Forest Reference Emission Levels (FRELs) for the Federal Republic of Nigeria: A Jurisdictional Approach focused on Cross River State

Federal Republic of Nigeria

Federal Department of Forestry
Federal Ministry of Environment
Federal Republic of Nigeria

January 2018

CONTACT INFORMATION

National Coordinator, Nigeria REDD+ Programme

Federal Department of Forestry, Federal Ministry of Environment

Plot 393/394, Augustus Aikhomu way, Utako District, Abuja, Nigeria.

E-mail: Nigeria_redd@yahoo.com. Or. Mema20ng@yahoo.com

Phone: +234-8033486909

Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms

AD	Activity Data
CRS	Cross River State
CRSFC	Cross River State Forestry Commission
CRSMCCF	Cross River State Ministry of Climate Change and Forestry
DCC	Department of Climate Change
EFs	Emission Factors
FME	Federal Ministry of Environment
FORMECU	Forestry Monitoring and Evaluation Coordinating Unit
FRELs/FRLs	Forest Reference Emission Levels/ Forest Reference Levels
FRIN	Forestry Research Institute of Nigeria
FUTA	Federal University of Technology, Akure
GHG-I	Greenhouse gas Inventory
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Landuse, Landuse Change and Forestry
MCCF	Ministry of Climate Change and Forestry
MRV	Measurement, Reporting and Verification

NAGIS	Nasarawa State Geographic Information Services
NASRDA	Nigerian Airspace Research and Development Agency
NESREA	National Environmental Standards & Regulations Enforcement Agency
NFI	National Forest Inventory
NFMS	National Forest Monitoring System
R-PP	REDD+ Preparatory Proposal
SLMS	Satellite Land Monitoring System
SPC	State Planning Commission
UNFCCC	United Nations Convention on Climate Change

1. Introduction

The Federal Republic of Nigeria welcomes the invitation to submit a Forest Reference Emission Levels (FREL) on a voluntary basis as expressed in Decision 12/CP.17, paragraph 13. This FREL submission is in the context of results-based payments for the implementation of reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (REDD+) under the United Nations Framework Convention on Climate Change (UNFCCC).

The government has followed the guidance provided by the UNFCCC through the decisions taken at the Conference of the Parties (CP), notably the modalities for forest reference emission levels and forest reference levels in Decision 12/CP.17 and the guidelines for submission of information on reference levels in the Annex of Decision 12/CP.17. This submission does not prejudge or modify any of Nigeria's Nationally Determined Contributions (NDCs) or Nationally Appropriate Mitigation Actions (NAMAs) pursuant to the Bali Action Plan.

The Government intends to take a step-wise approach to its national FREL development as stated in Decision 12/CP.17, paragraph 10. As such, the current FRL reflects the best available information at the time of submission at sub-national level. The scope and methodologies applied can be modified whenever improved data becomes available. The historical period considered, and/or the construction approach could also be revised.

2. FREL development process

The construction of the FREL was initiated during a workshop under the auspices and coordination of the Federal Ministry of Environment's Federal Department of Forestry from 24th to 26th May 2016, with support from the FAO-UN REDD Programme. The process was chaired by the National Secretariat of REDD+ hosted within the Federal Department of Forestry. Stakeholders drawn from various ministerial departments, universities and research institutions, NGOs, and CSOs from States and Federal Government participated in the workshop. Details of those involved can be consulted in Appendices 5 and 6. The technical team for the construction of the FREL is composed of national foresters, natural and environmental scientists, GIS and remote sensing experts drawn from relevant sectors and the mapping agencies of the Government, with technical support from a team of experts and consultants from FAO.

The entire FREL process was also subjected to a wider stakeholder consultation and review to ensure that it reflects the expectations of all stakeholders, and to also consider technical inputs from this broader group.

3. Scale of FREL: Area covered

While recommending that countries develop national FREL, the UNFCCC also suggest that countries could start at sub-national level as an *interim* measure, depending on national circumstances. Nigeria opted for a nested REDD+ programme in which the Cross River State was selected as pilot State. Nigeria's REDD+ Programme envisioned a two-track approach to achieve REDD+ readiness, based on: (i) the development of institutional and technical capacities at Federal level, and (ii) consolidating four key UNFCCC requirements for REDD+ Readiness (Warsaw Framework elements) on a pilot basis in Cross River State: REDD+ Strategy, Safeguards Information System, Forest Monitoring System, and Forest Reference Levels. FRELs has therefore been developed at CRS level as an *interim* measure.

The choice of CRS as pilot State was guided by the fact that it contains almost; 50% of the remaining tropical high forest in Nigeria, and secondly, the forest policies and governance favoured forest conservation and management, with CRS Forestry Commission playing a crucial role.

3.1 Geographical location and Vegetation of Cross River State

Cross River State is situated between latitudes 5° 32'N and 4° 27'N and longitudes 7° 50'E and 9° 28'E (Figure 1) and occupies about 20,156 km^2. The ecological zones present in Cross River State as documented by Oyebo et al. (2010) include: lowland rainforest, freshwater swamp forest, the mangrove vegetation, coastal vegetation, montane vegetation, savanna like vegetation, and wetlands (Figure 2).

The **lowland rain forest** covers extensive areas in the centre, north and east of Cross River State, and is contiguous with the forests of South West Cameroon. Although significant areas have been converted into agricultural farmlands and natural forests have been disturbed by indiscriminate felling and wood removal, the State is still home to the largest contiguous and well-preserved fragments of natural forest in Nigeria.

Figure 1. Map of Nigeria showing the location of Cross River State (CRS)

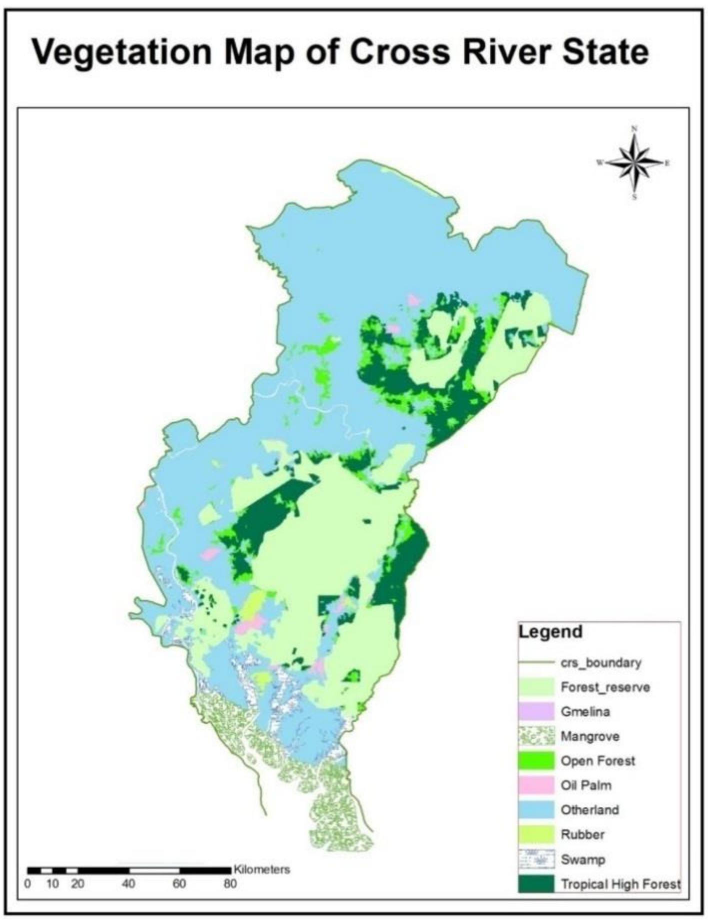

Figure 2. Vegetation Map of Cross River State (Adapted from Flasse Consulting)

The **Mangrove forest** in the State forms a narrow belt along the coast and in the estuary of Cross River. Mangroves are dominated by the following species: *Rhizophora racemosa, R. mangle, Avicennia africana* and *Laguncularia racemosa. R. racemosa* is the biggest of the R*hizophora spp,* and can attain heights of up to 40 meters and accounts for up to 95% of the species content of the mangrove forest. However, the mangroves are threatened by the exotics Nypa Palm, *Nypa fruticans,* that was introduced into Calabar and Oron between 1906 and 1912 from South East Asia. The palm tends to form pure stands and isolate endemic mangrove trees.

The **freshwater swamp forest** forms a wide belt immediately north of the mangrove vegetation zone, and has more open canopy and dense tangled undergrowth. It is usually flooded during the wet season and dries out during the dry season leaving portions of dry forest floor interspersed with permanent pools of water. Much of this vegetation type has been converted to agricultural and urban lands, and the original swamp forest remains mostly on alluvial sites along the major rivers: The Cross River, Calabar River and Great Kwa River.

The **coastal vegetation** is found at the outer edges of the mangroves and is composed of a mosaic of forest, thickets, and mangroves. Prevalent species include *Chrysobalanus orbicularis, Conocarpus erectus,* and *Hibiscus tiliaceus.*

The **montane vegetation** is predominant in the north eastern parts of the State on the Oshie Ridge of the Obudu Plateau around the border with Cameroon to the east and Benue State to the north. The highest peak is about 1,819 m above sea level. The vegetation type includes the lowland rain forest in the low lying areas progressively enriched with montane elements. The common woody plant species include *Xylopia Africana, Rauvolfia vomitoria, Tabernaemontana ventricosa,* and *Voacanga trouarsii.*

The **savanna-like vegetation**, probably attenuated variants of degraded rainforest occurs in the central (Yakurr) and northern (Obudu) areas of the State. These formations are characterized by relic rain forest species such as *Celtis zenkeri, Cola gigantea, Anthonotha macrophylla* and *Treculia africana*.

The **wetlands** in Cross River State are found at the Cross River Estuary, the Cross River Flood Plains at Obubra as well as scattered swamps or flood plains. They are made up of a mixture of seasonally flooded riparian lowland forests and tall grass swamps in the catchments of Cross River and its Enyong creek tributary. Some of the plant species found in these wetland areas include: *Nymphaea lotus, Vossia cuspidata*, *Echinochloa pyramidalis, E. stagnina, Ragmites sp, Leersia hexandra, Ipomoea asarifolia* and *Mimosa pigra.*

4. Scope: Activities, Pools and gases included

4.1 Activities included

The Cancun Agreement defines REDD+ activities as follows: reduction of emissions from deforestation, reduction of emissions from forest degradation, sustainable management of forests, enhancement of forest carbon stocks, and conservation of forest carbon stocks. Deforestation is the conversion of forest land to non-forest land (cropland, grassland, settlement, wetlands and other lands). Forestland is considered as in the forest definition adopted for Nigeria (see **section 6**), and any conversion below the threshold of forest definition is considered deforestation. Forest degradation results in the loss of carbon stocks and biodiversity in the forest remaining forests category, while enhancement is the enrichment in carbon stocks and biodiversity in forest remaining forest. While forest degradation (from logging, fuel wood extraction, charcoal production, forest fires, etc.) constitute a significant source of emissions, it has not been included in the present FREL due to lack of reliable, accurate and consistent data at state and federal levels. However, it is envisaged that forest degradation will eventually be included in a stepwise manner, as data becomes available. Nigeria has promoted natural forest restoration and plantation silviculture that leads to reduction in emissions from deforestation and forest degradation. However, no reliable data on forest degradation is available, so has this REDD+ activity has not been included in the present FREL submission. There is also no reliable data for sustainable management of forests to be included. The area of afforestation (enhancement of forest carbon stocks in forest land remaining forest land) was also assessed by Nigeria but the confidence value is currently very large and it still needs to be investigated how to assess the associated removal factor from the NFI data. Hence, only deforestation has been considered in the present FREL submission.

4.2 Pools included

While IPCC recognises six carbon pools: above ground (live tree) biomass, belowground (live tree) biomass, deadwood (standing and lying/down), litter, and soil organic carbon; only significant pools need to be included (cf. SBSTA Decision from COP17). Key category analysis is needed to determine which carbon pools should be included to capture significant emissions and removals from changes in forest cover, taking into account their magnitude and cost-effectiveness to monitor the pools. The above-ground biomass constitutes the main component/largest pool and has been included in the FRELs/FRLs. Belowground biomass constitutes a significant pool; however, its estimation is expensive and was indirectly undertaken using IPCC default root-to-shoot (R/S) ratio. Deadwood also constitutes a significant pool to be included, however, the deadwood pool was not consistently estimated during the inventory (see section 5.2). Soil organic carbon (SOC) is an important carbon pool, however major changes only occur when forest is converted to non-forest, and after a long time. It has not been considered in the present submission due to lack of data, and also data collection is expensive. Litter and non-herbaceous biomass pools constitute a small proportion of biomass and has not been included.

4.1 Gases included

Among the three greenhouse gases associated with land use change emissions, namely carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), CO_2 is the main gas emitted in the forest sector. However, significant non-CO_2 gases (CH_4 and N_2O) can also be emitted when land use change is as a result of fire incidences. No accurate statistics exist for forest fires. Methane is also produced when mangroves are disturbed, but no data exist in Nigeria at the moment. Therefore, only CO_2 emissions have been considered in the present submission.

5 Estimation of Historical Emissions

IPCC (GPG 2003 and Guidelines for National GHG Inventories in AFOLU, 2006) provides the framework for estimating emissions and removals of CO_2 in the AFOLU sector. Two basic inputs needed are: Activity data (AD: i.e. changes in areal extent of forest land (ha/year)) and emission factors (EF: that is, emissions/removals of GHG per unit area: tCO_2/ha of deforestation). The product of AD by EF produces an estimate of the amount of emissions/removals in a given year as a result of the activity.

IPCC present three approaches (1-3) for estimating AD and three Tiers (1-3) for estimating EF. The higher the approach or Tier, the more accurate/reliable are the estimates obtained. The estimation of historical emissions therefore requires estimates of historical activity data and emission factors.

5.1 Activity Data

Activity data is mostly obtained from land use change studies using satellite imagery. Several land use studies have been undertaken in Nigeria; however, their use is limited due to the fact that they were sample-based (not '*wall-to-wall*'), and used different methodologies and classification systems. The only study that produced wall-to-wall estimates of land use change was the 1976/78 and 1993/95 Vegetation and Landuse Assessment by FORMECU, Federal Department of Forestry. The study also produced a national classification system for Nigeria that is being used for reporting of global forest assessment (e.g. FRA2015 for Nigeria). In the absence of consistent datasets, the National Space Research and Development Agency (NASRDA) of Nigeria was contracted by FAO to design and undertake a "*wall-to-wall*" spatially-explicit study at Cross River State. The study led to the production of land use and land use change data and maps for 2000-2007-2014 time periods or epochs (NASRDA 2015). The national classes were also aggregated into the six IPCC classes. However, accuracy assessment was done only for each time period and not between time periods or for transitions.

The map area of deforestation between 2000-2014 as assessed by the NASRDA maps is 332,338 ha (or 23,738 ha/yr). This assessment was compared with the tree cover loss assessment from the Global Forest Change product from the University of Maryland (Hansen et al 2013) which for the period 2004-2014 consisted of 42,382 ha (or 4,238 ha/yr). The large discrepancy between these two assessments suggested the need for an accuracy assessment of change (loss) as assessed by both maps and also provided an indication that the use of map areas (or pixel counts) are not very reliable. For this reason, Nigeria proposes to use area statistics based on reference data following the procedure described in Olofsson et al 2014 which can be considered a combination of a wall-to-wall map including change classes and sample-based reference data. In this method, one of the maps is used to stratify the reference data points to be collected to ensure sufficient representation in the rare classes of change (forest loss and forest gain). The resulting area statistics are referred to as stratified area estimations. Reference data concerns interpretations of satellite data of greater quality with respect to both resolution and accuracy than remote sensing-based map data. GFOI (2016) suggests for accuracy assessment and estimation to be valid for an area of interest using the familiar design- or probability-based framework (McRoberts, 2014), the reference data must be collected using a probability sampling design, regardless of how the training data used to classify for example a satellite image are collected. Probability sampling designs to consider are simple random (SRS), systematic (SYS), stratified random (simple random sampling within strata) or systematic (systematic sampling within strata) (STR), and two-stage and cluster sampling. Nigeria used stratified random sampling using the global forest change map (also referred to as Hansen map) for stratification into forest loss, forest gain, stable forest and stable non-forest. The minimum number of reference data points to be collected per stratum were assessed following the formulas by Cochran (1977 in Olofsson et al 2014). This method assesses the accuracy of the map and stratified area estimates based on the reference data with associated confidence intervals.

Nigeria assessed the overall weighted accuracy of both the NASRDA map (2000-2014) and the Hansen map (2004-2014), which were 33% and 83% respectively. Based on the higher accuracy of Hansen and the fact that Nigeria considers the period 2004-2014 more representative for future deforestation expected in absence of REDD+ implementation than the period 2000-2014, currently the Hansen map is used for stratification. However, Nigeria is currently working on a direct change assessment based on the NASRDA 2014 map hoping to use this in the future. The stratified area estimation using the Hansen map was undertaken using the reference data generated by the Nigeria REDD+ Team with the aid of Collect Earth tools. The results of the AA are found in Table 1 and Appendix 1

Table 1. Results of Stratified Area Estimation for Forest Gain

	Results stratified area estimation
Weighted overall accuracy Hansen map	**83%**
Stratified Area Estimate loss	**15,440 ha/yr**
Confidence Value loss	**+/- 34%**
Stratified Area Estimate gain	**6,029 ha/yr**
Confidence Value gain	**+/- 57%**
Forest area	**1,668,352 ha**

As the above Table indicates, Nigeria also assessed the stratified area estimate of forest gain which corresponds to the afforestation area. However, as the confidence value currently exceeds 50% and because Nigeria has not yet considered how to best approximate the associated removal factor (the carbon removals per hectare afforested land), this activity is not yet included in this Forest Reference Emission Level. Nigeria plans to include this activity in a future submission, if possible by reducing the confidence value, and approximating the removal factor, if possible using the NFI data.

In total 428 reference points were collected and independently interpreted by two different interpreters. Of the total of 476 points collected, 48 were excluded because of low confidence while 428 were included.

5.2 Emission factor estimation

Emission factors are derived from forest inventory data. However, a review of historical inventories in Nigeria and CRS indicated a lot of limitations in their usage for biomass estimation, and carbon stocks; and hence, their use for estimating emission factors for REDD+ purposes. The inventories were originally designed for timber volume estimation for commercial trees and not for all trees, and estimations were limited to bole volume, and not all carbon pools. In order to circumvent this situation a forest carbon inventory was designed and implemented at CRS. The study was jointly funded by UN REDD Programme and GCF (Governors Climate Fund). A total of 80 sample plots were established for field data collection. The spatial distribution of the plots is shown in Figure 3. The sampling frame was overlaid on the 2014 land use map produced by NASRDA (2015) while information from a preliminary inventory by Winrock International was used to optimize the design.

5.2.1 Inventory Design

The sampling design consisted of nested sample plots that were randomly distributed across 13 land use categories of CRS as depicted in the current 2014 land use thematic map for the state, prior to the commencement of the field work. The plot distribution aspect was guided by two criteria – (i) extent of each of the 13 land use categories; and (ii) carbon contribution in each of the land use categories. 16 plots were established in the tropical high forest, 12 in the open forest, 13 in farm land/fallow lands, 8 in mangroves, 11 in swamps, 6 in montane forest, 5 in derived savanna, 3 in Gmelina plantations and 3 in grazing fields. A **stratified random sampling design** was used in order to capture spatial variability of land-use types and forest carbon stocks.

5.2.2. Sample plots layout and data collection

Each plot was composed of four nested sub-plots of 35m x 35m (**Nest 1**), 25m x 25m (**Nest 2**), 7m x 7m (**Nest 3**), and 2m x 2m plot (**Nest 4**) (**Figure 4**). In **Nest 1** all living and dead standing trees greater than 50 cm dbh were measured for dbh. Trees between 20 cm and 50 cm were measured in **Nest 2**, while those between 5 cm and 20 cm were measured in **Nest 3**. Saplings were identified by species and counted on a 2m x 2m (**Nest 4**). Standing and lying dead wood was collected, but was not used because decomposition classes were not consistently assessed in all plots.

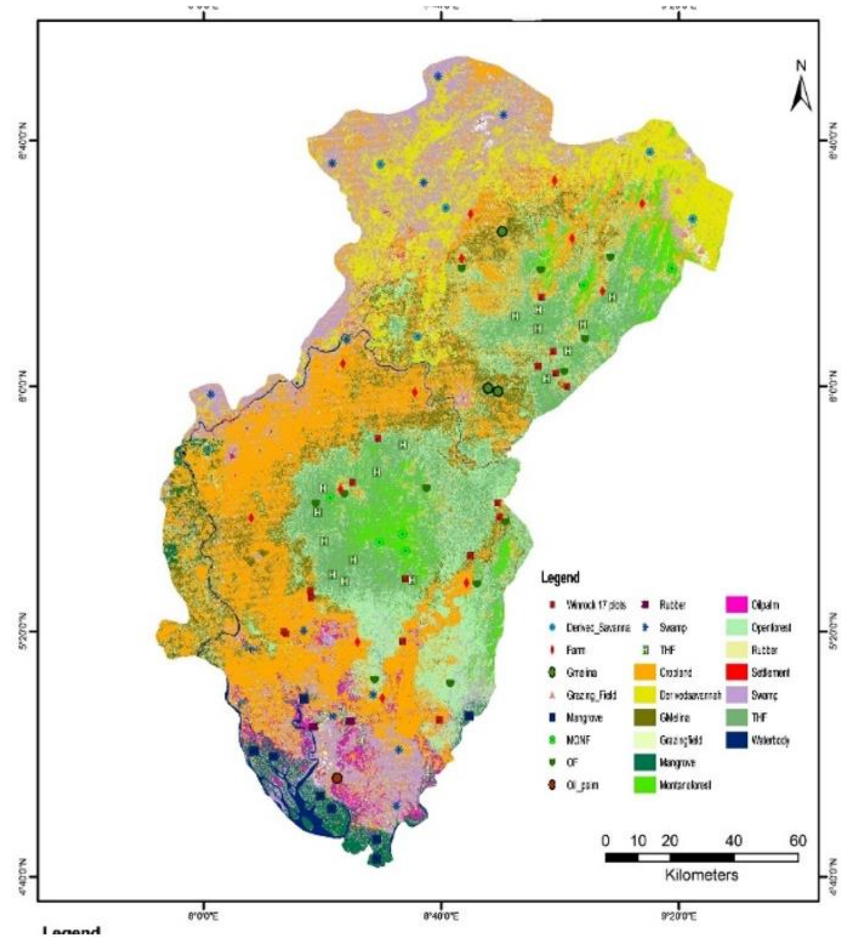

Figure 3. Spatial distribution of sample plots used in the study

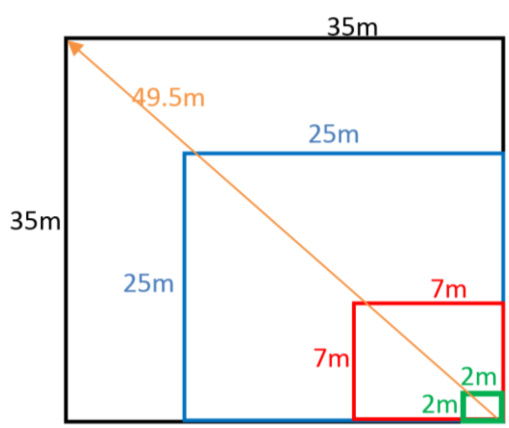

Figure 4. Nested plot design for data collection

For data collection in mangroves, three (10x20 m) plots were laid on 100 m transects at 10 m intervals as shown in **Figure 9** (cf. Ajonia 2008).

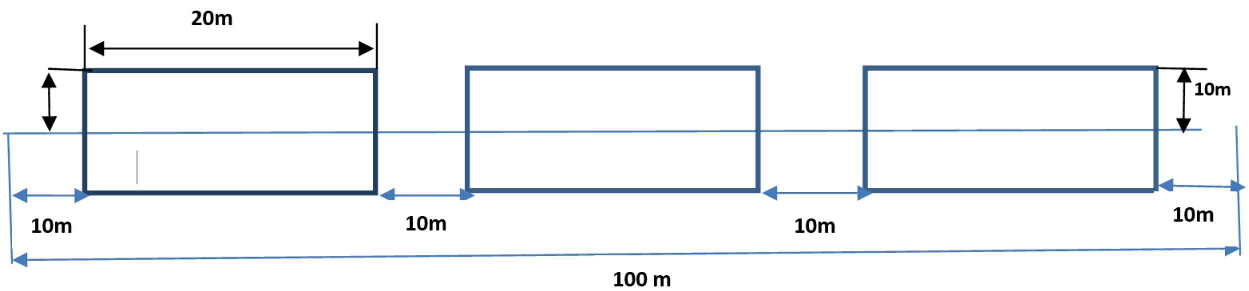

Figure 5. Transect sample plots for mangroves data collection

5.2.3. Data Analysis

5.2.1.1 Above Ground Biomass

The conversion of field data collected to biomass and carbon stocks require the use of biomass allometric equations. In the absence of country-specific allometric equations, a pan-tropical allometric equation by Chave *et al* (2014) below was used to estimate above ground biomass from field measurements.

$$AGB_{est} = (0.0673\rho D^2 H)^{0.976}$$

Where:

AGB_{est} = above ground biomass (kg)

ρ =species wood density (g/cm3)

D=diameter at breast height (cm)

H=tree height (m)

The equation also requires an estimate of tree height, and wood density. Given that tree heights were not measured during the inventory, we resorted to the use of a height-diameter equation developed by Feldpausch *et al* (2012) for West Africa:

H=53.133*(1-EXP(-0.0331*DBH^0.839),

while wood density estimates were obtained from Zanne *et al*. (2009).

For above ground biomass for mangroves the following equations for all mangrove species by Komiyama *et a*l (2005) is the most widely used (cf. Komiyama et *al*. 2008; Kauffman and Donato, 2012; Allemayehu et *al*. 2014.):

For above ground biomass (including stilt): $W_{top} = 0.251.\rho.D^{2.46}$: R^2=0.98, n=104

5.2.1.2 Below Ground Biomass

The estimation of below ground biomass (BGB) is difficult and expensive to undertake in most tropical high forest, and few country-specific allometric equations exist for BGB. Most projects or studies therefore resort to the use of a proxy root-to-shoot (R/S) ratios (Kauffman and Donato, 2012). In the present study we used a ratio equation for moist tropical forests developed by Mokany *et al*. (2006; also reported in the IPCC 2006 AFOLU), which predicts below ground biomass (BGB) based on above ground biomass (AGB) as follows:

$$\boldsymbol{BGB} = \begin{cases} \boldsymbol{0.235 * AGB\ if\ AGB} > 62.5\boldsymbol{t\ C/ha} \\ \boldsymbol{0.205 * AGB\ if\ AGB \leq 62.5\ t\ C/ha} \end{cases}$$

Belowground biomass for **mangroves** (excluding stilt) was estimated using the following equation by Komiyama *et al* (2005) :

$$W_{root} = 0.199.\rho^{0.899}D^{2.22}$$

R^2=0.95; n=26.

5.2.2 Estimation of Carbon content

The carbon content of biomass was estimated by applying a conversion factor of **0.47** to total biomass, while the carbon dioxide equivalent (CO_2e) was computed by multiplying the carbon content by **3.67** (44/12) (IPCC 2003, 2006). **Table 2** present summary results for the estimation of above ground biomass (AGB), below ground biomass (BGB) and carbon stocks for different forest types at Cross River State. Biomass and carbon stocks for **Forestland** was estimated as a weighted average of the mean values estimated for different forest types (open forest, tropical high forest, montane forest, mangrove forest, etc.) using stratified sampling technique (cf. Freese 1976; Avery and Burkhart, 2002).

Table 2. Summary results for above ground biomass (AGB), below ground biomass (BGB) and carbon stocks for different forest types at Cross River State

Land use Type	ABG (t/ha)	ABG (tC/ha)	BGB (tC/ha)	ABG (tCO2/ha)	BGB (tCO2/ha)	Total Biomass (tCO2/ha)
Derived Savanna (4)	99.65±132.6	46.84±62.30	20.91±28.4	171.73±228.5	76.67±104.20	248.0±332.6
Farmland(9)	80.58±56.8	37.87±26.69	16.52±11.64	138.86±97.87	60.57±42.69	199.4±140.5
Gmelina	162.85±54.3	76.54±25.56	34.11±8.98	280.64±93.71	125.08±32.92	405.72±126.00
Montane (7)	709.88±245.74	333.65±115.50	154.74±53.47	1223.37±423.50	567.37±196.04	1790.73±619.53
Open Forest (14)	311.41±119.72	146.36±56.27	67.57±27.45	536.67±206.32	247.76±100.66	784.43±306.92
Swamp (7)	76.42±51.94	35.92±24.41	15.67±10.65	131.70±89.51	57.44±39.04	189.15±128.55
Tropical High Forest (15)	531.71±190.17	249.90±89.38	115.82±43.66	916.32±327.73	424.68±160.10	1341.00±487.78
Mangroves (7)	380.57±210.64	178.87±99.00	163.15±72.24	655.85±363.00	598.23±264.89	1254.08±626.59
Forest Land*	392.39±68.88	184.42±31.74	94.10±16.18	676.23±116.38	345.04±59.32	1021.23±175.28

*Forest Land values were calculated as a weighted average of the means from the different forest type estimates.

6. Forest Definition

When submitting a FRELs/FRLs to the United Nations Framework Convention on Climate Change (UNFCCC), countries are expected to provide a definition of what they mean by forest in their FREL/FRL construction and, demonstrate how the definition is in line with the definition used in the national GHG inventory or in other international reporting. Forest definition in the context of REDD+ has to take into account UNFCCC thresholds which are currently defined as follows:

- Minimum tree crown cover between 10 and 30%
- Minimum land area between 0.05 and 1 hectare
- Minimum tree height between 2 and 5 meters (at maturity *in situ*)

Hitherto, Nigeria had not got a forest definition, but had been using the FAO FRA definition as follows: *"Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use".*

During the workshop of 24th to 26th May 2016, participants went through brain storming sessions in order to craft a forest definition for FREL purposes. An initial stage involved an appraisal of existing definitions and/or descriptions of forest in the forest laws, policies and Acts and other documents. After general heated discussions, a technical working group was tasked to work on the draft version (see **Appendix 5**). They explored and reviewed some policy documents, at Federal and State levels, in order to have an in-depth understanding of what the law and policies documents consider as forest across the different States. Based on the above background information, participants arrived at the following functional forest definition for FREL/FRL in Nigeria.

*An ecological community predominated by trees and other layers of woody plants with a minimum area of **0.5ha**, a minimum tree height of **3metres**, and a minimum tree canopy cover of **15%**, or stands with potentials to reach the above thresholds in situ.*

7. Transparent, complete, consistent and accurate information

7.1. Transparent information

During the development of the FREL document, all processes followed and methodologies used for the estimation of activity data and emission factors were documented in a transparent manner. Some information is provided in the appendices to this document. All maps used for estimating activity data have been referenced, and both metadata and spatial datasets are available in a spatial database. Also for the estimation of emission factors, based on forest inventory data, all calculations have been done in a transparent manner. The spreadsheets are available, and some detail results have been included in the Appendix to this document.

7.2. Complete information

Annex I in Decision 12/CP.17 indicates that complete information means information provided that allows for the reconstruction of forest reference emission levels and/or forest reference levels. All information used in the context of the construction of the present FREL has been developed by Nigeria, and allows for the reconstruction of the FREL and is publicly available. Nigeria also ascertains that all information used for the construction of Nigeria's FREL will be uploaded to the website and is available for download.

7.3. Consistent information

Consistency with the national greenhouse gas inventory paragraph 8 in Decision 12/CP.17 establishes that FRELs and/or FRLs shall maintain consistency with anthropogenic forest related greenhouse gas emissions by sources and removals by sinks as contained in the country's national greenhouse gas inventory.

Compared to the second National GHG Inventory submitted by Nigeria in its Second National Communication, there was no clear forest definition used.

7.4. Accurate information

7.4.1 Accuracy of the estimated activity data

The qualitative assessment of land use maps for the years 2014 produced from the spatially explicit study by NASRDA (2015) was done. Same process was repeated for Hansen maps for the purpose of comparison. The results of the comparative analysis informed the decision to opt for Hansen datasets for the creation of new change layer through direct change assessment using FAO-SEPAL platform at FAO Rome. Reference data were generated by Nigeria REDD+ technical team for the accuracy assessment using NASRDA and Hansen maps stratifications. (**Appendix 1**)

7.4.2. Uncertainty of the estimated emission factor

The estimation of emission factors is associated to many sources of uncertainty, including the use of default values, sampling errors and bias from field measurements, etc. All biomass estimates (**Table 2**) from the inventory were reported with 95% uncertainty values associated with the estimates (**Appendix 2**). Also, **Table 3** gives 95% uncertainty estimates for above and below biomass carbon pools for different land use types. The Derived savannah has a very high uncertainty values (> 100%), followed by farmland (>70%), Swamp (>60%) and mangroves (>40%). The high uncertainties are also linked to the small sample sizes for those land uses. However, the weighted average for all forest land estimates has an uncertainty value of 17.2%.

Table 3. Uncertainty estimates (95% confidence intervals) for carbon pools by land use types

Land use Type	**ABG tCO2/ha**	**BGB tCO2/ha**	**Total Biomass tCO2/ha**
Derived Savanna	133.0%	135.9%	133.9%
Farmland	70.5%	70.5%	70.5%
Gmelina	33.4%	26.3%	31.1%
Montane	34.6%	34.6%	34.6%
Open Forest	38.4%	40.6%	39.1%
Swamp	68.0%	68.0%	68.0
Tropical High Forest	35.8%	37.7%	36.4%
Mangroves	55.3%	44.3%	50.0%
Forest Land (Weighted Average)	**17.2%**	**17.2%**	**17.2%**

8. FREL/FRL Construction

8.1. Reference Period

The initial reference period will include data from 2004 to 2014, and annual historical deforestation rates will be considered during this period.

8.2. Average Method

The calculations gave a weighted average CO_2 equivalent of **1021.23 ± 175.28** tons of CO_2e/ha (**Se=17.2%=**Uncertainty); and the GFC estimated annual deforestation rate for the period 2004-2014 was **15,440 ± 34%** ha/yr (Activity Data).

Therefore, the annual emissions for the period 2004-2014 was estimated as the product of the average annual deforestation (Activity Data: AD) and the estimated CO_2 e per hectare (Emission Factor) as follows:

Annual Emissions [Total Biomass] = AD x EF = (15,440 x 1021.23 = **15,677,791.2±** tons CO_2e/; and the 95% confidence interval is [**10,347,342.2 or 21,008,240.2**] tons CO_2e/year.

9. Areas for future improvement

The initial inventory was deigned to collect data for standing live and dead trees as well as lying deadwood. Data was collected for deadwood, unfortunately the decomposition classes for standing deadwood were not noted, so the data could not be analysed, and has been left out in the present FREL submission.

As an improvement, future work will include the deadwood carbon pool, for example, in the ongoing FCPF project, FAO is supporting Nigeria to undertake a forest carbon inventory at National Level in order to up-scale the present sub-national FREL, measures will be put in place to ensure the best data is collected. Furthermore, height measurements during the study were ocularly appreciated, so were not used as inputs into the biomass estimation allometric equation. During the on-going study, laser dendrometers (TruPulse 200B) will be used to measure tree height in the field.

Checking the quality of reference data for the estimation of Activity Data is another area for future improvement. By this, we intend to adopt a third-party interpretation of the reference data where disagreements between two first-hand interpreters to further validate and improve accuracy of the data. Furthermore, we will also want to stratify the Activity Data in the future by forest type.

10. References

Ajonia G.N. 2008. Inventory and Modelling Mangrove Forest Stand Dynamics following different levels of wood exploitation pressures in the Douala-Edea Atlantic Coast of Cameroon. PhD Thesis. Albert-Ludwig-Univers sitat Freiburg im Breisgau, Germany.

Alemayehu, F., Richard O., Mwangi J. K., and Wasonga O. 2014. Assessment of Mangrove Covers Change and Biomass in Mida Creek, Kenya. Open Journal of Forestry, 2014, 4, 398-413

Avery, T.E. and Burkhart, H. 2002 Forest Measurements. Mcgraw-Hill Ryerson, pp. 1 –480.

Chao K-J, Phillips O.L., and Baker T.R. 2008. Wood density and stocks of coarse woody debris in a northwestern Amazonian landscape.

Chave, J., Andalo, C., Brown, S., Cairns, M.A., Chambers, J.Q., Eamus, D., Fölster, H., Fromard, F., Higuchi, N., Kira, T. et al. 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145 : 87-99.

Chave, J., Réjou-Méchain, M., Búrquez, A., et al., 2014. Improved allometric models to estimate the aboveground biomass of tropical trees. Glob. Change Biol. 20, 3177–3190.

Feldpausch, T.R., Lloyd, J., Lewis, S.L., Brienen, R.J.W. et al. 2012. Tree height integrated into pantropical forest biomass estimates. Biogeosciences 9, 3381–3403.

Freese F. 1976. Elementary Forest Sampling. Agriculture Handbook No. 232. U.S. Department of Agriculture. Southern Forest Experiment Station, Forest Service. USA. 95 Pages.

Hansen M. C., Potapov P. V., et al., Moore R., 2013. High-Resolution Global Maps of 21st-Century Forest *Cover Change*. Department of Geographical Sciences, University of Maryland, College Park, MD 20742, USA. *Google, Mountain View, CA, USA.*

IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

Kauffman J.B. and Donato D.C. 2012. Protocols for the measurement, monitoring and reporting of structure, biomass and carbon stocks in mangrove forests. Working Paper 86, CIFOR, Bogor, Indonesia. 50 pages.

Komiyama, A., Poungparn, S., Kato, S. 2005 Common allometric equations for estimating the tree weight of mangroves. Journal of Tropical Ecology 21: 471-477.

Komiyama, A., Ong, J.E., Poungparn, S. 2008 Allometry, biomass, and productivity of mangrove forests: A review. Aquatic Botany 89: 128-137.

Mokany, K., Raison, R.J., Prokushkin, A.S., 2006. Critical analysis of root: shoot ratios in terrestrial biomes. Global Change Biol. 12, 84–96.

Olofsson P., Giles M. Foody, et al., **2014.** Good practices for estimating area and assessing accuracy of land change

Zanne, A.E., Lopez-Gonzalez, G., Coomes, D.A., Ilic, J., Jansen, S., Lewis, S.L., Miller, R. B., Swenson, N.G., Wiemann, M.C., Chave, J., 2009. Towards a worldwide wood economics spectrum.

11. Appendices

Appendix 1. Statistical details of the Stratified Area Estimation for Forest Gain

Error matrix (values in matrix are samples)

2000-2010		Reference data						
		Forest loss	Forest gain	Stable Forest	Stable non-forest	**Total samples in map class**	User's accuracy	
Map data	Forest loss	3	1	17	5	26	12%	
	Forest gain	2	2	17	3	**24**	8%	
	Stable Forest	16	6	276	12	310	89%	
	Stable non-Forest	12	5	11	40	**68**	59%	
Total reference samples per class		**33**	**14**	**321**	**60**	**428**		
Producer's accuracy		9%	14%	86%	67%		**Overall accuracy**	**75%**
Weighted PA		**3%**	**0.56%**				Weighted OA	83%

Proportional error matrix (samples in agreement/diagreement divided by total samples in map class)

		Reference data				
		Forest loss	Forest gain	Stable Forest	Stable non-forest	Map area (ha)
Map data	Forest loss	0.12	0.04	0.65	0.19	42,382
	Forest gain	0.08	0.08	0.71	0.13	4,069
	Stable Forest	0.05	0.02	0.89	0.04	1,780,546
	Stable non-Forest	0.18	0.07	0.16	0.59	324,535
m						**2,151,532**

Weighed proportional error matrix in ha (proportional agreement/disagreement weighed by area class)

		Reference data				
		Forest loss	Forest gain	Stable Forest	Stable non-forest	Map area
Map data	Forest loss	4,890	1,630	27,712	8,150	42,382
	Forest gain	339	339	2,882	509	4,069
	Stable Forest	91,899	34,462	1,585,260	68,924	1,780,546
	Stable non-Forest	57,271	23,863	52,498	190,903	324,535
	Adjusted area	154,399	60,294	1,668,352	268,487	

More step by step adjusted area for deforestation:

Map area	Commission errors	Omission errors	Adjusted area = map area - over detection + misses					
							Map area loss	42,382
42,382	37,492	149,509	154,399.44				Adj area loss	154,399
							CI loss	53,248

Error matrix of standard error

		Reference data

Map data	Forest loss	1.58431E-06	5.74025E-07	3.51303E-06	2.4109E-06
	Forest gain	1.18797E-08	1.18797E-08	3.21292E-08	1.70096E-08
	Stable Forest	0.000108492	4.20681E-05	0.00021643	8.24757E-05
	Stable non-Forest	4.9352E-05	2.31338E-05	4.60472E-05	8.22533E-05
	Total	**0.00015944**	**6.57878E-05**	**0.000266022**	**0.000167157**

Standard error	27,167	17,451	35,092	27,817
95%Confidence Interval	53,248	34,204	68,780	54,521
95%Confidence Interval as percent of adjusted area	34%	57%	4%	20%

Appendix 2. Results for Data Analysis of Forest land using stratified sampling formulae

Tot_Biomass (tCO2/ha)	**Gmelina**	**MonF**	**OF**	**THF**	**Mangrove**	**Total**				
Surface Area	157742.4	93874.41	312291.4	236029.9	49152.25	849090.36				
nh	3	7	14	15	7	46				
nh-1	2	6	13	14	6	41				
Plot Size	0.1225	0.1225	0.1225	0.1225	0.06	0.55				
Nh	1287693	766322	2549318	1926775	819204	7349311		N		
mean	405.72	1790.73	784.43	1341	1254.08					
SD	50.72	669.87	531.56	880.81	677.5					
(Nh*Sh)^2	4.26563E+15	2.64E+17	1.836E+18	2.88022E+18	3.08037E+17					
(Nh*Sh)^2/nh	1.42188E+15	3.76E+16	1.312E+17	1.92015E+17	4.40053E+16	4.06254E+17		sy	86.72656355	Stderr
Nh*mean	522442828.8	1.37E+09	2E+09	2583804864	1027347561	7505631705	Sum(Nh*mean)	**Yst**	**1021.270091**	
								t	2.02	
							95% Confidence Interval=t*sy	tsy	175.2809233	
							95% CI_Lower		845.99	
							95% CI_Upper		1196.55	
							Uncertainty=(CI/mean)*100			**17.2%**
							Coeficient of variation (CV)			**8.5%**
BGB(tCO2/ha)	**Gmelina**	**MonF**	**OF**	**THF**	**Mangrove**	**Total**				
Surface Area	157742.4	93874.41	312291.4	236029.9	49152.25	849090.36				
nh	3	7	14	15	7	46				
nh-1	2	6	13	14	6	41				
Plot Size	0.1225	0.1225	0.1225	0.1225	0.06	0.55				
Nh	1287693	766322	2549318	1926775	819204	7349311		N		
mean	125.08	567.37	247.76	424.68	598.23					

SD	13.25	211.97	174.34	289.1	286.42					
(Nh*Sh)^2	2.9111E+14	2.64E+16	1.975E+17	3.10283E+17	5.50543E+16					
(Nh*Sh)^2/nh	9.70365E+13	3.77E+15	1.411E+16	2.06855E+16	7.8649E+15	4.65264E+16		sy	29.34967668	Stderr
Nh*mean	161064648.1	4.35E+08	631618916	818262677	490072508.6	2535806701	Sum(Nh*mean)	**Yst**	**345.0400502**	
								t	2.02	
							95% Confidence Interval=t*sy	tsy	59.31790925	
							95% CI_Lower		285.72	
							95% CI_Upper		404.36	
							Uncertainty=(CI/mean)*100			**17.2%**
							Coeficient of variation (CV)			**8.5%**
AGB(tCO2/ha)	**Gmelina**	**MonF**	**OF**	**THF**	**Mangrove**	**Total**				
Surface Area	157742.4	93874.41	312291.4	236029.9	49152.25	849090.36				
nh	3	7	14	15	7	46				
nh-1	2	6	13	14	6	41				
Plot Size	0.1225	0.1225	0.1225	0.1225	0.06	0.55				
Nh	1287693	766322	2549318	1926775	819204	7349311		N		
mean	280.64	1223.37	536.67	916.32	655.85					
SD	37.72	457.91	357.34	591.8	392.49					
(Nh*Sh)^2	2.35922E+15	1.23E+17	8.299E+17	1.3002E+18	1.03381E+17					
(Nh*Sh)^2/nh	7.86406E+14	1.76E+16	5.928E+16	8.66803E+16	1.47687E+16	1.79103E+17		sy	57.58436106	
Nh*mean	361378180.7	9.37E+08	1.368E+09	1765542187	537275052.7	4969832667	Sum(Nh*mean)	**Yst**	**676.2310834**	
								t	2.02	
							95% Confidence Interval=t*sy	tsy	116.382335	
							95% CI_Lower		559.85	
							95% CI_Upper		792.61	
							Uncertainty=(CI/mean)*100		**17.2%**	
							Coeficient of variation (CV)		**8.5%**	
BGB(tC/ha)	**Gmelina**	**MonF**	**OF**	**THF**	**Mangrove**	**Total**				
Surface Area	157742.4	93874.41	312291.4	236029.9	49152.25	849090.36				
nh	3	7	14	15	7	46				
nh-1	2	6	13	14	6	41				
Plot Size	0.1225	0.1225	0.1225	0.1225	0.06	0.55				
Nh	1287693	766322	2549318	1926775	819204	7349311		N		
mean	34.11	154.74	67.57	115.82	163.15					
SD	3.61	57.81	47.55	78.84	78.11					
(Nh*Sh)^2	2.16092E+13	1.96E+15	1.469E+16	2.30757E+16	4.09447E+15					
(Nh*Sh)^2/nh	7.20307E+12	2.8E+14	1.05E+15	1.53838E+15	5.84924E+14	3.46047E+15		sy	8.004254801	
Nh*mean	43923210.32	1.19E+08	172257387	223159045	133653159.8	691573424.1	Sum(Nh*mean)	**Yst**	**94.10044105**	

								t	2.02
							95% Confidence Interval=t*sy	tsy	16.1772024
							95% CI_Lower		77.92
							95% CI_Upper		110.28
							Uncertainty=(CI/mean)*100		**17.2%**
							Coeficient of variation (CV)		**8.5%**
AGB(tC/ha)	**Gmelina**	**MonF**	**OF**	**THF**	**Mangrove**	**Total**			
Surface Area	157742.4	93874.41	312291.4	236029.9	49152.25	849090.36			
nh	3	7	14	15	7	46			
nh-1	2	6	13	14	6	41			
Plot Size	0.1225	0.1225	0.1225	0.1225	0.06	0.55			
Nh	1287693	766322	2549318	1926775	819204	7349311		N	
mean	76.54	333.65	146.36	249.9	178.87				
SD	10.29	124.89	97.46	161.4	107.04				
(Nh*Sh)^2	1.75572E+14	9.16E+15	6.173E+16	9.67095E+16	7.68912E+15				
(Nh*Sh)^2/nh	5.8524E+13	1.31E+15	4.409E+15	6.4473E+15	1.09845E+15	1.33221E+16		sy	15.70507235
Nh*mean	98560026.91	2.56E+08	373118117	481500996	146531049.3	1355393429	Sum(Nh*mean)	**Yst**	**184.4245528**
								t	2.02
							95% Confidence Interval=t*sy	tsy	31.74113522
							95% CI_Lower		152.68
							95% CI_Upper		216.17
							Uncertainty=(CI/mean)*100		**17.2%**
							Coeficient of variation (CV)		**8.5%**
AGB(t/ha)	**Gmelina**	**MonF**	**OF**	**THF**	**Mangrove**	**Total**			
Surface Area	157742.4	93874.41	312291.4	236029.9	49152.25	849090.36			
nh	3	7	14	15	7	46			
nh-1	2	6	13	14	6	41			
Plot Size	0.1225	0.1225	0.1225	0.1225	0.06	0.55			
Nh	1287693	766322	2549318	1926775	819204	7349311		N	
mean	162.85	709.88	311.41	531.71	380.57				
SD	21.89	265.71	207.36	343.41	277.75				
(Nh*Sh)^2	7.94541E+14	4.15E+16	2.794E+17	4.37812E+17	5.17717E+16				
(Nh*Sh)^2/nh	2.64847E+14	5.92E+15	1.996E+16	2.91875E+16	7.39596E+15	6.27317E+16		sy	34.07978288
Nh*mean	209700815	5.44E+08	793882979	1024485372	311764529.7	2883830154	Sum(Nh*mean)	**Yst**	**392.3946178**
								t	2.02
							95% Confidence Interval=t*sy	tsy	68.87781049
							95% CI_Lower		323.52
							95% CI_Upper		461.27

							Uncertainty=(CI/mean)*100	**17.6%**
							Coeficient of variation (CV)	**8.7%**

Appendix 3. List of participants at the drafting of the FREL

Nigeria REDD+ Programme
National Technical Workshop on Forest Reference Emission Levels for Nigeria
24 – 26 May, 2016, Reiz Continental Hotel, Abuja
ATTENDANCE

S/N	Name	Organisation	Location	E-mail/Phone no	Signature Day 1	Signature Day 2	Signature Day 3
1.	IGE PETER O.	FRIN ~~IBA~~	IBADAN	08035826207 igepeterо@[illegible]			
2	Dr O.A Okeyoyin	National Parks	Abuja	okeyoyingeorge@yahoo.co.uk 08083414505			
3.	KARSHIMA T. HENRY	FEDERAL MIN ENVT	ABUJA	henrykarshima@yahoo.com 08032216127			
4	FRANCIS OKEKE	WCS	CALABAR	fokeke@wcs.org 08030652799			
5	Bridget Nkor	MCCF (CRS)	Calabar	bridgetnkor@yahoo.com			
6	ASUQUO OKON	MANGROVE SITES UN-REDD+	AKPABUYO	asuquo4sure@gmail.com			
7	Agala Ebiaga	MCCSF	Calabar	agalaebiaga409@yahoo.com 08038291192			
8	Anthony Atah	UN-REDD Sect. Cal.	Calabar	08037759864			
9	Ita, Ekpenyong Eyo	MCCF, CALABAR	CALABAR	08063459636			
10	Dr. S.B. Shamaki	UDU, SOK	Sokoto	07034724715 [illegible]			

Nigeria REDD+ Programme
National Technical Workshop on Forest Reference Emission Levels for Nigeria
24 – 26 May, 2016, Reiz Continental Hotel, Abuja
ATTENDANCE

S/N	Name	Organisation	Location	E-mail/Phone no	Signature Day 1	Signature Day 2	Signature Day 3
11	OLOGUN B. FREEMAN	FMENV FED DEPT OF FOR	ABUJA	ologfreeman@hotmail.com			
12	Thomas F Famose	Consultant	Ado Ekiti	tomfamose@gmail.com			
13	Tunde Adigun	NESREA	Abuja	tundeadigun21@yahoo.com			
14	Joel H. Nzwak	NESREA	Abuja	nzwakharuna@yahoo.com			
15	OKIBE RICHARDS	NAT REDD+ SEC	ABUJA	okiberichard@gmail.com			
16	Ajagun Ebunoluwa	FDF Abuja	Abuja	ebunoluwa2016@gmail.com			
17	Olusegun Fabiyi	RECTAS	Ife	segfabiyi@yahoo.com			
18	Falana B.O (Ms)	FMENV	Abuja	benedisrael123@gmail.com			
19.	Shehu Aldamam	,,	,,	shehuanda@yahoo.com			
20	Abdulkareem Isah	NASRDA	Abuja	akdam@yahoo.co.uk			

Nigeria REDD+ Programme
National Technical Workshop on Forest Reference Emission Levels for Nigeria
24 – 26 May, 2016, Reiz Continental Hotel, Abuja
ATTENDANCE

S/N	Name	Organisation	Location	E-mail/Phone no	Signature		
					Day 1	Day 2	Day 3
21	Prof. A. U. Ogogo	Unical	Calabar	07035463361 au.ogogo@unical.edu.ng			
22	Ajibola Abimbola	Forestry Dept, Abuja	Abuja	08033659158 ajiforsure@gmail.com			
23	Edu Effiom	CRSFC	Calabar	educhom@ [illegible]			
24	Mr. Adedoyin Os	Consultant	[illegible]	osadedoyeg[illegible]			
25	Bassey, Itimiang	DCC/FMEnv	Abuja	bitimtang@yahoo.com			
26	John Dolapo E.	DCC/FMENV	Abuja	johndolapo81@yahoo.com			
27	Prof. S.O. Akindele	FUTA	Akure	soakindele@futa.edu.ng 08063040384			
28	Prof Haruna K. Ayuba	Nasarawa State Univ. Keffi	Keffi	hkayuba@yahoo.com 08024523151			
29	Olojo Olabamiji	NASRDA	Abuja	OLOJOLABAMIJI @GMAIL.COM 0703 [illegible]			
30	P. O. Bankole	FMENV	Abuja	08037260542 philipbankole@gmail.com			

Nigeria REDD+ Programme
National Technical Workshop on Forest Reference Emission Levels for Nigeria
24 – 26 May, 2016, Reiz Continental Hotel, Abuja
ATTENDANCE

S/N	Name	Organisation	Location	E-mail/Phone no	Signature		
					Day 1	Day 2	Day 3
31	Dr James Godstime Kadiri	NASRDA	Abuja	godstimej@gmail.com 08022739154			
32	Mrs. Henrietta N. Alhassan	NEWMAP	Abuja	08067288072 henriettaajonathan@gmail.com			
33	Prof Ademola Omojola	UNILAG, Lagos	Lagos	[illegible] 08033228622			
34	Saadat Yusuf	NESREA	Abuja	saadat[illegible]@yahoo.com 08083193122			
35	Aya, Felix	Dept of Forestry & Wildlife Res. Mgt UNICAL	Calabar	ayafelix@yahoo.co.uk 08023574551			
36	Osu Danladi Kure	Ministry of Environment and Natural Resources Lafia	Lafia	kosudanladi@yahoo.com 09065901958			
37	Ebet Xavier O.	Nat REDD+ Secretariat	Abuja	xavierox89@yahoo.com 07050499999			
38	Moses Ama	N-F REDD+ Sec	Abuja	08033486589			
39	Razak Adekola	FAO(UNREDD)	Calabar	Razak.Adekola@fao.org			
40	Umar Hamza	Nat REDD+ Sec	Abuja	07030673518			

Appendix 4. List of participants at the validation of the Draft FREL and Draft NFMS documents

Nigeria REDD+ Programme

Validation Workshop on the Draft NFMs Action Plan & Forest Reference Emission Levels for Nigeria

29– 30 September, 2016, at Reiz Continental Hotel, Abuja

ATTENDANCE

S/N	Name	Organisation	Location	E-mail	Phone no	Signature Day 1	Signature Day 2
1.	Dr. F. A. Akinsanmi	Forestry, Unilorin	Ilorin	francisakinsanmi@yahoo.com	08033145603		
2.	Dr. Edu Effiom	MCCF	Calabar	edu.effiom@biol.lu.se	08023815032		
3	Akomaye Ashikem	MCCF	Calabar	akoslueks@yahoo.com	08067083651		
4	Asuquo Etim Okon	Mangrove Pilot Site	Akpabuyo	asuquo4sure@yahoo.com	08030867600		
5	Thomas F. Fameso	For. mgt. Consultant	Ado Ekiti	tomfameso@ymail.com	08055142456		
6	Ebonine O. Raymond	NAT. R+ Secretariat, Abuja	Abuja	rayomyeje@yahoo.com	08055431793		
7	Anthony Atah	REDD + Sect.	Calabar	tonyatah@gmail.com	08037759864		
8	Barr Dan Takon Etta	MCCF/Gov's Office	"	dantakon2007@yahoo.com	08063840827		
9	Agala Ebagu Atte	MCCF	Calabar	agalaebagu079@yahoo.com	08028241192		
10	Ige Peter O.	FRIN Ibadan	Ibadan	igepeter0@gmail.com	08035826907		
12	Ekpenyong Eyo Ita	MCCF, Calabar	Calabar	e.eyoita39@gmail.com	0806345983		
13	Adeyekun J. Oludare	MNR Akure	Akure	adeyekunoopyh2015@gmail.com	08034751235		
14	Obadan Femi Michael	MNR, Akure	Akure	obadan.obafemi@yahoo.co.uk	08033774389		
15	Edet, Xavier O.	NAT. REDD+ Secretariat	Abuja	xavierec89@yahoo.com	08160102416		
16	Emmanuel Ozobia	NAT REDD+ SEC	Abuja	emmaozobi@gmail.com	08151882393		
17	Patrick Coco Bassey	S.P.C. Calabar	Calabar	patrick.bassey.coco@yahoo.com	08034742834		
18	Victor Ayo Fodeke	African Environmental Action Network (EAN+)	Lagos	victorfodeke@gmail.com	08036460880		
19	Okibe Richard	REDD NAT SEC Abuja	Abuja	okiserichards@gmail.com	08066808222		
20	Ajagun Ebunoluwa	FDF, Abuja	Abuja	ebunoluwa2025@gmail.com	08155381261		
21.	Ohikhueme Clement Omoyemi	Fidon Plants & Shelter Ltd.	Abuja	clemohi2013@gmail.com	08036352544		

S/N	Name	Organisation	Location	E-mail	Phone no	Signature Day 1	Signature Day 2
22	Bridget Nkor	MCCF	Calabar	bridgetnkor@yahoo.com	08036672882		
23	AJANG, ROSE A	✓	✓	roseekpor@gmail.com	07039529665		
24	DR. ALICE EKWU	✓	✓	ekwualice@yahoo.com	07034493843		
25	TIJJANI AHMAD ZAKIRAI	NAT. R+ SECT. ABUJA	ABUJA	tahmadzakirai@yahoo.com	08085547756		
26	Hauwa'u Umar	NAT REDD+ SEC ABUJA	ABUJA	ijzakiriya@yahoo.com	07030673518		
27	PROF. S. O. AKINDELE	FUTA	AKURE	soakindele@futa.edu.ng	08063040384		
28	Prof. A.U. Ogogo	Unical	Calabar	auogogo@unical.edu.ng	07039463349		
29	AJIBOLU AMINU	NAGS	Abuja Lagos	tolujinh29@gmail.com	0803...		
30	Shehu Ndaman	REDD+ Nat. Secretariat	Abuja	shehunda@yahoo.com	08032183327		
31	Adedoyin OS	OSRA	Ibadan	osadedoyin@yahoo.co	0805455...		
32	Michael Simire	EnviroNews	Lagos	msimire@yahoo.com	08037146384		
33	Dr. James Godstime	NASRDA	Abuja	godstimej@gmail	0802273154		
34	Sakinatu Ibrahim	AIT	Abuja	gsakinatuibrahim@yahoo	08032457874		
35	Ikeh A. A.	REDD+	Abuja	ike.augustine@yahoo.co	08063611305		
36	SYLVESTER A. OKONOFUA	UKOSEN Consultants	BENIN	AREBOIOKONOFUA@YAHOO.com	08023262736		
37	AYA, Felix	UNICAL	CALABAR	ayafelix@yahoo.co.uk	08023574551		
38	OLAH ANTHONY	Ideal development Concept IDC	Lagos	tonyolah@yahoo.com	08054725679		
39	Atiyu M. Yauri	DCC	Abuja	alhajimusayauri@yahoo.com	08163466370	29/9/16	30/9/16
40	Dolapo E John	FMENV/DCC	Abuja	johndolapo81@yahoo.com	08036917639		
41	BASSEY, Itimitang	FMENV/DCC	Abuja	bitimitang@yahoo.com	08035870590		
42	NWOKO, CHIAGOZIEM J.	DEPT OF CLIMATE CHANGE, FMENV ABUJA	ABUJA	nchiagoziem finwol94@yahoo.com	0816751804		
43	Olabode Michael A.	NAGGW	Abuja	michaelolabode@gmail.com	08059648320		
44	AKINOLA SEGUN B	NAGGW	ABUJA	akinolasegunb@yahoo.com	08089648564		
45	CHIEF EYO O. OKU	OSG-CR	CALABAR	eyo.oku@osg.crgov.ng	08033171022		
46	JOHN FONWEBAN	FAO	GHANA	john.fonweban@fao.org	+233 240220830		
47	Rasak Adekola	FAO	Ibadan	Rasak.Adekola@fao.org	08033704528		
48	Francis Bisong	UNICAL	CALABAR	febisong@gmail.com	08033380318		
49	Adekanmbi. O	Fmenv Abuja	Abuja	oreleke2000@yahoo.com	07037960060		