forest villages.</p>
Detailed description of the technology	<p>The Densified Total Mixed Ration Block (DTMRB) technology has mostly been developed in India, through the collaborative efforts of animal nutritionists and feed technologists. It is different from the green forages or silage based complete feeds (Schroeder and Park, 1997; Kononoff, 2005). Since the fibrous crop residues are low density feeds, apart from difficulties in its handling and transportation, making a densified block from this loose and lighter stuff is challenging. A different approach and machinery are required for making such blocks from these residues and other dried roughages such as tree leaves and forest grasses.</p>

⁶² Kishore Talukdar, "Assam needs a white revolution", NEZINE (27-04-2016)

	<p>The first step in the process of making straw based feed blocks is the grinding of concentrate ingredients, followed by their mixing and addition of the feed additives. This is then followed by mixing of these ingredients and straw in proper proportions along with addition of molasses in a specifically designed TMR mixer, taking care that mixing is uniform and ingredients are not separated due to gravity. Finally, the weighed quantity of the mixed stuff is transferred into a hydraulic press to get the final product – the DTMRB.</p> <p>Machinery Needed</p> <ul style="list-style-type: none"> • A grinder (hammer mill) and a mixer is required for making a normal concentrate mixture. • A specially designed TMR Mixer is required for mixing weighed quantities of low density crop residue (straws, stovers, bagasse, dried forest grasses, dried tree leaves etc.) and the high density concentrate. Molasses and any other liquid feed additive are also added at this stage. The mixing is done through vertical motion, so that there is no separation due to gravity • Weighed quantity of the mixed ingredients is transferred into densification machine (works on the principle of hydraulic compression) which compresses the forage and concentrate mixture into densified complete feed block.  <p>Machines of different capacities and different efficiencies are available in India. Installed capacity can vary from 0.5 to 3 tons per hour, which requires a motor of 20–40 horse power having a power consumption of 12–16 KW per tonne. These machines can produce feed blocks weighing from 7 kg to 30 kg.</p>
Partner institutes	DoEF, Food and Agriculture Organization of the United Nations (FAO), District Animal Husbandry and Veterinary Department, Nagaon (Assam)
Identified barriers	<ul style="list-style-type: none"> • Insufficient nutrient provision to livestock • Lack of technical know-how to make densified fodder blocks in the region. (Technical barrier) • Lack of financial resources. (Financial barrier)
How will these be overcome through REDD+ project?	<ul style="list-style-type: none"> • Efficient nutrients delivery system – less feed wastage • Provision of training and setting up of required machinery • Easy credit facilities
Implementation plan	<ul style="list-style-type: none"> • Fodder densification through establishing of fodder banks and promotion of fodder grasses and legumes. • DTMRB can be effectively utilized as a combined source of protein, energy and minerals during drought situations. They also help in preventing loss of fertility in case of prolonged drought. • Establishment of Fodder Banks for storing and distribution of dry fodder.

	<ul style="list-style-type: none"> The existing Gaushalas in the region should be made use of for storing and distribution of dry fodder/ feed blocks. Fodder grasses and legumes of <i>Cenchrus ciliaris</i>, <i>Chloris gayana</i>, <i>Dichanthium</i>, <i>Stylosanthes</i>, <i>Clitori</i> needs to be propagated especially in the common grazing lands
Co-benefits	Fodder availability throughout the year for livestock. Better health of livestock because of optimum nutrient intake. Increased productivity of livestock.
Potential convergence	<ul style="list-style-type: none"> Sub-Mission on Fodder and Feed Development, National Livestock Mission (Government of India) Accelerated Fodder Development Programme, Department of Agriculture (Government of India)

12.3 Vaccination of livestock

Name of the intervention:	Vaccination camps for disease-free livestock in forest villages
Code:	ALM-VACC-LIV
Description of the problem	The livestock in the district is prone to diseases like rinderpest and Contagious Bovine Pleuropneumonia (CBPP), especially around the monsoon season. This leads to decline in productivity of livestock and livestock deaths.
Description of the solution	Vaccination camps can be arranged in the forest villages with support from the Veterinary Department along with Awareness camp on Dairy Development.
Detailed description of the technology	From the Veterinary and Animal Husbandry Department, their ongoing Vaccination Scheme for cattle for prevention of BQ, HS and FMD is given twice in villages throughout the state during the two seasons- pre monsoon and post monsoon.
Partner institutions	<ol style="list-style-type: none"> Veterinary and Animal Husbandry Department JFMCs/EDCs/SHGs and Gram Panchayats
Identified barriers	<ol style="list-style-type: none"> Lack of awareness and knowledge animal treatments Lack of resources and capacity of local communities towards livestock vaccination Lack of coordination among institutions for the deployment livestock vaccination programmes
How will these be overcome through REDD+ project?	<ol style="list-style-type: none"> Undertaking communication campaigns on benefits from livestock vaccination Training and capacity building
Implementation plan	<ol style="list-style-type: none"> Convergence of public funds and schemes for promoting and implementing livestock vaccination Development of an Action Plan for administration and monitoring of the intervention with Gram Panchayats, JFMCs, and DoEF.
Co-benefits	Improved livestock health. Increased productivity of livestock.
Potential convergence	<ul style="list-style-type: none"> Sub-Mission on Fodder and Feed Development, National Livestock Mission (Government of India) Accelerated Fodder Development Programme, Department of Agriculture (Government of India)

6.4 Convergence

On 23 September, 2016, the Government of Assam published a notification vide No. FRM.60/2011/Pt/32 which enable REDD+ Cell in the State. There were two meetings conducted at the district level to constitute a REDD+ Cell for inter-departmental coordination in efforts for enhancing green cover and reduction of emissions of the State. On 25 July, 2016, the DoEF, Government of Assam published a notification vide No. FRM.60/2011/Pt/29 to create REDD+ Task Force with objective to identify potential landscapes for the REDD+ project, facilitate capacity development within the department and beyond as needed for planning and implementation with intimation to the DoEF.

The second meeting was held on 5th July 2017. The REDD+ team was directed by the Deputy Commissioner of Nagaon to present the details of inter-departmental convergence at the District Development Committee (DDC) meeting. With respect to this, details of the LEEF project and the inter-departmental actions were presented by the REDD+ team at the DDC meeting held at the premises of Jongal Balahu Garh Fish Seed Farm. These actions proposed are based on the socio-economic survey conducted in the District. The details were chalked out through a series of meetings with the officers of various departments, which was further discussed and finalized with the officers of the Forest Department. Chair also instructed the inline department to identify at least 2 schemes which can be linked to LEEF project and also nominate a REDD+ nodal officer from each office at the earliest. Few departments such as Health and PWD departments have shown interest in contributing towards convergence activities of the LEEF project.

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7 Quantification of Emission Reduction

7.1 Introduction

The Jurisdictional Baseline start date and timeline have been described in Section 1.4 of this document. The Baseline will be aligned at 10 years.

The six IPCC LULC classes, namely Forestland, Cropland, Grassland, Wetland, Settlement and Other Land have been distinguished and the area under each classification has been detailed.

The LULC classes have been further sub-divided into forest strata, to achieve the goal of defining classes that are homogeneous in forest Carbon stock density. Predominantly, 4 forest types have been found in the forestlands in Nagaon. These forests have been further sub-divided based on canopy densities, so as to accurately pinpoint forest degradation. Land transitions within the same forest types have been mapped between different density classes and between forest classes and non-forest classes, so as to estimate rates of forest degradation and deforestation.

7.2 Historical Reference Periods

The land transitions from 2000 to 2006, from 2006 to 2010 and from 2010 to 2015, were analysed. The average of these 3 transitions were used to create the baseline transitions. The mean rate of LULC transition over the historical period has been calculated and is represented in the Emissions Reductions spreadsheet.

7.3 Organic Matter Content

For the aboveground (AGB) and belowground (BGD) biomass the average stock densities of stratum i and associated statistics are calculated as per the equation:

$$OM_o(i) = \text{average} \left(OM_{o, \text{plot-wise}}(i, p) \right)$$

Stratum specific average organic matter can be estimated by summing organic matter in different carbon pools. Subsequently, the average total carbon stock is calculated by applying the carbon fraction. Summation of average carbon stock densities of LULC stratum i , pool o (Mg C ha⁻¹) shall give the average carbon content of that specific stratum. Equations 23, 24 and 25 adapted from an approved VCS methodology VM0006 Ver. 2.2 have been used to calculate the OM to arrive at these figures. As mentioned, Soil Organic Carbon has not been accounted for in this juncture. It can however be added in due course of time while updating the baselines.

$$OM(i) = \sum_o OM_o(i)$$

$$C_o(i) = CF \cdot OM_o(i)$$

$$C(i) = \sum_o C_o(i)$$

Where:

$OM(i)$ = Average plant-derived organic matter of LULC class or forest stratum i . [MG DM ha⁻¹]

$OM_o(i)$ = Plant-derived organic matter of LULC class or forest stratum i in pool o . [Mg DM ha⁻¹]

$C_o(i)$ = Average carbon stock density of LULC class or forest stratum i in pool o . [MT C ha⁻¹]

CF = Carbon fraction of dry matter in wood (default = 0.5). [Mg C (Mg DM)⁻¹]

$C(i)$ = Average carbon stock density of LULC class or forest stratum i . [MT C ha⁻¹]

Forest Stratum	Carbon content in 2000 (tC)	Carbon content in 2006 (tC)	Carbon content in 2010 (tC)	Carbon content in 2015 (tC)
AKS 10-30	1810	29747	40864	50022
AKS 30-50	33412	190973	230143	143396
AKS 50-70	792612	621996	517565	558565
AKS Above 70	736273	296166	355247	365660
EMMD 10-30	138	1816	3985	790
EMMD 30-50	1599	56272	79594	11193
EMMD 50-70	203580	228725	239683	313935
EMMD Above 70	766431	119601	249458	180007
CSE 10-30	10	44	168	29
CSE 30-50	417	520	1081	457
CSE 50-70	15694	9847	17535	16080
CSE Above 70	237423	109142	180470	165738
BAMBOO BRAKES	117601	42157	24244	51841
Total	2906999	1707007	1940036	1857712

TABLE 33: ORGANIC CARBON CONTENT IN ABOVE GROUND (AGL) AND BELOW GROUND (BG) BIOMASS

7.4 Emission Factors

The Emission Factor for AGB has been calculated as:

$$EF_{AGL}(CS1 \rightarrow CS2) = \frac{44}{12} \cdot (C_{AGL}(CS2) - C_{AGL}(CS1))$$

Where:

$EF_{AGL}(CS1 \rightarrow CS2)$ = Emission factor for change in aboveground live plant organic matter from an LULC Class or forest Stratum (CS) 1 to 2. [tCO₂e ha⁻¹]

$CS1 \rightarrow CS2$ = Land transition from LULC class or forest stratum 1 to 2.

$C_{AGL}(i)$ = Carbon density of aboveground plant organic matter of classes or forest stratum *i*. [MT C ha⁻¹]

The Emission Factor for BGB must also be gradually spread over time. The project proponent may propose their own temporal component (e.g., an exponential equation) if the conservative nature of the temporal component can be demonstrated using peer-reviewed literature or measurements conducted by the project proponent. Here, the default temporal component has been calculated from:

For $t \leq 10$:

$$EF_{BG}(CS1 \rightarrow CS2, t) = \frac{44}{12} \cdot \frac{(C_{BG}(CS2) - C_{BG}(CS1))}{10}$$

For $t > 10$:

$$EF_{BG}(CS1 \rightarrow CS2, t) = 0$$

Where:

$EF_{BG}(CS1 \rightarrow CS2, t) =$ Emission factor for change in belowground plant organic matter from an LULC Class or forest Stratum (CS) 1 to 2 at t years after transition. [tCO₂e ha⁻¹]

$CS1 \rightarrow CS2 =$ Land transition from LULC class or forest stratum 1 to 2.

$C_{BG}(i) =$ Carbon density of belowground plant organic matter of classes or forest stratum i . [MT C ha⁻¹]

For this project, the default value has been chosen for the temporal component for BGB, which is 10 years.

However since we have used the latest RS/GIS technique called fractional analysis (full field analysis), there is no need to calculate emission factor of each transition. The change in C-stock has been estimated as net change.

7.5 Baseline Scenario

From the ecological and spatial analyses conducted across the PA for the historical reference period, the REDD+ Baseline has been developed, which depicts the patterns of changes in LULC per year (in ha/year). Similarly, LULC changes in the Project Scenario have been estimated, where no LULC transitions are expected across LULC categories and land area under each category remains constant. These scenarios have been represented in the Emissions Reductions spreadsheet attached with the PDD.

Net change in total forest carbon stocks between 2000 and 2006 is found to be -1199992 tC or -41.28%. For the time periods of 2006-10 and 2010-15 this is respectively 233030 tC and -82324 tC or 13.65% and -4.24%. Annual change in percentage is computed for each of the time period, which is -6.88%, 3.41%, -0.85% respectively. An average of these three values gives the annual average change in AGB and BGB forest carbon stock in Nagaon district, which is -1.44%.

Total forest carbon stock as on 2015 is 1857712 tC. The expected emissions are calculated from 2017 after considering changes in forest stock for two more years.

TABLE 34: BASELINE EMISSIONS

Year	Forest C-stock (tC)	Annual change in forest carbon (tC/year)	GHG emissions from forest (tCO ₂ /year) in the baseline
2017	1804263	-26725	97991
2018	1777538	-26725	97991
2019	1750813	-26725	97991
2020	1724088	-26725	97991
2021	1697364	-26725	97991
2022	1670639	-26725	97991
2023	1643914	-26725	97991
2024	1617189	-26725	97991
2025	1590465	-26725	97991
2026	1563740	-26725	97991
2027	1537015	-26725	97991
2028	1510290	-26725	97991
2029	1483566	-26725	97991
2030	1456841	-26725	97991

Year	Forest C-stock (tC)	Annual change in forest carbon (tC/year)	GHG emissions from forest (tCO ₂ /year) in the baseline
2031	1430116	-26725	97991
2032	1403391	-26725	97991
2033	1376667	-26725	97991
2034	1349942	-26725	97991
2035	1323217	-26725	97991
2036	1296492	-26725	97991

7.6 Emission Reductions and Sequestration from Identified Interventions

7.6.1 Project Sequestration

Conservative estimates have been taken to account for afforestation, agro-forestry, and ANR activities across Nagaon over the next 20 years, considering that these activities start from the 3rd year of project initiation. The plantation to be undertaken in the REDD+ project has been synchronised with the working plan being prepared for Nagaon division, details of which is provided in Annexure I. Apart from this plantation of 100 ha is taken up using CAMPA funds. Hence the total plantation already undertaken is 100 ha, and planned in the coming years is 17,867.2 ha.

Considering the annual increment of broadleaved species at 7.8 tdm/ha/year for Above-Ground Biomass (Table 3A.1.6, GPG LULUCF), root-shoot ratio of 0.24 and carbon fraction of 0.5, the annual change in C-stock is estimated. Since the plantations to be taken up are block plantations, and the species to be planted are yet to be ascertained, this gives a conservative estimate. A Buffer of 30% has been applied to consider mortality and any other unexpected eventuality. The projected sequestration from afforestation, reforestation and gap plantation activities is given as follows:

TABLE 35: ACTIVITIES PLANNED TOWARDS CARBON SEQUESTRATION

Year	Total area planned for plantation (ha)	Cumulative Land for plantation (ha)	Annual Carbon sequestration (tC/year)	Annual GHG removal (tCO ₂ /year) after applying buffer
2017	100	100	484	1241
2018	1786.72	1886.72	9124	23419
2019	1786.72	3673.44	17765	45596
2020	1786.72	5460.16	26405	67774
2021	1786.72	7246.88	35046	89951
2022	1786.72	9033.6	43686	112129
2023	1786.72	10820.32	52327	134306
2024	1786.72	12607.04	60968	156484
2025	1786.72	14393.76	69608	178661
2026	1786.72	16180.48	78249	200839
2027	1786.72	17967.2	86889	223016
2028	0	17967.2	86889	223016
2029	0	17967.2	86889	223016
2030	0	17967.2	86889	223016
2031	0	17967.2	86889	223016

Year	Total area planned for plantation (ha)	Cumulative Land for plantation (ha)	Annual Carbon sequestration (tC/year)	Annual GHG removal (tCO ₂ /year) after applying buffer
2032	0	17967.2	86889	223016
2033	0	17967.2	86889	223016
2034	0	17967.2	86889	223016
2035	0	17967.2	86889	223016
2036	0	17967.2	86889	223016

7.7 Net Emission Reductions

Any reduction in emissions from baseline is emission reduction. All sequestration is accounted as carbon removals. Emissions saved completely depends on the success rate of each of the interventions to curb emissions. For the estimations, we have considered a conservative estimate of 70% success in bringing down emissions from forests through the interventions. Further it will take time for interventions to be effective, for which we have also introduced an implementation factor to project realistic emission reductions over years.

Emissions Reductions from the project are given below.

TABLE 36: EMISSIONS REDUCTIONS FROM THE LEEF REDD+ PROJECT

Year	Baseline emissions (tCO ₂ e/year)	Project emissions (tCO ₂ e/year)	Emission Reductions (tCO ₂ e/year)	Potential sequestration (tCO ₂ e/year)	Total Annual reductions (tCO ₂ e/year)
Year 1	97991	0	3430	1241	4671
Year 2	97991	0	6859	23419	30278
Year 3	97991	0	13719	45596	59315
Year 4	97991	0	20578	67774	88352
Year 5	97991	0	27437	89951	117389
Year 6	97991	0	34297	112129	146425
Year 7	97991	0	41156	134306	175462
Year 8	97991	0	48015	156484	204499
Year 9	97991	0	54875	178661	233536
Year 10	97991	0	61734	200839	262573
Year 11	97991	0	68593	223016	291610
Year 12	97991	0	68593	223016	291610
Year 13	97991	0	68593	223016	291610
Year 14	97991	0	68593	223016	291610
Year 15	97991	0	68593	223016	291610

Year	Baseline emissions (tCO ₂ e/year)	Project emissions (tCO ₂ e/year)	Emission Reductions (tCO ₂ e/year)	Potential sequestration (tCO ₂ e/year)	Total Annual reductions (tCO ₂ e/year)
Year 16	97991	0	68593	223016	291610
Year 17	97991	0	68593	223016	291610
Year 18	97991	0	68593	223016	291610
Year 19	97991	0	68593	223016	291610
Year 20	97991	0	68593	223016	291610
Total					4,238,595
Average per year over 20 years					211,930

Hence the total emission reductions expected from the REDD+ prjocet in the lifetime is **4,238,595 tCO₂e**. The average emission reductions per year is estimated to be **211,930 tCO₂e**.

7.8 Leakage

The jurisdiction of the REDD+ project is the administrative boundaries of Nagaon District. Any displacement of emissions outside these boundaries would fall outside the jurisdiction of the Nagaon Administration. Hence, Leakages are not considered for this REDD+ project.

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8 Implementation Strategy

This chapter details the institutional arrangement and implementation strategy of the project. The REDD+ project will be implemented by the DoEF through the REDD+ Steering Committee and the REDD+ Cell. Deployment of intervention activities will be taken up after identification of beneficiaries for each of the intervention. This will be followed by convergence with any existing schemes. Each intervention will be geo-tagged for easy monitoring and evaluation and reporting of various project parameters, including those on mitigation.

8.1 Institutional Arrangement

DoEF under the Government of Assam is responsible for the formulation, management, implementation, monitoring and evaluation of activities under the project. A robust management structure has been designed to steer the implementation of the identified interventions and oversee the convergence activities. For the purposes of the overall management and implementation of the LEEF project, three bodies have been set up: the **REDD+ Task Force**, **REDD+ Cell** and **District REDD+ Committee**.

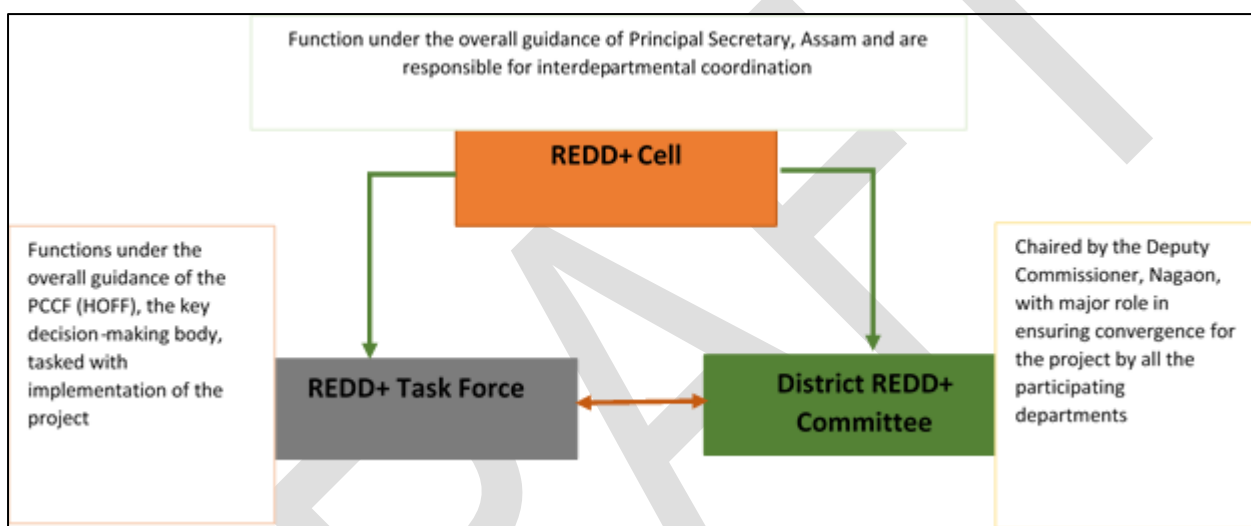


FIGURE 54: MANAGEMENT AND GOVERNING BODIES FOR LEEF, NAGAON

REDD+ Cell: As per the Reference document for REDD+ in India, REDD+ Cells are to be established in every state (also called the Sub-National level) which shall be coordinated by the State Forest Department with representations from other relevant organizations. The State-level REDD+ Cells shall coordinate with the National REDD+ Cell in planning and implementing REDD+ activities and accounting at sub-national level. On 23 September, 2016, the Government of Assam published a notification vide No. FRM.60/2011/Pt/32 to constitute REDD+ Cell for inter-departmental coordination in efforts for enhancing green cover and reduction of emissions in the State.

Major tasks:

- Meet once quarterly or as and when required
- Oversee the implementation of REDD+ at State and smaller levels
- Facilitate capacity building within various sectors of the Government to implement REDD+ mechanism in line with the REDD+ architecture of the country
- Enable co-ordination among the various sectors of the Government to formulate REDD+ plans and oversee its implementation
- Monitor progress of REDD+ project(s) (in this case LEEF project) from time to time and suggest corrective measures/additional measures as may be necessary

- Advise the Government on issues relating to REDD+ or Carbon Credits for necessary policy interventions.
- Ensure convergence of state scheme spending towards forest conservation, sustainable management and enhancement in Assam

The REDD+ Cell consists of the following members (Refer Table 40).

TABLE 37: ASSAM REDD+ CELL MEMBERS

Department	Designation
The Principal Secretary to the Government of Assam, Environment and Forest Department	Chairman
The Secretary, Agriculture Department	Member
The Secretary, Horticulture Department	Member
The Secretary, Soil Conservation Department	Member
The Secretary, Water Resources Department	Member
The Secretary, Panchayat and Rural Development Department	Member
Nodal Officer, Environment and Climate Change Cell	Member
An Expert from domain knowledge of REDD+	Member
The Additional PCCF (RE&WP), & CD4	Member

REDD+ Task Force – The REDD+ Task Force functions under the overall guidance of the PCCF (HOFF). Members to the REDD+ Task Force shall be nominated by the PCCF (HOFF). On 25 July, 2016, the DoEF, Government of Assam published a notification vide No. FRM.60/2011/Pt/29 to create REDD+ Task Force with objective to identify potential landscapes for the REDD+ project, facilitate capacity development within the department and beyond as needed for planning and implementation with intimation to the DoEF.

Major tasks:

- Overall management and overseeing the REDD+ activities in the state by closely working with the REDD+ Cell
- Develop capacity on various technical components of REDD+ within the Forest Department
- Coordinate the forest carbon calculation analysis
- Coordinate the RS/GIS analysis of the REDD+ landscape as required
- Coordinate development of baselines/ FRELS
- Coordinate and implement monitoring plans for REDD+ in the state
- Identify and apply for funding opportunities in REDD+ and Climate Change.
- Implement a safeguards and monitoring system for REDD+
- Ensure a fair and equitable sharing of REDD+ benefits by developing and implementing a REDD+ Access Benefit Sharing system.

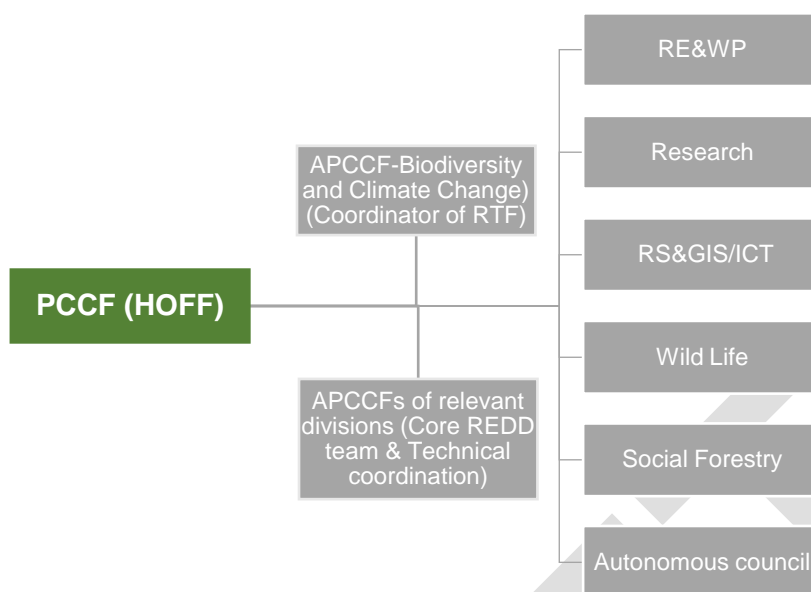


FIGURE 55: ORGANISATIONAL FRAMEWORK OF THE REDD+ TASK FORCE, ASSAM

District REDD+ Committee: A meeting was held on 15/12/2016 at District Commissioner's Office, Nagaon where REDD+ and the need for planning this project on a landscape level i.e. covering the whole district of Nagaon, regardless of land classification since the major drivers of deforestation and forest degradation lie outside forests, was discussed. It was highlighted that an important activity would be measuring carbon stocks and emissions in Nagaon so that the base reference levels could be established. The improved forest health would result in enhanced intangible benefits from forests like improved water quality, quantity, soil health, etc. all contributing to making Nagaon a 'climate friendly' district. Simultaneous measures like climate smart agriculture, ICS, LPG and other renewable sources of energy for communities as well as for programs like mid-day meals, green buildings, municipal waste management, improved cattle breeds, etc. would need to be encouraged. Hence, a holistic approach would be followed and convergence of all the ongoing schemes of respective participating departments should take place. With this, the District REDD+ Committee was formed. Deputy Commissioner, Nagaon is the Chair and DFO Nagaon is the Convener. As per the agreed terms, the committee shall meet once every month. Notification regarding this shall be done by the PMU, APFBC, and Forest Department.

Major task:

- Meet once quarterly or as and when required
- Facilitate capacity building of key functionaries of participating department
- Synergise resources during design, planning and implementation of the project
- Monitor progress of the project and suggest corrective measures
- Encourage sharing of best practices from within the State as well as outside to enable development of a model mitigation project
- Ensure convergence of budgets and schemes of various departments towards forest conservation, sustainable management and land use, and safeguards (benefits) for local communities
- Collaboration with Assam Energy Development Agency (AEDA) shall be set up
- Create awareness among the people, including schools and colleges, about climate change and benefits from the project

On 19 December 2016, Member Secretary of REDD+ Cell, Assam published a notification vide No. APFBC/PMU/COMP-4/REDD+/CELL/2016, dated 06/12/2016, wherein the line departments of Nagaon district nominated as members of Nagaon District REDD+ Committee have to select a Nodal Officer from each of the department and the name and other details of the Nodal Officer should be submitted to the Member Secretary of the REDD+ Cell. Further, the participating departments should submit at least two schemes/programmes with high potential of convergence with the LEEF project.

In pursuance of the decision taken by the REDD+ launch meeting on 16/11/2016 chaired by Chief Secretary of the State, District REDD+ Committee was constituted for Nagaon and the committee consist of the following members (Refer Table 41).

TABLE 38: NAGAON DISTRICT REDD+ COMMITTEE MEMBERS

Department	Designation
Deputy Commissioner – Nagaon	Chairman
CEO Zila Parishad	Member
Principal Secretary – Tiwa Autonomous Council	Member
Project Director – DRDA	Member
Divisional Forest Officer, Nagaon	Member
Divisional Forest Officer (Wildlife), Nagaon	Member
Divisional Forest Officer (Social Forestry), Nagoan	Member
Additional Deputy Commissioner (Forests)	Member
Sub Divisional officer (Civil), Kaliabor	Member
District Agriculture Officer	Member
Divisional Officer, Soil Conservation	Member
District Veterinary Officer	Member
District Fishery Development Officer	Member
Chairman, Nagaon Municipal Board	Member
Chairman, Dhing Municipal Board	Member
Chairman, Raha Town Committee	Member
Chairman, Kampur Town Committee	Member
District Social Welfare Officer	Member
Joint Director Health Services	Member
Dy. Director Food and Civil Supplies	Member
Sub Divisional Welfare Officer	Member
Technical Expert on REDD+ and Carbon Markets	Member

The LEEF project being developed is to be guided and directed by DoEF, Assam, with technical support from IORA Ecological Solutions. The project activities requires a concerted effort, and looks at active inter-departmental convergence, for which a District REDD+ Committee is being constituted in Assam. Along with this, a REDD+ Task Force is being formed under the aegis of Assam Forest Department to coordinate the

activities of the REDD+ Cell and District REDD+ Committee and manage REDD+ activities in the State of Assam. The structure has taken into account all relevant stakeholders at the local and regional levels. Further, Nodal Officers from each Department, nominated by REDD+ Cell for the members of the District REDD+ Committee, have been tasked to submit at least two schemes/programmes with high potential of convergence with the LEEF project.

DoEF will be the key decision-making body, tasked with the implementation of the project. However, where other government line departments are also involved, the District REDD+ Steering Committee shall take necessary decisions for implementation of program activities in consultation with the DoEF. Monitoring of the performance and viability of the identified LEEF interventions would be at the district level. Interventions would be subject to review and assessment at pre-specified intervals as part of the periodic monitoring undertaken by the EE.

8.2 Implementation strategy

The implementation structure further builds on the management structure, and the EE and village-level JFMCs to oversee a community-based implementation and monitoring program. Led by the REDD+ Task Force, it mandates that the implementation of program activities and interventions involve local JFMCs and EDCs. This will ensure that no new implementation arrangement is required and the department can deploy the interventions through the established and tested delivery routes.

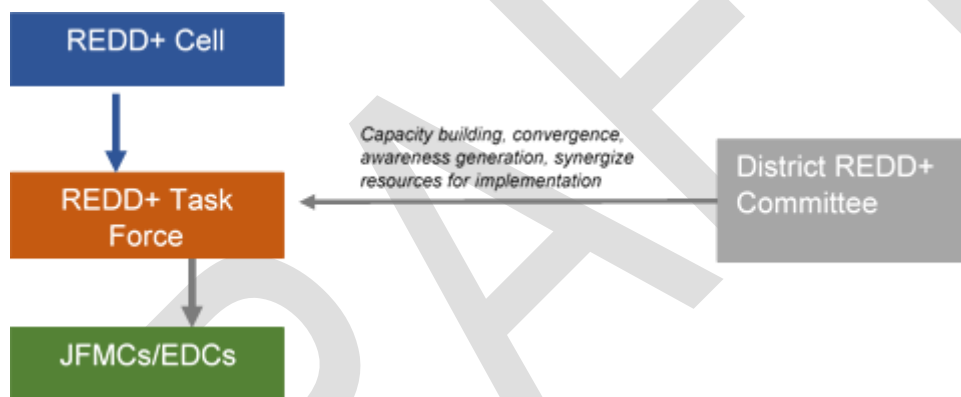
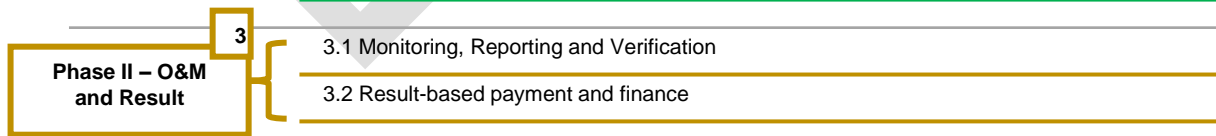
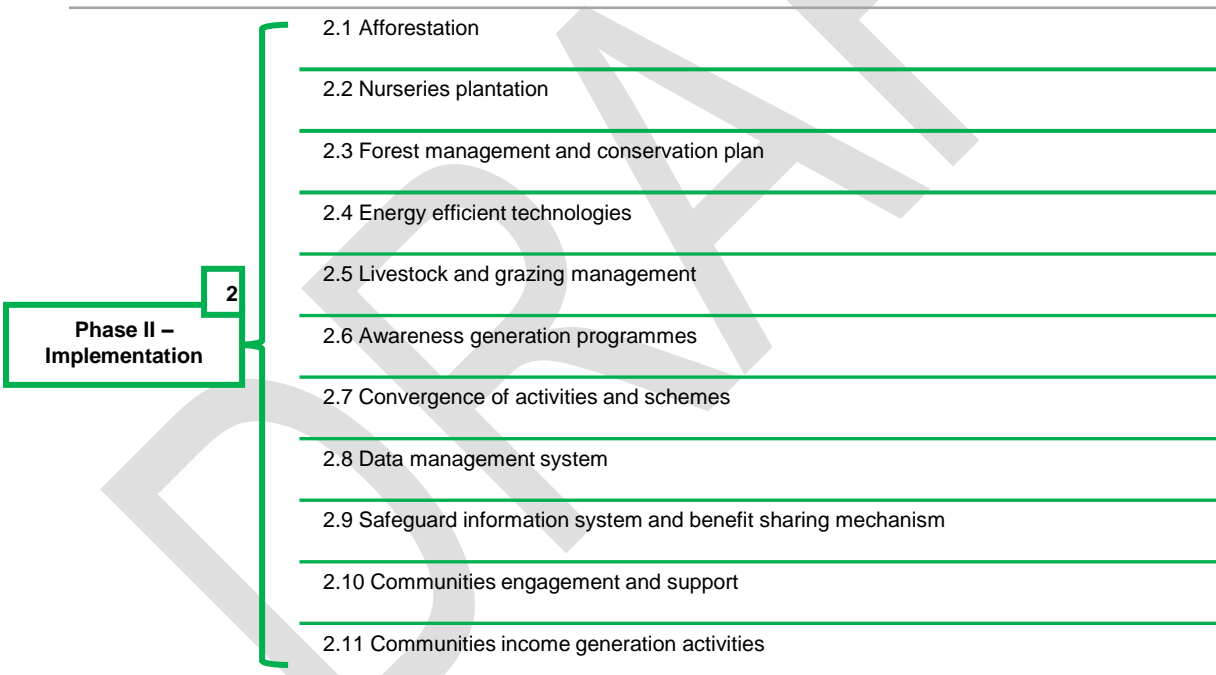
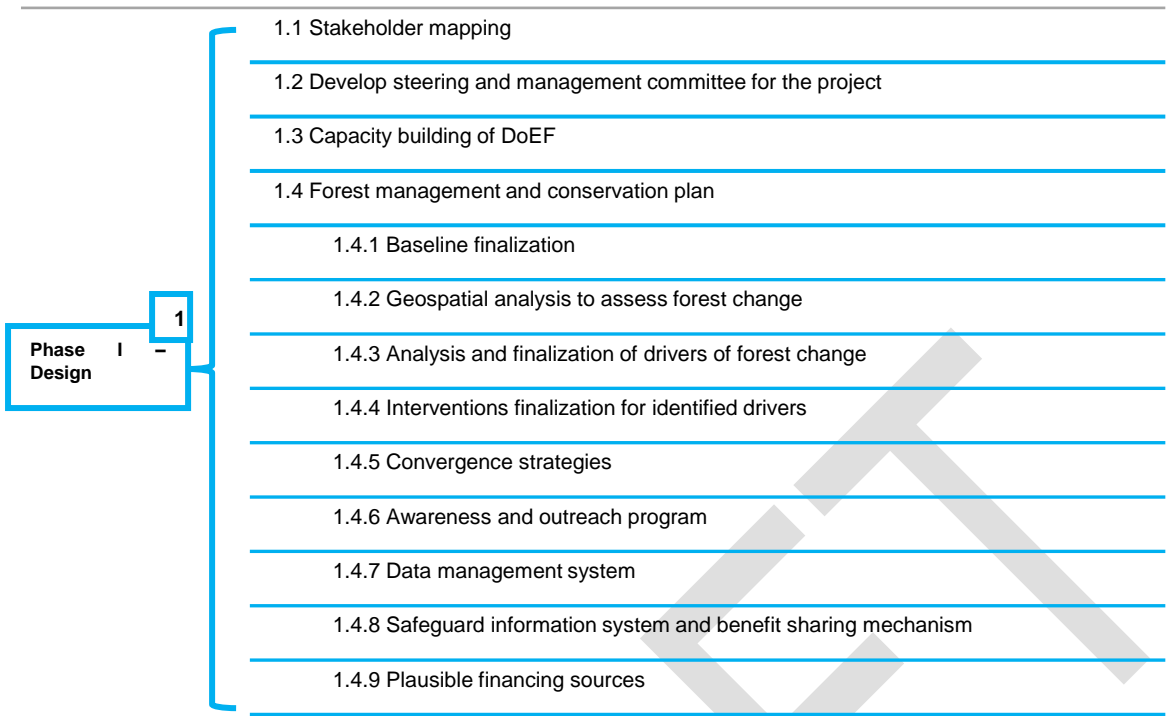


FIGURE 56: IMPLEMENTATION STRUCTURE FOR THE PROGRAM



9 Monitoring Plan

9.1 Institutional Arrangement

Once the project is initiated, it is the responsibility of the DoEF to monitor and measure the emissions reductions accrued from the implementation of the identified interventions, and the carbon and non-carbon benefits accrued in the landscape. Concurrently, the DoEF is responsible for disseminating all relevant information to stakeholders across the project lifetime. In particular, the REDD+ Task Force would be the authority for monitoring, review and reporting of all monitoring data. A team of forestry professionals from the DoEF, trained in monitoring, surveying and collecting data is needed to implement the monitoring plan. The relevant information and data will be documented and made accessible (if required) in both paper and electronic formats. If required, external consultants may be employed to assist in the development of relevant monitoring reports. To facilitate the efficient monitoring and implementation of project activities, all monitoring reports shall be uploaded on APFBC's or the DoEF's website for easy access to all stakeholders.

An 'Operational Manual' will be developed by the DoEF and distributed to monitoring personnel at the time of project initiation and/or implementation. The Manual will describe the SOPs for field staff and the implementation of the monitoring program, and will be used for capacity building of monitoring staff. The Manual will take inputs from DoEF and other stakeholders as applicable.

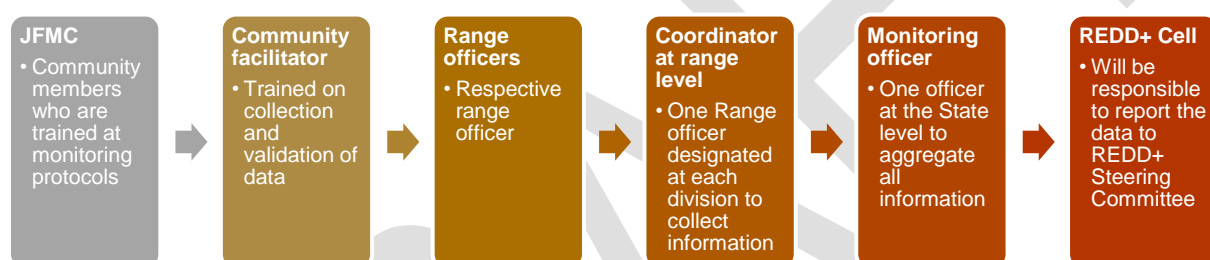


FIGURE 57: FLOW OF INFORMATION DURING MONITORING OF THE REDD+ PROJECT

9.2 Monitoring Plan

The Monitoring Plan that has been developed for the project will enable the DoEF to monitor the performance of the REDD+ interventions advanced under the project, based on estimation of the achievement of given targets. The indicators measured as part of monitoring will also help in validation of the carbon (in the form of emissions reductions) and non-carbon benefits accrued to the project and assess the extent of community involvement in project activities.

In addition, evaluation of the following indicators will also be made possible by the monitoring plan:

- Effectiveness of project activities to mitigate drivers of deforestation and forest degradation
- Uptake of proposed intervention activities by the local communities
- Deployment of alternative energy technologies, grazing techniques and land-use management initiatives.
- Environmental impacts of the projects.
- Socio-economic impacts of the project and participation of local communities towards monitoring.

The project has already established baselines at the start of the program, including (a) forest types and forest cover, (b) forest carbon stock based on remote sensing imagery and field surveys and (c) socio-economic surveys to evaluate forest dependency of the rural population.

The project proposes **two** stages of monitoring and assessment to be undertaken by the DoEF:

- **Annual Monitoring:** Measurement of indicators and monitoring of activities supported by the project. This shall be documented in the Annual Progress Report.
- **Baseline Re-evaluation at 10 Years:** Re-development of the baseline to be considered for estimating emissions reductions accrued from the project activities.

The components under annual monitoring carried out by the DoEF are summarized below.

TABLE 39: PARAMETERS TO BE MEASURED TOWARDS ANNUAL MONITORING

Community indicators	No. of JFMC meetings in the current year and attendance
	No. of people attending JFMC meetings, % of men and women.
	No. of trainings imparted and no. of people trained for community monitoring of forests
	Funding and audit of community groups – JFMCs and EDCs.
	Community involvement in forest management
Land use management indicators	Methodology of site selection for plantation activities.
	Planting area (Ha) for fuelwood and fodder plantations
	Species planted and planting density (tree ha ⁻¹)
	Survival rate (measured the following year) in %
	Information on climatic extremes which may affect stand growth
	Lands cleared to make grazing areas (Ha)
Environmental indicators	Amount of forestlands diverted for non-forest activities (Ha)
	Amount of forestlands damaged due to fire, pests, grazing (Ha)
	Information on general forest management techniques carried out – fire prevention, pest management
	No. of LPG connections installed
	No. of briquette-making equipment distributed
	Details of fodder management techniques advanced
	Details of alternative livelihoods – No. of families impacted, schemes introduced, inter-departmental convergences
	No. of induction devices and ICS distributed and installed
	No. of large ICS distributed in schools
	No. of organic certifications supplied for horticultural crops

The baseline estimated for calculating emissions reductions across the landscape will be re-evaluated at an interval of every 10 years from the project start date to reflect changing environmental and socio-economic scenarios in the project area. This will enable an accurate and up-to-date estimation of the forest carbon stocks, emissions from the forestlands and the characteristics of the forest dependency of the local rural population.

Baseline re-evaluation will include:

- Estimation of the changes in Nagaon's forest strata through spatial analysis to reflect shifts in density classes
- Calculation of the forest carbon stock in each strata through spatial and field analysis.
- Assessment of the forest dependency of local communities, the provenance of the drivers of forest change in the landscape and the success of the REDD+ interventions.

For this activity, spatial analysis techniques shall remain consistent across baseline re-evaluation, although data sources may be updated if new and improved sources are found, provided there exists reasonable consistency and overlap. At the same time, consistency and compatibility with a future national carbon accounting system (as and when developed and ratified), will be explored.

For the calculation of forest carbon stock, biomass plots have been laid in every forest strata in Nagaon as per standard methodologies detailed in the National Working Plan Code 2014. These will be adhered to for future baseline re-evaluation, until newer versions of the National Working Plan Code are introduced by the MoEFCC. The REDD+ Task Force at the DoEF will facilitate resources required for the survey (equipment, logistics etc.). Permanent plots which have been established in Nagaon will act as Random Control Plots (RCPs) to validate the baseline, and effects of the interventions on the emissions from forests.

With the project activity, it is expected that project activities result in the enhancement of forest carbon stock in Nagaon. Estimated project benefits and technical specifications may be modified contingent on the assessment of these characteristics.

9.3 Quality Assurance and Quality Control (QA/QC)

A Manual will be developed by the DoEF and a QA/QC plan, including protocols for field measurements, data collection and verification, data entry and archiving, will be developed and circulated to ensure the integrity of data collected and improve the monitoring efficiency for subsequent monitoring cycles shall be established.

For all activities, Standard Operating Procedures (SOPs) shall be developed by the DoEF. These shall be adhered to at all times during monitoring. This will include:

- Training of field-team members on field data collection and analysis
- Deployment of alternative energy interventions
- Monitoring and assessment of lands identified for fodder and fuelwood plantations
- Monitoring of forest management techniques applied towards timber and fire prevention & patrolling

9.4 Parameters (fixed)

Those parameters that are available at the development stage, and are fixed during the monitoring are termed as Parameters (fixed). These do not change during the monitoring unless a more conservative value is applied based on scientifically accepted practices. These parameters are detailed below.

Data/parameter	A _{jur}
Data unit	hectare (ha)
Description	Area of the jurisdiction (in Ha)
Data source	Official national and state records
Value applied	2,52,346.53 ha

Justification of choice of data or description of measurement methods and procedures applied	The value has been mapped and confirmed by the Assam Government.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project sequestrations
Comments	None

Data/parameter	CF
Data unit	t C t d.m ⁻¹
Description	Carbon fraction of dry matter in t C t d.m ⁻¹
Data source	Values from the literature (e.g. IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3) shall be used if available (otherwise default value of 0.47 t C t-1 d.m).
Value applied	As per given in the data source
Justification of choice of data or description of measurement methods and procedures applied	Calculated as a ratio of AGB, based on 2006 IPCC Guideline to prepare National GHG inventory.
Purpose of data	Calculate carbon content in biomass, to be used in baseline and project sequestration calculations.
Comments	None

Data/parameter	$f_j(X,Y)$
Data unit	t d.m. tree ⁻¹
Description	Volume of tree used allometric equation for species <i>j</i> linking measured tree variable(s) to aboveground biomass of living trees, expressed as t d.m. tree ⁻¹
Data source	<p>Equations derived using a range of measured variables like DBH and tree height based on datasets that comprise at least 30 trees. Equations must be based on statistically significant regressions and must have an r^2 that is ≥ 0.8.</p> <p>The source of equation(s) shall be chosen with priority from higher to lower preference, as available, as follows:</p> <p>(a) National species-, genus-, family-specific;</p> <p>(b) Species-, genus-, family-specific from neighbouring countries with similar conditions (i.e. broad continental regions);</p> <p>(c) National forest-type specific;</p>

	<p>(d) Forest-type specific from neighbouring countries with similar conditions (i.e. broad continental regions);</p> <p>(e) Pan-tropical forest type-specific</p> <p>such as those provided Tables 4.A.1 to 4.A.3 of the GPG-LULUCF (IPCC 2003),</p> <p>or in</p> <p>Pearson et al. (2005); Sourcebook for Land Use, Land-Use Change and Forestry Projects. Available at: http://www.winrock.org/Ecosystems/files/Winrock-BioCarbon_Fund_Sourcebook-compressed.pdf</p> <p>or in</p> <p>Chave et al. (2005); Tree allometry and improved estimation of carbon stocks and balance in tropical forests. <i>Oecologia</i> 145: 87-99.</p> <p>Species-, genus- and family-specific allometric equations may not always be available, and may be difficult to apply with certainty, hence it is acceptable practice to use equations developed for regional or pantropical forest types, provided that their accuracy has been validated with direct site-specific data. If a forest-type specific equation is used, it should not be used in combination with species-specific equation(s).</p>
Value applied	Refer the emission reduction spreadsheet for the volume equations which have been applied.
Justification of choice of data or description of measurement methods and procedures applied	Peer reviewed literature.
Purpose of data	Calculation of baseline and project sequestration.
Comments	Volume equations can be changed during the life of the project based on the CDM guidance.

Data/parameter	f_j (vegetation parameters)
Data unit	t. d.m. individual ⁻¹
Description	Allometric equation for non-tree species, linking parameters such as stem count, diameter of crown, height etc. to AGB of an individual
Data source	Use of allometric equations that are species-specific or group of species-specific wherever available, provided the equations have been derived using a wide range of

	diameters and heights, based on datasets that comprise at least 30 individuals. Project participants may create project location specific equation where appropriate.
Value applied	Not used for the current baseline, and hence not applicable.
Justification of choice of data or description of measurement methods and procedures applied	None
Purpose of data	Baseline and project emission reductions
Comments	Maybe included in revised baselines in the future.

Data/parameter	R
Data unit	t root d.m. t ⁻¹ shoot d.m.
Description	Root to shoot ratio appropriate to species or forest type. Here, this ratio is given by <i>belowground biomass per unit area: aboveground biomass per unit area</i> .
Data source	From Table 4.4 in IPCC GL AFOLU, based on ecological domain and AGB.
Value applied	0.24
Justification of choice of data or description of measurement methods and procedures applied	Based on GPG LULUCF in the absence of country specific data.
Purpose of data	Calculate carbon content in biomass, to be used in baseline and project sequestration calculations.
Comments	None

Data/parameter	Risk Maps
Data unit	Metric
Description	Describes the risk of deforestation for each pixel in project area as a numerical scale.
Data source	Satellite imagery
Value applied	
Justification of choice of data or description of measurement methods and procedures applied	Government validated data

Purpose of data	For mapping LULC change and baseline
Comments	None

Data/parameter	Baseline deforestation maps
Data unit	Metric
Description	Maps showing location of deforested areas in the project area in the last 15 years
Data source	Satellite imagery
Value applied	NA (NRSC/USGS)
Justification of choice of data or description of measurement methods and procedures applied	Government validated data
Purpose of data	For mapping LULC change and baseline
Comments	None

Data/parameter	AA _u
Data unit	%
Description	Accuracy assessment of the classification of LULC for each map.
Data source	<ul style="list-style-type: none"> Existing maps and models Literature and expert consultations
Value applied	93%
Justification of choice of data or description of measurement methods and procedures applied	Based on actual classification data.
Purpose of data	Uncertainty due to classification errors
Comments	Will be updated during every revision of the baseline.

Data/parameter	T _{hrp}
Data unit	Years
Description	Duration of the historical reference period in years
Data source	<ul style="list-style-type: none"> Expert consultations Secondary data review
Value applied	15 years (2000 to 2015)

Justification of choice of data or description of measurement methods and procedures applied	The historical time period that has been chosen for analysing change in forests is 15 years. Such analyses can choose a time horizon of more than 10 years to map changes. Further images are free of cloud cover, and takes into consideration seasonal consistency across the time horizon.
Purpose of data	To map LULC change for the baseline.
Comments	None

Data/parameter	WD
Data unit	g/cm ³
Description	Mean wood density of species
Data source	Chosen from: (a) Averaged national and commercial species-specific inventories, or from such estimates in neighbouring countries. (b) Averaged regional commercial species-specific (e.g. Table 4.13 IPCC National Guidance for Greenhouse Gas Inventories AFOLU Section). (c) Regional averages (0.58 for tropical Africa, 0.60 for tropical America; 0.57 for tropical Asia). Taken from Brown, 1997; Estimating Biomass and Biomass Change of Tropical Forests: a Primer (FAO Forestry Paper - 134).
Value applied	Specific to the species of trees. Refer the base volume calculation spreadsheets associated with the emission reduction spread sheet.
Justification of choice of data or description of measurement methods and procedures applied	Based on peer reviewed literature
Purpose of data	Calculation of baseline and project emission reductions.
Comments	None

Data/parameter	V _{FW}
Data unit	m ³ /year/household
Description	Mean annual consumption of fuelwood in the baseline period
Data source	<ul style="list-style-type: none"> • Interviews/PRAs • Field measurements and expert appraisals
Value applied	As given in the emission reduction spreadsheet

Justification of choice of data or description of measurement methods and procedures applied	Based on peer reviewed literature or surveys
Purpose of data	Calculation of baseline and project emission reductions.
Comments	None

Data/parameter	GWP _g
Data unit	Dimensionless
Description	Global warming potential for gas <i>g</i>
Data source	IPCC Assessment Report 5
Value applied	As given in the emission reduction spreadsheet
Justification of choice of data or description of measurement methods and procedures applied	Based on peer reviewed literature
Purpose of data	Calculation of baseline and project emission reductions.
Comments	None

Data/parameter	A _i
Data unit	Ha
Description	Area of baseline stratum <i>i</i>
Data source	<ul style="list-style-type: none"> • GIS coverage and remote imagery • Ground survey data
Value applied	As given in the emission reduction spreadsheet
Justification of choice of data or description of measurement methods and procedures applied	Land Use Land Cover classification follows IPCC guidelines. Forest strata has been based on the Champion and Seth classification. Forests have been further divided into strata based on the canopy density.
Purpose of data	Calculation of baseline emissions
Comments	None

Data/parameter	U _{BSL}
Data unit	%
Description	Percentage uncertainty (expressed as 95% confidence interval as a percentage of the mean where

	appropriate) for carbon stocks and greenhouse gas sources in the baseline case
Data source	Field measurements and calculations
Value applied	10%
Justification of choice of data or description of measurement methods and procedures applied	Based on approved REDD+ methodology VM0006 version 2.1
Purpose of data	Calculation of uncertainty
Comments	None

Data/parameter	BD _s
Data unit	g/cm ³
Description	Bulk density of soil in soil stratum 's'
Data source	Field measurements and literature study
Value applied	--
Justification of choice of data or description of measurement methods and procedures applied	The value has been sourced from peer reviewed literature.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emissions
Comments	None

Data/parameter	BEF
Data unit	Dimensionless
Description	Biomass Expansion Factor
Data source	Values from IPCC Good Practice Guidance for LULUCF (2003) Table 3A.1.10. Default values of biomass expansion factors (BEFs)
Value applied	IPCC GPG Default value
Justification of choice of data or description of measurement methods and procedures applied	BEF must be sourced from data on local ecological systems. In case of unavailability of this data, regional, national and international data must be used, in that order. Since no other data was available, IPCC value has been used.

Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emissions
Comments	None

Data/parameter	ROC_{NF}
Data unit	ha/yr.
Description	Rate of conversion of forest land stratum 'f' into non-forest land stratum 'f' where I is denoted by 1.2...etc.
Data source	Literature study and expert appraisals
Value applied	Please refer the emission reduction calculation spread sheet.
Justification of choice of data or description of measurement methods and procedures applied	Latest RS/GIS techniques have been used to map the LULC changes.
Purpose of data	Calculation of baseline emissions
Comments	None

Data/parameter	ROC_{oF}
Data unit	ha/yr.
Description	Rate of conversion of forest land stratum 'f' into another forest land stratum 'f' where I is denoted by 1.2...etc.
Data source	Literature study and expert appraisals
Value applied	Please refer the emission reduction calculation spread sheet.
Justification of choice of data or description of measurement methods and procedures applied	Latest RS/GIS techniques have been used to map the LULC changes.
Purpose of data	Calculation of baseline emissions
Comments	None

Data/parameter	N_{TS}
Data unit	Dimensionless
Description	Thermal efficiency of traditional stoves
Data source	Expert appraisal, market information

Value applied	10% default value based on IPCC/CDM approved methodology AMS-II.G
Justification of choice of data or description of measurement methods and procedures applied	This is considered as default value based on IPCC/CDM approved methodology.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emissions
Comments	None

Data/parameter	N_{FES}
Data unit	Dimensionless
Description	Thermal efficiency of fuel-efficient stoves
Data source	MNRE information for the public
Value applied	As per the model of the stove
Justification of choice of data or description of measurement methods and procedures applied	MNRE has compiled information of all stoves that are efficient and have been empanelled.
Purpose of data	Calculation of project emissions reductions
Comments	None

Data/parameter	EF_f
Data unit	Dimensionless
Description	Emission factor of fossil fuel 'f'
Data source	IPCC 2006
Value applied	Based on the fuel used (eg: LPG)
Justification of choice of data or description of measurement methods and procedures applied	IPCC 2006 lists all default values
Purpose of data	Calculation of project emissions
Comments	None

Data/parameter	$ROCA_i$
Data unit	Ha/yr.
Description	Rate of change in area of a stratum 'i'

Data source	RS/GIS analysis and field data
Value applied	Refer spreadsheets
Justification of choice of data or description of measurement methods and procedures applied	Latest RS/GIS techniques have been used to map the LULC changes.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emissions
Comments	

Data/parameter	DF_d
Data unit	%
Description	Proportion of driver 'd' in causing deforestation.
Data source	Based on socio-economic surveys
Value applied	Refer spreadsheets
Justification of choice of data or description of measurement methods and procedures applied	Based on key informant interviews.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emission reductions
Comments	None

Data/parameter	DG_d
Data unit	%
Description	Proportion of driver 'd' in causing forest degradation
Data source	Based on socio-economic surveys
Value applied	Refer spreadsheets
Justification of choice of data or description of measurement methods and procedures applied	Same as DF_d
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emission reductions
Comments	

Data/parameter	SR_{int-d}
Data unit	%

Description	Efficacy or success rate of an intervention activity planned on driver 'd' in completely eliminating emissions due to driver 'd'
Data source	Based on socio-economic surveys
Value applied	Refer spreadsheets
Justification of choice of data or description of measurement methods and procedures applied	Based on expert opinions and key informant interviews.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emission reductions
Comments	Applicable in case more than one intervention activities are planned

Data/parameter	RB
Data unit	Mg/year
Description	Demonstrably renewable biomass within the project area
Data source	PRAs, expert appraisals and literature study
Value applied	--
Justification of choice of data or description of measurement methods and procedures applied	Not used in this phase, but may be used in the latter stages of the project.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of project emissions
Comments	Estimation to be made of proportion of fuelwood that is demonstrably renewable

Data / Parameter	CF_{Tree}
Data unit	t C td.m. ⁻¹
Description	Carbon fraction of dry matter for species of type <i>j</i>
Data source	Methodological tool: " <i>Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities</i> " Latest version. Referred in equation number 13.
Value applied	A default value of 0.47 is used following the AR CDM methodological tool.
Justification of choice of data or description of measurement methods and procedures applied	To convert the dry biomass into carbon weight
Purpose of Data	Project emission and project sequestration
Comments	None

Data / Parameter	D_j
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Data unit	t d.m. m ⁻³
Description	Density overbark of tree stem for tree species j.
Source of data	Good Practices IPCC Guidelines, 1996 and Published literature
Value applied	Please refer to the C-calculation spreadsheet associated with the ER calculations
Justification of choice of data or description of measurement methods and procedures applied	<i>D_j</i> must be sourced from data on local ecological systems. In case of unavailability of this data, regional, national and international data must be used, in that order.
Purpose of Data	Project emission and project sequestration
Comments	

3.1.1 Parameters to be monitored

Data / Parameter	<i>A_i</i>
Data unit	<i>Ha</i>
Description	<i>Area of stratum i</i>
Source of data	RS/GIS analysis by the EE
Description of measurement methods and procedures to be applied:	Standard land use land cover classification techniques.
Frequency of monitoring/recording	<i>Minimum every 10 years prior to baseline renewal.</i>
Value applied	--
Monitoring equipment	--
QA/QC procedures to be applied	All RS/GIs related SOPs to be followed including validation of classification and accuracy assessment.
Purpose of data	<ul style="list-style-type: none"> • <i>Calculation of baseline emissions</i> • <i>Calculation of program emissions</i> • <i>Calculation of leakage</i>
Calculation method	None
Comments	None

Data / Parameter	<i>A_{unplanned_hrp}</i>
Data unit	<i>Ha</i>
Description	Total area deforested during the historical reference period in the jurisdiction
Source of data	Remote sensing and GIS analysis imagery
Description of measurement methods	Standard land use land cover classification techniques

and procedures to be applied:	
Frequency of monitoring/recording	Minimum 10 years prior to baseline renewal
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	All RS/GIs related SOPs to be followed including validation of classification and accuracy assessment.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	None
Comments	Monitored for the purpose of baseline revisions also.

Data / Parameter	A_{deg}
Data unit	Ha
Description	Area potentially impacted by forest degradation processes
Source of data	GIS delineation and ground truthing
Description of measurement methods and procedures to be applied:	A_{deg} shall be composed of a buffer from all access points like roads, rivers and previously cleared areas. Extent of this buffer determined by PRA results.
Frequency of monitoring/recording	Repeated each time a PRA requests so.
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	All RS/GIs related SOPs to be followed including validation of classification and accuracy assessment.
Purpose of data	Calculation of program emissions
Calculation method	None
Comments	Monitored for the purpose of baseline revisions also.

Data / Parameter	AP_i
Data unit	Ha
Description	Total area of degradation sample plots in stratum i
Source of data	Ground measurements
Description of measurement methods and procedures to be applied:	Plots systematically placed over the buffer zone such that they cover a reasonable area of the buffer zone.

Frequency of monitoring/recording	At least every 5 years. If verification occurs on a frequency of less than every 5 years, then before any verification event.
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	Standard SOPs to be followed.
Purpose of data	<ul style="list-style-type: none"> • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	C_{deg}
Data unit	t CO ₂ eq
Description	Biomass of trees cut and removed through fuelwood and charcoal extraction from plots in the given strata at time t
Source of data	Field measurement
Description of measurement methods and procedures to be applied:	The diameter of all tree stumps in the designated plots will be measured and conservatively assumed to be the same as the DBH. If the stump is a large buttress, identify several individuals of the same species nearby and determine a ratio of the diameter at DBH to the diameter of buttress at the same height above ground as the measured stumps. This ratio will be applied to the measured stumps to estimate the likely DBH of the cut tree. The above and below ground carbon stock of each harvested tree must be estimated using the same allometric regression equation and root to shoot ratio used in the module for estimating the carbon pool in trees (CP-AB) in the baseline scenario.
Frequency of monitoring/recording	At least every 5 years. If verification occurs on a frequency of less than every 5 years, then before any verification event.
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	SOPs if any to be followed.
Purpose of data	Calculation of program emissions
Calculation method	Please refer to relevant sections in this PDD.
Comments	Ex-ante, an estimation shall be made of likely degradation in the with-project case. Such an estimation shall be based on rates of degradation in surrounding areas and the degree of protection that will be in place (e.g. forest guards) in the with-project case.

Data / Parameter	F_{LU} , F_{MG} and F_L
Data unit	Dimensionless

Description	Land use Factor, Management Factor and Input Factor before and after conversion respectively
Source of data	Stock Change Factors are provided in Tables 5.5, 5.10, and 6.2 of the IPCC 2006GL Volume 4
Description of measurement methods and procedures to be applied:	Stock Change Factors as defined in IPCC 2006 Guideline are equal to the carbon stock in the altered condition as a proportion of the reference carbon stock.
Frequency of monitoring/recording	Every monitoring cycle (5/10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of program emissions
Calculation method	
Comments	

Data / Parameter	A _{DF_PA}
Data unit	Ha
Description	Area of unplanned deforestation in the given year
Source of data	
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Every monitoring cycle (5/10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	A _{DG_PA}
Data unit	Ha
Description	Area of unplanned forest degradation in the given year

Source of data	
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Every monitoring cycle (5/10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	$C_{PA,t}$
Data unit	t CO ₂ eq.
Description	Carbon stock in all pools in given stratum
Source of data	Field measurement
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Every monitoring cycle (5/10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	$Df_{\%}$
Data unit	%
Description	% of land deforested in the given stratum at the present monitoring period
Source of data	--

Description of measurement methods and procedures to be applied:	--
Frequency of monitoring/recording	Every monitoring cycle (5/10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of program emissions
Calculation method	
Comments	

Data / Parameter	E _{biomass_burn} (M-MON)
Data unit	t CO ₂ eq.
Description	Non-CO ₂ emissions due to biomass burning in given stratum
Source of data	
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Every monitoring cycle (5/10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of program emissions
Calculation method	
Comments	

Data / Parameter	A _{sp} (CP-AB)
Data unit	Ha
Description	Area of sample plots
Source of data	Recording of number and size of sample plots
Description of measurement methods and procedures to be applied:	

Frequency of monitoring/recording	Every 10 years for baseline renewal. If C stock enhancement is included, it may be done once every 5 years
Value applied	0.1 ha
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	Ex-ante, number and size of sample plots may be estimated based on projected effort relative to scale of emissions and growth.

Data / Parameter	N
Data unit	Dimensionless
Description	Number of sample points
Source of data	Recording of sample points during field activities
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Every 10 years for baseline renewal. If C stock enhancement is included, it may be done once every 5 years
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	Ex-ante, number and size of sample plots may be estimated based on projected effort relative to scale of emissions and growth.

Data / Parameter	DBH
Data unit	cm
Description	Diameter at breast height of an individual in centimetres.
Source of data	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	Typically measured 1.3 m aboveground. Measure all trees above a minimum DBH of 10cm in the sample plots. Minimum DBH employed in inventories is held constant for the duration of the project.

Frequency of monitoring/recording	Every 10 years for baseline renewal. If C stock enhancement is included, it may be done once every 5 years
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Purpose of data	Calculation of program emissions
Calculation method	
Comments	Ex-ante, number and size of sample plots may be estimated based on projected effort relative to scale of emissions and growth.

Data / Parameter	H
Data unit	m
Description	Height of individual in metres
Source of data	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Every 10 years for baseline renewal. If C stock enhancement is included, it may be done once every 5 years
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of program emissions
Calculation method	
Comments	Ex-ante, height shall be estimated based on projections of growth.

Data / Parameter	Pop
Data unit	
Description	Number of individuals per census
Source of data	National and state records/representative surveys
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Updated every 10 years
Value applied	

Monitoring equipment	
QA/QC procedures to be applied	Census data to ensure adequate representation of both urban and rural households.
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	Df
Data unit	Ha
Description	Forest area cleared in Nagaon in last 10 years
Source of data	Official national and state records/representative surveys
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Updated once every 10 years
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	Any spatial feature subject to change over time – Risk Maps, Deforestation Maps
Data unit	
Description	Risk Map depicts the potential for deforestation for each pixel location on a numerical scale. Deforestation Maps shows the location of deforested hectares.
Source of data	
Description of measurement methods and procedures to be applied:	

Frequency of monitoring/recording	Updated each time the baseline is re-evaluated (atleast once every 10 years).
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	AAu
Data unit	%
Description	Accuracy assessment of the rate of unplanned deforestation
Source of data	Existing maps/models, expert consultation and literature
Description of measurement methods and procedures to be applied:	Multi-criteria analysis performed in a Geographical Information System
Frequency of monitoring/recording	Updated every time a baseline is re-evaluated (at least once every 10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	PAF
Data unit	Ha
Description	Area of forest available for fuelwood and charcoal extraction located within jurisdiction
Source of data	Determination of maximum distance of travel from communities for fuelwood collection/charcoal production and assessment of available forest within project boundaries
Description of measurement methods	

and procedures to be applied:	
Frequency of monitoring/recording	Updated every time a baseline is re-evaluated (at least once every 10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	V_{FW}
Data unit	m ³ /year
Description	Mean annual per capita consumption of fuelwood and charcoal within state boundaries
Source of data	Interviews, PRAs, field measurements and literature study. Verifiable information from anecdotal evidences may be used in some cases.
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Updated every time a baseline is re-evaluated (at least once every 10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	U_{Cpool}
Data unit	%
Description	Percentage uncertainty (expressed as 95% confidence interval as a percentage of the mean where appropriate) for carbon stocks and greenhouse gas sources in the (1) baseline case and (2) project case

Source of data	Calculations from field measurements
Description of measurement methods and procedures to be applied:	Uncertainty in pools derived from field measurement with 95% confidence interval calculated as the standard error of the averaged plot measurements in each stratum multiplied by the t-value for the 95% confidence level.
Frequency of monitoring/recording	Updated every time a baseline is re-evaluated (at least once every 10 years)
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	FG _{PA}
Data unit	m ³ /year
Description	Volume of fuelwood gathered within the given strata in project area in the given year
Source of data	Interviews, PRAs, field measurements and literature study. Monitoring should be conducted in communities within the project boundary as well as in communities outside the boundary but potentially collecting fuelwood or producing charcoal from within the project boundaries.
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years, examination must occur prior to any verification event
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	GHG _{DG}
Data unit	t CO ₂ eq.
Description	Greenhouse gas emissions as a result of degradation activities within the project boundaries
Source of data	Field measurements, expert appraisals
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years, examination must occur prior to any verification event
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	GHG _{DF}
Data unit	t CO ₂ eq.
Description	Greenhouse gas emissions as a result of deforestation activities within the project boundaries
Source of data	Field measurements, expert appraisals
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years, examination must occur prior to any verification event
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage

Calculation method	
Comments	

Data / Parameter	FOR
Data unit	Ha
Description	Total area of forest cover available within the state of Assam and Nagaon district, which is under active management as a protected forest, National Park, Wildlife Sanctuary, Biosphere Reserve etc.
Source of data	Official data, peer reviewed publications and other verifiable sources
Description of measurement methods and procedures to be applied:	A demonstration is required that areas will be protected against deforestation. Such a demonstration may include the existence of forest guards in sufficient numbers to prevent illegal colonization and an active management plan detailing harvest plans and return intervals, and/or evidence that the concession owner has previously evicted illegal colonists/squatters from the forest areas. Ex-ante, it can be assumed that FOR remains constant.
Frequency of monitoring/recording	Must be monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of baseline emissions • Calculation of program emissions • Calculation of leakage
Calculation method	
Comments	

Data / Parameter	C _{JUR_GHG}
Data unit	t CO ₂ eq.
Description	Net emissions in the jurisdiction in the given year
Source of data	Field measurements
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	

Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of program emissions
Calculation method	
Comments	

Data / Parameter	$C_{PA_unplanned}$
Data unit	tCO ₂ eq.
Description	Net GHG emissions due to activity shifting for projects preventing forest degradation and unplanned deforestation
Source of data	Calculations from field measurements
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of leakage
Calculation method	
Comments	

Data / Parameter	C_{actual}
Data unit	t CO ₂ eq.
Description	Net GHG emissions by sinks, in the given year
Source of data	Calculations from field measurements
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	
Monitoring equipment	

QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	ALU
Data unit	Ha
Description	Total area of a specific land use that has shifted from the last monitoring (forest to non-forest).
Source of data	RS/GIS based analysis and ground validation
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	Refer to attached spreadsheet
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	A _F -LU
Data unit	Ha
Description	Total area of forest land that has shifted from one strata to another from the last monitoring
Source of data	RS/GIS based analysis and ground validation
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	Refer to attached spreadsheet
Monitoring equipment	

QA/QC procedures to be applied	
Purpose of data	Calculation of project emissions
Calculation method	
Comments	

Data / Parameter	C_{AGB-i}
Data unit	t CO ₂ eq./Ha
Description	Carbon stock per hectare in aboveground biomass in given stratum <i>i</i>
Source of data	Estimation through data collected from field studies and sample plots. Please refer to the attached worksheet.
Description of measurement methods and procedures to be applied:	Most accurate estimation is based on Tier-3 data collected. Appropriate methodology has been applied. Where applicable Tier-3 data has been used. Tier-2 or Tier-1 data has been applied in the order based on availability. Allometric equations are based on Forest Survey of India estimates, and applicable for Nagaon.
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	Refer to attached spreadsheet
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of project emissions • Calculation of emissions credits
Calculation method	
Comments	

Data / Parameter	C_{BGB-i}
Data unit	t CO ₂ eq./Ha
Description	Carbon stock per hectare in belowground biomass in given stratum <i>i</i>
Source of data	Estimation through data collected from field studies and sample plots. Please refer to the attached worksheet.
Description of measurement methods and procedures to be applied:	Most accurate estimation is based on Tier-3 data collected. Appropriate methodology has been applied. Where applicable, Tier-3 data has been used. Tier-2 or Tier-1 data has been applied in the order based on availability. Allometric equations are based on Forest Survey of India estimates, and applicable for Nagaon.
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	<i>Refer to attached spreadsheet</i>

Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • <i>Calculation of project emissions</i> • <i>Calculation of emissions credits</i>
Calculation method	
Comments	

Data / Parameter	C_{DW-i}
Data unit	t CO ₂ eq./Ha
Description	Carbon stock per hectare in deadwood in given stratum <i>i</i>
Source of data	Estimation through data collected from field studies and sample plots. Please refer to the attached worksheet.
Description of measurement methods and procedures to be applied:	Most accurate estimation is based on Tier-3 data collected. Appropriate methodology has been applied. Where applicable, Tier-3 data has been used. Tier-2 or Tier-1 data has been applied in the order based on availability. Allometric equations are based on Forest Survey of India estimates, and applicable for Nagaon.
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	Refer to attached spreadsheet
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • <i>Calculation of project emissions</i> • <i>Calculation of emissions credits</i>
Calculation method	--
Comments	--

Data / Parameter	C_{LI-i}
Data unit	t CO ₂ eq./Ha
Description	Carbon stock per hectare in litter biomass in given stratum <i>i</i>
Source of data	Estimation through data collected from field studies and sample plots. Please refer to the attached worksheet.
Description of measurement methods and procedures to be applied:	Most accurate estimation is based on Tier-3 data collected. Appropriate methodology has been applied. Where applicable, Tier-3 data has been used. Tier-2 or Tier-1 data has been applied in the order based on availability. Allometric equations are based on Forest Survey of India estimates, and applicable for Nagaon.

Frequency of monitoring/recording	<i>Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event</i>
Value applied	<i>Refer to attached spreadsheet</i>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • <i>Calculation of project emissions</i> • <i>Calculation of emissions credits</i>
Calculation method	
Comments	

Data / Parameter	C _{SOC-i}
Data unit	t CO ₂ eq./Ha
Description	Carbon stock per hectare in the soil organic matter in given stratum <i>i</i>
Source of data	Estimation through data collected from field studies and sample plots. Please refer to the attached worksheet.
Description of measurement methods and procedures to be applied:	Most accurate estimation is based on Tier-3 data collected. Appropriate methodology has been applied. Where applicable, Tier-3 data has been used. Tier-2 or Tier-1 data has been applied in the order based on availability. Allometric equations are based on Forest Survey of India estimates, and applicable for Nagaon.
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	Refer to attached spreadsheet
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • Calculation of project emissions • Calculation of emissions credits
Calculation method	
Comments	

Data / Parameter	C _i
Data unit	t CO ₂ eq./Ha
Description	Carbon stock per hectare in total in given stratum <i>i</i>
Source of data	Estimation through data collected from field studies and sample plots. Please refer to the attached worksheet.
Description of measurement methods	Most accurate estimation is based on Tier-3 data collected. Appropriate methodology has been applied. Where applicable, Tier-3 data has been used. Tier-2 or Tier-1 data has been applied in the order based on

and procedures to be applied:	availability. Allometric equations are based on Forest Survey of India estimates, and applicable for Nagaon. Summation of all carbon pools considered in the study – AGB + BGB + DW + SOC + LI
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	<i>Refer to attached spreadsheet</i>
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • <i>Calculation of project emissions</i> • <i>Calculation of emissions credits</i>
Calculation method	
Comments	

Data / Parameter	A _{UDF}
Data unit	Ha
Description	Projected area for unplanned deforestation within jurisdiction
Source of data	Field investigations and remote sensing data
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	<i>Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event</i>
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<i>Calculation of project emissions</i>
Calculation method	
Comments	

Data / Parameter	A _{UDg}
Data unit	Ha
Description	Projected area for unplanned forest degradation within jurisdiction
Source of data	Field investigations and remote sensing data

Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	<i>Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event</i>
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<i>Calculation of project emissions</i>
Calculation method	
Comments	

Data / Parameter	LB
Data unit	Ha
Description	Area of leakage belt for the jurisdiction
Source of data	Field investigation and remote sensing data
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording	Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<ul style="list-style-type: none"> • <i>Calculation of project emissions</i> • <i>Calculation of leakage</i>
Calculation method	
Comments	

Data / Parameter	FW _D
Data unit	Km
Description	Distance travelled to collect fuelwood
Source of data	PRAs, FGDs, socio-economic surveys
Description of measurement methods	

and procedures to be applied:	
Frequency of monitoring/recording	<i>Monitored at least every 5 years or if verification occurs on a frequency of less than every 5 years examination must occur prior to any verification event</i>
Value applied	
Monitoring equipment	
QA/QC procedures to be applied	
Purpose of data	<i>Calculation of project emissions</i>
Calculation method	
Comments	

DRAFT

10 LEEF Safeguard Information System and Benefit Sharing Mechanism

Assam Project on Forest Biodiversity Conservation Society (APFBCS) under the Department of Environment and Forests (DoEF), Government of Assam with technical assistance from IORA Ecological Solutions (IORA) is developing a Jurisdictional Reducing Emissions from Deforestation and Forest Degradation (REDD+) project, called Lowering Emissions, Enhancing Forests (LEEF) in Nagaon district of Assam. The objective of LEEF is to decrease GHG emissions from the forests of the district by deploying effective intervention instruments to address drivers of deforestation and forest degradation. The resultant carbon benefits and co-benefits will be quantified under the project.

Co-benefits include biodiversity conservation, access to cleaner cooking devices, improved standard of living, better options for livelihood, enhanced climate resilience etc., which are also an integral part of any REDD+ project. A well-designed REDD+ project benefit sharing mechanisms will support the effectiveness of forest management and increases the efficacy of the project. Even though, primarily a climate change mitigation project, LEEF has safeguards built-in to ensure that community and/or environmental interests are not compromised in the design of the project or in its implementation. These safeguards are to be monitored during the life of the REDD+ project.

By linking the climate change mitigation benefits, and the social and environmental co-benefits, the State of Assam will attempt to access national and/or international incentive mechanisms on climate change. These benefits, can either be monetary or be in other forms (e.g.: direct transfer of cooking devices), and it is the prerogative of the project developer to design a functional benefit sharing mechanism.

This report details two major elements of the REDD+ project:

1. Safeguards Information System (SIS), which will be in place to monitor whether community and environmental interests are appropriately adhered to during the implementation of the REDD+ project, and
2. Benefit Sharing Mechanism (BSM) on how the benefits accrued through the project will be shared with the stakeholders.

Safeguards of environmental resources can be traced from 1972 Stockholm Conference where it says that environmental resources need to be preserved and improve for the benefit of present and future. The Principle 12 of the Declaration affirms that the developing countries need finance to develop environmental safeguards.

Set of seven safeguards agreed to under the UNFCCC, which should be promoted and supported when undertaking REDD+ activities also known as Cancun Safeguards are given in Box 1.

Box 1

Cancun Seven Safeguards are:

1. Actions complement or are consistent with the objectives of national forest programmes and relevant international conventions and agreements;
2. Transparent and effective national forest governance structures, taking into account national legislation and sovereignty;
3. Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples;
4. Full and effective participation of relevant stakeholders, including, in particular, indigenous peoples and local communities;
5. Actions that are consistent with the conservation of natural forests and biological diversity, ensuring that actions are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits;
6. Actions to address the risks of reversals;

7. Actions to reduce displacement of emissions.

An important element of REDD+ safeguards, negotiated under the UNFCCC, is systems for providing information on how safeguards are addressed and respected. A decision at the climate change meetings in the 17th Conference of the Parties held at Durban (2011) agreed to work on safeguard information systems (SIS) and to “build upon existing systems, as appropriate” (UNFCCC, 2012).

10.1 Methodology

Only some details and guidelines are available on how Parties address and respect Cancun Safeguards. The guidelines, however, emphasize that it should be in line with national and local circumstances, respective capabilities, recognizing national sovereignty and legislation, relevant international obligations, agreements and should respect gender considerations. Therefore, the project SIS mechanism in its approach shall reflect its unique needs and situation for a Jurisdictional project and the range of socio-economic issues prevalent in the State of Assam and in Nagaon district which are to be recorded and analyzed in order to reduce and reverse the rate of deforestation and forest degradation. The data collection design can be scaled-up to State level.

Key to assessment and reporting of safeguards is establishment of robust datasets and inclusion of feedback loops, including continuous review of risk areas, as these may change over time. Stepwise approach for safeguards operationalization and the setup of SIS for LEEF in Nagaon include:

- Conduct risk assessment to identify priority areas in the REDD+ design
- Develop safeguard criteria and indicators through analysis of available data
- Review of legal frameworks and identification of gaps
- Identification of existing information sharing systems
- Analysis of existing practices and lessons

Based on the above study, the goal and the scope of the safeguards system is decided.

Set the safeguards goal

Restrict to Cancun Safeguards or any other safeguards standard chosen by the State or follow the funder safeguards

Set the safeguards scope

Determine which Jurisdictional REDD+ actions will be used to which the shortlisted safeguards will be applied

For developing Safeguard standards for information collection and monitoring, the following REDD+ measures were considered:

- Environmental factors—biodiversity, Forest ecosystem services, High Conservation Value (HCV) species
- Socio-economic factors—poverty reduction, job creation, improved well-being, benefits sharing
- Social factors—impacts on indigenous peoples and marginalized groups; gender impacts
- Economic—distribution of costs and benefit
- Governance—law implementation, law enforcement, legal situation of land, land and resource tenure
- Sustainable production of goods and services
- Capacity building of people

Parameters to accurately quantify indicators are finalized to monitor the indicators of the SIS. The indicators could be process indicators (e.g. to illustrate whether or not an output has been achieved) or impact indicators (e.g. linked to actual social or environmental impacts), and the associated parameters to monitor as finalized.

TABLE 40: IMPLEMENTING CANCUN SAFEGUARDS

Safeguard no.	Description of safeguard	Understanding and Implementing the safeguard
Safeguard (a) (i)	REDD+ actions complement or are consistent with the objectives of national forest programme	<ul style="list-style-type: none"> Identify relevant national and state level forest policies including labor law, indigenous people rights, programs, governance structure and law enforcement practices National as well as State level forest, environmental, labor, indigenous people rights, laws and policies should be considered and respected in the design of LEEF actions.
Safeguard (a) (ii)	REDD+ actions complement or are consistent with relevant international conventions and agreements	<ul style="list-style-type: none"> Identify relevant international law to which India is a Party. Examine the extent to which the REDD+ action address and respect the identified international policies. The action plan for LEEF should be in line with international policies. The project should respect the international social, environmental, cultural, labor and commercial treaties to which India is signatory
Safeguard (b)	Transparent and effective national forest governance structures, taking into account national legislation and sovereignty	<ul style="list-style-type: none"> Identify the current forest governance and institutional structure in the State. Identify relevant international, national and state level laws and policies against corruption and for transparency. The project manager shall make all its information available to the public for free, both in Assamese and English languages. Periodic auditing of information trail and functioning of information platforms. Promote anti-corruptions measures through robust M&E system. Information related financial reporting and benefit sharing shall be transparent and freely available Develop a comprehensive grievance redressal mechanism.
Safeguard (c)	Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples	<ul style="list-style-type: none"> Identify the state, national and international laws and policies related to protection of indigenous communities and respect to traditional knowledge. The project's design shall incorporate statutory, customary and cultural rights of the indigenous and local communities including United Nations Declaration on the Rights of Indigenous Peoples. Recognize and respect local and traditional knowledge without any discrimination. Land ownerships and rights shall be respected without any discrimination.
Safeguard (d)	The full and effective participation of relevant stakeholders, in particular indigenous peoples and	<ul style="list-style-type: none"> Identify relevant legal and regulatory framework which respect and promote effective participation of stakeholders, in particular indigenous peoples and local communities.

Safeguard no.	Description of safeguard	Understanding and Implementing the safeguard
	local communities, in the actions referred to in paragraphs 70 and 72 of this decision	<ul style="list-style-type: none"> • Ensure effective participation of stakeholders in particular indigenous peoples and local communities throughout the project cycle and they can take part in decision making processes including benefit sharing • Establish a mechanism to promote information sharing, awareness generation and active participation in the project development and implementation process • Consult the stakeholders in particular indigenous and local communities and obtain their free, prior and informed consent (FPIC) on the project actions and interventions.
Safeguard (E)	That actions are consistent with the conservation of natural forests and biological diversity, ensuring that the actions referred to in paragraph 70 of this decision are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits	<ul style="list-style-type: none"> • Identify state and national policies, laws and rules related to forest conservation and protection of biological diversity • The project shall be consistent with conservation and protection of natural forest and biodiversity • Avoid invasive and exotic species for plantation. • Promote plantation of native trees. • Endangered, threatened and HCV species shall be identified and conserved/will not be harmed in any way through the REDD+ project.
Safeguards (f) and (g)	Actions to address the risks of reversals And Actions to reduce displacement of emissions	<ul style="list-style-type: none"> • The project shall provide alternative livelihood opportunities in order to avoid leakage or displacement of emission. • Proper leakage management plan shall be designed and implemented in order to avoid displacement of emission.

10.2 Developing SIS

Stepwise approach for safeguards operationalization and the setup of SIS for LEEF Nagaon are as follows:

- Conduct risk assessment through multi-level stakeholder consultation with all relevant stakeholders to identify priority areas in district specific REDD+ design.
- Develop safeguard criteria and indicators through analysis of available data.

Review of REDD+ discourses to identify:

- Objectives for REDD+ Social and Environmental Safeguards (SES).
- Legal frameworks and identification of gaps.
- Analysis of existing SES practices and lessons.
- Identification of existing information sharing systems.

This project follows the Durban Declaration (See Box 2) which sets the background for SIS development in the context of REDD+ for developing SIS for LEEF in Nagaon.

For developing SIS, the following important factors were considered:

- Existing international, national and state laws, policies, regulation, programmes
- Environmental factors – biodiversity, forest ecosystem services ,HCVs
- Socioeconomic factors – poverty reduction, livelihood opportunities, improved well-being,
- Social factors – impacts on indigenous peoples and marginalized groups; gender impacts, traditional and local knowledge of forest conservation and protection

Box 2

Durban Decision 12/CP.17 Guidance on developing SIS:

- Be consistent with guidance in decision 1/CP.16, Appendix 1, Paragraph 1
- Provide transparent and consistent information that is accessible by all relevant stakeholders and updated on a regular basis
- Be transparent and flexible to allow improvements over time
- Provide information on how all of the safeguards are being addressed and respected
- Be country-driven and implemented at national level
- Build upon existing systems, as appropriate

- Cultural impacts
- Economic – distribution of costs and benefit
- Governance – transparency and effectiveness, law implementation, law enforcement, legal situation of land, land and resource tenure, corruption and fraud management, grievance redressal, adequate information sharing mechanism
- Benefits sharing
- Drivers of deforestation and forest degradation
- Sustainable management of forest goods and services
- Existing capacity and capacity building of institutions, individuals.
- Risk of reversal and displacement of emissions
- Monitoring and Reporting mechanisms.

In order to collect information on whether safeguards are being addressed and respected, indicators had to be developed. The first step involved reviewing all existing national and state level policies which can have direct or indirect influence on forests and safeguards the interests of stakeholders. These policies can help in two aspects: i) Form the guiding post in developing REDD+ relevant safeguards ii) Allow existing system to be building blocks of safeguards for REDD+ and in that way use an existing system instead of 'reinventing the wheel'. The table below details the policies and schemes which have been reviewed for developing the SIS for LEEF in Nagaon.

TABLE 41: EXISTING POLICIES THAT ARE CONSISTENT WITH CANCUN SAFEGUARDS

Safeguard No.	Description of safeguard	Existing policies which address and respect Cancun Safeguards
Safeguard (a) (i)	REDD+ actions complement or are consistent with the objectives of national forest programme	National Level Law, Policies and Programmes - National Forest Policy 1988, Indian Forest Act 1927, Wild life Protection Act, 1972, Forest Conservation Act, 1980, Environment Protection Act, 1986, Forest Conservation Rules, 2004, Biological Diversity Act,2002, National Environmental Policy 2006, National Afforestation Programme (NAP), Green India Mission (GIM), Twenty Point Programme (TPP), Finance Commission Outlay, National Agroforestry Policy, 2014, Integrated Watershed Development Programme (IWMP), Compensatory Afforestation Fund Management and Planning Authority (CAMPA), Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Aajeevika National Rural Livelihoods Mission (NRLM), Safety, Health and Welfare Act 2005, Labor Act 2016, Draft National REDD+ Policy, 2014

Safeguard No.	Description of safeguard	Existing policies which address and respect Cancun Safeguards
		State Laws and Policies - Assam Forest Policy, 2004, Sylhet Jhumland Regulation, 1891, The Assam Rhinoceros Preservation Act 1954, Elephant Preservation (Assam Amendment), Act 1959, The Assam National Park Act 1968, Assam Forest Regulation, 1891 including Assam Forest Regulation (Amendment) Act, 1995, Assam Forest Protection Force Act 1986, The Assam Forest (Removal And Storage of Forest Produce) Regulation Act, 2000, Assam Minor Mineral Concession Rules, 1994, Assam Compensatory Afforestation Fund Rules, 1994, Assam Wood Based Industries (Establishment & Regulation) Rules, 2000, Assam Revolving Fund(Forest Department) Rules, 2000, Assam (Control of Felling & Removal of trees from Non-forest Land) Rules, 2002, Assam Forest (Rewards) Rules, 2002, Assam Joint Forest Management Rules ,1998, Bamboo & Cane Policy, 2005, Jhum (Swidden) Cultivation
Safeguard (a) (ii)	REDD+ actions complement or are consistent with relevant international conventions and agreements	Stockholm Declaration of the United Nations Conference in Human Environment (1972), United Nation Framework Convention on Climate Change (UNFCCC), 1992, Convention on Biological Diversity (CBD), 1992, United Nation Forum on Forest (UNFF), 2000, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973, RAMSAR Convention, 1971, World Trade Organization (WTO),1995, UNESCO's Man and Biosphere (MAB), 1971, International Labor Organization Conventions (107 and 169), 1989
Safeguard (b)	Transparent and effective national forest governance structures, taking into account national legislation and sovereignty	National Forest Policy 1988, Indian Forest Act 1927, Wild life Protection Act, 1972, Forest Conservation Act, 1980, Biological Diversity Act,2002, National Environmental Policy 2006, Assam Forest Policy, 2004, The Scheduled Tribe and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, United Nations Declaration on the Rights of Indigenous Peoples, 2007, Draft National REDD+ Policies, 2014, National Agroforestry Policy, 2014, Assam Forest Policy, 2004, Assam Forest Protection Force Act 1986, Assam Joint Forest Management Rules, 1998
Safeguard (c)	Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples	National Forest Policy 1988, Indian Forest Act 1927, The Scheduled Tribe and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, United Nations Declaration on the Rights of Indigenous Peoples, 2007, National Agroforestry Policy, 2014, Draft National REDD+ Policy, 2014, Forest Conservation Rules, 2004, United Nations Declaration on the Rights of Indigenous Peoples, 2007, UNFCCC, 1992, CBD, 1992, UNFF, 2000, Assam Forest Policy, 2004, Bamboo & Cane Policy, 2005, Assam Joint Forest Management Rules ,1998
Safeguard (d)	The full and effective participation of	National Forest Policy 1988, Indian Forest Act 1927, The Right to information Act, 2005, The Scheduled Tribe and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Draft

Safeguard No.	Description of safeguard	Existing policies which address and respect Cancun Safeguards
	relevant stakeholders, in particular indigenous peoples and local communities, in the actions referred to in paragraphs 70 and 72 of this decision	National REDD+ Policy, 2014, Assam Forest Policy, 2004, Bamboo & Cane Policy, 2005, Assam Joint Forest Management Rules ,1998
Safeguard (e)	That actions are consistent with the conservation of natural forests and biological diversity, ensuring that the actions referred to in paragraph 70 of this decision are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits	National Forest Policy 1988, Indian Forest Act 1927, Wild life Protection Act, 1972, Forest Conservation Act, 1980, Environment Protection Act, 1986, Forest Conservation Rules, 2004, Biological Diversity Act,2002, National Environmental Policy 2006, NAP, GIM,TPP, Finance Commission Outlay, National Agroforestry Policy, 2014, IWMP, CAMPA, MGNREGS, NRLM, Safety, Health and Welfare Act 2005, Labor Act 2016, Draft National REDD+ Policy, 2014, Assam Forest Policy, 2004, Assam Joint Forest Management Rules ,1998
Safeguards (f) and (g)	Actions to address the risks of reversals <i>And</i> Actions to reduce displacement of emissions	Draft National REDD+ Policy, 2014 and REDD+ Reference Document, 2015, MoEFCC

10.3 INSTITUTIONAL ARRANGEMENT

The Assam State REDD+ Cell set up under the Office of the Chief Secretary will oversee the finalization of the SIS for REDD+ in the State. The REDD+ Task Force under the Office of the PCCF (HoFF) and the District REDD+ Committee will implement the system, and will also play a key role in monitoring, reporting, collation and verification of the safeguards through the life of the LEEF project. The district forest officers will coordinate and guide LEEF actions at every point and engage with the range level forest officials and other institutions to collect, process, and manage all relevant information and data relating to forest carbon accounting and related safeguards.

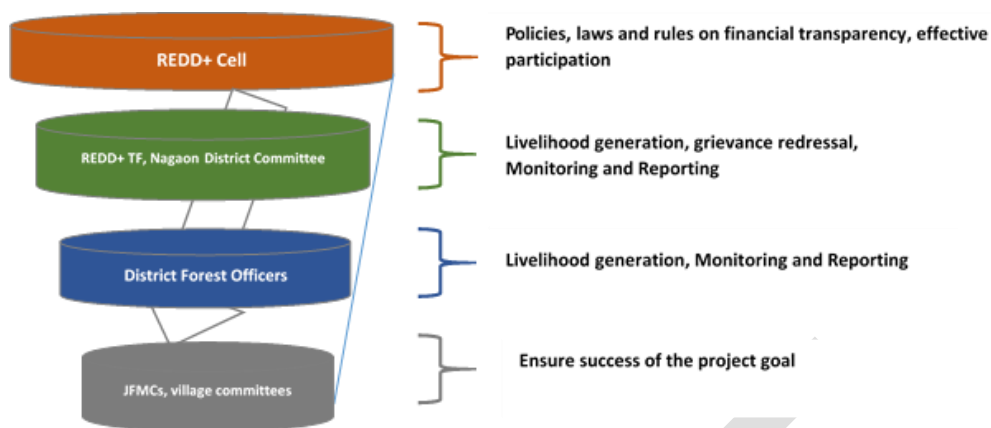


FIGURE 58: BASIC INSTITUTIONAL ARRANGEMENT FOR LEEF

The monitoring of safeguards will be done in the same way monitoring of project parameters will be done. Flow of information shall be from the JFMCs to the district forest officials, the district committee, REDD+ Task Force and the REDD+ Cell. However, all the information will be collated by the DoEF before the same is presented to the REDD+ Task Force and the REDD+ Cell. In case of any changes in the data/parameters, the same may be decided with the permission of the REDD+ Task Force and information to the Nagaon District REDD+ Committee. The Nagaon district REDD+ Committee will also be responsible for any capacity development of community and CBOs on monitoring and reporting of parameters on safeguards.

10.4 CRITERIA AND INDICATORS FOR SAFEGUARDS

Chapter 11, Agenda 21 of United Nations Conference on Environment and Development (UNCED) (also known as the Earth Summit) in 1992, called for the identification of criteria and indicators (C&I) for evaluating progress in national and regional efforts to practice Sustainable Forest Management (SFM). As a result, several international organizations have developed country or region-specific C&Is, including the International Tropical Timber Organization (ITTO), the Pan-European (or Helsinki) Process, the Montreal Process and the Dry Zone Asia and Dry Zone Africa Processes, each of which have generated sets of C&I.

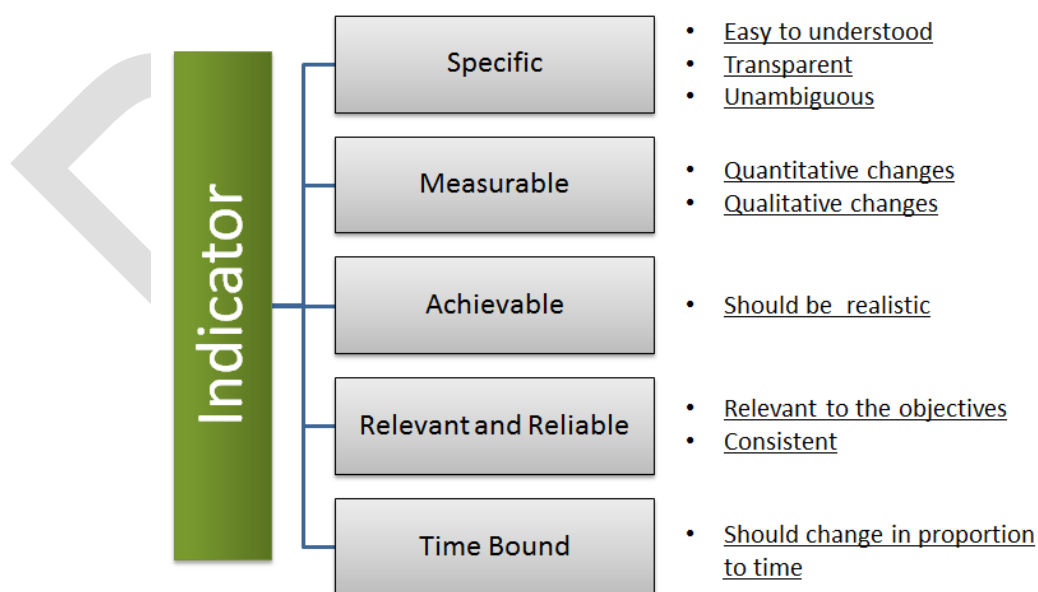


FIGURE 59: SMART INDICATORS FOR REDD+

Criteria are the standards that define the goals to be met through implementing a REDD+ project. A criteria of analyzing safeguards should have SMART (specific, measurable, achievable, relevant and time-bound) and

simple indicators with clear institutional mandates and sufficient operational budgets for the compilation of information over time⁶³.

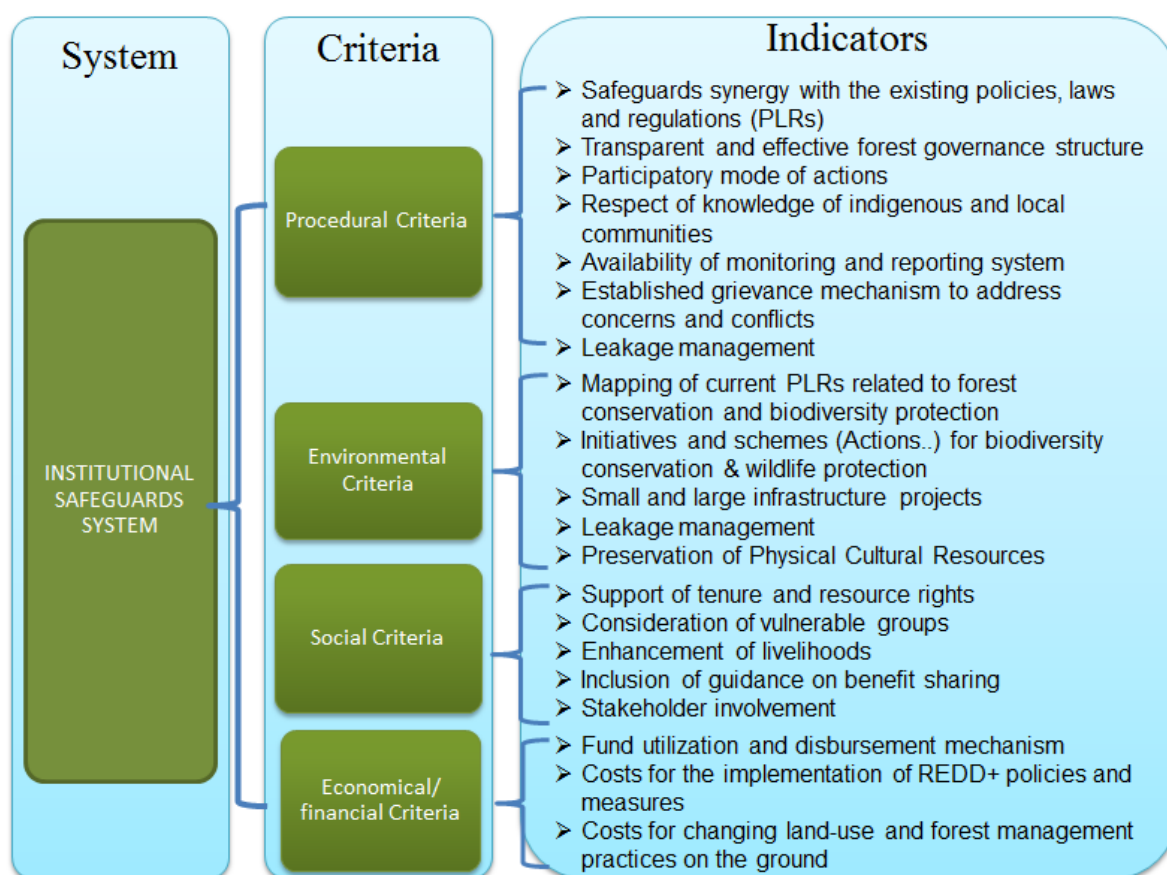


FIGURE 60: CRITERIA AND INDICATORS ADDRESSING REDD+ SAFEGUARDS

10.5 MONITORING SAFEGUARDS

10.5.1 Procedural Criteria

Procedural criteria are governance issues that relate to the proper functioning of national level, sub-national level and forest sector decision making and management. This criteria is focused to address the issues related to the integration of REDD+ into policies, laws, and regulations; transparency; stakeholder participation; and grievance mechanisms, which can be referred to either as “safeguards” or as procedural standards depending on the initiative. Seven indicators are designed to address procedural criteria of the project.

Indicator No.	C-PROC 1
Name of the Indicator	Safeguards synergy with the existing policies, laws and regulations (PLRs)
Synergy with Cancun Safeguards	Cancun Safeguard 1
Parameter	No of actions divergent or against to existing policies, laws, regulations and international treaties
Description of parameters	It will be ensured that LEEF actions do not conflict with state and national law or international agreements.
Unit of measurement	Number
Source of data	<ul style="list-style-type: none"> Existing PLRs - state portals

⁶³ UN-REDD Programme 2015c

	<ul style="list-style-type: none"> • Project reports • Project verification reports
Methodology of collection of data	Through literature survey for PLRs and project implementation report
Measuring/recording frequency	Shall be reported for compliance at the formulation stage and reported at every monitoring.
Calculation/analysis method where applicable	NA
Additional comments	Nil

Indicator No.	C-PROC 2
Name of the Indicator	Transparent and effective forest governance structure
Synergy with Cancun Safeguards	Cancun Safeguard 2
Parameter	Existing and newly formed village level committees in the project area for effective implementation of the project
Description of parameters	<p>Transparency is an important component for ensuring accountability in governance. It will help to ensure transparency and access to information, and effectiveness and efficiency of systems for feedback, oversight and accountability.</p> <p>By requiring that information on REDD+ policies, programs and projects be available to the public, identified delivery partners and government stakeholders are held responsible for finance as well as successes and failures of a program or project.</p> <p>It will address transparency in implementation, execution, benefit sharing, information sharing, gender equality, implementation of PLRs, monitoring etc.</p>
Unit of measurement	Number
Source of data	<ul style="list-style-type: none"> • Project records • Project verification reports • Government reports
Methodology of collection of data	Through consultation and field monitoring as well from secondary sources
Measuring/recording frequency	Annually
Calculation/analysis method where applicable	<ul style="list-style-type: none"> • Number of committee formed at the district level • Number of committee formed to the total villages in the project area
Additional comments	Uploading information on online portals or databases (APFBC or DoEF websites) should be encouraged to make information easily available and up to date. Availability of information in local languages can help increase accessibility.

Indicator No.	C-PROC 3
Name of the Indicator	Participatory mode of actions
Synergy with Cancun Safeguards	Cancun Safeguard 4
Parameter	<p>Extent of participation of relevant stakeholders, in particular indigenous peoples and local communities in</p> <ol style="list-style-type: none"> 1. Committee meetings for LEEF activities 2. Implementation and other project activities 3. Negotiation and benefit sharing 4. Free, prior and informed consent (FPIC)
Description of parameters	<p>This indicator has potential to strengthen recognition of the rights of indigenous peoples, including the right to FPIC.</p> <p>It will ensure active participation of all the stakeholders in REDD+ activities.</p>

Unit of measurement	Percentage participation
Source of data	<ul style="list-style-type: none"> Meetings, consultations and PRAs attendance sheets Record books
Methodology of collection of data	Through record books, meetings and consultations Minutes of Meetings, invitation letters and attendance list.
Measuring/recording frequency	Annually
Calculation/analysis method where applicable	Enumeration of total participation
Additional comments	Full and effective participation of relevant stakeholders at all stages of project development is a critical component of good governance and important in strengthening public institutions, transparency and promoting democratic processes ⁶⁴ .

Indicator No.	C-PROC 4
Name of the Indicator	Respect of knowledge of indigenous and local communities
Synergy with Cancun Safeguards	Cancun Safeguard 3
Parameters	<ul style="list-style-type: none"> Number of micro plans in the project area In the absence of micro plan, No. of PRAs, focal group discussions, resource mapping Effective consultation without discrimination Capacity building support for indigenous and local peoples Appropriate steps taken to protect and fulfil rights and culture of indigenous peoples
Description of parameter	<ul style="list-style-type: none"> Total number of micro plan prepared by communities in the LEEF will be evaluated. In the absence of micro plan, total number of PRA exercise, FGDs and resource mapping carried out will be evaluated. Number of Capacity building programs conducted and steps taken to improve and strengthen local communities rights and interests under the project activities
Unit of measurement	Number
Source of data	Micro plans, Minutes of the meeting,
Methodology of collection of data	Review of micro plans and/or reports/ peer reviewed papers
Measuring/recording frequency	At least every 5 years
Calculation/analysis method where applicable	NA
Additional comments	Nil

Indicator No.	C-PROC 5
Name of the Indicator	Availability of monitoring and reporting system
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguard 2
Parameters	To monitor progress and device compliance
Description of parameter	Information on how data are stored and shared and how safeguards are being addressed and respected has to be collected and reported in a systematic way throughout the project process
Unit of measurement	Qualitative (Yes/No)
Source of data	Annual report and consultation/ meetings, sample surveys
Methodology of collection of data	Project records, project verification reports, etc.
Measuring/recording frequency	Annually

⁶⁴ FCMC. REDD+ Social Safeguards and Standards Review. Forest Carbon, Markets and Communities Program (FCMC) for USAID (p. 9). 2013

Calculation/analysis where applicable	method	NA
Additional comments		Uploading information on online portals or databases should be encouraged to make information easily available and up to date. Availability of information in local languages can help increase accessibility.

Indicator No.	C-PROC 6	
Name of the Indicator	Established grievance mechanism to address concerns and conflicts	
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguard 3	
Parameters	To address concerns in cases where REDD+ projects cause conflicts or when safeguards are not applied.	
Description of parameter	It involved verifying the existing grievance and redress mechanism and comparing with the international standards. Parameters like conflict resolution mechanism available, number of grievance recorded and solved, availability of redressal mechanism etc. to be evaluated. This mechanism will provide a way for local communities to have a voice and a channel for resolution and redress	
Unit of measurement	Yes/No	
Source of data	Annual report, conflict register, Grievance redressal cells, complain register etc.	
Methodology of collection of data	Verification reports, project records, grievance redressal cells, conflict register, registered complaint in grievance redressal cells and complaint resolved etc.	
Measuring/recording frequency	At least every 5 years	
Calculation/analysis where applicable	method	N/A
Additional comments	Nil	

Indicator No.	C-PROC 7	
Name of the Indicator	Leakage management	
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguards 6 and 7	
Parameters	To monitor shift in drivers from project area to non-project areas	
Description of parameter	A procedural requirement to identify possible leakage displacement from the project in the jurisdiction.	
Unit of measurement	Quantitative (tons)	
Source of data	Annual report	
Methodology of collection of data	Project records and verification reports	
Measuring/recording frequency	At least every 5 years	
Calculation/analysis where applicable	method	Amount of CO ₂ equivalent in tons.
Additional comments	Analyze the CO ₂ leakage, Random checks/site audits/interviews of key personnel etc. to validate the quantity of leakage.	

10.5.2 Environmental Criteria

Environmental criteria mandates that biodiversity and ecosystem services possibly affected by the LEEF project are identified, prioritized and mapped, and the project maintains and enhances the identified biodiversity and ecosystem service. Further, the project should not lead to the conversion or degradation of natural forests or

other areas that are important for maintaining and enhancing the identified biodiversity and ecosystem service priorities. Five indicators are designed to address procedural criteria of Jurisdictional REDD+ project in Nagaon:

Indicator No.	C-ENV 1
Name of the indicator	The mapping of current policies, laws and regulations related to forest conservation and biodiversity protection
Synergy with Cancun Safeguards	1/CP.16 Safeguard 1
Parameters	To monitor implementation of PLRs
Description of the indicator	These policies have been developed after extensive consultations with stakeholders over the years. It will be evaluated how these PLRs have been implemented and operationalized in the jurisdiction.
Unit of measurement	Qualitative
Source of Data	Policy documents at state and national level, including: <ul style="list-style-type: none"> • Gazette of India • Human Development Reports • Other relevant documents
Methodology of data collection	Desk study of relevant policy documents
Measuring/Recording Frequency	At each monitoring
Calculation/analysis method (where applicable)	N/A
Additional Comments	This will help to ensure LEEF actions do not conflict with national law or international agreements.

Indicator No.	C-ENV 2
Name of the indicator	Initiatives and actions for biodiversity conservation and wildlife protection at the state and national level
Synergy with Cancun Safeguards	1/CP.16 Safeguard 5
Parameters	To analysis impacts of conservation initiatives undertaken.
Description of the indicator	Evaluation of the success of these initiatives on the ground. There will be assessment of factors like: <ul style="list-style-type: none"> • No. of poachers arrested/no. of weapons seized • Mode of surveillance and spatial distribution of surveillance instruments • Information from field surveys/camera trapping studies/tagging (if any) • No. of ex-situ and in-situ conservation measures for rare, endangered and endemic species in the project area <p>This will help to incentivize protection and conservation of natural forests and biodiversity, and their services and other benefits.</p>
Unit of measurement	Contingent on information presented.
Source of Data	<ul style="list-style-type: none"> • Desk-based studies • Field studies • Information from other state departments • Project records • Verification reports

Methodology of data collection	Data collection will be based on the reconciling of results from desk-based studies, periodic reports of field studies and the procurement of relevant information from other state departments wherever applicable.
Measuring/Recording Frequency	At each monitoring
Calculation/analysis method (where applicable)	Total number of activities/incidence took place per annum.
Additional Comments	Nil

Indicator No.	C-ENV 3
Name of the indicator	Small and large infrastructure projects, including the construction of hydro projects, dams and roads.
Synergy with Cancun Safeguards	1/CP.16 Safeguard 6
Parameters	Loss of forest cover due to infrastructure projects
Description of parameter	An assessment of the small and large infrastructure projects currently under development in state, which have a potential for reversing benefits through the loss of forest carbon biomass. This will help ensure REDD+ activities result in long-lasting positive changes.
Unit of measurement	Nos.
Source of Data	<ul style="list-style-type: none"> • Minutes of Cabinet meetings and State Assembly • Annual Reports of state government departments, including Agriculture, Water Resources, Rural Development, Home Affairs, Horticulture, Finance.
Methodology of data collection	Government annual reports and other records.
Measuring/Recording Frequency	At each monitoring
Calculation/analysis method (where applicable)	Calculation of the benefits lost through the loss of forest carbon biomass in terms of emissions, based on extent of forest and tree cover lost to given developmental activity.
Additional Comments	Nil

Indicator No.	C-ENV 4
Name of the indicator	Initiatives towards Pest and Fire Management
Synergy with Cancun Safeguards	1/CP.16 Safeguard 6
Parameters	Incidence of fire and pest attack
Description of the indicator	Ensuring that the environmental risks associated with pests and forest fires are minimized, and that safe and environmentally-sound pest and forest fire management techniques are promoted. This will help ensure LEEF activities result in long-lasting positive changes.
Unit of measurement	Total land area affected due to fire and paste attack
Source of Data	Working Plans and other periodic subject-specific reports
Methodology of data collection	Field study and desk-based analysis of pest and fire management techniques currently underway in the jurisdiction.
Measuring/Recording Frequency	Annual

Calculation/analysis method (where applicable)	Calculation of the benefits lost through the loss of forest carbon biomass in terms of emissions, based on extent of forest and tree cover lost due to fire or disease.
Additional Comments	Nil

Indicator No.	C-ENV 5
Name of the indicator	Preservation of Physical Cultural Resources (PCRs)
Synergy with Cancun Safeguards	1/CP.16 Safeguard 3
Parameters	To avoid or mitigate, adverse impacts on cultural resources from development projects.
Description of parameter	Evaluation of PCRs using field surveys by experts, to document the presence and significance of these PCRs, including sacred groves. This will ensure that the project draws upon the knowledge of local communities on local forest conditions and appropriate actions.
Unit of measurement	Quantitative
Source of Data	Field-based sample surveys
Methodology of data collection	Data collection will involve field based sample surveys, including village-level discussions and consultations with <ul style="list-style-type: none"> • Panchayat leaders and JFMC members. • Social Welfare Department of the jurisdiction. • Prominent civil society activists.
Measuring/Recording Frequency	At each monitoring
Calculation/analysis method (where applicable)	Percentage of resources depleted/impacted per annum.
Additional Comments	Nil

10.5.3 Social criteria

To ensure full and effective participation of all relevant stakeholders, especially indigenous communities and peoples, five indicators are designed to address procedural criteria of the LEEF project.

Indicator No.	C-SOC 1
Name of the Indicator	Support of tenure and resource rights
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguards 3 and 4
Parameters	<ul style="list-style-type: none"> • Total land allotted to indigenous communities and total number of beneficiary households. • What are the kinds of rights they have under FRA in the jurisdiction?
Description of parameter	<ul style="list-style-type: none"> • Data on prevailing customary land and resource rights, • Steps taken to strengthening tenure security, • Implementation of FRA and number of beneficiaries
Unit of measurement	Quantitative
Source of data	Annual report, FRA online portal, land record book etc.
Methodology of collection of data	Data will be collected through primary and secondary sources including published reports, record book and online portal.
Measuring/recording frequency	At each monitoring
Calculation/analysis method where applicable	Percentage of beneficiaries to the total populations
Additional comments	Addressing land tenure and rights is highly complementary to the overall goals of Jurisdictional REDD+ because forest

	communities with stronger land tenure have also been shown to be better stewards of sustainable resource use and conservation of forests ⁶⁵
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Indicator No.	C-SOC 2
Name of the Indicator	Consideration of vulnerable groups
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguards 3 and 4
Parameters	Involvement of vulnerable groups in REDD+ activities
Description of parameter	<ul style="list-style-type: none"> • Involvement of indigenous peoples, women, religious or ethnic minorities in various LEEF activities as per project guidelines. • Activity wise involvement of vulnerable communities in decision making.
Unit of measurement	Quantitative
Source of data	Annual report, Activity register, FRA online portal, etc.
Methodology of collection of data	Data will be collected from record books and published literatures
Measuring/recording frequency	At each monitoring
Calculation/analysis method where applicable	Percentage of involvement to the total populations
Additional comments	Nil

Indicator No.	C-SOC 3
Name of the Indicator	Enhancement of livelihoods
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguards 4 and 5
Parameters	Existing program implemented in the project area to support livelihood and capacity development of forest dependent communities
Description of parameter	Address alternative income sources as well as capacity building and knowledge transfer mechanism adopted to enhance livelihoods of the community.
Unit of measurement	Quantitative
Source of data	Annual report and activity register, sample survey
Methodology of collection of data	Data will be collected from annual report and activity register
Measuring/recording frequency	Annual
Calculation/analysis method where applicable	Percentage of beneficiaries to the total populations.
Additional comments	Nil

Indicator No.	C-SOC 4
Name of the Indicator	Inclusion of guidance on benefit sharing
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguard 5
Parameters	Availability of standard benefit sharing mechanism
Description of parameter	To ensure that benefits are distributed equitably among all stakeholders including local communities, government, and concession holders, as well as project developers and facilitators in the jurisdiction, if applicable. It will address vertical and horizontal transfer of benefits (both direct and indirect) arising from LEEF project.
Unit of measurement	Quantitative
Source of data	Annual report, activity register and audit report

⁶⁵ Gregersen, H et al. The Greener Side of REDD+: Lessons for REDD+ from Countries where Forest Area is Increasing. Rights and Resources Initiative. 2011.

Methodology of collection of data	Data will be collected from annual report, activity register and audit report
Measuring/recording frequency	At each monitoring
Calculation/analysis method where applicable	Percentage of beneficiaries to the total populations.
Additional comments	Benefits are usually considered in terms of cash, but may also come in the form of capacity building, infrastructure, and social and environmental services ⁶⁶ .

Indicator No.	C-SOC 5
Name of the Indicator	Stakeholder involvement
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguards 4 and 7
Parameters	Effective involvement of all stakeholders
Description of parameter	Involving all relevant stakeholders (local communities, wood producers, wood processing industries, governments, NGOs etc.) for Joint long-term planning on resource availability and utilization. It will help in ensuring long term sustainability and also minimizing the risk of displacement of emissions (leakage) from LEEF project.
Unit of measurement	Quantitative
Source of data	Government reports and published literatures
Methodology of collection of data	Data on involvement of various stakeholder on different REDD+ activities will be accessed from government reports and literatures available.
Measuring/recording frequency	At each monitoring
Calculation/analysis method where applicable	Total number of stakeholder per village/village community area.
Additional comments	Stakeholders will have a significant impact on the regional trade in forest products which affects national emissions.

10.5.4 Economic criteria

In order to ensure economic or financial security of the LEEF project, a transparency fund utilization and disbursement mechanism should be ensured and cost benefit analysis of the project shall be undertaken. Three indicators are designed to address economic criteria of the project.

Indicator No.	C-ECON 1
Name of the Indicator	Fund utilization and disbursement mechanism
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguard 2
Parameters	To evaluate fund disbursement and utilization mechanism.
Description of parameter	This will ensure transparency in the system. It could help to ensure relevant stakeholder groups can access necessary information, and that decision-makers are held to account for meeting REDD+ targets and goals that have been set.
Unit of measurement	Quantitative
Source of data	Annual report, audit report, Ledgers maintained at JFCM/VFC/EDC level
Methodology of collection of data	Data should be collected through study of existing annual report, audit reports and Ledger book.
Measuring/recording frequency	Annual
Calculation/analysis method where applicable	Total fund utilized/disbursed (INR)
Additional comments	Nil

⁶⁶ Climate Focus (2013). Safeguard Standard Review.

Indicator No.	C-ECON 2
Name of the Indicator	Costs for the implementation of policies and measures of LEEF project
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguard 6
Parameters	To analyses implementation cost of REDD+.
Description of parameter	This indicator will help in feasibility study through cost-benefit analysis. It will ensure REDD+ results in long-lasting change for the good of the climate.
Unit of measurement	Quantitative
Source of data	Annual report, audit report, Ledgers maintained at JFCM/VFC/EDC level
Methodology of collection of data	Data should be collected through study of existing annual report, audit reports and Ledger book.
Measuring/recording frequency	Annual
Calculation/analysis method where applicable	Expenditure (INR) per annum
Additional comments	Nil

Indicator No.	C-ECON 3
Name of the Indicator	Costs for changing land-use and forest management practices on the ground.
Synergy with Cancun Safeguards	1/CP.16 Cancun Safeguard 6
Parameters	To analyses expenditure for changing land-use and forest management practices.
Description of parameter	This indicator will help in cost-benefit analysis. This will help in analyzing suitability of the system
Unit of measurement	Quantitative
Source of data	Annual report and audit report
Methodology of collection of data	Data should be collected through study of existing annual report, audit reports. It will ensure LEEF project results in long-lasting change for the good of the climate.
Measuring/recording frequency	At each monitoring
Calculation/analysis method where applicable	Expenditure per annum
QA/QC	Random checks/site audits/interviews of key personnel etc. to validate how effective the involvement is.
Additional comments	Nil

10.6 Benefit Sharing System

REDD+, along with carbon storage benefit, also provides financial and other co-benefits. These monetary and non-monetary benefits need to be distributed among the people involved in its development and implementation. Benefit sharing is required to:

- Maximize equity among the stakeholders
- Enhance sustainability of the project
- Enhance legitimacy and increase trust of all stakeholders
- Effective forest management
- Increase efficiency of LEEF project.

For the benefit sharing the project will require a system and instruments to designate who, when, how and how much to reward. Benefit sharing is important in order to incentivize the actions which reduces deforestation and forest degradation. Therefore, for a sustainable REDD+ project, it is important to earn the trust of stakeholders by building a fair, and transparent benefit sharing system. A well-designed benefit sharing will also ensure efficiency and effectiveness of the REDD+ project.

The monetary benefit can be distinguished into three categories⁶⁷:

1. **Compensation for opportunity cost** – compensation to be provided to cover the loss of revenue that would otherwise be generated in absence of the project implementation.
2. **Transaction cost** – project implementation incentives to support implementation cost.
3. **REDD+ rent** – rent is the difference between the cost of implementing the project plus the opportunity cost for the project, and the expected revenue from selling the carbon credits that would be generated by the project. It is an overall economic measurement of the profit/loss (i.e. rent would be <0 / >0) that the project would make during implementation and monitoring.

Economically the project may be loss-making (in terms of rent i.e. communities will be altering their land management practices or livelihood activities or lost production), but the overall impact should also take into consideration the contributions from social and environmental gains. Hence, benefit sharing is important in creating necessary incentives to reverse and reduce deforestation and forest degradation.

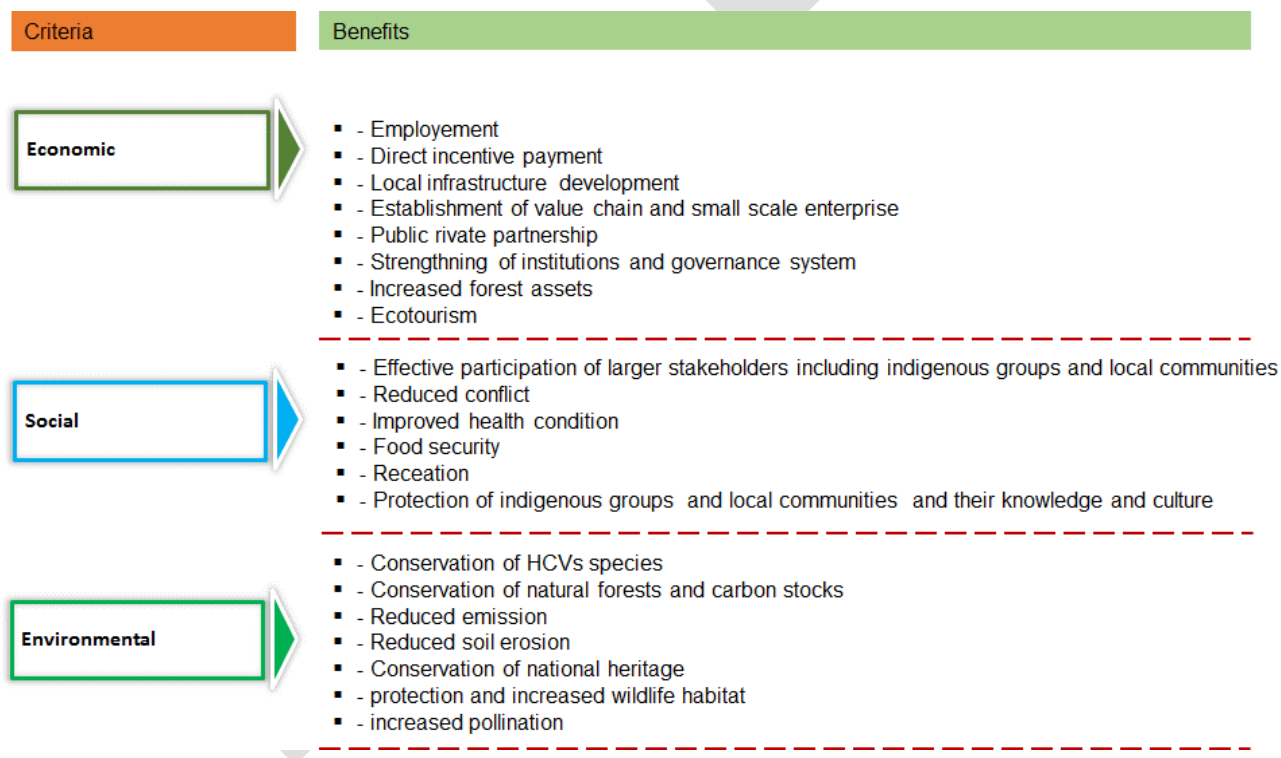


FIGURE 61: TYPES OF BENEFITS FROM LEEF (BROAD SUSTAINABLE DEVELOPMENT CRITERIA)

The following is one such mechanism which could be considered for this project.

⁶⁷ https://cmsdata.iucn.org/downloads/benefit_sharing_english.pdf

3.1.2 Fund flow through DoEF and proposed Benefit Sharing

REDD+ has the potential to generate a variety of benefits. Direct financial incentives (e.g., carbon credits payments) are the primary mechanism for achieving emissions reductions, and REDD+ proponents hope that these payments will flow to local forest communities and others directly contributing to REDD+. There are also a number of (monetary and non-monetary) 'co-benefits' that can arise from REDD+.

Decision-making process for REDD+ benefit sharing should include effectively engagement of state level government agency (i.e., DoEF) and local/village level community (i.e., JFM/ EDC etc) to help maintain the legality of LEEF and to lead to solutions suited to different local contexts. Benefits then distributed horizontally by states agency to local level constituencies could be either monetary or non-monetary, allocated based on efforts made to address the drivers of deforestation and forest degradation, reduce barriers to sustainable natural resource management, and support sustainable rural development.

“A local investment plan should be an instrument that allows communities to agree with government agencies and civil society as a whole on their sustainable development proposals to strengthen local management, add incentives and economic support,” (Rafael Obregon, CONABIO).

Sharing of funds should be finalized after consultation with all the stakeholders and following existing policy/norms. However, a generalised fund sharing mechanism is proposed for LEEF based on the benefit sharing mechanism proposed for various REDD+ project across the globe^{68,69,70}. The existing resource sharing mechanisms in community managed forest lands of India was also taken into consideration⁷¹.

Local stakeholders should have the opportunity to develop their own investment plans that specify how they intend to reduce deforestation and forest degradation. Multi-stakeholder committees should be formed at the state level to select investment plans based on state-level REDD+ strategies, guided by the central/state government. Safeguards will guide the development and implementation of investment plans, government policies and benefit sharing.

Sharing of funds should be finalized after consultation with all the stakeholders and following existing policy/norms. However, a generalised fund sharing mechanism is projected for various forest areas of India based on the benefit sharing mechanism proposed for various REDD+ project across the globe^{72,73,74}. The existing resource sharing mechanisms in community managed forest lands of India was also taken into consideration⁷⁵.

Government Forest areas

1. **Funds for higher institutions:** 70% of the fund may be utilized for implementation, institutional charges and maintenance of project activities of higher level institutions.
2. **Funds for village community/households-** 30% of the fund may be utilized for distribution at the village level. Effective method of disbursement of fund should be adopted at community level (detail is described in next section).

⁶⁸ Institutional and Cost-Benefit-Sharing Arrangement for Implementation of Emission Reductions Programme in 12 TAL Districts of Nepal. REDD Implementation Centre, Ministry of Forests and Soil Conservation, Nepal.

⁶⁹ Developed comparing REDD+ case study of Tanzania, Africa, Indonesia, Nepal.

⁷⁰ USAID (2012). Institutional assessment tool for benefit sharing under REDD+.

⁷¹ Vemuri A (2008). Joint Forest Management in India: An Unavoidable and Conflicting Common Property Regime in Natural Resource Management. Journal of Development and Social Transformation.

⁷² Institutional and Cost-Benefit-Sharing Arrangement for Implementation of Emission Reductions Program in 12 TAL Districts of Nepal. REDD Implementation Centre, Ministry of Forests and Soil Conservation, Nepal.

⁷³ Developed comparing REDD+ case study of Tanzania, Africa, Indonesia, Nepal.

⁷⁴ USAID (2012). Institutional assessment tool for benefit sharing under REDD+.

⁷⁵ Vemuri A (2008). Joint Forest Management in India: An Unavoidable and Conflicting Common Property Regime in Natural Resource Management. Journal of Development and Social Transformation.

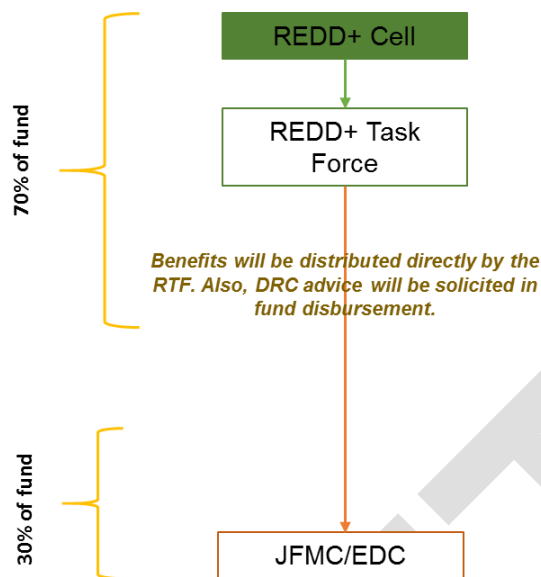


FIGURE 62: FLOW OF FUND FOR GOVERNMENT FORESTS

Protected Forest areas

1. **Funds for higher institutions:** 50% of the fund may be utilized for institutional charges and maintenance activities of higher level institutions (like REDD+ cell, DoEF, etc.) subject to approval.
2. **Funds for village community/households-** 50% cent of the fund may be utilized for distribution at the village level. Effective method of disbursement of fund should be adopted at community level (detail is described in next section).

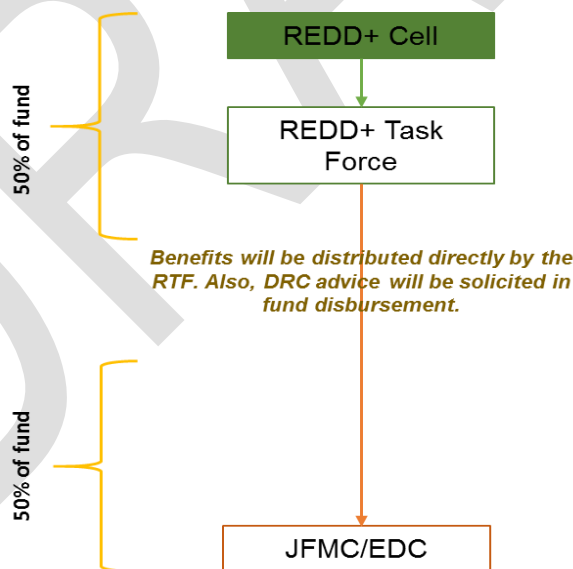


FIGURE 63: FLOW OF FUND FOR PROTECTED FORESTS

10.7 Benefit distribution at village level

Two major factors that are likely to affect benefit flow from LEEF Nagaon at a local level are whether payments are made to the communities (like JFMCs/EDCs) as a whole or are they going directly to the

households; and whether payments are made in cash or in kind. There can be three possible scenarios of benefit distribution at local level:-

1. Distribution of benefit at community level
2. Distribution of benefit at household level
3. Distribution of benefit directly to the individuals

There are potential advantages and limitations of each option, but the 'best' option will depend on the preferences of the community residents.

India already has a well-defined institutional based fund transfer mechanism in forestry based activities where funds are transferred directly to the community [as in the case of National Afforestation Program (NAP), Japan International Cooperation Agency (JICA) projects, Joint Forest Management (JFM) program etc.], to household [e.g., National Rural Livelihood Mission (NRLM), MGNREGA, Start-up Village Entrepreneurship Development Programme (SVEP), National Rural Drinking Water Programme (NRDWP) and Swachh Bharat Abhiyan] and also to individual beneficiaries [like in Jawahar Gram Samridhi Yojna (individual beneficiary schemes for SC/STs), Green Indian Mission (GIM) and MGNREGA]. MGNREGA have payments options to individual beneficiary in MIS⁷⁶ and under farm forestry schemes.

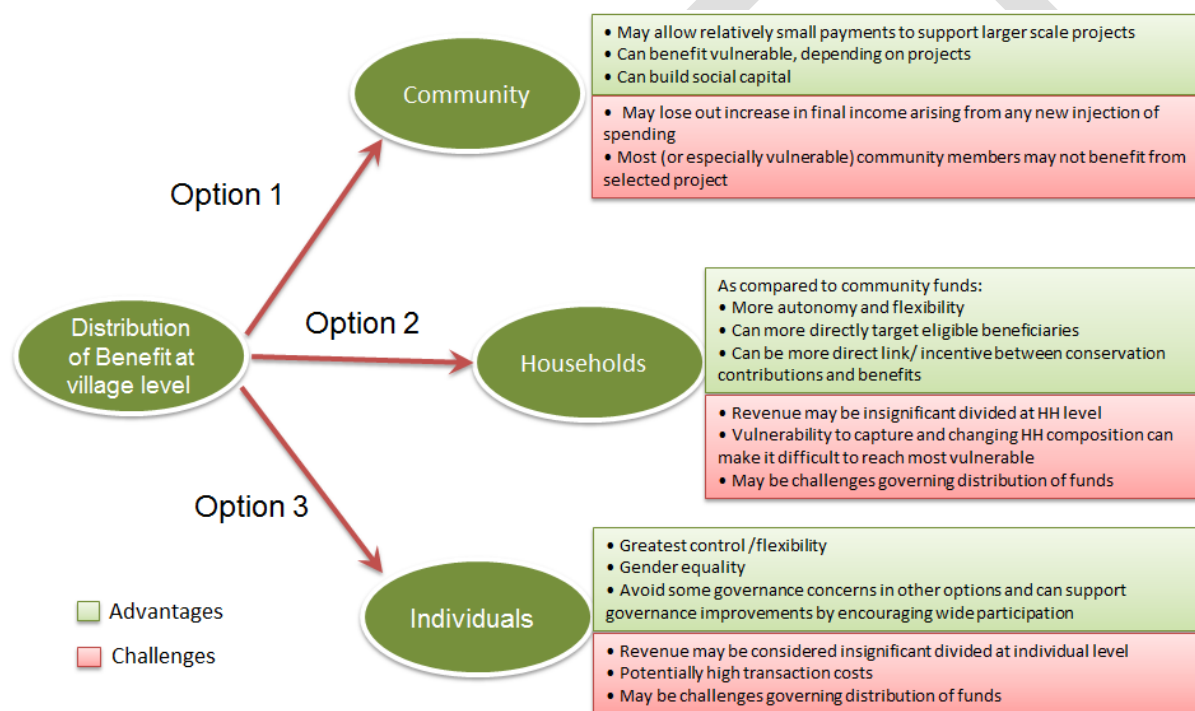


FIGURE 64: OPTIONS FOR DISTRIBUTION OF BENEFIT AT LOCAL LEVEL

10.8 Integrating Safeguards in Benefit Sharing Mechanisms

Safeguard policies often provide a platform for the participation of stakeholders in assessing impacts, as well as mitigating negative impacts. An appropriately designed safeguard system could identify potential positive impacts of LEEF activities, and actions that could support positive move. An important element of any REDD+ safeguard system is broad participation and open access to information.

REDD+ benefit sharing should be in accordance with the following:

- Full and effective participation;

⁷⁶ <http://nrega.nic.in/releases.htm>

- Free, prior and informed consent;
- Effective representation;
- Transparency;
- Accountability;
- Gender equality;
- Respect for human rights;
- Secure land, forest and carbon tenure;
- Dispute resolution; and monitoring

In India, a broad institutional framework for implementing REDD+ safeguards is already in place. This includes the MoEFCC, and the state government department. The DoEF will be responsible for carrying out their roles and responsibilities required for developing and implementing Safeguards and Benefit Sharing Mechanism for the LEEF project in Nagaon.

10.9 Grievance Mechanism

Feedback and grievance redress procedure will be through the JFMC/EDC meetings that would be held on periodic basis at the village level. The minutes of the meeting are maintained which will include the issues heard and the response to the issue and eventually addressing the issue. The annual general meeting of the village will also be a platform to address the grievances of the village communities. These meeting books with minutes of the meeting will be accessible to the village communities.

A handbook⁷⁷ on Joint Forest Management has been developed by MoEFCC where in Chapter 12 it is clearly mentioned on conflict resolution or grievances are addressed in JFMCs and EDCs. The same model will be adopted in this project since the EE intends to use JFMC and EDC in all the project activities.

⁷⁷ http://rtmoef.nic.in/Docs/JFM_Booklet.pdf (page number 44 and 45)

Annexure I: Details of plantations planned

TABLE 42: DETAILS OF THE PLANTATION PLANNED IN NAGAON

Name of the Reserve Forest	Compartment	Plantation Type	Area_(ha)
BAGSER R.F	1	Block Plantation	25.2
BAGSER R.F	2	Block Plantation	33.5
BAGSER R.F	3	Block Plantation	4.7
BAGSER R.F	4	Block Plantation	2.9
BAGSER R.F	6	Block Plantation	2.0
BAGSER R.F	7	Block Plantation	10.3
BAMUNI R.F	1	Block Plantation	0.3
BAMUNI R.F	2	Block Plantation	2.7
BAMUNI R.F	3	Block Plantation	2.9
BARPANI R.F	1	Block Plantation	4.5
BARPANI R.F	2	Block Plantation	90.2
BARPANI R.F	3	Block Plantation	27.8
BARPANI R.F	7	Block Plantation	0.1
DABAKA Part R.F	29	Block Plantation	5.8
DABAKA Part R.F	30	Block Plantation	13.8
DABAKA Part R.F	31	Block Plantation	118.7
DABAKA Part R.F	32	Block Plantation	58.4
DABAKA Part R.F	33	Block Plantation	144.8
DABAKA Part R.F	34	Block Plantation	152.9
DABAKA Part R.F	35	Block Plantation	147.8
DABAKA Part R.F	36	Block Plantation	183.1
DABAKA Part R.F	37	Block Plantation	129.2
JOKOTA R.F	1	Block Plantation	4.2
JOKOTA R.F	2	Block Plantation	11.9
JOKOTA R.F	3	Block Plantation	73.6
JOKOTA R.F	4	Block Plantation	10.6
KAMAKHYA HILL R.F	1	Block Plantation	24.5
KAMAKHYA HILL R.F	2	Block Plantation	22.3
KAPHITALI	1	Block Plantation	15.5
KAPHITALI	2	Block Plantation	16.3
KAPHITALI	3	Block Plantation	3.2
KHOLAHAT R.F	1	Block Plantation	4.2
KHOLAHAT R.F	2	Block Plantation	2.7
KHOLAHAT R.F	3	Block Plantation	16.1
KHOLAHAT R.F	4	Block Plantation	20.7
KHOLAHAT R.F	5	Block Plantation	15.6
KHOLAHAT R.F	6	Block Plantation	6.9
KHOLAHAT R.F	7	Block Plantation	12.2
KHOLAHAT R.F	8	Block Plantation	10.7
KHOLAHAT R.F	10	Block Plantation	18.6

Name of the Reserve Forest	Compartment	Plantation Type	Area_(ha)
KHOLAHAT R.F	11	Block Plantation	4.5
KHOLAHAT R.F	12	Block Plantation	0.5
KHOLAHAT R.F	13	Block Plantation	0.5
KHOLAHAT R.F	14	Block Plantation	11.6
KHOLAHAT R.F	15	Block Plantation	35.6
KHOLAHAT R.F	16	Block Plantation	14.8
KILING R.F	1	Block Plantation	1.7
KILING R.F	2	Block Plantation	0.4
KUKURAKATA R.F	1	Block Plantation	46.0
LUTUMAI R.F	4	Block Plantation	0.6
NORTH DIJU R.F	1	Block Plantation	13.8
NORTH DIJU R.F	2	Block Plantation	13.2
NORTH DIJU R.F	3	Block Plantation	0.1
NORTH DIJU R.F	4	Block Plantation	4.5
NORTH DIJU R.F	5	Block Plantation	15.5
NORTH DIJU R.F	6	Block Plantation	1.9
NORTH DIJU R.F	7	Block Plantation	1.2
NORTH DIJU R.F	8	Block Plantation	7.4
NORTH DIJU R.F	9	Block Plantation	1.0
NORTH DIJU R.F	10	Block Plantation	1.1
NORTH DIJU R.F	14	Block Plantation	1.2
NORTH DIJU R.F	15	Block Plantation	3.3
NORTH DIJU R.F	18	Block Plantation	2.1
NORTH DIJU R.F	19	Block Plantation	1.0
SOUTH DIJU	1	Block Plantation	1.2
SOUTH DIJU	2	Block Plantation	11.5
SOUTH DIJU	3	Block Plantation	0.7
SOUTH DIJU	4	Block Plantation	12.9
SOUTH DIJU	5	Block Plantation	10.7
SOUTH DIJU	6	Block Plantation	0.9
SOUTH DIJU	7	Block Plantation	12.6
SOUTH DIJU	8	Block Plantation	5.9
SOUTH DIJU	9	Block Plantation	1.8
SOUTH DIJU	10	Block Plantation	6.3
SOUTH DIJU	11	Block Plantation	11.2
SOUTH DIJU	12	Block Plantation	6.0
SOUTH DIJU	13	Block Plantation	35.4
SUANG R.F	1	Block Plantation	23.4
SUANG R.F	2	Block Plantation	4.1
SUANG R.F	3	Block Plantation	192.7
SUNAIKUCHI R.F	1	Block Plantation	46.1
SUNAIKUCHI R.F	2	Block Plantation	16.5

Name of the Reserve Forest	Compartment	Plantation Type	Area_(ha)
SUNAIKUCHI R.F	3	Block Plantation	376.5
TETELIA BAGHARA R.F	1	Block Plantation	764.3
TETELIA BAGHARA R.F	2	Block Plantation	284.1
Sum			3459.9
BAGSER R.F	1	Gap Plantation	0.4
BAGSER R.F	2	Gap Plantation	9.8
BAGSER R.F	3	Gap Plantation	10.6
BAGSER R.F	4	Gap Plantation	1.6
BAGSER R.F	5	Gap Plantation	8.1
BAGSER R.F	6	Gap Plantation	4.0
BAGSER R.F	7	Gap Plantation	3.0
BARPANI R.F	1	Gap Plantation	0.0
BARPANI R.F	2	Gap Plantation	35.6
BARPANI R.F	3	Gap Plantation	0.6
DABAKA Part R.F	29	Gap Plantation	1.0
DABAKA Part R.F	30	Gap Plantation	27.3
DABAKA Part R.F	31	Gap Plantation	57.2
DABAKA Part R.F	32	Gap Plantation	110.6
DABAKA Part R.F	33	Gap Plantation	66.8
DABAKA Part R.F	34	Gap Plantation	203.2
DABAKA Part R.F	35	Gap Plantation	139.3
DABAKA Part R.F	36	Gap Plantation	64.1
DABAKA Part R.F	37	Gap Plantation	21.6
JOKOTA R.F	1	Gap Plantation	0.2
JOKOTA R.F	2	Gap Plantation	27.5
JOKOTA R.F	3	Gap Plantation	27.4
JOKOTA R.F	4	Gap Plantation	4.4
KAMAKHYA HILL R.F	1	Gap Plantation	9.7
KAMAKHYA HILL R.F	2	Gap Plantation	10.1
KAPHITALI	1	Gap Plantation	0.2
KAPHITALI	2	Gap Plantation	2.0
KAPHITALI	3	Gap Plantation	0.2
KHOLAHAT R.F	14	Gap Plantation	2.5
KHOLAHAT R.F	15	Gap Plantation	68.4
KUKURAKATA R.F	1	Gap Plantation	13.6
NORTH DIJU R.F	2	Gap Plantation	1.8
NORTH DIJU R.F	6	Gap Plantation	0.7
NORTH DIJU R.F	8	Gap Plantation	0.0
NORTH DIJU R.F	11	Gap Plantation	0.0
NORTH DIJU R.F	13	Gap Plantation	0.2
NORTH DIJU R.F	14	Gap Plantation	0.1
NORTH DIJU R.F	15	Gap Plantation	0.1

Name of the Reserve Forest	Compartment	Plantation Type	Area_(ha)
SOUTH DIJU	2	Gap Plantation	1.2
SOUTH DIJU	4	Gap Plantation	0.3
SOUTH DIJU	6	Gap Plantation	0.1
SOUTH DIJU	7	Gap Plantation	0.7
SOUTH DIJU	11	Gap Plantation	1.8
SOUTH DIJU	13	Gap Plantation	2.9
SUANG R.F	1	Gap Plantation	1.0
SUANG R.F	2	Gap Plantation	2.7
SUANG R.F	3	Gap Plantation	52.2
TETELIA BAGHARA R.F	1	Gap Plantation	19.3
TETELIA BAGHARA R.F	2	Gap Plantation	18.7
Sum			1034.8

TABLE 43: DETAILS OF THE PLANTATION PLANNED IN NAGAON

Name of the Reserve Forest	Compartment	Area (ha)
BAGSER R.F	1	284.6
BAGSER R.F	2	164.7
BAGSER R.F	3	366.7
BAGSER R.F	4	356.2
BAGSER R.F	5	384.3
BAGSER R.F	6	380.2
BAGSER R.F	7	447.1
BAMUNI R.F	1	10.4
BAMUNI R.F	2	32.0
BAMUNI R.F	3	19.3
BARBARI R.F	1	2.9
BARPANI R.F	1	12.9
BARPANI R.F	2	105.8
BARPANI R.F	3	53.0
BARPANI R.F	7	0.4
DABAKA Part R.F	29	22.8
DABAKA Part R.F	30	14.9
DABAKA Part R.F	31	63.1
DABAKA Part R.F	32	60.6
DABAKA Part R.F	33	9.1
DABAKA Part R.F	34	106.5
DABAKA Part R.F	35	80.2
DABAKA Part R.F	36	30.6
DABAKA Part R.F	37	1.6
JOKOTA R.F	1	40.2
JOKOTA R.F	2	58.3

Name of the Reserve Forest	Compartment	Area (ha)
JOKOTA R.F	3	118.1
JOKOTA R.F	4	54.7
KAMAKHYA HILL R.F	1	143.1
KAMAKHYA HILL R.F	2	158.0
KAPHITALI	1	36.4
KAPHITALI	2	75.2
KAPHITALI	3	93.7
KHOLAHAT R.F	1	57.5
KHOLAHAT R.F	2	105.2
KHOLAHAT R.F	3	131.8
KHOLAHAT R.F	4	607.6
KHOLAHAT R.F	5	224.8
KHOLAHAT R.F	6	88.2
KHOLAHAT R.F	7	173.1
KHOLAHAT R.F	8	179.6
KHOLAHAT R.F	9	233.6
KHOLAHAT R.F	10	284.2
KHOLAHAT R.F	11	158.4
KHOLAHAT R.F	12	186.3
KHOLAHAT R.F	13	337.4
KHOLAHAT R.F	14	405.1
KHOLAHAT R.F	15	280.8
KHOLAHAT R.F	16	153.9
KUKURAKATA R.F	1	765.4
LUTUMAI R.F	4	3.0
LUTUMAI R.F	5	0.3
NORTH DIJU R.F	1	24.5
NORTH DIJU R.F	2	32.0
NORTH DIJU R.F	3	27.7
NORTH DIJU R.F	4	5.8
NORTH DIJU R.F	5	21.3
NORTH DIJU R.F	6	57.0
NORTH DIJU R.F	7	36.0
NORTH DIJU R.F	8	35.2
NORTH DIJU R.F	9	73.8
NORTH DIJU R.F	10	31.3
NORTH DIJU R.F	11	36.7
NORTH DIJU R.F	12	37.4
NORTH DIJU R.F	13	23.0
NORTH DIJU R.F	14	35.5
NORTH DIJU R.F	15	51.6
NORTH DIJU R.F	16	27.2

Name of the Reserve Forest	Compartment	Area (ha)
NORTH DIJU R.F	17	31.4
NORTH DIJU R.F	18	23.4
NORTH DIJU R.F	19	53.3
NORTH DIJU R.F	20	32.2
SOUTH DIJU	1	22.2
SOUTH DIJU	2	6.9
SOUTH DIJU	3	31.0
SOUTH DIJU	4	16.0
SOUTH DIJU	5	68.6
SOUTH DIJU	6	17.5
SOUTH DIJU	7	31.9
SOUTH DIJU	8	17.0
SOUTH DIJU	9	59.1
SOUTH DIJU	10	202.6
SOUTH DIJU	11	121.8
SOUTH DIJU	12	258.2
SOUTH DIJU	13	82.3
SUANG R.F	1	253.0
SUANG R.F	2	133.1
SUANG R.F	3	1506.1
SUNAIKUCHI R.F	1	343.4
SUNAIKUCHI R.F	2	146.9
SUNAIKUCHI R.F	3	1172.2
Sum		13350.1

TABLE 44: DETAILS OF TEAK PLANTATIONS PLANNED

Name of the Reserve Forest	Compartment	Area (ha)
BAGSER R.F	1	10.6
BAGSER R.F	2	41.8
BAGSER R.F	3	62.1
BAGSER R.F	4	48.6
BAGSER R.F	5	34.6
BAGSER R.F	6	58.5
BAGSER R.F	7	50.5
BAMUNI R.F	1	0.1
BAMUNI R.F	2	1.6
BAMUNI R.F	3	1.9
BARPANI R.F	2	25.2
BARPANI R.F	3	12.5
DABAKA Part R.F	29	1.7
DABAKA Part R.F	30	20.9
DABAKA Part R.F	31	23.3
DABAKA Part R.F	32	54.8
DABAKA Part R.F	33	82.1
DABAKA Part R.F	34	53.3
DABAKA Part R.F	35	217.4
DABAKA Part R.F	36	82.4
DABAKA Part R.F	37	140.9
JOKOTA R.F	1	0.4
JOKOTA R.F	2	8.0
JOKOTA R.F	3	8.8
JOKOTA R.F	4	1.7
KAMAKHYA HILL R.F	1	25.9
KAMAKHYA HILL R.F	2	21.9
KAPHITALI	1	6.6
KAPHITALI	2	7.1
KAPHITALI	3	11.2
KHOLAHAT R.F	1	1.8
KHOLAHAT R.F	2	15.8
KHOLAHAT R.F	3	9.4
KHOLAHAT R.F	4	92.1
KHOLAHAT R.F	5	44.2
KHOLAHAT R.F	6	23.2
KHOLAHAT R.F	7	45.9
KHOLAHAT R.F	8	33.4
KHOLAHAT R.F	9	35.7
KHOLAHAT R.F	10	95.9

Name of the Reserve Forest	Compartment	Area (ha)
KHOLAHAT R.F	11	56.0
KHOLAHAT R.F	12	62.1
KHOLAHAT R.F	13	69.3
KHOLAHAT R.F	14	100.5
KHOLAHAT R.F	15	63.7
KHOLAHAT R.F	16	25.8
KILING R.F	1	0.5
KUKURAKATA R.F	1	145.6
NORTH DIJU R.F	1	4.9
NORTH DIJU R.F	2	5.3
NORTH DIJU R.F	3	3.0
NORTH DIJU R.F	4	0.6
NORTH DIJU R.F	5	2.4
NORTH DIJU R.F	6	4.5
NORTH DIJU R.F	7	3.7
NORTH DIJU R.F	8	10.9
NORTH DIJU R.F	9	8.9
NORTH DIJU R.F	10	5.1
NORTH DIJU R.F	11	6.9
NORTH DIJU R.F	12	16.0
NORTH DIJU R.F	13	5.7
NORTH DIJU R.F	14	10.4
NORTH DIJU R.F	15	24.8
NORTH DIJU R.F	16	4.0
NORTH DIJU R.F	17	7.4
NORTH DIJU R.F	18	4.9
NORTH DIJU R.F	19	8.2
NORTH DIJU R.F	20	14.2
SOUTH DIJU	1	3.2
SOUTH DIJU	2	17.6
SOUTH DIJU	3	4.0
SOUTH DIJU	4	2.9
SOUTH DIJU	5	1.0
SOUTH DIJU	6	3.9
SOUTH DIJU	7	3.1
SOUTH DIJU	8	0.3
SOUTH DIJU	9	3.7
SOUTH DIJU	10	17.1
SOUTH DIJU	11	38.2
SOUTH DIJU	12	28.7
SOUTH DIJU	13	29.9
SUANG R.F	1	41.3

Name of the Reserve Forest	Compartment	Area (ha)
SUANG R.F	2	32.6
SUANG R.F	3	243.7
SUNAIKUCHI R.F	1	145.0
SUNAIKUCHI R.F	2	78.8
SUNAIKUCHI R.F	3	504.1
TETELIA BAGHARA R.F	1	71.9
TETELIA BAGHARA R.F	2	22.2
Sum		3482.3

DRAFT

Annexure II: Notification of Formation of District REDD+ Committee



GOVT. OF ASSAM
OFFICE OF THE DEPUTY COMMISSIONER :: :: NAGAON
Phone: 03672-233185 (O) / 233202(R) / 233193 (F),
E-mail: dc-nagaon@nic.in

No. DCNPA 24/2016/7

Dated 30/01/2017

To,

1. Chief Executive Officer, Zilla Parishad, Nagaon.
2. Principal Secretary, Tiwa Autonomous Council.
3. Chairman, Nagaon Municipality Board, Nagaon.
4. Chairman, Dhing Municipality Board, Dhing.
5. Chairman, Raha Town Committee, Raha.
6. Chairman, Kampur Town Committee, Kampur.
7. Project Director, DRDA, Nagaon. ✓
8. Divisional Forest Officer (W.L.), Nagaon Division, Nagaon.
9. Divisional Forest Officer (Social Forestry), Nagaon Division, Nagaon.
10. Sub-Divisional Officer (Civil), Kaliabor.
11. District Agriculture Officer, Nagaon. ✓
12. Divisional Officer, Soil Conservation, Nagaon.
13. District Animal Husbandry and Veterinary Officer, Nagaon ✓
14. District Fishery Development Officer, Nagaon.
15. District Social Welfare Officer, Nagaon.
16. Joint Director of Health Services, Nagaon.
17. Dy. Director, Food and Civil Supplies and Consumer Affairs, Nagaon.
18. Sub-Divisional Welfare Officer, Nagaon.

Sub: Regarding nomination of Nodal Officer and submitting details of two schemes / programmes with high potential of convergence with the REDD+ project.

Ref: Govt. Notification No. APFBC/PMU/COMP-4/REDD+/Cell/2016 Dated 06/12/2016.

Sir/ Madam,

With reference to the subject above and as per the decision taken in the District REDD+ meeting held on 05/12/2016, wherein the line departments of Nagaon District has to nominate a Nodal Officer from each of the participating Department with contact details and submit atleast 2 (two) schemes / programmes with high potential of convergence with the REDD+ project to Divisional Forest Officer, Nagaon.

Therefore, you are requested to submit the same to Divisional Forest Officer, Nagaon at the earliest with a copy to the undersigned accordingly.

This may be treated as Most Priority.

Encl: As stated above.
(three copies)

Memo No. DCNPA 24/2016/7(A)

Copy for favour of information and necessary action to :

1. The Member Secretary REDD+ Cell, Assam, Panjabari, Guwahati-37.
2. The Conservator of Forest, Norther Assam Circle, Tezpur.
3. Addl. Deputy Commissioner (Forest), Nagaon.
4. Divisional Forest Officer (T), Nagaon Division, Nagaon.
5. Office copy.

Yours Faithfully,

(Shamsher Singh, IAS)
DEPUTY COMMISSIONER,
NAGAON

Dated 30/01/2017

(Shamsher Singh, IAS)
DEPUTY COMMISSIONER,
NAGAON

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(C)

**GOVERNMENT OF ASSAM
PROJECT MANAGEMENT UNIT
ASSAM PROJECT OF FOREST AND BIODIVERSITY CONSERVATION SOCIETY
ARANYA BHAWAN, PANJABARI :: GUWAHATI-37**

No APFBC/PMU/COMP-4/REDD+/Cell/2016

6th Dec 2016

The Assam State Action Plan on Climate Change (2015-2020) has been launched as a convergent plan for taking up mitigation and adaptation measures for addressing the issues arising out of climate change. According to IPCC 20-60% of the cumulative mitigation could be provided by the land sector by 2030. Hence it is imperative that a landscape approach for project planning and implementation is taken up. Further, mitigation actions in the land sector, viz conservation, sustainable management, and restoration of degraded forests will not only reduce emissions, but also open up cost effective ways to build resilient livelihoods to help communities adapt to impacts of climate change. This has become an imperative under a new instrument "Reducing Emissions from Deforestation and Forest Degradation (REDD+)".

2 pilot projects under REDD+ have been approved for implementation in the districts of Nagaon and Majuli under the Assam Project. In pursuance of the decisions taken at the REDD+ launch meeting on 16.11.2016 chaired by Chief Secretary, Assam district level REDD+ committees are constituted for Nagaon and Majuli as follows:

Nagaon district

1. Deputy Commissioner – Nagaon	Chairman
2. CEO Zilla Parishad	Member
3. Principal Secretary, Tiwa Autonomous Council	-do-
4. Project Director, DRDA	-do-
5. Divisional Forest Officer (Wildlife), Nagaon	-do-
6. Divisional Forest Officer (Social Forestry), Nagaon	-do-
7. Additional Deputy Commissioner (Forests)	-do-
8. SDO (Civil), Kaliabor	-do-
9. District Agriculture Officer	-do-
10. Divisional Officer, Soil Conservation	-do-
11. District Veterinary Officer	-do-
12. District Fishery Development Officer	-do-
13. Chairman, Nagaon Municipal Board	-do-
14. Chairman Dhing Municipal Board	-do-
15. Chairman, Raha Town Committee	-do-
16. Chairman, Kamrup Town Committee	-do-
17. District Social Welfare Officer	-do-
18. Joint Director Health Services	-do-
19. Dy Director Food and Civil Supplies	-do-
20. Sub Divisional Welfare Officer	-do-
21. Technical expert on REDD+ and carbon markets	-do-
21. Divisional Forest Officer, Nagaon	Member Secretary

4


Majuli district

1. Deputy Commissioner	Chairman
2. CEO Zilla Parishad	Member
3. Principal Secretary, Mising Autonomous Council	-do-
4. Project Director, DRDA	-do-
5. Additional Deputy Commissioner	-do-
6. Divisional Forest Officer, Jorhat	-do-
7. Assistant Commissioner	-do-
8. Majuli Cultural Landscape Management Authority	-do-
9. District Agriculture Officer	-do-
10. District Soil Conservation Officer	-do-
11. District Veterinary Officer	-do-
12. District Fishery Development Officer	-do-
13. Chairman, Majuli Municipal Board	-do-
14. District Social Welfare Officer	-do-
15. District Transport Officer	-do-
16. Joint Director Health Services	-do-
17. Dy. Director Food and Civil Supplies	-do-
18. A.E., PWD (Roads)	-do-
19. A.E., PWD (Buildings)	-do-
20. Char Areas Development Authority	-do-
21. Sub Divisional Welfare Officer	-do-
22. Technical expert on REDD+ and carbon markets	-do-
22. Divisional Forest Officer (Social Forestry), Golaghat	Member Secretary

Other members can be co-opted as required.

Terms of Reference

1. Meet at least once every month or as and when required;
2. Facilitate capacity building of key functionaries of participating Departments
3. Synergize resources during design, planning and implementation of the project.
4. Monitor progress of the project and suggest corrective measures
5. Encourage sharing of best practices from within the State as well as outside to enable development of a model mitigation project
6. Ensure convergence of budgets and schemes of various departments towards forest conservation, sustainable management and land use, and safeguards (benefits) for local communities
7. Collaboration with Assam Energy Development Agency (AEDA) shall be set up.
8. Create awareness among the people, including schools and colleges, about climate change and the benefits from the project.


7/12/16
(Alka Bhargava)
APCCF (REWP) &
Member Secretary RED+ Cell

6

MDC (AS)



GOVT. OF ASSAM
OFFICE OF THE DIVISIONAL FOREST OFFICER, NAGAON DIVISION, NAGAON

Letter No. FNGT/B/REDD+/Nagaon/2016/4,837

Date-19/12/2016

To
The Deputy Commissioner &
Chairman,
Nagaon District REDD+ Project, Nagaon.

Subject: Nagaon District Committee on REDD+ activities.

Reference: Meeting on REDD+ pilot project of Nagaon District held on 05/12/16 in the Conference Hall of the Deputy Commissioner, Nagaon.

Sir,

With reference to the subject cited above, I have the honour to inform you that the Member Secretary REDD+ Cell, Assam has published a Notification vide No. APFBC/PMU/COMP-4/REDD+/Cell/2016 dtd. 06/12/2016, wherein the line departments of Nagaon District are nominated as Members of the Nagaon District REDD+ Committee, copy of which is enclosed herewith for your ready reference.

In this connection, mention may be made that, a Nodal Officer from each of the participating department should be nominated and the name & other details of the Nodal Officer, should be submitted to the undersigned, being Member Secretary of the District Committee as per decision of the District REDD+ meeting held on 05/12/2016. Further, the participating departments should submit at least 2 (two) schemes / programmes with high potential of convergence with the REDD+ project.

Therefore, I request your kind honour to direct the concerned departments to nominate their Nodal Officer and submit schemes under REDD+ project, pertaining to Nagaon District at the earliest.

This is for favour of your kind information and necessary action.

*Branch
let up in REDD+
File
20/12*

(Signature)
(Deepika Chaudhary, IFS)
Divisional Forest Officer
Nagaon Division, Nagaon

Letter No. FNGT/A/REDD+/Nagaon/2016/4,060-61

Date-19/12/2016

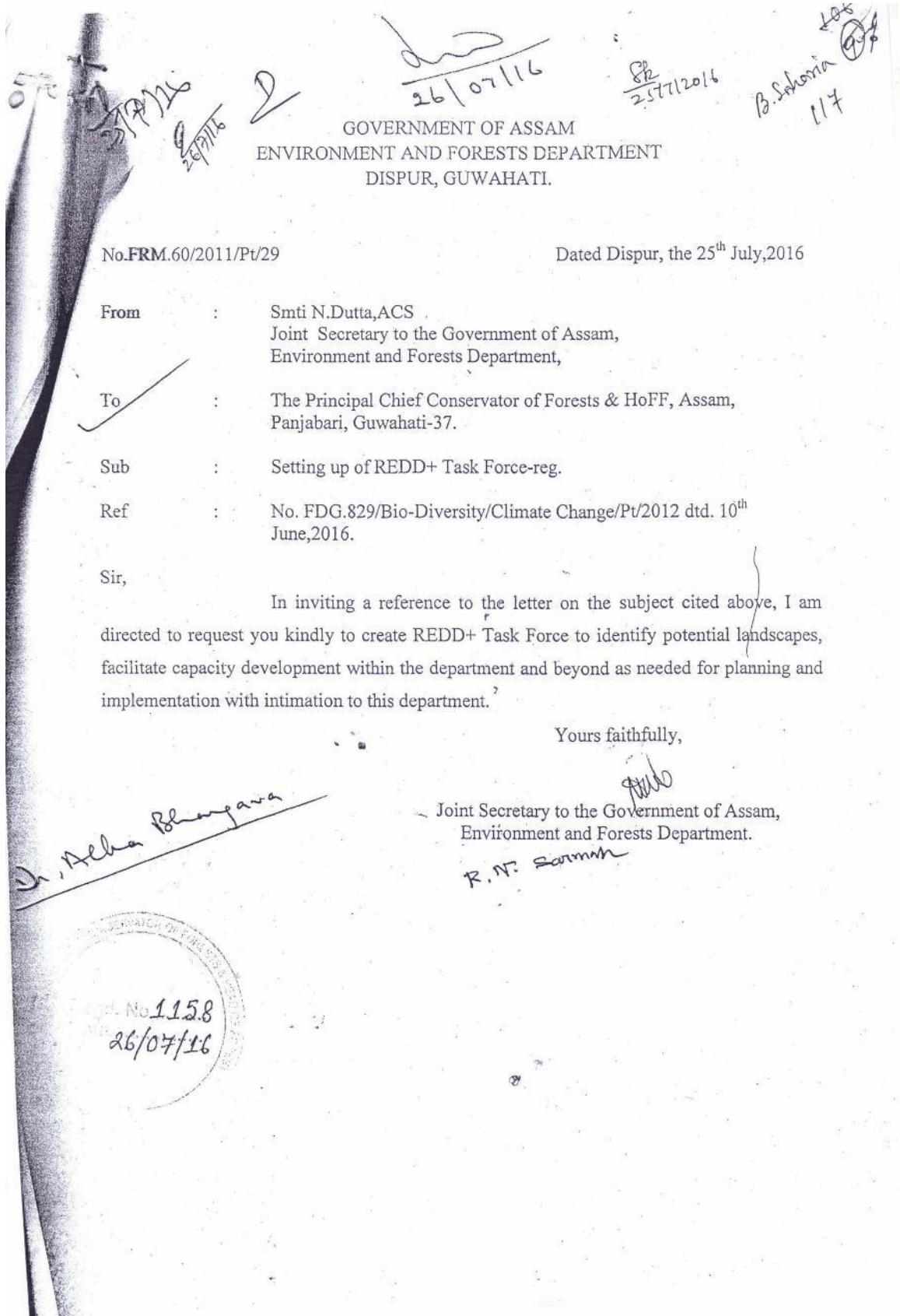
Copy forwarded for favour of kind information to -

1. The Member Secretary REDD+ Cell, Assam, Panjabari, Guwahati - 37.
2. The Conservator of Forests, North Assam Circle, Tezpur.

Jak Management System
No. 113030
Date 20/12/16
Hc Forest.
Branch Officer / Officer
Deputy Commissioner's Office
Nagaon (Assam)

(Deepika Chaudhary, IFS)
Divisional Forest Officer
Nagaon Division, Nagaon

Annexure III: Notification of Formation of REDD+ Task Force



GOVERNMENT OF ASSAM
ENVIRONMENT AND FORESTS DEPARTMENT
DISPUR, GUWAHATI.

No. FRM.60/2011/Pt/29

Dated Dispur, the 25th July, 2016

From : Smti N. Dutta, ACS
Joint Secretary to the Government of Assam,
Environment and Forests Department,

To : The Principal Chief Conservator of Forests & HoFF, Assam,
Panjabari, Guwahati-37.

Sub : Setting up of REDD+ Task Force-reg.

Ref : No. FDG.829/Bio-Diversity/Climate Change/Pt/2012 dtd. 10th
June, 2016.

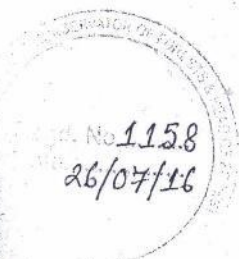
Sir,

In inviting a reference to the letter on the subject cited above, I am directed to request you kindly to create REDD+ Task Force to identify potential landscapes, facilitate capacity development within the department and beyond as needed for planning and implementation with intimation to this department.

Yours faithfully,

Joint Secretary to the Government of Assam,
Environment and Forests Department.

R. N. Sarma



Annexure IV: Notification of Formation of State level REDD+ Cell

22/48

**GOVERNMENT OF ASSAM
ENVIRONMENT AND FOREST DEPARTMENT
DISPUR, GUWAHATI-6**

NOTIFICATION

Dated Dispur, the 23rd September, 2016

No. FRM.60/2011/Pt/32 : The Governor of Assam is pleased to constitute the REDD+ Cell for Inter Departmental coordination in efforts for enhancing green cover and reduction of emission of the State with the following members and with immediate effect and until further orders :

- | | |
|---|--------------------|
| 1. The Principal Secretary to the Govt. of Assam,
Environment & Forest Department. | - Chairman |
| 2. The Secretary, Agriculture Department | - Member |
| 3. The Secretary, Horticulture Department | - Member |
| 4. The Secretary Soil Conservation Department. | - Member |
| 5. The Secretary, Water Resources Department. | - Member |
| 6. The Secretary, Panchayat & Rural Development Deptt. | - Member |
| 7. The Secretary, WPT & BC Department | - Member |
| 8. Nodal Officer, Environment & Climate Change Cell | - Member |
| 9. An expert with domain knowledge of REDD+ | - Member |
| 10. The Addl. PCCF (RE& WP), & CD-4 | - Member Secretary |

Sd/- Ali Askar, ACS,
Secretary to the Govt. of Assam
Environment & Forest Department
Dated Dispur, the 23rd September, 2016

Memo No. FRM.60/2011/Pt/32 -A

Copy to :-

- 26/9/16
Tulu
1. The P.S. to Hon'ble Minister, Environment & Forests Department, Dispur, Guwahati-6.
 2. The P.S. to Principal Secretary Environment & Forests Department, Dispur, Guwahati-6.
 3. The Principal Chief Conservator of Forest, & HoFF, Assam, Panjabari, Guwahati-37.
 4. The Principal Chief Conservator of Forest(W/L) Assam, Basistha, Guwahati-29.
 5. The P.S. to Secretary, Agriculture Department, Dispur, Guwahati-6.
 6. The P.S. to Secretary Horticulture Department, Dispur, Guwahati-6.
 7. The P.S. to Secretary, Soil Conservation Department, Dispur, Guwahati-6.
 8. The P.S. to Secretary, Water Resource Department, Dispur, Guwahati-6.
 9. The Commissioner & Secretary to the Govt. of Assam, Science and Technology Department, Dispur, Guwahati-6.
 10. The P.S. to Secretary, Panchayat & Rural Development Department, Dispur, Guwahati-6.
 10. The P.S. Secretary, WPT & BC Department, Dispur, Guwahati-6.
 11. Nodal Officer, Environment & Climate Change Cell, Environment & Forests Department, Dispur, Guwahati-6.
 - ✓ 12. The Addl. PCCF (RE& WP), O/o. the Principal Chief Conservator of Forests & HoFF, Assam, Panjabari, Guwahati-37.

By order etc.,

Joint Secretary to the Govt. of Assam,
Environment and Forest Department







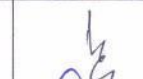







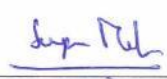
Annexure V: Attendance of REDD+ Meeting at the Office of the Chief Secretary, Government of Assam

MEETING UNDER CHAIRMANSHIP OF CHIEF SECRETARY TO DISCUSS REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION (REDD) HELD ON 16-11-16 AT 3-30 PM IN THE CONFERENCE ROOM OF CHIEF SECRETARY, ASSAM.

MEMBERS PRESENT :-

SL. NO.	NAME	DESIGNATION	SIGNATURE
01.	SHRI V. K. PIPERSENIA, IAS	CHIEF SECRETARY, ASSAM	
02.	D. MATHUR	PCCF & HOFF	
03.	AK Jhansi	APCCF (BLCE)	
04.	V. B. Pyarelal	Addl. CS, P&RD, Finance	 16.11.16
05.	S K Surantam	APCCF (DUAR)	 16.11.16
06.	P. SIVAKUMAR	CF, NBR, TELPDR	 16/11/16
07.	M. Tungnung	CF, EAC, Jorhat	
08.	G. Saikia	D.F.O (SF) Golaghat	
09.	A. Hazne	Secy, Forest Conservation	
10.	Armit Saha	APCCF (Adm & Vig)	
11.	Santam Basu	Sr. Manager, JORA Ecological Solutions	
12.	ALI ASKAR	Secretary, Environment & Forest Dept.	 16/11/16

MEMBERS PRESENT :-

SL. NO.	NAME	DESIGNATION	SIGNATURE
13.	K.K. MITTAL	Asst. CS. Agriculture	
14.	A. D. Baruah	CCF (CAC) & OSD Dept. of EOP	
15.	Alka Bhargava	APCCF (REWP)	
16.	P.K. Haryani	CS & WOT & DC	
17.	S. Ramthar dupa	DC Nagaon	
18.	Deepika chandelkey	DFO Nagaon	
19.	Sanjiv Kumar	DCF (RE)	
20.	Bomi Baruah	ADC Nagaon	
21.	Sukhas Kadam	ACF Nagaon	
22.	ASHWIN. A.S.	Ss. Namayis, IORA	
231.	J. A. Ahmad.	ACE, Golaghat S.F. Div ⁿ .	
24.	D. R. N. Goswami	Gr Manager, IORA	
25.	Sudipam Debbar	IORA	
26.			
27.			

Annexure VI: Proceedings from the District Development Committee Meeting, Nagaon



GOVT. OF ASSAM
OFFICE OF THE DEPUTY COMMISSIONER ::::::::::: NAGAON
(DECENTRALISED PLANNING BRANCH)
Phone : 03672-233185 (O) 233222 / 233193 (F)
E-mail : dc-nagaon@nic.in

Minutes of DDC Meeting for the month of July/2017.

Venue : JUNGAL BOLAHUGARH, RAHA, NAGAON.
Time : 11.00 A.M.
Date : 05/07/2017

(Members present in the meeting is in Annexure-I)

The DDC meeting for the month of July/2017 was held on 05/07/2017 at Jongal Batalugarh, Raha, Nagaon. The meeting was presided over by Sri Shamsheer Singh, IAS, Deputy Commissioner and assisted by Smti Punam Rao Borah, ACS, District Development Commissioner, Nagaon. At the outset District Fishery Development officer welcomed all the members present in the meeting and briefed about the Historical background of Jungal Balahu Garh covering with 42 hect. Land and 21 hect. of Water body.

Session - I : Discussion on REDD+ Programme was initiated by representative of IORA (Ecological solution Pvt. Ltd.). The representative elaborated the importance of REDD+ (Reduction of Emissions from deforestation and Forest degradation) Pilot project in Nagaon District in view of lowering emissions and enhancing forests (LEAF) in Nagaon. Through Power Point the background of REDD+, vision for jurisdiction of REDD+ Pilot project in Nagaon, roles of departments for convergence of schemes, data required for development of the project and outcomes with timelines were shown.

DECISION i) The concerned department like Forest, Social Forestry, Agriculture, A.H.& Vety., Fishery, Panchayat Rural Devt., APDCL, Water Resource and other line department were instructed for convergence of their schemes and take up schemes with reconciled boundary for the REDD+ Pilot project.

ii) All departments will nominate Nodal Officer for REDD+ within 2/3 days and prepare strategy to achieve the goal for providing sustainable livelihood to the public.

iii) It was instructed to provide presentation copy to all heads of the Departments.

Session - II : Review of last DDC Minutes /issues discussed and decisions taken are summarized as follows:

FLAGSHIP PROGRAMME:- Regarding erection of standi about important Flagship Programme, the concerned heads of the department who have not yet erected were directed to erect Standi on important Flagship programme in their own offices within one week. The size of the standi should be standard and as per the standi of Deputy Commissioners Office.

AGRICULTURE:- The DAO reported that for selection of location and beneficiaries, guidelines of C.M.s Samagra Grammya Unuayan Yojana have already been distributed and after selection of group, action plan will be prepared.

BAGAN BAZAR:- Discussing about Bagan Bazar, the DPO NLM informed that letters have been issued to Garden Management in this regard.

DECISION i) The DPO, NLM was instructed to take initiative for construction of Market Shed under Bagan Bazar scheme in collaboration with garden management and the Food & Civil Supplies department.

CO-OPERATIVE SOCIETIES:- Regarding about progress of Cooperative movements the Official of BRCS Orkut was directed to organize a workshop with all coop. societies Nagaon, wherein the representative from successful coop. societies should attend in the workshop and discuss their strategy adopted by such societies for benefit of other societies. The workshop should be held within this month.

Contd.....

PWD STATE ROADS DIVISION (PMGSY):- The EE, PWD, State Road informed that a meeting with the Higher Authority was held for sorting out the problem for construction of Road under World Bank Project Sani Mandir to Naltoli and now the issues are solved. Regarding half done work, EE PWD Rural Road informed that proposal for 6 nos half done was submitted.

DECISION: i) The Chair directed all concerned HOD for submission of list of half done/ abandoned works if any for necessary intervention with the concerned authority.

Other Issues:- EE PHE Nagaon was instructed to submit list of beneficiaries which were left out from the baseline survey report for construction of IHHL and also for community toilet so that these could be taken up under MGNREGA.

On being requested by DPM, NLM for vaccination of SHG's animals, the Chair suggested A.H. Vety Officer to give guidance to DPM, NLM for vaccination of the animals of SHGs. DSWO reported that a few AWC are affected by flood. She also informed that some AWC are not functioning and therefore fund has not been released to them. The Chair directed her convene a meeting with their organization for taking action.

Miscellaneous:-

- DFDO will furnish Proposal for development Jungal Balhugarh seed farm as a tourist destination.
- The JDHS will meet Deputy Commissioner for discussion of damage health institutions.
- The Chair informed all HOD that as per the Govt. Notification vide No AR. 46/2017/15 dated 18th April/2017, the Planning and Development Deptt. Govt of Assam is renamed as "Transformation and Development Deptt."
- All heads of department are directed to submit ATR of DDC meeting separately by 15th to 20th of each month with one officer so that this could be uploaded in DDC MIS.
- All Heads of the Departments were directed to submit their report in both hard and soft copy. He also directed all Heads of Department to keep ready a power point presentation of their department to be presented in DDC meeting on or before 3rd August/2017 without fail. The next DDC meeting for the month of August will be held on 05/08/2017 at 11:00 A.M. in the Conference Hall of Deputy Commissioner's Office, Nagaon.

The meeting ended with vote of thanks from the chair.

Sd/
(Shamsher Singh, IAS)
Deputy Commissioner,
Nagaon.

Memo No. NDC(D) 115/2014/Pt.-I/155 (A)

Date:18/07/2017

Copy forwarded to:

1. The Addl. Chief Secretary to the Govt. of Assam, P&D Department, Dispur, Guwahati-6 for kind information.
2. The Commissioner & Secretary to the Hon'ble Chief Minister, Assam, Guwahati-6 for kind information.
3. The Commissioner, Central Assam Division, Nagaon Camp Guwahati for kind information.
4. The S.O. to C.S. to the Govt. of Assam for kind appraisal of Chief Secretary.
5. The Director, DCP Division, T&D Department, Dispur for kind information.
6. The Director, Evaluation & Monitoring Division, Transformation & Development Department, Dispur for kind information.
7. The Circle Officer, Nagaon Sadar / Dhing / Raha / Kaliabor and Kampur Revenue Circle for information and necessary action.
8. The DIO, NIC, Nagaon. He is requested to upload the DDC minutes in the District Website urgently.
9. All Members of DDC for information and necessary action.
10. Office copy.

Deputy Commissioner,
Nagaon