

Project Closure Report

**Estimation of Potential Value of
Ecosystem Services and
Development of REDD+ Project for
Assam (TA -9)**

Developed for
Assam Forest Department
under the aegis of
**Assam Project on Forest and
Biodiversity Conservation**

Submitted by
IORA Ecological Solutions Pvt. Ltd.





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as per

Contract No: AVOM-PVE-C-ES-2/34/CDM-2/35

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Abbreviations

AFD	Assam Forest Department
APFBC	Assam Project on Forest and Biodiversity Conservation
CH ₄	Methane
tCO _{2e}	Tons of Carbon dioxide equivalent
DFO	Divisional Forest Officer
EDC	Eco-Development Committee
EE	Executive Entity
FSI	Forest Survey of India
GHG	Greenhouse Gas
GoI	Government of India
GPG-LULUCF	Good Practice Guidelines on Land Use, Land Use Change and Forestry
GWP	Global Warming Potential
ICS	Improved Cook Stove
IORA	IORA Ecological Solutions Pvt. Ltd.
IPCC	Intergovernmental Panel on Climate Change
IPCC	Intergovernmental Panel on Climate Change
ISFR	Indian State Forest Report
JFMC	Joint Forest Management Committee
LEEF	Lowering Emission Enhancing Forests
LPG	Liquefied Petroleum Gas
LULC	Land Use Land Cover
MoEFCC	Ministry of Environment, Forest and Climate Change
MRV	Monitoring Reporting & Verification
NTFP	Non Timber Forest Produce
PA	Project Area
PDD	Project Design Document
REDD+	Reduction in emission from deforestation and degradation of forest lands, conservation of forest carbon, enhancement of forest carbon and sustainable forest management
RS/GIS	Remote Sensing and Geo-Information System
SACReD	Sustainable Actions for Climate Resilient Development in Majuli
SAPCC	State Action Plans on Climate Change
tCO _{2e}	Tons of Carbon Dioxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change

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Introduction

Visible changes in climatic patterns the world over have raised concern over the present and future impacts of climate change on the various parameters affecting humans and biodiversity at large. Around 25% emissions are from agriculture, forestry and other land uses making it the largest emitter after the energy sector. 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 Reducing Emissions from Deforestation and Forest Degradation (REDD+) which was agreed to in the Paris negotiations.

Assam is home to the Eastern Himalayan ecosystem, a biodiversity hotspot. The forests in these landscapes contain natural stocks of high environmental, economic and cultural value, and provide services to 32 million people¹ spread across more than 26,000 villages (2001 census) and 110 towns². However, forest of Assam are increasingly facing disturbances and degradation owing to many reasons³, *inter alia*, increase in demand of natural resources, encroachment in forest land, rotational felling in tea gardens, biotic pressure and shifting cultivation⁴. The drivers active in this region, the land tenure system, traditional forest resource management practices, shifting cultivation etc. pose unique challenges in conserving these forests. REDD+ is an effective instrument which can fast-track conservation of the threatened high value forests of Assam.

In this context, the Assam Project on Forest and Biodiversity Conservation (APFBC) has decided to kick start the state level readiness process for REDD+ by developing a pilot project in Assam, and initiated a public tendering process to procure the services of consultant to assist the Assam Forest Department (AFD) in this activity. IORA Ecological Solutions Pvt. Ltd. (mentioned as IORA hereinafter) was awarded the consultancy (award number- AVOM-PVE-C-ES-2/34/CDM-2/35) and shall be assisting AFD in developing the REDD+ project. In the course of the development of the project the Assam Forest Department decided to choose two landscapes – Nagaon and Majuli. The Assam REDD+ project in Nagaon, and a low emission development strategy for the district of Majuli. The project activities were respectively named **Lowering Emission, Enhancing Forests (LEEF) in Nagaon** and **Sustainable Actions for Climate Resilient Development (SACReD) in Majuli**. Start of both these projects were launched by the Chief Secretary, government of Assam on 16th November 2017. This Project Closure Report for the project has been developed to detail out the methodology and step-by-step approach which was adopted in developing these projects; actions and results.

REDD+ and Carbon Neutrality

REDD+ is an emerging international mechanism, negotiated under the UNFCCC, to incentivize activities that reduce greenhouse gas (GHG) emissions arising out of deforestation and degradation of forest lands, conservation of forest carbon stocks, sustainable forest management and increasing the carbon stocks in forest lands. The critical nature of REDD+ in mitigating climate change is evident by the fact that a whole article (article 5) of Paris

¹ <http://assam.gov.in/>

² http://censusindia.gov.in/towns/asm_towns.pdf

³ <http://www.fao.org/docrep/ARTICLE/WFC/XII/>

⁴ http://asmenvis.nic.in/Database/Hazards_840.aspx

Agreement dedicated to REDD+. REDD+ is in advanced stages of development worldwide. Techniques, methods and tools on procedural frameworks to quantify baseline emissions, project emission savings, geo-spatial analysis, socio-economic assessment and monitoring & reporting of activities are being developed and deployed. REDD+ projects have been initiated in some of the states in India also. Initiating a REDD+ project in the state at this stage gives India and Assam a good opportunity to be on the forefront of REDD+ implementation, and influence its development globally.

Assam is home to the Eastern Himalayan ecosystem, a biodiversity hotspot. The forests in these landscapes contain natural stocks of high environmental, economic and cultural value, and provide services to 32 million people⁵ spread across more than 26,000 villages (2001 census) and 110 towns⁶. However, forest of Assam are increasingly facing disturbances and degradation owing to many reasons⁷, *inter alia*, increase in demand of natural resources, encroachment in forest land, rotational felling in tea gardens, biotic pressure and shifting cultivation⁸. The drivers active in this region, the land tenure system, traditional forest resource management practices, shifting cultivation etc. pose unique challenges in conserving these forests. REDD+ is an effective instrument which can fast-track conservation of the threatened high value forests of Assam. In this context, the Assam Project on Forest and Biodiversity Conservation (APFBC) has decided to kick start the state level readiness process for REDD+ by developing a pilot project in Assam, and initiated a public tendering process to procure the services of consultant to assist the Assam Forest Department (AFD) in this activity.

Carbon neutrality refers to achieving a net zero carbon footprint or net zero carbon emissions by decreasing the Greenhouse Gas emissions and balancing the emissions by offsetting them against sequestration. This process can be applied to a process, event, business or landscape. Many businesses are striving to become carbon neutral, owing to their environmental commitments and pressures from the shareholders. International standards such as ISO 14064 have been developed to account emissions from businesses and industrial processes. However a landscape based approach at controlling emissions is at the nascent stage in India; and the State of Assam will be the torch bearer in establishing the pathway for achieving carbon neutrality at a jurisdictional basis. This will be very helpful in combating climate change, building resilience and will feed into the SDGs. Both the actions also will feed into the country's NDC commitments.

Vision

- Pioneer climate resilient and mitigation actions in India and pave way for landscape based GHG mitigation and adaptation work which will contribute to India's NDC commitments and the State's SDGs. Through this project, specifically:
 - o To assist the State of Assam in conserving and enhancing its forest carbon stock and develop capacity in utilizing national and/or international incentive mechanisms on climate change and forestry by developing a REDD+ pilot project in Assam.

⁵ <http://assam.gov.in/>

⁶ http://censusindia.gov.in/towns/asm_towns.pdf

⁷ <http://www.fao.org/docrep/ARTICLE/WFC/XII/>

⁸ http://asmenvi.nic.in/Database/Hazards_840.aspx

- To assist the State of Assam in developing climate resilient actions by implementing and launching India's first district level carbon neutral project.

Objectives

The objectives of the project is to support AFD in the following:

1. Establish an inter-departmental REDD+ Cell and an intra-departmental REDD+ Task Force in Assam.
2. Develop a pilot REDD+ project in Nagaon and Carbon Neutrality project in Majuli and document it in an appropriate template.
3. Analyse drivers and agents of forest change and GHG emissions corresponding to the project landscape with reference to meeting the objective given in point 2 above.
4. Develop a baseline using RS/GIS techniques and ecological data analysis, based on nationally and internationally accepted guidelines, with reference to meeting the objective given in point 2 above.
5. Develop a REDD+ implementation plan to reduce emissions due to drivers of deforestation and degradation of forest lands and enhance positive drivers of forest change in the chosen landscape. The implementation plan will be synchronised with Working Plan(s) and associated activities of the forest department. Further, convergence with other departments, leverage of private sector finance and finally identifying possible international and national/international sources for leveraging ecosystem (carbon) finance will be explored.
6. Training and capacity building of Assam Forest Department personnel to take control of the project during its implementation.
7. Identify and propose a benefit sharing mechanism and recommend safeguard measures for forest dwellers.
8. Develop communication tools for publicising the efforts to decrease emissions from forests in Assam.
9. Assist AFD in accessing national and/or international finance on REDD+ and forestry.

The specific objectives for SACReD project included:

A. Carbon neutral Majuli

1. Establish sector wise GHG emission base line and emission projections till 2020.
2. Identify the most feasible low Carbon interventions and quantify their respective emission reduction potential and estimate the costs involved
3. Estimate plantation requirement to sequester the residual emissions
4. Establish a registry of annual emissions and interventions to Measure, Review and Verify (MRV) the year to year emission reductions achieved w.r.t base line

B. Actions towards strengthening river bank to avoid erosion

5. Develop a draft NAF project on bioengineering for erosion control in Majuli

C. Identifying community climate risks and developing strategies towards a Climate Resilient Majuli

6. Undertake survey to assess the level of vulnerability of the communities to floods and erosion faced by Majuli annually
7. Undertake literature survey to assess the level of the vulnerabilities due to likely escalation of the hazards
8. Design strategies to ameliorate the impacts and adapt to the changes.

Inception phase

The sections below explain actions undertaken beginning creation of institutional structure and landscape selection; which was common for both the projects. Then we move onto explaining the major components of each project and learnings from the actions.

Institutional structure

The Ministry of Environment, Forest and Climate Change in its Reference Document for REDD+ in India and in its draft National Policy on REDD+ has defined the essential elements of REDD+ framework. As per the Reference document for REDD+ in India, REDD+ cells are to be established in every state (also called the Sub-National level). This REDD+ cell shall be coordinated by the State Forest Department with representations from other relevant organizations. In accordance to this, the REDD+ Task force was constituted vide notification no. FRM.60/2011/Pt/29 dated 25/07/2016 to coordinate day to day implementation of REDD+ activities in the state. Following this, the REDD+ Cell was constituted vide notification FRM.60/2011/Pt/32 dated 23/09/2016. The REDD+ Cell functions under the overall guidance of the Chief Secretary with the main mandate to coordinate interdepartmental convergence. Once these two institutes were formed, under their guidance district REDD+ committees were in Majuli and Nagaon were notified vide APFBC/PMU/COMP-4/REDD+/Cell/2016 dated 06/12/2016. The REDD+ committees were tasked with development of the projects. These notices have been provided in Annexure I, Annexure II and Annexure III to this report. The REDD+ Cell, Task Force and the district committee played crucial roles in the successful development of the design of the projects.

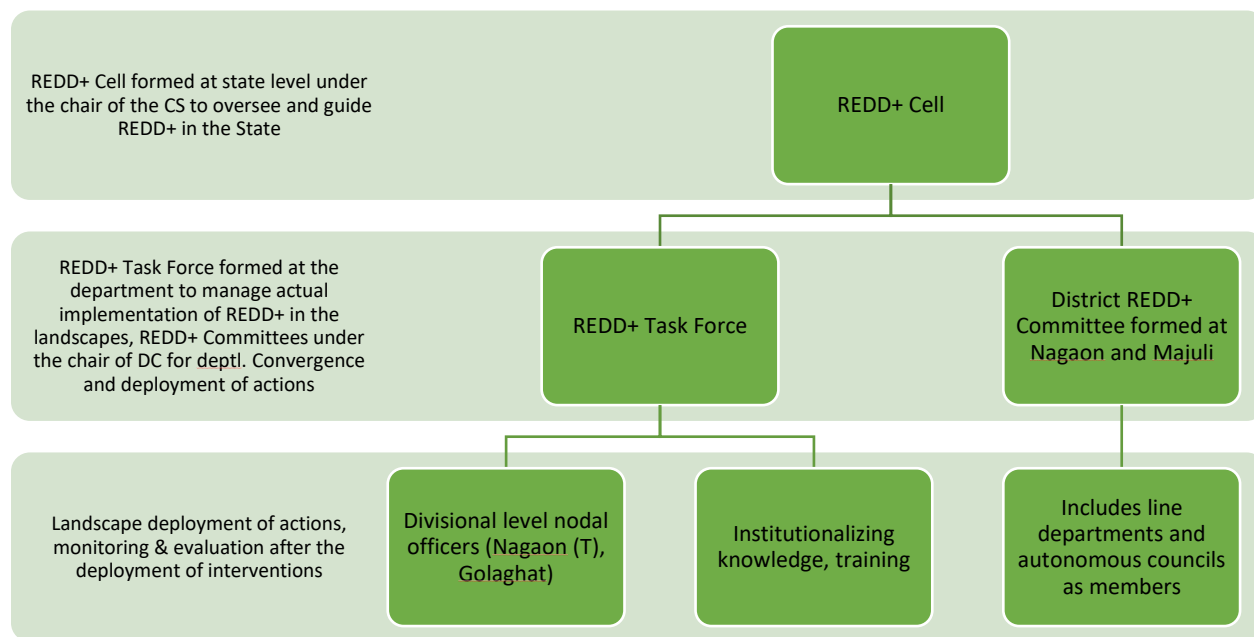


Figure 1: The REDD+ institutional arrangement created in the State of Assam

Identifying project landscapes

One of the immediate tasks is to finalize the project landscape to implement the REDD+ and carbon neutrality projects. A project area selection matrix was developed to find potential districts for the pilot projects. A separate report on landscape identification has been generated by us, which details the parameters used in the matrix.

Potential areas where REDD+ can be implemented was shortlisted following an exercise wherein all the districts in Assam was given a score as per the methodological priorities and demands of the REDD+ instrument mandates. From the project area selection matrix, it was found that Nagaon scored the highest and Dibrugarh came second among potential districts where REDD+ can be implemented. Based on this Nagaon district was selected to develop the REDD+ project named Lowering Emission, Enhancing Forests (LEEF) in Nagaon. Since the REDD+ mechanism is moving towards a jurisdictional approach and it will become easier in the future to integrate with jurisdictional baselines that India is planning to develop, the district was selected to be the sub-national jurisdiction to develop the REDD+ project.

Selection of Majuli also included an iterative process. Majuli was declared as 35th district of Assam in September 2016. It is the world's largest river island in the world. It is also a world heritage site, therefore large numbers of development activities are initiated which will lead to degradation of pristine environment of Majuli, hence all the development activities in Majuli has to be environment friendly and carbon neutral. Keeping this in view the Government of Assam decided to initiate the programme - "Sustainable Action for

Climate Resilient Development in Majuli" (hereinafter referred as SACReD). The programme envisions to establish Majuli as the first carbon neutral district in India by 2020 by combating the impacts of climate change and reducing Green House Gas (GHG) emissions. Majuli also is a good site for a pilot carbon project as it is an insular landscape with better control over mapping sources of emissions.

Assam Forest Department convened a preliminary inter-departmental meeting held on 4th August 2016 to ascertain the views of other departments on feasibility and suitability of these potential landscapes and the role they could play in design and implementation. Based on the recommendations at this meeting, followed by a second round of meetings in October under the chair of the Chief Secretary of Assam, it was decided to select Nagaon and Majuli as the project landscapes. The final intimation on selection was made on 23/10/2016

During this phase of the project the inception report, project road map and implementation plan were prepared.

Development phase

In the development phase, the two projects were developed by ear-marked teams in both the landscapes. Development of the projects are detailed for each of the project in the following sections.

Sustainable Action for Climate Resilient Development (SACReD) in Majuli

The newly formed Majuli district (September 2016) which is the largest river Island in the World, located within Brahmaputra in the State of Assam in India, and was chosen as the landscape for this project. Since its inception, many developmental projects have been announced that include new office complexes, schools, auditoriums, other institutional buildings, granaries, macro and mini solar parks, roads, and bridges connecting Majuli with mainland, river water pumping, purification and distribution system, scientific waste management system amongst others. Majuli so far was a rural division of Jorhat, and has retained for centuries its unique cultural identity and biodiversity.

In addition to being energy intensive, the scale of development envisioned for Majuli, is will disrupt the pristine environment of Majuli with implications for its biodiversity, unless planned well. Considering that on an almost annual basis Majuli is flood and erosion prone, any development project implemented has to be resilient to the climate risks, which may escalate in the future.

In this context a meeting on Sustainable Action for climate resilient development in Majuli was held on 14th December 2016 at the conference room of Deputy Commissioner, Majuli. For establishing carbon neutrality in Majuli following steps would involve:

- a) Emission baseline for various sectors
- b) Future emission projection till 2020 and packages of carbon neutral strategies with in developmental planning.

It was decided in the meeting that carbon neutral strategies for all the department have to be addressed in the integrated manner by involving all the relevant departments.

Module 1: Development of GHG emission Baseline and emission projections

An inception meeting was organised in Majuli by the district administration on December 21, 2016 wherein IORA Ecological Solutions the technical Partner for the SACReD programme, presented the concept of Carbon neutral Majuli and bioengineering an alternative technology that can be applied to control Erosion in Majuli.

This meeting was chaired by Shri A K Johri, PD and PCCF (B&CC) & Member Secretary Assam Biodiversity Board and Shri Pallav Gopal Jha Deputy Commissioner Majuli also presided over the meeting. Mr Gunin Saikia, DFO, Golaghat and nodal point REDD+ along with representatives of all departments in Majuli also attended the meeting.

Through consultations in the meeting, IORA identified all operational activities that contribute to GHG emissions in the island and respective departments that manage the same. Also the Forest department was requested to identify the locations that are most vulnerable to erosion and where bioengineering methods can be applied.

The annual activity data collected were for the following for the period 2010-2016:

- Electricity consumption by consumer type

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- Number of vehicles registered in Majuli by type
- Number of industries by type and their production capacities
- Sale of HSD, petrol, kerosene and LPG in Majuli
- Number of pump sets and their power used for pumping drinking water and for irrigation
- Annual area under Sali, Bao, Boro and Ahu rice, and other crops
- Area under crop residue burning
- Number of diesel pump sets and their power used for irrigation
- Number of livestock by type
- Afforested/ Plantation area and planned plantation/afforestation
- Plans if any for waste management

The GHG inventory was prepared using IPCC 2006 guidelines. Estimates of CO₂, CH₄ and N₂O and their CO₂ eq was made. The following table indicates the data collected from different departments and the emission factors applied for estimating the emissions.

Table 1: Sector wise emission data collected and emission factors used

Data	Data Source	EF-CO ₂	EF-CH ₄	EF-N ₂ O	EF-Source
Energy					
Electricity supplied	APDCL	0.82 tCO ₂ /MWh	-	-	CEA CDM guide ver. 12
Coal	Kiln owner	95.81 tons/Tj (coal)	2 kg/TJ	1.5 kg/TJ	IPPC, 2006
Fuelwood	Kiln owner	112 tons/TJ	30 kg/TJ	4.0 kg/TJ	IPCC, 2006
Road Transport					
Petrol sales for vehicles	DFCS	69.3 tons/TJ	4.15 Kg/TJ	28.6 Kg/TJ	IPCC, 2006
Diesel sales for vehicles	DFCS	74.1 tons/TJ	33Kg/TJ	3.2Kg/TJ	IPCC, 2006
Residential Sector					
Fuelwood use/ HH	Survey	112 tons/TJ	30Kg/TJ	4Kg/TJ	IPCC, 2006
Kerosene sales	DFCS	71.9 tons/TJ	10 Kg/TJ	0.6 Kg/TJ	IPCC, 2006
LPG cylinder sales	DFCS	63.1 tons/TJ	1Kg/TJ	0.1 Kg/TJ	IPCC ,2006
Diesel sales - agriculture pump sets	AD & DFCS	74.1 tons/TJ	33.0 Kg/TJ	3.2Kg/TJ	IPCC, 2006
Diesel for pumping drinking water	PHED & DFCS	74.1 tons/TJ	33Kg/TJ	3.2Kg/TJ	IPCC ,2006
Agriculture					
Area under Sali rice	AD	-	15.3 g/m ²	-	Gupta et al, 2002
Area under Bao rice	AD	-	25.0 g/m ²	-	Gupta et al, 2002
Area under Summer rice	AD	-	15.3 g/m ²	-	Gupta et al, 2002
Area under Autumn rice	AD	-	15.3 g/m ²	-	Gupta et al., 2002
Annual Urea sales	AD	0.73 tons/yr.	0.0196 tons/yr.	-	IPCC, 2006

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Data	Data Source	EF-CO ₂	EF-CH ₄	EF-N ₂ O	EF-Source
Area under Crop residue burning	Expert Judgement - area burnt	0.414 (Carbon fraction)	0.005 (CH ₄ fraction)	0.007 (N ₂ O Emission ratio)	Jain et al., 2014.
Cattle population	DAHD	-	0.02225 tons/cattle/yr.	-	Swamy et al.,
Buffalo population	DAHD	-	0.0305 tons/buffalo/yr	-	Swamy et al, 2016
Goat population	DAHD	-	0.002 tons/animal/yr.	-	Swamy et al, 2016
Solid waste					
Population Statistics, per capita waste generation per day	Census 2001 and 2011; MoUD, 2016	-	2.34 E-06 Gg/yr	-	IPCC, 2006
Landuse change and Forestry	LANDSAT (2006) and Seinel (2015)				IPCC 2006

For the present study LANDSAT Thematic Mapper (TM) was used for the year 2006 and Sentinel-2A data for the year 2015 to see the change in the various land use classes in Majuli, namely, Grassland, Cropland, Other land, Wetland, and Trees outside Forests. Land-use land cover maps were assessed by overlaying the 2006 map onto the 2015 map (figures provided in Annexure IV to this document). Major change has been observed in the other land class (Tables below).

Table 2: Change in land use observed between 2006 and 2015

LULC	2006 (ha)	2015 (ha)	Change (ha)
Trees Outside Forest	7402	6283	-1118
Cropland	15299	46896	+31597
Grassland	14120	5551	-8569
Other land	23386	3504	-19882
Waterbody	3350	1323	-2028

Note: (-) means decrease in area, and (+) means increase in area

Additional plantation plan by forest department will make the tree cover encompass 6843 ha.

The trees in Majuli represent moist deciduous vegetation type. IPCC default value corresponding to this vegetation type have been used and they include a value of 9 tons dm /ha/yr as above-ground biomass growth rate (Asia (continental ≤20 y)), 0.24 as a conservative root-shoot ratio of and carbon fraction value of 0.5. Using these we estimate that the tree cover in Majuli sequestered -128557.341 tons of CO₂-e in 2015, about -134173.611 tons CO₂-e in 2016 and is projected to sequester -136628.811 tons CO₂-e in 2020.

Table 2 presents the base line GHG emissions and emission projections in 2020. The emission projections were made based on consultations with the departments taking into account the perceivable growth of each activity till 2020 in view of demand expected vis a vis the population growth as development takes place in the island after its conversion into a district. The estimates

indicate that in 2016 Majuli emitted 342531.94 tons CO₂-e, and with sequestration from 'trees outside forests' factored in, the net emission was 208358.33 tons CO₂-e. In 2020, the CO₂-e emissions in Majuli is projected to rise to 378594.24 tons CO₂-e and with inclusion of sequestration by "trees outside forests", it is estimated that the net emissions will only be around 241965.43 tons CO₂-e. Source wise emissions and sequestrations for 2016 and 2020 are summarized in Table 2.

Table 3: Summary of emissions between 2016 and projected emissions in 2020

Sector	2016	2020
Energy		
<i>Electricity generation</i>	0.00	0.00
<i>Electricity Consumption</i>	9453.92	13549.25
<i>Bricks</i>	6770.19	6770.19
Total –Energy	16224.11	20319.44
Transport		
Road Transport	12333.47	34898.20
Residential		
<i>Fuelwood</i>	155730.30	121827.78
<i>LPG</i>	2915.83	10271.74
<i>Kerosene</i>	4790.42	2744.41
Total-Residential	163436.55	134843.93
Agriculture		
<i>Paddy cultivation</i>	133653.92	171989.71
<i>Cattle</i>	5735.99	5585.58
<i>Buffalo</i>	2194.43	1927.16
<i>Goat</i>	429.461	429.72
<i>Urea application</i>	3718.33	758.14
<i>Burning of crop residue</i>	17.84	93.30
<i>Agriculture pump sets</i>	4787.84	7068.74
Total –Agriculture	150537.81	187852.36
Waste		
<i>Solid Waste management</i>	NO	680.32
Total Emission	342531.94	378594.24
LULUCF		
Trees outside forest	-134173.611	-136628.811
Net Emission	208358.33	241965.43

Module 2: GHG emission mitigation interventions and sequestration opportunities in Majuli

Consultative meetings were carried out in the week of 14th March 2017, with all the departments to identify the potential programmes, projects and other interventions that can be feasibly be implemented in Majuli to reduce the projected emissions in 2020. The strategies considered towards mitigation lead to an emission reduction of 90795.35 tons CO₂-e. The cost of implementing these strategies in current prices is estimated to be 1179.04 Cr INR. A summary of all strategies for emission reduction is presented in Table 4. The departments that will be responsible for each of the interventions is also indicated in this table along with cost of implementation.

Table 4: Interventions identified for GHG emission mitigation

Intervention	Proposed Capacity	Emission Reduction that can be achieved in 2020 (tons CO ₂ -e)	Cost (Crore INR)	Department Responsible
Energy sector				
Solar park	10MW	2501	81	NHPC
14 Solar micro grid (10-63 KW),	0.511MW	127.55	4.14	APDCL
Solar roof top for Kamalabari Satra,	0.05MW	12.51	0.95	AEDA
District Administration office complex	1.62MW	405.16	13.12	PWDB
Majuli college	0.09MW	22.51	0.73	Majuli College
Solar rooftop for all households	34.78MW	8,698.48	657.34	APDCL
Solar rooftop for 13 guest house/hotels	0.13MW	32.51	2.46	Private sector
Solar street lighting	836.2KW	2233.12	24.89	APDCL
Industry				
Retrofitting of FCBTK to Zig-Zag	20 Lakh Bricks for each of the 6 k kilns	1354.04	0.9	DoIn
Transport				
Electric cars	500	27426.50	115	DoRT
Electric two wheeler	23,000		30.5	DoRT
Agriculture				
Multiple aeration of irrigated summer rice	14764 ha	1,712.62	-	DoA

Project Closure Report- Estimation of potential value of ecosystem services and development of REDD+ project for Assam (TA -9)

Intervention	Proposed Capacity	Emission Reduction that can be achieved in 2020 (tons CO ₂ -e)	Cost (Crore INR)	Department Responsible
Crop residue for preparation of livestock feed	7573 tons	93.3	-	DoA
Dietary Manipulation	11954 Cattle	1396.40	-	DAHD
	2970 Buffalo	481.79	-	DAHD
Solar Pump sets	7382	7068.74	242.13	PHED
Efficient cook stoves	38577 (no's)	36548.33	4.24	DoAE
Composting using other farm waste	2000 vermi compost pits 2000 compost pits	340.63	2.00	DoA
Waste				
Composting at HH level using disposable organic waste	38 tons	340.16	-	FCSD
Total		90795.35	1179.04	

Additional Fiscal instrument to support GHG mitigation in the Transport Sector- Carbon cess

Also a carbon cess can be levied on people as well on all vehicles entering Majuli. For people it could be an additional Rs 10/- on the ticket to cross the Bramhaputra that currently costs Rs 15/. For vehicles it could be an additional Rs 100/- on the already levied Rs 700/- per car and Rs 10/- on goods transported to Majuli. It is estimated that currently, the biggest Ghat in Majuli earns in excess of Rs 80,00,00/- per day. The additional revenue generated through the carbon cess could be used for incentivising solar charging stations and for subsidising the electric powered vehicles to the consumer which is over and above the FAME (Faster Adoption and Manufacturing of (Hybrid & Electric Vehicle) subsidies provided by the GoI to the manufacturer.

Towards zero emission

As mitigation action would be able to reduce 90795.35 tons CO₂-e out of total emission which is 241965.43 tons CO₂-e, hence to make Majuli carbon neutral by 2020 residual emission of 151170.08 tons CO₂-e can be sequestered through tree plantation drives in fallow areas of Majuli (see figure below). No. of trees that need to be planted will be 69,53,824.

Figure 2: Towards Carbon Neutrality

Module 3: Development of Carbon registry

A registry dashboard was designed for web based and android based applications. The inputs to the registry were:

- Sector wise category based GHG emission trends from 2010 to 2016
- Sector wise and category based emission base line and emission projections till 2020
- Interventions with estimates of respective emission reduction potential
- Responsible departments, size of the interventions, timelines within which they have to be implemented
- Offset plan through plantation for neutralizing the residual emissions

A schematic diagram of the architecture of the Registry is shown in Figure below.

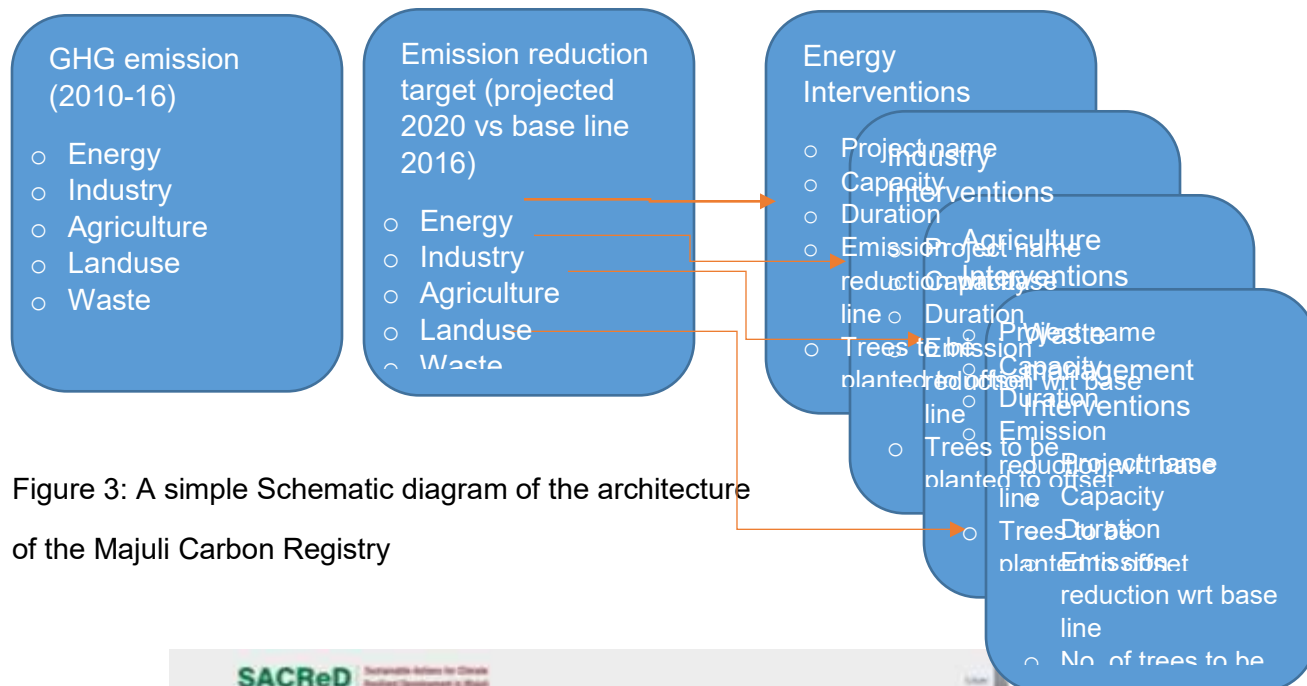


Figure 3: A simple Schematic diagram of the architecture of the Majuli Carbon Registry

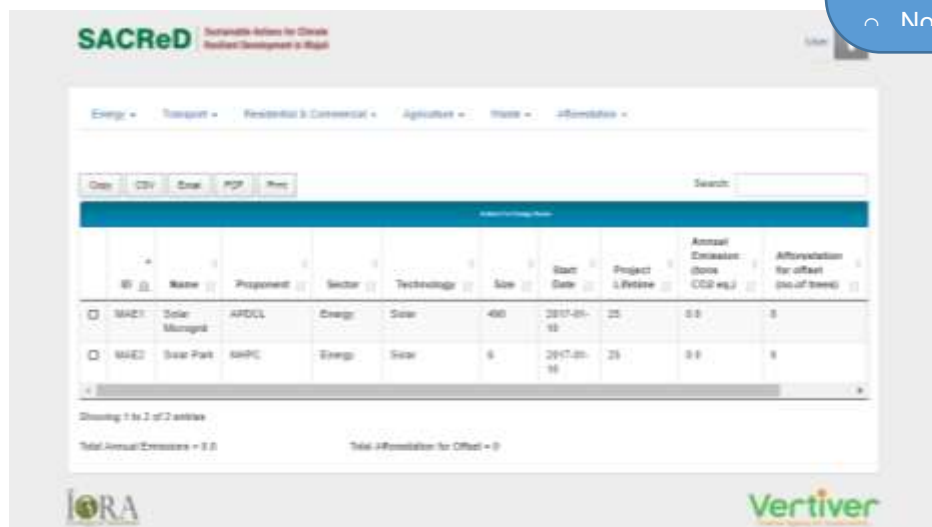
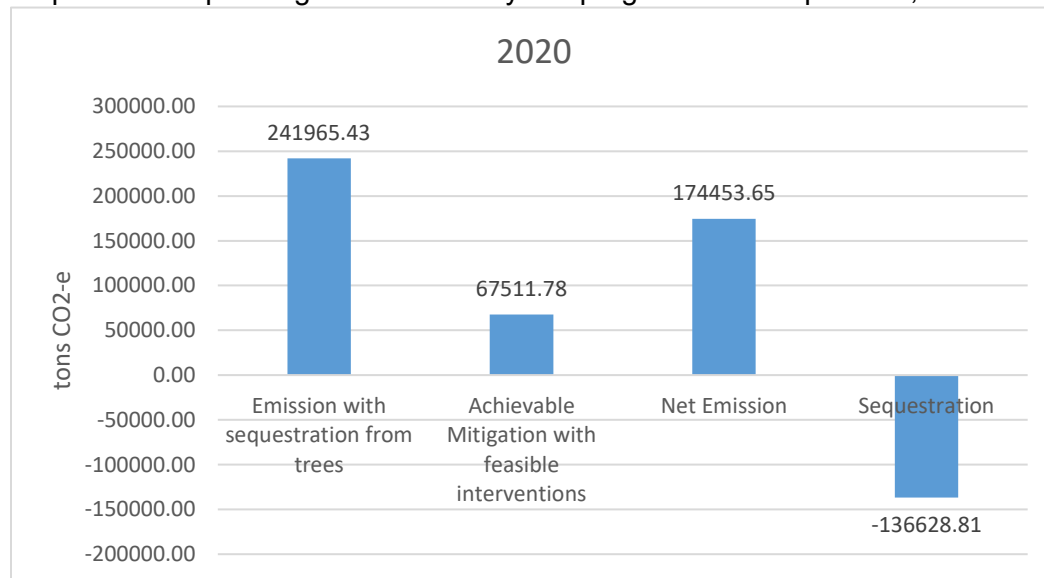


Figure 4: Web shot of the Registry

The SACReD Web Dashboard follows MVC Architecture. Based on Python Django framework the system is designed to scale with the needs of the institution. The system also provides security to common threats such as XSS, CSRF attack etc. The system follows modular approach that emphasizes separating the functionality of a program into independent, interchangeable modules,



such that each contains everything necessary to execute only one aspect of the desired functionality. The SACReD mobile app is based on Android Architecture. The App follows MVC

Design. The app syncs with server via REST API provided to update the App.

Module 4: Mapping intervention activities

The strategies considered towards mitigation lead to an emission reduction of 67511.78 tons CO₂-e. The cost of implementing these strategies in current prices is estimated to be 1178.8 Cr INR. A summary of all is presented in Table 17. The departments that will be responsible for each of the interventions is also indicated in this table.

Module 5: Development of strategies

In order to make Majuli Carbon neutral by 2020, a set of interventions have been identified that would lead to GHG emission mitigation and enhanced carbon sequestration (See Table below). Of the total projected 241965.43 tons CO₂-e emissions in 2020, around 67511.78 tons CO₂-e. can be mitigated by the interventions identified. These interventions together would require an investment of 1178.88 Cr INR at current prices. The residual emissions of the order of 174453.645 tons CO₂-e can be sequestered through tree plantation drives in fallow areas in Majuli, making Majuli Carbon neutral by 2020 (see figure below).

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Table 5: Envisaged strategies for mitigation and the ensuing emission reduction across sectors

Intervention	Proposed Capacity	Emission Reduction (tons CO ₂ -e)	Cost (Crore INR)	Department Responsible
Solar park	10MW	2501	81	NHPC
14 Solar micro grid (10-63 KW),	0.511MW	127.55	4.14	APDCL
Solar roof top for Kamalabari Satra,	0.05MW	12.51	0.95	AEDA
District Administration office complex	1.62MW	405.16	13.12	PWDB
Majuli college	0.09MW	22.51	0.73	Majuli College
Solar rooftop for all households	34.78MW	8,698.48	657.34	APDCL
Solar rooftop for 13 guest house/hotels	0.13MW	32.51	2.46	Private sector
Solar street lighting	836.2KW	2233.12	24.89	APDCL
Retrofitting of FCBTK to Zig-Zag	20 Lakh Bricks	1354.04	0.9	DoIn
Electric cars	500	245.67	115	DoRT
Electric two wheeler	23,000	678.06	30.5	DoRT
Multiple aeration of Summer		1,712.62		DoA
Can be used to feed livestock and compost	7573 tons	93.3		DoA
Dietary Manipulation	57,831 Cattle	1396.396		DAHD
	6,400 Buffalo	481.79		DAHD
Solar Pump sets	7382	7068.74	242.13	PHED
Efficient cook stoves	33,778 (no's)	36548.33	3.72	DoAE
Vermicomposting	4000 pits	3,559.84	2	DoA
Vermicomposting	38 tons	340.16		FCSD
Total		67511.78	1178.88	

Module 6: Development of detailed project report for NAFCC funding

A Project has been designed for funding from the National Adaptation fund. The total cost of the project will be around 24.50 Crore. Objective of the project is to apply bioengineering techniques to control erosion in erosion prone areas in Majuli which will be over and above the engineering methods used for erosion control in the region. The suggested scheme in consultation with the Forest department is presented in Table below.

Table 6: Proposed plantation scheme

From 0 m of the river bank	Species Proposed	Spacing	No of saplings per ha.	Preparation (simultaneously on the onset of monsoon)
Up to 100 m	Vetiver (Chrysopogon zizanioides)	Complete Coverage	10,000	Vetiver culture.
101 m to 300 m	Jhao (Tamarix dioica) Pure plantation	1.50 m x 1.50 m	4,500	Pit size : 30 cm x 30cm x 30cm Each pit should be filled up with borrowed silt/soil, mixed with organic manure, prior to planting exercise
301 m to the main dyke/main land mass	Sissoo (Dalbergia sissoo); Simul (Bombax ceiba); Velkor (Trewia nudiflora); Ajhar (Lagerstroemia flosreginae); Jamun (Eugenia jambolana)	2.00 m x 2.00 m	2,500	Pit size: 20 cm x 20cm x 30cm Each pit should be filled up with borrowed silt/soil, mixed with organic manure, prior to planting exercise
Source: DFO, SF, Golaghat				

The steps to achieve the erosion control measure will include the following components:

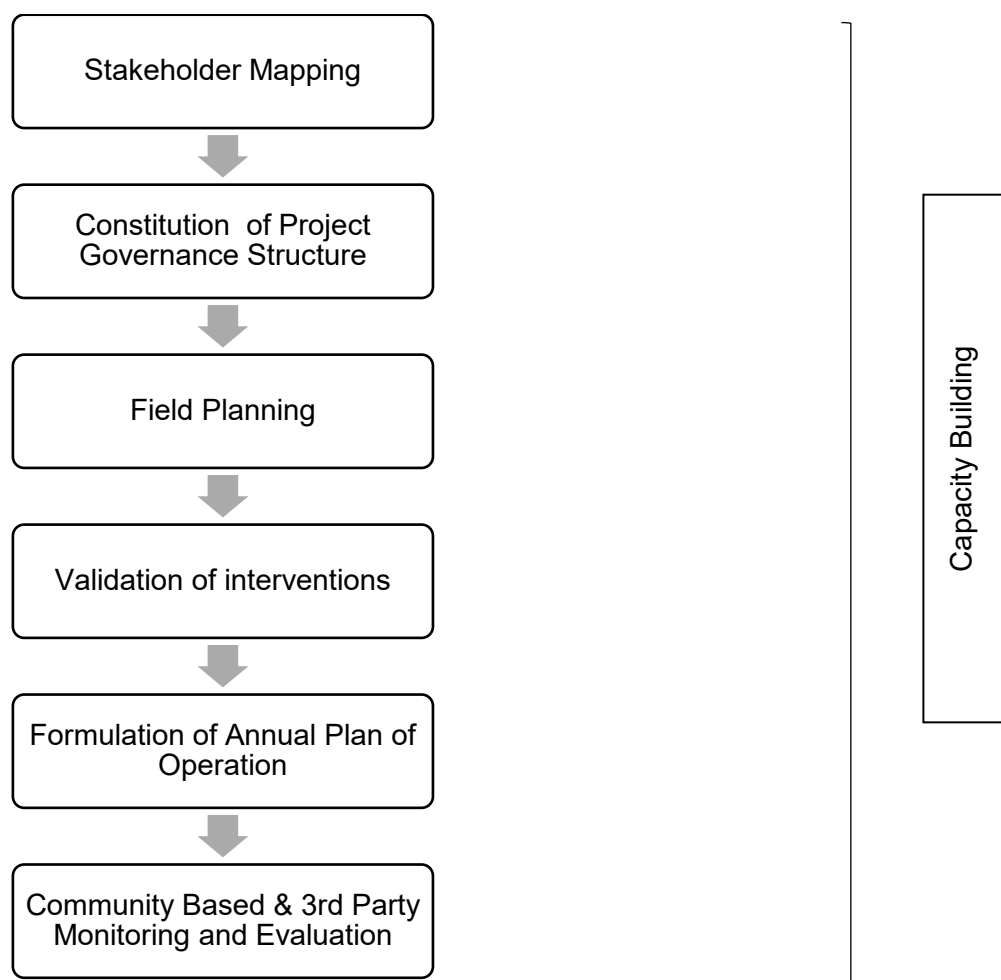


Figure 6: Schematic representation of activities to be carried out in the NAFCC
Module 7: Identifying community climate risks and developing strategies towards a Climate Resilient Majuli

Activities under this module was supported by the Climate Change Innovation Programme – A programme in turn supported by the DFID; and demonstrates how we have successfully leveraged finances for climate resilient actions through the AFD supported SACReD project.

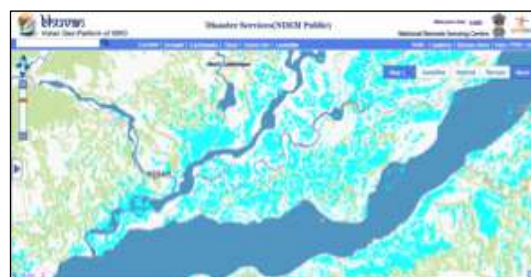
Sub-module 7.1: Identification of climate risks

Majuli being a river island faces recurrent floods (see figure below for extent of flooding in recent years) annually, damaging crop produce livestock, disrupting livelihoods and affecting health. The river banks of Majuli are highly erosion prone and complete landmass is often cutaway by the force of the river current. The Island has lost land incessantly and has been consistently shrinking from being as large as 734.0 sq km in 2014, to its size in 2016 at a

mere 524.29sq km⁹. Government intervention by way of erosion control dykes and embankments has offered some gain in land, however small despite efforts led by the Bramhaputra Board and Water resource department.



2011- 17 July to 18th August



2012- June to September



2013- 1st July to 12th September



2014- 16th August to 29th September



2015- 8th July to 26th September



2016- 23rd June to 29th July

Figure 5: Extent of flooding and days of flooding in Majuli in JJAS (June, July, August, September) during 2011 and 2016¹⁰

The risks and level of risks for all the 14 Gram Panchayats have been analysed based on the responses received during the survey and are presented in Table below. The risk perceptions are evidently high in areas that are flood and erosion prone in Majuli and the perception of risk is low in areas where the flooding is relatively rear and are in the upper reaches of Majuli.

⁹ Bramhaputra Board, 2016. Citizens Charter of Bramhaputra Board. http://www.brahmaputraboard.gov.in/NER/Archive/citizen_charter.pdf

¹⁰Bhuvan Portal. Indian Geoportal of ISRO. Available at: <http://bhuvan-noeda.nrsc.gov.in/disaster/disaster/disaster.php>

Table 7: Perception of risk due to floods and erosion in Majuli

	Bongaon	Dakhin Kamlabari	Dakhinpat	Pokajora	Kamlabari	Rawanaper
Displacement	H	H	H	L	M	L
Livelihood diruption	H	H	H	L	H	L
Propensity towards poverty	H	H	H	L	M	L
Crop and livestock loss	H	H	H	H	H	H
Food security	M	M	M	M	M	M
Potable water	H	H	H	H	H	H
Health and wellbeing	H	H	H	H	H	H
Access to electricity	M	M	M	M	M	M
Access to energy for cooking	H	H	H	H	H	H
Risk to infrastructure	M	M	M	M	M	M
Gender and floods	H	H	H	M	M	M
Overall Risk	H	H	H	L	M	L

Note: H: 76-90% of the respondent consider it as a risk; M: 40-75% of the respondent consider this as a risk; L: <40% consider this as a risk

Table 8: Perception of risk due to floods and erosion in Majuli (Contd.).

	Ahatguri	Dakhin Ahatguri	SriLuhit	Garamur	Sriram	Jengrai	Rengchahi	Ratanpur
Displacement	H	M	H	L	L	M	L	H
Livelihood diruption	H	M	H	L	L	L	L	H
Propensity towards poverty	H	H	H	L	L	L	L	H
Crop and livestock loss	H	H	H	H	H	H	H	H
Food security	M	M	M	M	M	M	M	M
Potable water availability	H	H	H	H	H	H	H	H
Health and well being	H	H	H	H	H	H	H	H
Access to electricity	M	M	M	M	M	M	M	M

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	Ahatguri	Dakhin Ahatguri	SriLuhit	Garamur	Sriram	Jengrai	Rengchahi	Ratanpur
Access to energy for cooking	H	H	H	H	H	H	H	H
Risk to infrastructure	H	M	H	L	L	M	L	H
Access to sanitation	H	M	H	L	L	M	L	H
Gender and livelihood	H	M	H	M	M	M	M	H
Overall Risk	H	M	H	L	L	L	L	H

Note: H: 76-90% of the respondent consider it as a risk; M: 40-75% of the respondent consider this as a risk; L: <40% consider this as a risk

Sub-module 7.2: Adaptation strategies

Risk	Strategy	Action	Cost	Responsible Department	Funding source
Damages due to floods	Strengthened flood early warning system	Create a local radio 24x7 FM station	20 Lakh annually	District Administration	Grant can be sought from MoB or can be supported by district administration funds
Food security	Increase area of rice cultivation during the dry season from November to May from 5500 ha to 10,000 ha	Increase irrigation potential - Solar pump sets - Bringing in river water	350 Solar pump sets to be funded through Low C strategy 20 Lift irrigation systems for each GP	Department of Agriculture	Pradhan Mantri Krishi Vikas Yojana

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Risk	Strategy	Action	Cost	Responsible Department	Funding source
	Create floating vegetable gardens to grow vegetables During floods	Train community to create these gardens – Gram Panchayat wise training (20). Repeated annually for next 3 years	5 lakhs annually	Department of Agriculture	National Horticulture Mission
Housing Security	Flood resilient housing away from erosion prone areas	Design and implement 5000 flood resilient housing. (813 beneficiaries already identified)	45 Cr	Department of Rural Development	Pradhanmantri Awaas Yojana
Livelihood security	Textile cluster development in Majuli. Components include: - Mechanisation of looms - Housing for looms to get protected from floods - GI tag for textile and design support and market linkage	Solar powered looms in next 3 years for 2000 HH looms Separate Housing for looms on stilts Special study for value chain and domestic & overseas market development	10 Cr Within above 10 lakh	Department of Textiles	JNNSM & NER Textile promotion scheme & Bi-laterals

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Risk	Strategy	Action	Cost	Responsible Department	Funding source
	Niche Tourism Promotion package - Canoeing as an activity in wetlands - Pottery and mask making classes - Visit to handlooms and creation of handloom shops - Home stays in typical Mishing houses - Biodiversity conservation & tours with siting kits	Make 60 more canoes for each Panchayat. Satra making masks and pottery to design training Train locals on biodiversity conservation and biodiversity guides Train locals for setting up clean homestays	20 lakhs per years	Department of Tourism	Skill India mission
Risk to Health	Make potable water available Make toilets available Create a Skin disease prevention programme for Majuli Strengthen Vector borne disease programme	Training and deployment to HHs to convert the turbid and contaminated rainwater into potable water : - NEERIs Portable Instant Water Filter "NEERI-ZAR",	8.44 Cr	Rural Development PHED	Jalmani- Ministry of Drinking water and sanitation

To take this assessment further, it is proposed that each of the recommendations be run through the district administration for their inputs and acceptance. Further once the recommendations are accepted, full-fledged project design documents will have to be formulated for funding. Where possible, convergence of the recommendations with ongoing schemes will be pursued. Examples include building climate resilient houses under the Pradhan Mantri Awas Yojana.

Lowering Emission, Enhancing Forests (LEEF) in Nagaon

The key steps undertaken in developing the project is explained in the figure below.



Figure 6: The key steps undertaken in developing the project.

Module 1: Historical change analysis using geospatial techniques

Reference emission levels are the benchmark compared to which the removals and emissions from all the carbon pools of the project will be compared. The Reference Level and is measured in terms of tons carbon dioxide equivalent (tCO₂e). Due to deforestation and forest degradation, there will be change/decrease in the land use type and canopy density while conservation, enhancement and sustainable management will lead to increase in the forest canopy density and quality. The baseline emissions in the year 2000 is considered as the reference year and emissions or reductions of CO₂e will be a benchmark to calculate any reductions that will happen until the baseline is updated, and is termed the Reference Forest Emission Level. This section details how the land use change has been mapped for this project to estimate the reference emission level for this REDD+ project.

Detailed geospatial and on ground field analysis was undertaken to identify and assess the actual and accurate changes in land use and forest canopy density in the project area over the selected historical reference period. Analysis on remote sensing platforms, backed up by field data validation, has been undertaken to accurately classify the LULC types in the district. This has enabled the development of maps for various aspects of analysis – LULC maps, forest strata maps and Fractional Cover maps, to map the deforestation and degradation over the historical reference period.

Table 9: Characteristics of the satellite imagery used

Data Source	Main Use of Data	Information about data collected		
Medium resolution of 30 m LANDSAT data of at least one image for 4-time periods				
Time Frame	Historical analysis of deforestation and forest degradation	0-3 years before project start date	4-9 years before project start date	10-15 years before project start date.
Year of Satellite Imagery		2015 (Landsat – 8)	2010 (Landsat-TM)	2006 and 2000 (Landsat – TM)
Sources		USGS Earth Explorer		
Type and Resolution (spatial and spectral)		Satellite imagery using visible (Green, Red), near-infrared bands (NIR), Shortwave infrared (SWIR). It is a multi-spectral data with a spatial resolution of 30m, operating in the visible, near infra-red, shortwave infra-red and thermal region.		
Coordinate system and pre-processing (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)		WGS 84 – UTM zone 46N Layer Extent: 599872.62 690630.18 		

Data Source	Main Use of Data	Information about data collected
Description of method used to produce these data		The LULC maps for historical baseline have been classified using supervised approach with Maximum Likelihood Classifier (MLC).
Descriptions of the LULC classes and/or LULC-change categories		<p>The LULC classes or categories described are as follows:</p> <ol style="list-style-type: none"> 1. App. Kamrup Sal Forest (AKS) 2. East Himalayan Mixed Deciduous Forest (EMMD) 3. Cachar Semi-Evergreen Forest (CSE) 4. Bamboo Brakes 5. Cropland 6. Waterbodies 7. Grassland 8. Other Land 9. Settlements

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, 1968¹¹), and each forest type has been further divided into 4 forest density sub-stratum 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.

Ecological data has been sourced through 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 neighbouring regions were very similar, and has been used to develop the carbon mapping of Nagaon to a higher accuracy. Since soil samples to estimate Soil Organic Carbon (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 four 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

¹¹ 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*.

against canopy density for conducting a full field analysis of Nagaon district. This gave Carbon content of each pixel of the scene for the district. Based on this equation, we have again calculated the Carbon content for rest of the years in each of the forest strata to study the dynamics, and also map the overall shift in forest carbon stock. The analysis shows that there is a net decrease of 1.44% every year in carbon content on an average in the historical period 2000-2015. Since the average annual change in carbon stock in each period (2000 to 2006, 2006-2010 and 2010-2015) was considered, any biases 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.

The details the change in carbon stock in each time period has been presented in the Annexure to this document and in the PDD.

Module 2: Surveys to map drivers

A thorough socio-economic survey across Nagaon district, including 58 villages and 567 households, was carried out to identify agents and driver responsible for deforestation and forest degradation. The driver identification process also resulted in a participatory identification of interventions. Activities in which unsustainable extraction of forest produces has been reported to be a major cause of deforestation and forest degradation. These activities include firewood collection, timber extraction, land clearing for agriculture, unsustainable NTFP collection, etc.

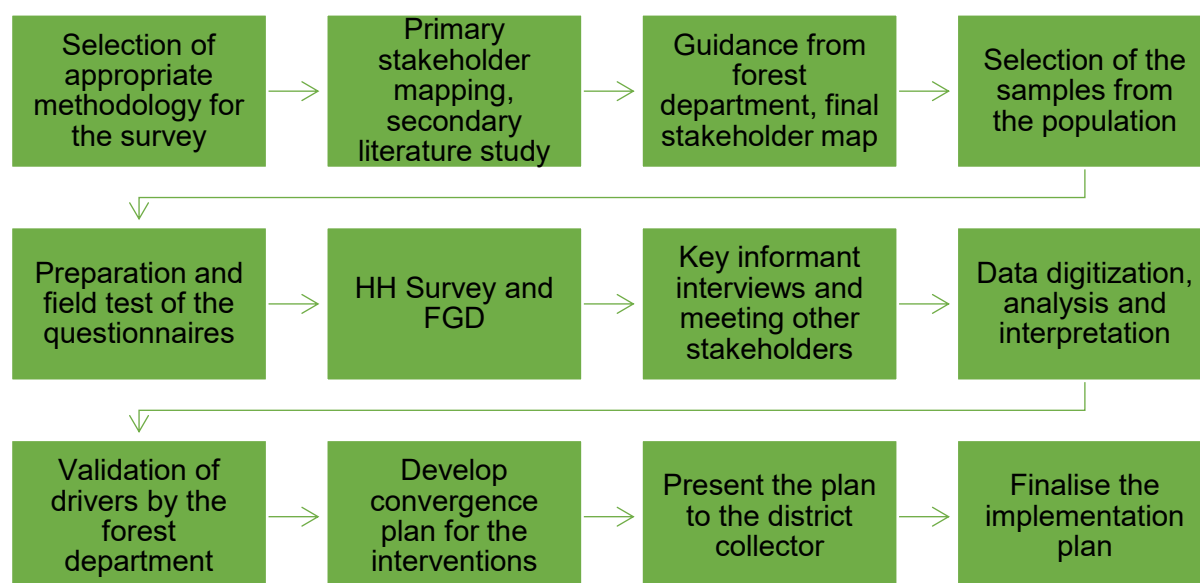


Figure 7: Process diagram on mapping drivers and development of driver-intervention matrix

Drivers of deforestation and forest degradation fall in two categories - first, those that are planned and projected in accordance with policies, legal framework and management plans, etc. and second, that are unplanned and spontaneous, beyond the 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 of policies and appropriate mitigation actions to counter these agents and drivers.

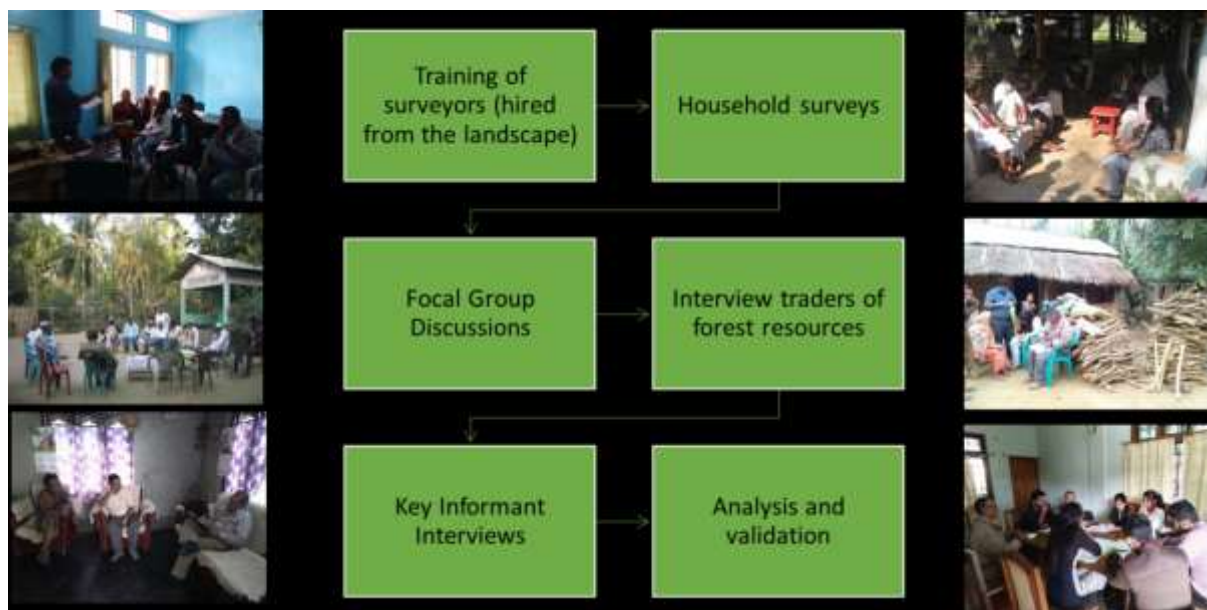


Figure 8: Schematic diagram of the survey conducted in Nagaon

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, timber, and food supplements, etc. To a small extent, illegal mining and timber collection activities within forest is also an unplanned driver of forest change, which is observed during the study.

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. 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.

Module 3: Developing intervention matrices

During the survey, communities were asked to list out the intervention activities which communities think possible in their area. Majority of households surveyed suggested LPG is an alternative solution to reduce fuelwood consumption followed by electric stoves. These interventions were discussed in detail at the range level and divisional level to finalise the set of interventions to be deployed under the project. The list of interventions is given below. A detailed list has been provided in the Project Design Document (PDD).

Table 10: List of interventions planned for Nagaon under the LEEF project

S. No.	Name of Intervention	Drivers Addressed
1	Alternative energy cooking system in households (Improved Cook Stoves or ICS, LPG connection, biogas for cooking, solar based community cooking systems)	Unsustainable fuelwood extraction from forests for cooking and heating
2	Efficient fuelwood based driers for Arecanut processing in Arecanut processing industrial units in Nagaon	
3	Adoption of new brick manufacturing technology in existing brick kilns in Nagaon.	
4	Promotion of smokeless biomass briquettes as a fuelwood substitute	
5	Smart patrolling to check unplanned extraction of forest resources and unplanned mining within forest land	Encroachment, unplanned felling and mining
6	Construction of Cattle Proof Trenches (CPTs) and Elephant Proof Trenches (EPTs) for better defined boundaries and reduce encroachments	Grazing, unplanned felling of trees, collection of forest resources and its transport, encroachment
7	Bio-fencing to reduce encroachment, unplanned felling and decrease man-animal conflicts	Encroachment, unsustainable fuelwood and NTFP extraction, grazing
8	Plantation: 1) Afforestation and Reforestation in non-forest lands for tree cover 2) Assisted Natural Regeneration in forests to stop degradation	Unsustainable extraction of fuelwood
9	Promoting agro-forestry in non-forest lands	Unsustainable extraction of fuelwood and timber
10	Cultivation of medicinal plants as a measure of alternative livelihood and income enhancement	Unsustainable extraction of NTFPs from forests
11	Sustainable grazing and livestock management 1) Silvi-pastoral and Horti-pastoral models 2) Fodder densification and stall feeding 3) Vaccination of livestock	Unsustainable fodder extraction from forests and overgrazing in forest lands

Module 4: PDD and the MRV System

There are several international standards; most prominently the Verified Carbon Standard (VCS) ¹², under which REDD methodologies on baseline and monitoring have been developed. Frameworks under discussions under UNFCCC also focuses on various components including safeguards and quantifying emissions. The PDD template for LEEF borrows from the UNFCCC, VCS and other such standards and draws extensively on the experience of IORA across development of several projects. The PDD describes all the steps involved in developing the baseline, interventions, emission reduction calculations and the MRV.

The change in carbon stock within the project area is to be monitored periodically. Each parameters to be monitored is listed in an elaborate monitoring plan along with a monitoring procedure. Monitoring has to be conducted in a timely manner while meeting the desired accuracy and precision. A mechanism for internal data verification will be operationalized for checks and balances at appropriate levels. Once analysis is complete, the monitoring reports can also be put up for third party verification and certification and can be published for transparency. Trained staff, data management systems, scientific forest mensuration equipment and geospatial analysis capabilities are core components of an efficient monitoring, reporting and verification system, which are detailed in the chapter in the PDD. We have already trained staff on data collection techniques and mobile app under the LEEF project.

Module 5: Safeguards Information System

Project specific REDD+ safeguards have been developed to ensure that the project does not cause any social or biological harm. Social parity and gender equality are to be promoted in deploying intervention actions. Biological diversity is to be conserved, existing forest should never be diverted for monoculture plantations. To ensure that such non-carbon aspects of REDD+ projects are considered while developing a REDD+ project, a Safeguards Information System (SIS) is developed. The SIS details indicators and parameters to be monitored, reported and verified during the life of the REDD+ project. The SIS will be in consonance with the Cancun safeguards and national/regional policies in this regard.

Module 6: Training and capacity building

Range officers were trained on REDD+ and various mechanisms under REDD+ in tow training programs – one in Nagaon and one for the trainees at the training school, Jalukbari. In total 110 staff have been trained.

¹² <http://www.v-c-s.org/project/vcs-program/methodologies/>



Image 1: REDD+ workshop at the office of DFO, Nagaon



Image 2: Training program at the training school in Jalukbari

Finance accessed

We have been able to raise further finance for the activities in Majuli and Nagaon. ACT funded by the UK Department for International Development (DFID) has already invested in low emission development strategies in Majuli. We have also tapped into CSR funding where Oil India Limited (OIL) has supported deployment of 1000 improved cook stoves (ICS) in Majuli. GIZ India funded pilot NAMA project has selected 5 villages from Nagaon for pilot implementation of actions to decrease fuelwood extraction from forests. Key interventions will be deployed through convergence of Government schemes such as Pradhan Mantri Ujjwala Scheme and plantation under CAMPA. A GCF concept note has been prepared for accessing funding from GCF for implementation of the LEEF project. The SACReD

project is planned to be proposed for funding under National Adaptation Fund for Climate Change.

Conclusion

All the objectives of the project have been successfully met. All the deliverables as mandated in section 5 of Appendix A of the contract also have been submitted to APFBCS in paper and electronic form. List of deliverables is also attached as Annexure VI to this report.

The next actions include continuation of awareness creation through the posters that was developed under the project and further interactions. The actions planned needs to be sustained through a multi-pronged approach of accessing internal and external finance. The SACReD registry, which will track the GHG emissions from all new schemes has to be updated periodically.

Both these projects can be termed as path breaking initiatives of the Assam Forest Department. The work in Majuli has generated immense interest around the country, where Sikkim has already decided to become carbon neutral in the same lines; and is working on developing a baseline. Many districts in India, such as Wayanad in Kerala, may follow suit and start work on being carbon neutral. The jurisdictional REDD+ program will lead to renewed effort in the forestry sector to access finance for protection of natural resources; and will be a window for financing forestry conservation activities. The LEEF project will be part of the State's contribution to India's NDC commitments and will help in achieving Assam specific SDGs.

The ecosystem services from forests directly and indirectly makes a huge contribution to the State's GDP. Storing carbon is just one of the services provided by forests. LEEF will surely assist projects on valuation of ecosystem services from Assam's forests.

Annexure I: Notification of the REDD+ Task Force

57-1
3/7/16
26/07/16
26/07/16
25/7/2016
B. Sharma
117

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

Dr. Neel Bhargava

1158
26/07/16

Annexure II: Notification of the REDD+ Cell

23/9/16

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
Tulsi

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

26/9/16
2327

Chief Conservator of Forests
ASSAM, GUWAHATI

Annexure III: Notification of the District level REDD+ committee

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), Kalibor	-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 Dibring Municipal Board	-do-
15. Chairman, Baha Town Committee	-do-
16. Chairman, Kalapur 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

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Project Closure Report- Estimation of potential value of ecosystem services and development of REDD+ project for Assam (TA -9)

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 Area 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.

(Alka Bhargava)
APCCF (REWP) &
Member Secretary RED+ Cell

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Project Closure Report- Estimation of potential value of ecosystem services and development of REDD+ project for Assam (TA -9)

(6)

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.

(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, Norther Assam Circle, Tezpur.

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

Forest Management System
No. 112030
Date 20/12/16
Hbc Forest
Branch Officer / Officer
Deputy Commissioner's Office
Nagaon (Assam)

Branch Officer / Officer
Deputy Commissioner's Office
Nagaon (Assam)

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Project Closure Report- Estimation of potential value of ecosystem services and development of REDD+ project for Assam (TA -9)



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

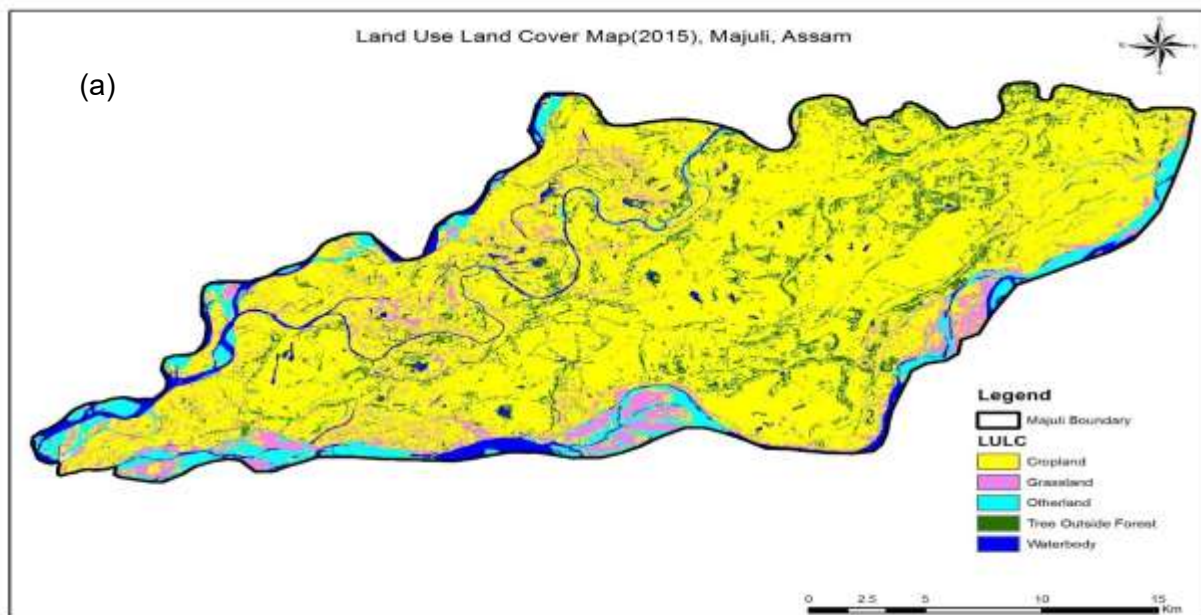
Dated 30/01/2017

(Shamsher Singh, IAS)
DEPUTY COMMISSIONER,
NAGAON

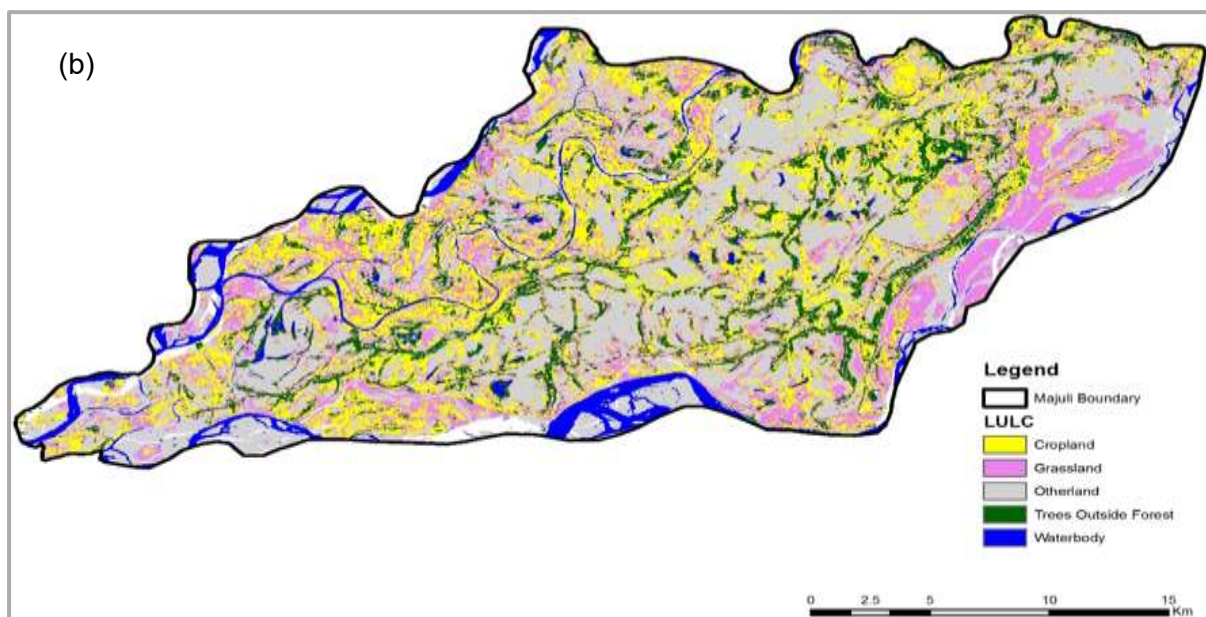
Scanned by CamScanner

Annexure IV: LULC maps generated for SACReD project in Majuli

Figure 1: (a) Land-use land cover for 2006, (b) Land-use land cover for 2015



Source: (a) Landsat classification; (b) Sentinel 2A classification



Annexure V: Maps generated for the LEEF project in Nagaon

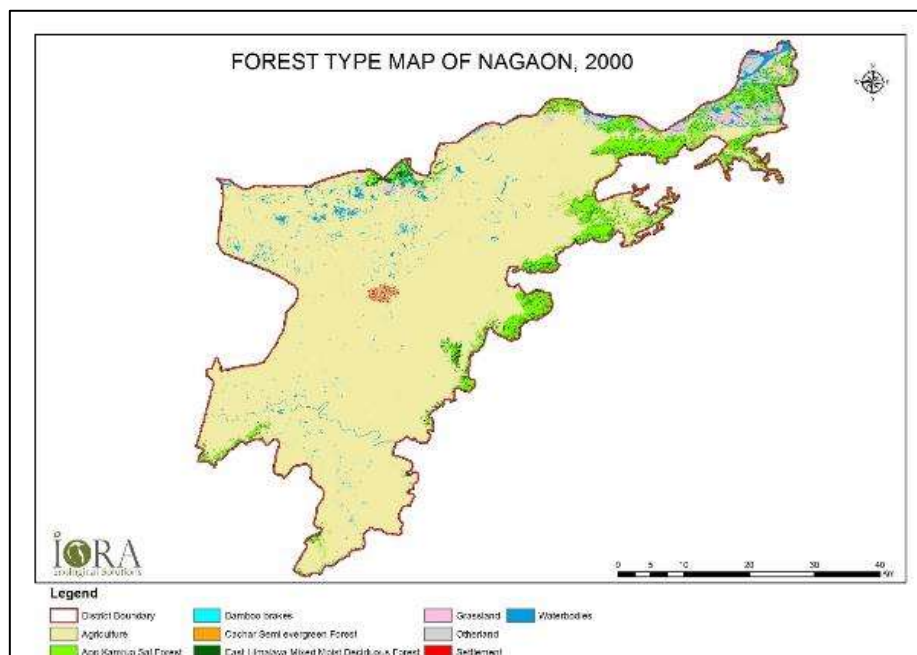


Figure 9: Forest type map Nagaon, 2000

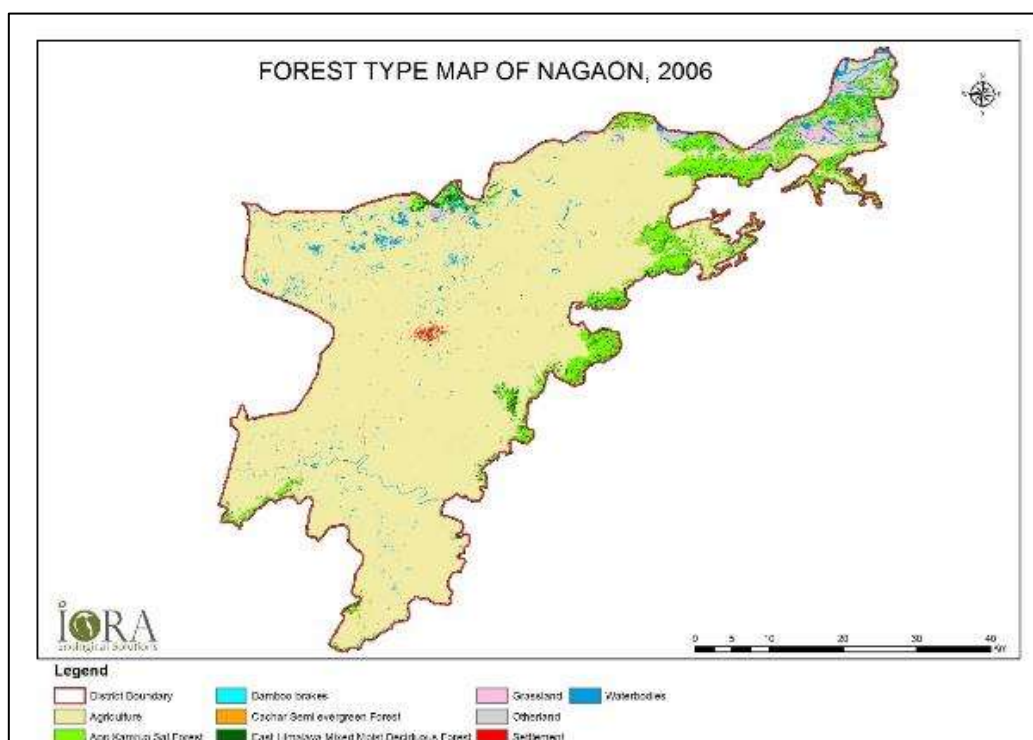


Figure 10: Forest type map Nagaon, 2006

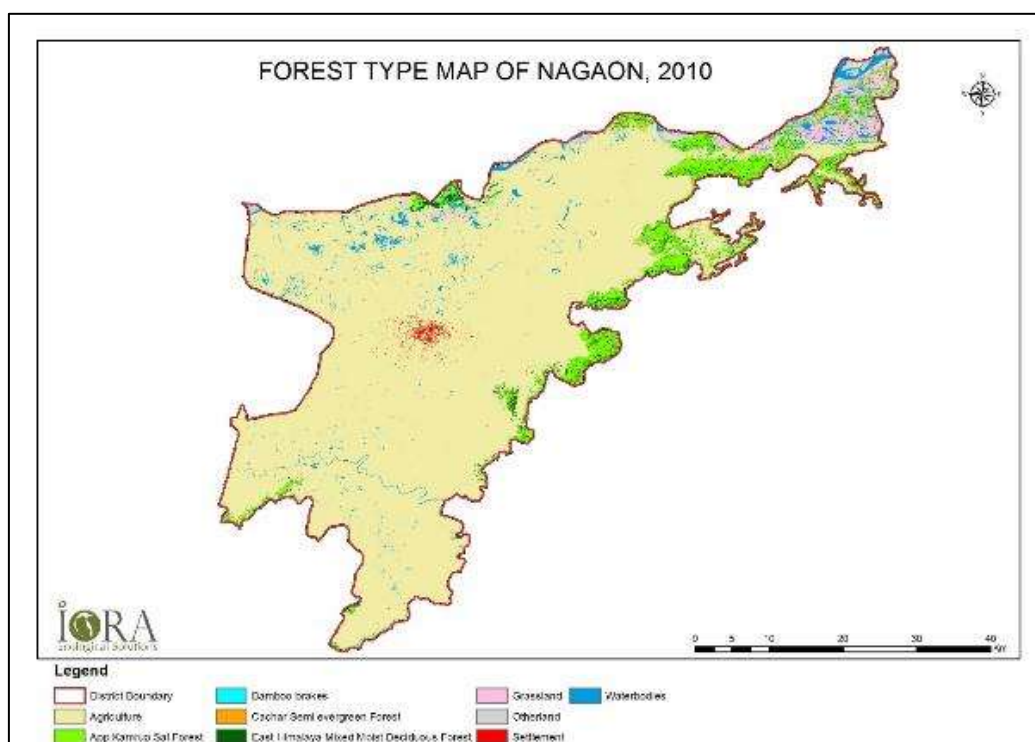


Figure 11: Forest type map Nagaon, 2010

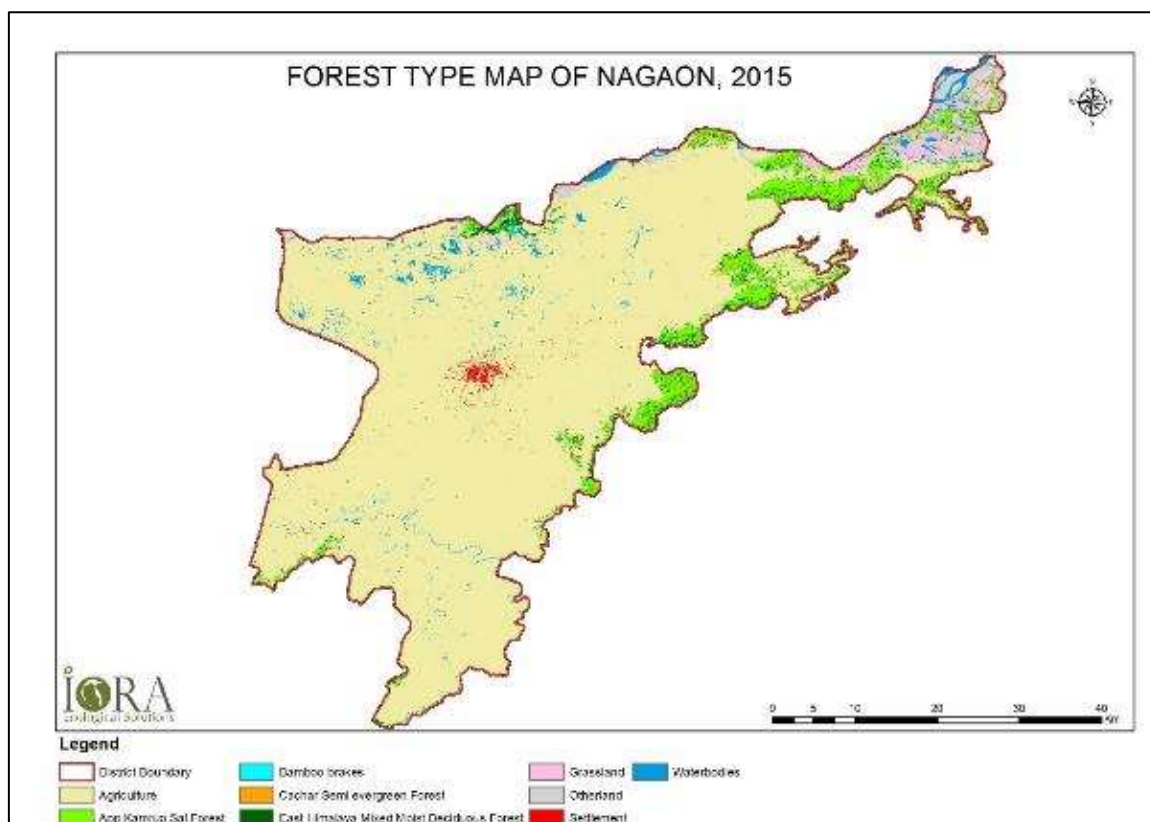


Figure 12: Forest type map Nagaon, 2015

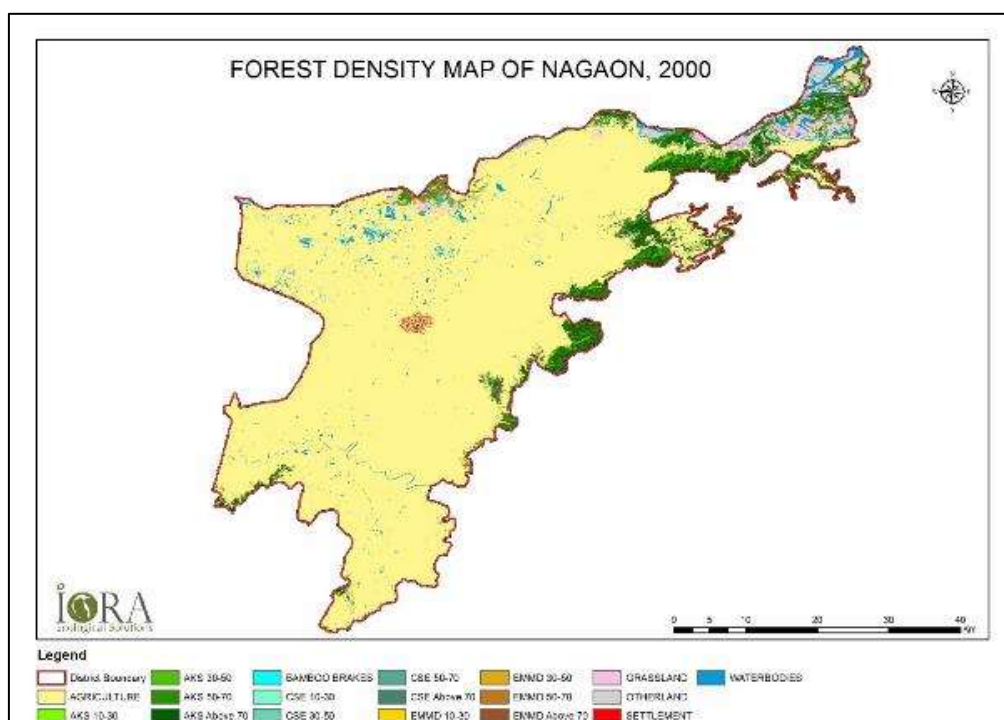


Figure 13: Forest density map of Nagaon, 2000

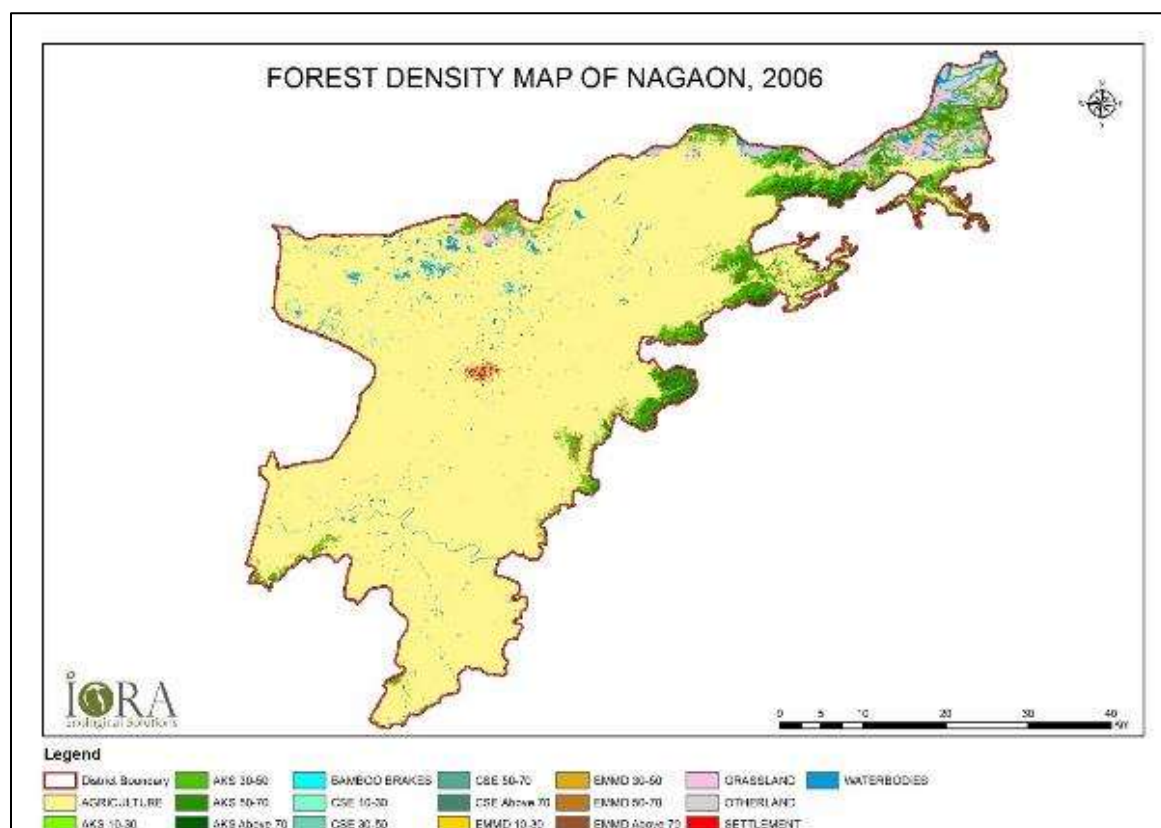


Figure 14: Forest density map Nagaon, 2006

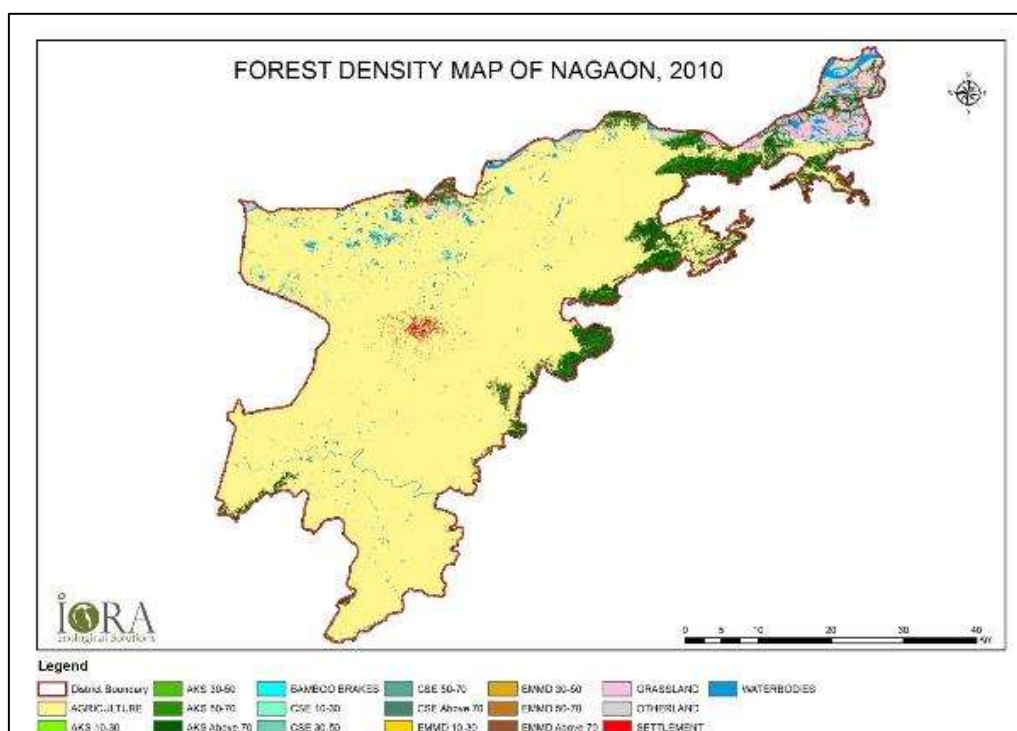


Figure 15: Forest density map Nagaon, 2010

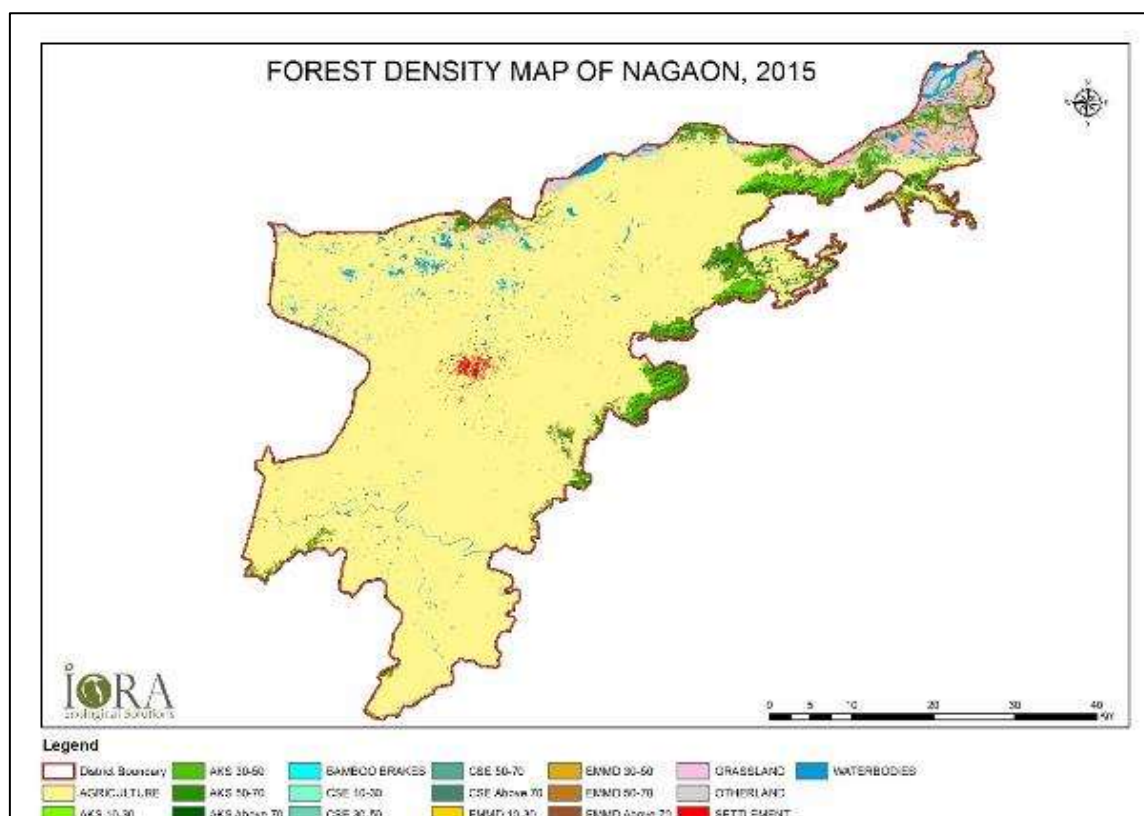


Figure 16: Forest density map Nagaon, 2015

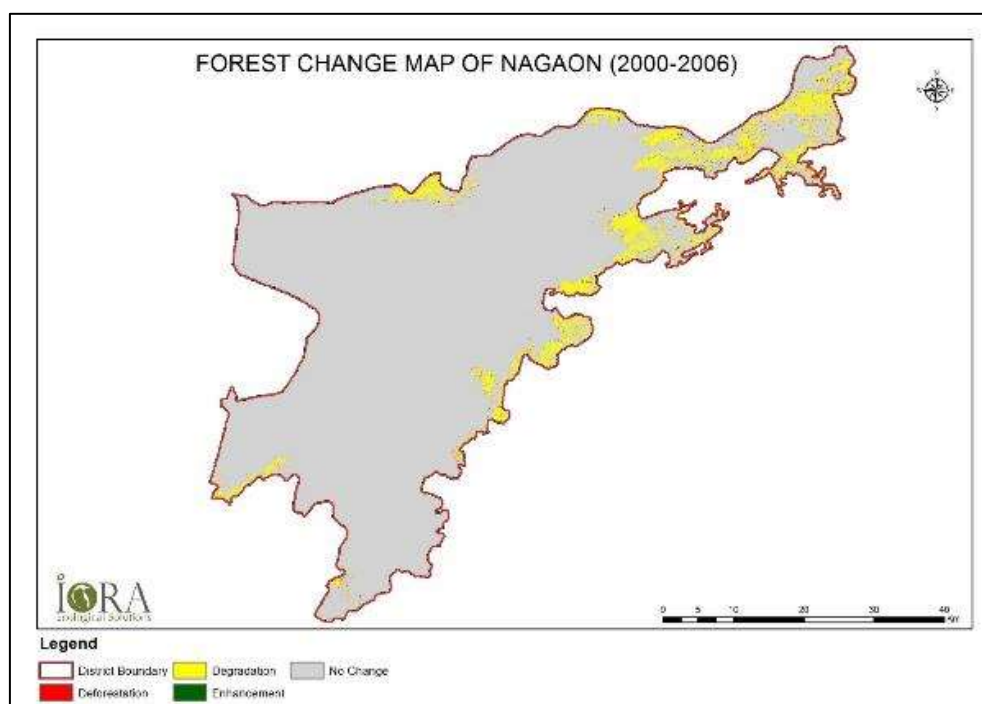


Figure 17: Forest change map of Nagaon, 2000 – 2006

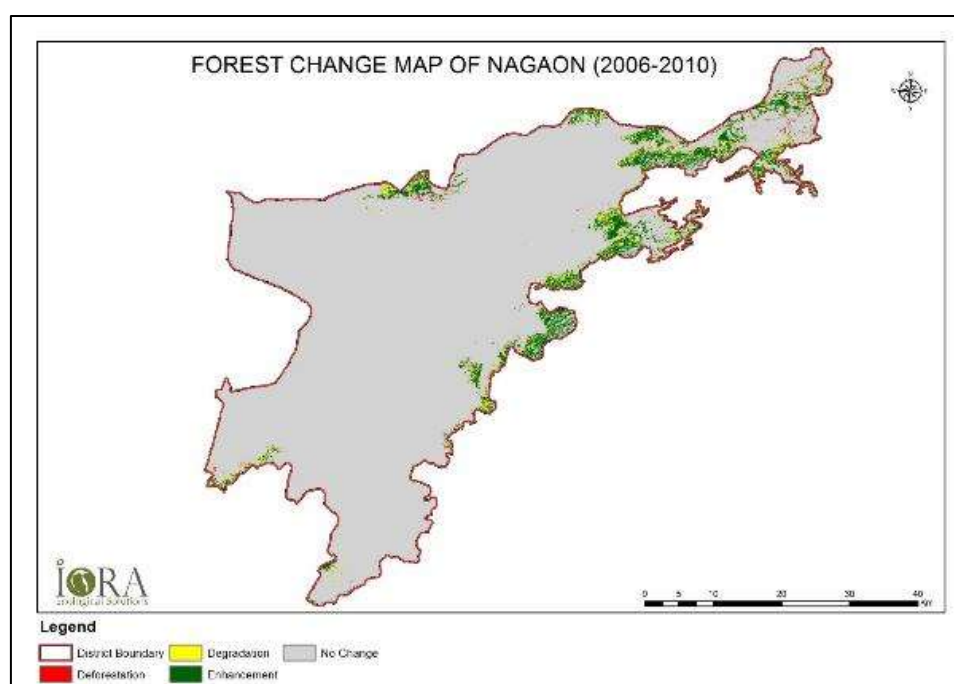


Figure 18: Forest change map of Nagaon, 2006 - 2010

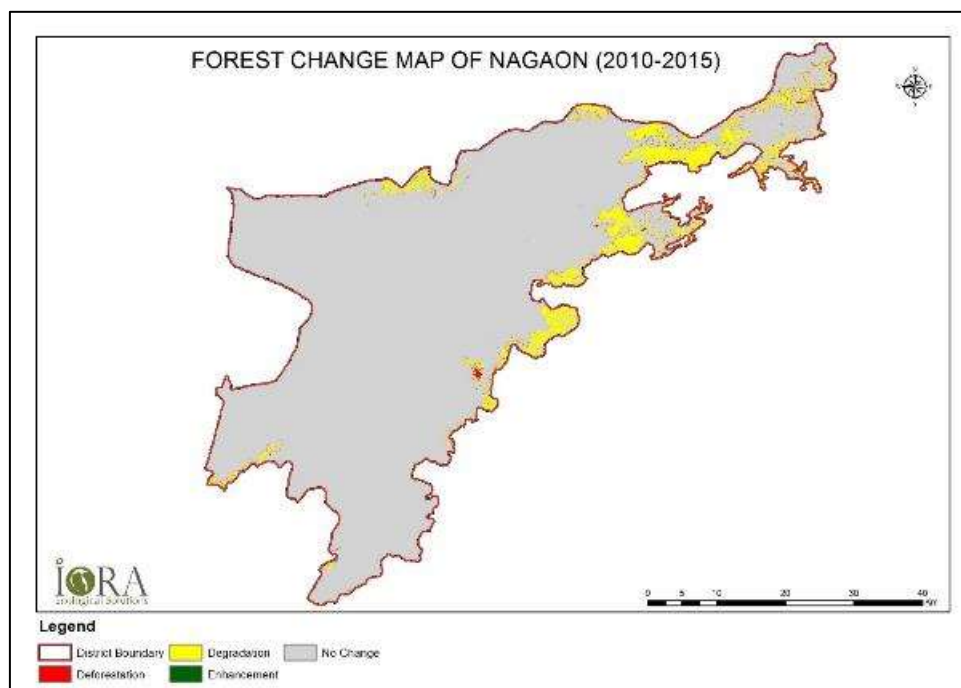


Figure 19: Forest change map of Nagaon, 2010 - 2015

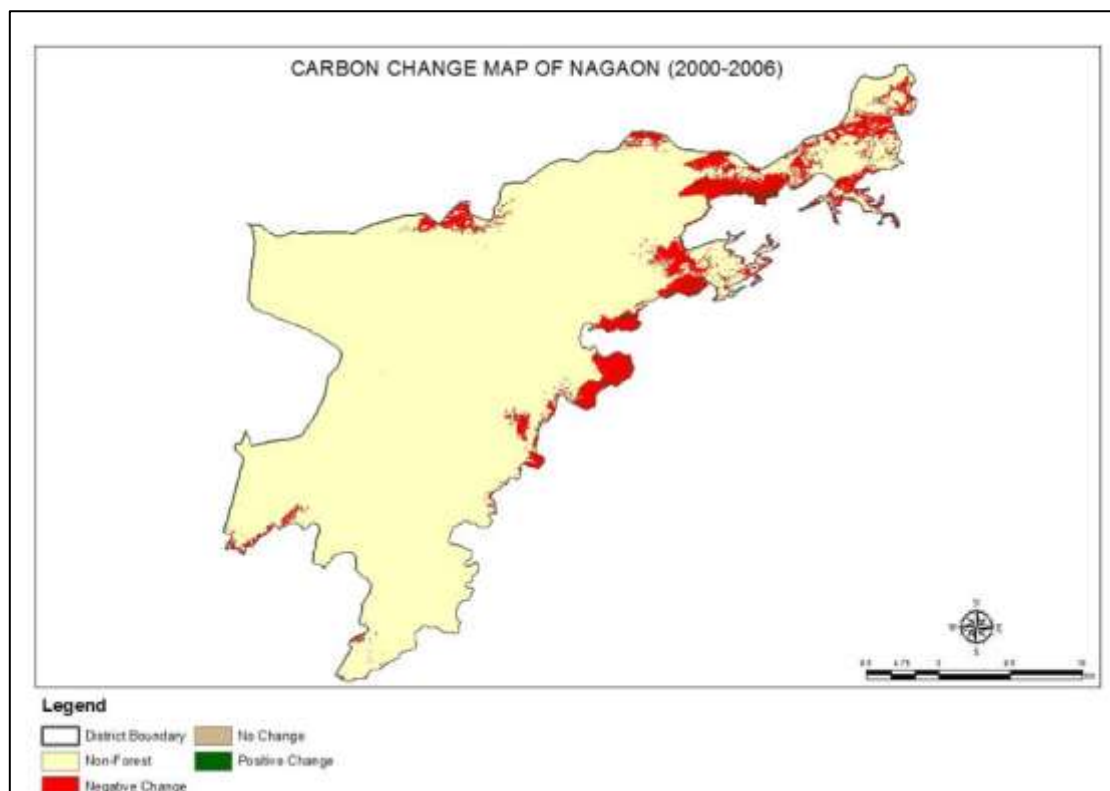


Figure 20: Forest change map of Nagaon, 2000 – 2006

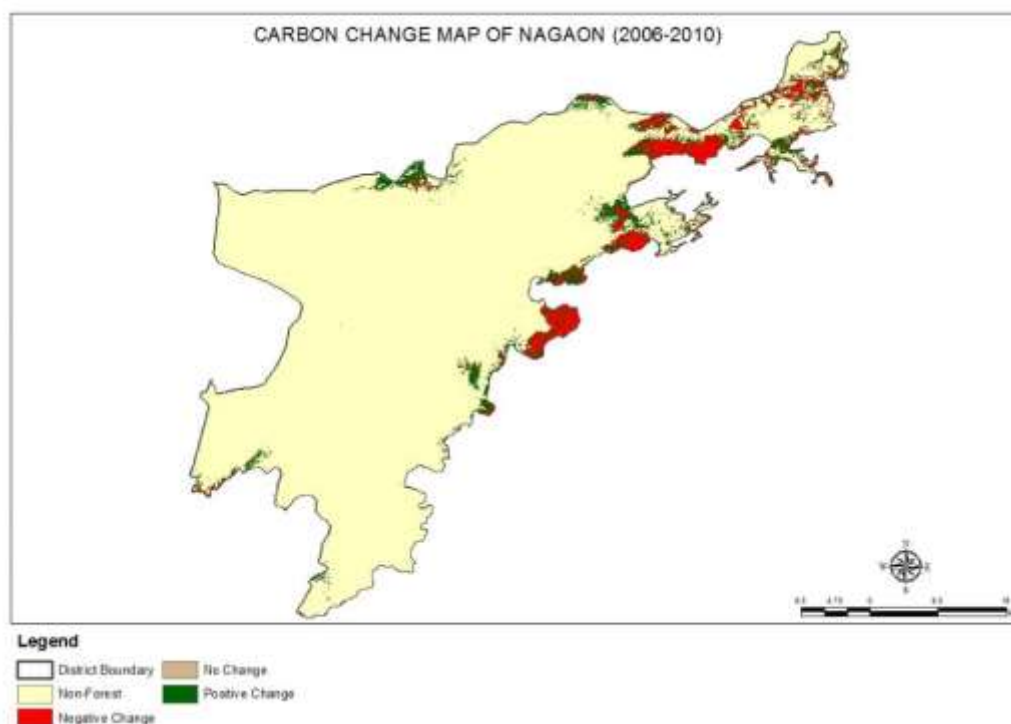


Figure 21: Forest change map of Nagaon, 2006 – 2010

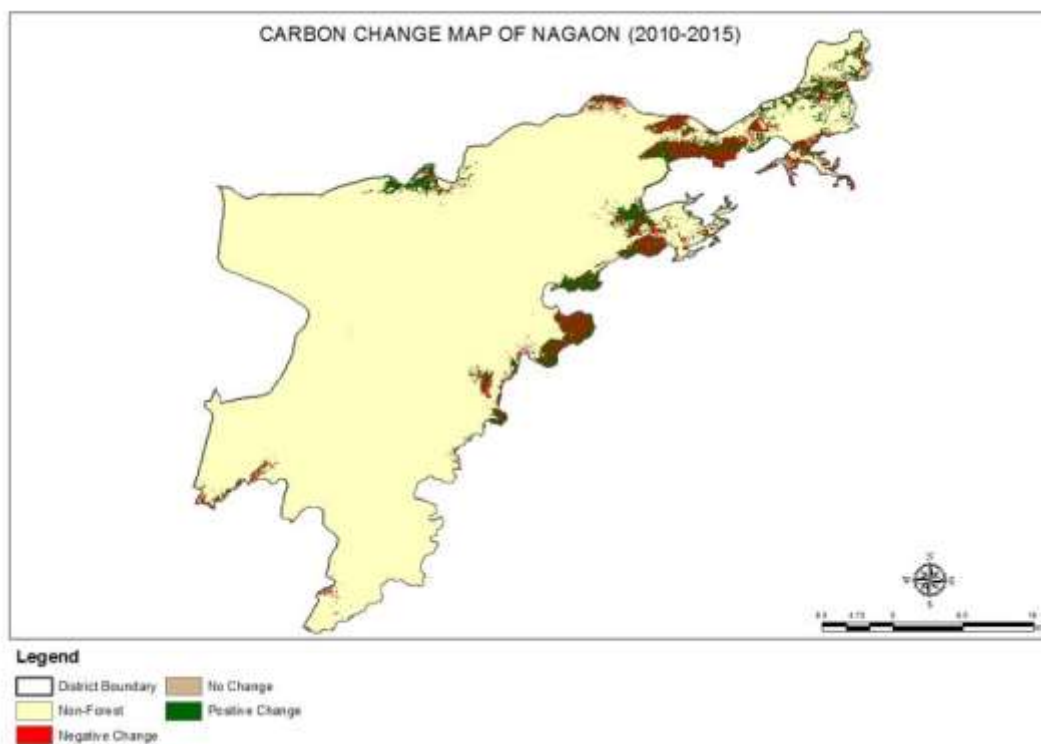


Figure 22: Forest change map of Nagaon, 2010 - 2015

Annexure VI: List of deliverables

Outputs as per section 5 of Appendix A of the contract	Status	Documents submitted and/or evidence supporting successful completion
Selection of appropriate Jurisdiction(s) and its boundary(ies)	Completed: Selection of landscapes finalized. Final intimation on selection was made on 23/10/2016	Report 1: Notification on constitution of REDD+ Cell, REDD+ Task Force and REDD+ Committees in Assam, Report 2: Note on selection of landscapes; which was approved by the Department. Report 3: Inception report Report 4: Implementation Plan Report 5: Road Map
LULUCF change matrix analysis for chosen reference area.	Completed: Final analysis has been completed based on inputs from the range officers and field staff in Nagaon. Land Use Land Cover map for Majuli has also been completed; and validated from field observations.	Report 6: Report on LULUCF change matrix analysis for Nagaon Report 7: LULC change matrix analysis for Majuli is given as part of the final report.
Report on stakeholder mapping.	Completed: Stakeholder mapping completed, validated and revised based on consultations with officers in December at both the landscapes.	Report 8: Report on stakeholder mapping for Nagaon Report 9: Report on stakeholder mapping for Majuli
Report on stakeholder consultations and socio-economic analysis for identification of drivers and agents of forest and land use change.	Completed: Report finalized after validation by staff under the DFO's office in Nagaon and the DC's office in Majuli.	Report 10: Stakeholder analysis and socioeconomic report for Nagaon. Report 7: Socioeconomic report for Majuli is given as part of the final report.
Jurisdictional REDD+ baseline,	Completed: Has been developed and is a part of the PDD	Report 11: Project Design Document with all the requisite

Project Closure Report- Estimation of potential value of ecosystem services and development of REDD+ project for Assam (TA -9)

Outputs as per section 5 of Appendix A of the contract	Status	Documents submitted and/or evidence supporting successful completion
in an appropriate design.		elements has been designed. Baseline is explained in the PDD.
REDD+ intervention plan and synchronization with working plan;	Completed: Report on synchronizing working plan and REDD+ design completed.	Report 12: REDD+ Intervention plan is also given as part of Report 11 (PDD) Report 13: Synchronization of working plan data with development of REDD+ PDD: Nagaon a case study. Report 14: Standees prepared to explain Majuli project and interventions
REDD+ Monitoring, Reporting and Verification (MRV) Plan included community based MRV	Completed: Monitoring report and MRV plan has been completed and is added as a part of the project design document	Report 11: MRV plan is given as a part of the PDD. Report 15: REDD+ Safeguards Information system with details on monitoring
REDD+ Project Design Document	Completed: The PDD has been finalized	Report 11: Project Design Document of PDD
Identification of current financing and potential future financing for ensuring project sustainability	Successful in accessing finance from CDP for climate resilient actions in Majuli, CSR funding from OIL for distribution of improved cook stoves, and Nagaon has been selected among the pilot landscape for implementing NAMA in the forestry sector in India by GIZ/MoEFCC. Apart from this, the draft GCF Concept Note has been completed and to be submitted to the dept.	Report 16: Potential inter-departmental convergence identified is collated as a report.
Launch of a certified REDD+ project based on a	The SACReD GHG registry was launched by the Hon. Chief Minister of Assam.	Report 18: Final presentations on both the projects

Project Closure Report- Estimation of potential value of ecosystem services and development of REDD+ project for Assam (TA -9)

Outputs as per section 5 of Appendix A of the contract	Status	Documents submitted and/or evidence supporting successful completion
landscape approach		<p>Report 19: News clippings from various newspapers</p> <p>Report 20: 4 Videos in the public on Majuli project including news clipping from Doordarshan news</p> <p>Report 17: Project Closure Report</p>



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