MONITORING REPORT

INNER MONGOLIA CHAO'ER IMPROVED FOREST MANAGEMENT PROJECT

Document Prepared by Beijing Institute of Green Resources

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Project Title	Inner Mongolia Chao'er Improved Forest Management Project
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Inner Mongolia Chao'er Improved Forest Management Project (hereafter "the project") is to protect the once logging forest. The project is located in south region of the Greater Khingan Mountains, HulunBuir City, Inner Mongolia Autonomous Region, P.R.C, and is implemented by Chao'er Forest Bureau (hereafter "project owner").

The geographic coordinate of Chao'er Forest is 120°17'52''~121°37'50''E and 47°35'21''~48°10'13''N, the total area is 426,580ha, of which 421,901 ha is the forestry area, accounting 98.9% of the total area. The forest land area is 355,622 ha, and the forest coverage rate is 83.37%, mainly composed by mountainous regions, the project area has a complex geomorphologic characteristic. The elevation level of the region is ranged from 700~1,500m and the climate feature is cold temperate zone continental monsoon. The dominant tree species within the project area are Pinus and Brich. Prior to the implementation of the project, the forest was logged annually according to the timber production plan issued by Chao'er Forest Industrial Co., Ltd, a subsidiary of Inner Mongolia Forest Industry Group. In order to protect the ecological system, the local forest authority has tried to reduce the annual forest timber volume within the project area, which can be seen from the timber production plan, the commercial harvest is cancelled and only tending and managing is permitted.

The proposed project is implemented by Wuyi Forestry Centre, which is affiliated to Chao'er Forest Bureau and is in the south west part of it. The project has approximately 11,010ha commercial forest, whose ages ranging from sapling, middle age to mature forest. Before the implementation of the project, the forest within the project area was designed and planted as commercial forest, and logged annually according to the timber production plan issued by Chao'er Forest Industrial Co., Ltd. The main object of the project is to improve the forest coverage rate, protect local ecological environment, reduce carbon emissions and carbon sequestration by enhance the management level and converse logged to protected forest within the project area. The implementation of the project will result in significant carbon sequestration and improve the sustainable development of ecological system. The project generated 380,247t CO_2e emission reductions within the first monitoring period from 01/01/2010 to 31/12/2014 with the average annual emission reductions of 76,049 t CO_2e. The first 5 years' VCU was proved in Nov, 2016. With buffering deducting, during the second monitoring period from 01/01/2015 to 31/12/2019, the project has generated 343,998 tCO_2e (VCUs eligible for issuance) with the annual emission reduction of 68,800 tCO_2e.

From 2010, the project has strictly cancelled the once annual commercial timber harvest and only allowed the tending and managing. In order to control the annual forest timber volume and achieve reliable and verified carbon sequestration, a forest protection plan will be issued by local forest authority, and strictly executed by the project owner (Project Proponent). The forest growth amount and forest second class investigation will be monitored by local forestry bureau periodically.

1.2 Sectoral Scope and Project Type

The project falls into Scope 14: Agriculture Forestry and Other Land use. It is improved forest management (IFM) project.

1.3 Project Proponent

Organization name	Chao'er Forest Bureau of Inner Mongolia Autonomous Region, P.R.China
Contact person	Shiping Yu
Title	Manager
Address	Ta'erqi Town, Yakeshi City, Inner Mongolia Autonomous Region.
Telephone	+86-470-7798329 +86-138 4803 9680
Email	Yushiping1109@163.com

1.4 Other Entities Involved in the Project

Organization name	Beijing Institute of Green Resources
Role in the Project	Consultant
Contact person	Jinliang Li
Title	Founder & President
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1.5 Project Start Date

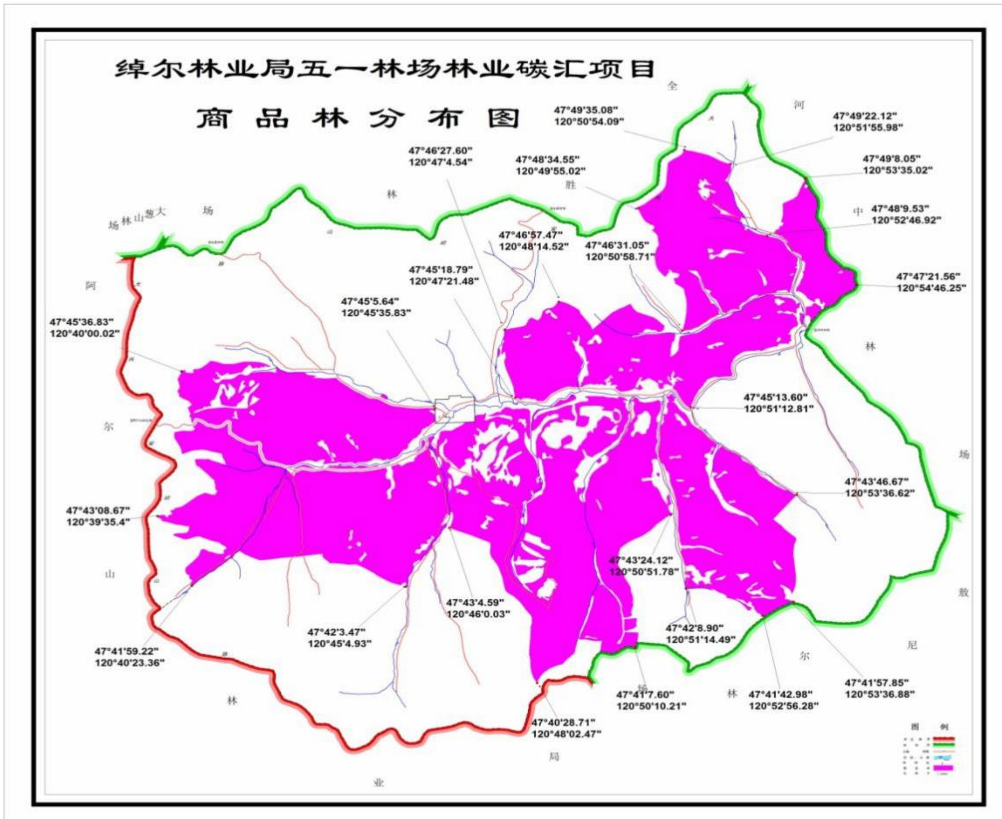
The Project Start Date is represented by the implementation of the forest protection project on 01/01/2010. The project longevity of project lifetime is 60 years, from January 1, 2010 to December 31, 2069.

1.6 Project Crediting Period

The total length of the crediting period is 20 years, which starts from 01/01/2010, ends on 31/12/2029.

1.7 Project Location

The emission reduction of the project is from all the commercial forest of Wuyi Forestry Center, which is affiliated to Chao’er Forest Bureau and is located in the south west part of it. The location diagram of the project is listed in the following:



The boundary of the project (as stressed by the purple colour)

1.8 Title and Reference of Methodology

The methodology and tools applied by the project is:
VM0010 Methodology for Improved Forest Management: Conversion from Logged to Protected Forest, v1.2

VCS Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, v3.0
AFOLU Non-Permanence Risk Analysis Tool, v4.0
Tool for Calculation of the Number of Sample Plots for Measurements within A/R CDM Project Activities, v2.1.0

1.9 Participation under other GHG Programs

The project has not registered under any other GHG programs, only registered by the VCS program with the ID of 1529 in June, 2016.

1.10 Other Forms of Credit

- The project activity is not involved in any other emission trading program and binding limits.
- The project has not sought or received another form of GHG related environmental credit.

1.11 Sustainable Development

As one of the most precious ecological resources, forest is key to biodiversity and all life forms. The protection of local forest will enrich the biodiversity and provide more opportunity for adaptive response to natural challenges and economic development (e.g. climate change and new medical discoveries);

Offer job opportunities. Instead of casual labor demand for forest timber (once a year or several years), the protected forest will create some employment opportunities for forest management. The related training process will improve the skill of the local employees.

Meet the strategy development plan of host country and local area. After the implementation of the project, the increasing forest coverage rate will benefit the local environmental condition by producing more oxygen and absorb more greenhouse gas.

2 SAFEGUARDS

2.1 No Net Harm

From 2010, the project has strictly cancelled the once annual commercial timber harvest and only allowed tending and managing, therefore, there has been no negative environment and socio-economic impacts by the implementation of the project.

No villagers live nearby the project activity, the only stakeholders are the forestry center staff. Due to the implementation of the project activity, the once 45 loggers become forest ranger, their income has not decreased due to the cancelling of the commercial logging.

On the other side, their income has increased instead to some extent by the means of VCU selling, planting under forest, forest tourism, etc.

2.2 Local Stakeholder Consultation

During the monitoring period, the forestry centre staff has convenient access to express their concern about the project activity, on the other hand, the management team will also inform the staff about the breakthrough and pay attention their concern.

For example, in 2016, when the project was registered and obtained the issuance approval, they held a meeting to announce the good news, the expected VCUs amount and the attempt on VCU selling. Moreover, the staff was consulted for illegal logging, fir and other natural disturbance. And they were encouraged to communicate their ideas without any hesitation.

In 2018, when the VCU was successfully transferred and sold, they also held meeting to inform that. The expected income will be invested on the forest management, which will promote the forest protection, set good examples and stimulate more forest centres join in and eventually form a good ecological protection cycle.

In 2019, prior to the on-site verification for the second monitoring period, they held meeting to make preparation for the sample plot monitoring. The illegal logging, fir and other natural disturbance was also consulted. Since the forest centre has been awarded for ¥20,00 Yuan for their smooth operation without fire accident for 10 years, they were encouraged and discussed hopefully to keep up striving for the better achievements.

They were also informed that the VVB would conduct the on-site verification, the document review, the sample plots monitoring inspection and stakeholder consultation could be included. They are also encouraged to express any concern about the project activity.

2.3 AFOLU-Specific Safeguards

As a result of the project implementation, the once commercial harvest is cancelled and only tending and managing is permitted. In order to mitigate the risks for fire and other natural disturbance, the loggers become patrollers and more sensors are equipped on disturbance prevention.

No villagers live nearby the project activity, the only stakeholders are the forestry center staff. Due to the implementation of the project activity, the once 45 loggers become forest ranger, according to the survey and communication with the stakeholder, nobody loses their jobs, their income has not decreased due to the cancelling of the commercial logging, no conflict arose by the project activity, so no compensation is relevant.

The land ownership right belongs to Chao’er Forestry Bureau, the management team and staff of Wuyi Forest Center agreed to the implementation of the project, property and land occupation compensation is not relevant to the project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project starts from 01/01/2010, this first monitoring period lasts five year ending on 31/12/2014, the second monitoring period lasts from 01/01/2015 to 31/12/2019, During the second monitoring period, the project activity operates smoothly without any events that may impact the GHG emission reductions or removals and monitoring.

For the project activity, no new project activities that lead to the intended GHG benefit commenced during the monitoring period, project activities that commenced prior to the monitoring period continued to be implemented during the monitoring period. From 2010, the project has strictly cancelled the once annual commercial timber harvest and only allowed the tending and managing.

As for the non-permanent risk, please refer to the separate annex of "Inner Mongolia Chao'er Improved Forest Management Project Non-Permanence Risk Report".

For the detailed discussion on leakage, please refer to part 5.3 of the monitoring report.

3.2 Deviations

2.1.1 Methodology Deviations

There is no methodology deviation applicable to the project activity during this monitoring period.

2.1.2 Project Description Deviations

There is no project description deviations applied during this monitoring period.

3.3 Grouped Projects

This project is not relevant to the grouped project; there is no new instance of the project activity.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$V_{l,j,I,sp}$
Data unit	m^3
Description	Merchantable volume for tree l of species j in sample plot sp in stratum i

Source of data	The local volume table, which lists the volumes corresponding to the DBH.
Value applied	Please refer to the ER spreadsheet for details.
Justification of choice of data or description of measurement methods and procedures applied	The volume calculated from the volume table of the dominant tree species of Greater Khingan Mountains in Inner Mongolia Province, which is issued by the local Forest Management Bureau. The volume table lists the relationship between the DBH and volume. Based on the volume table, the volume can be easily obtained if DBH is available. What needs to do is to measure the DBH with band tape, and then applied the DBH to the volume table to get the results.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**CF_j**
Data unit	tC·tdm-1
Description	Carbon fraction of dry matter for species j
Source of data	Either the default value 0.5 tC·t d.m-1 or species-specific values from the literature must be used. The same value, however, must be used in all instances where this parameter is used.
Value applied	Default value of 0.5 tC·t d.m-1 is applied for this project
Justification of choice of data or description of measurement methods and procedures applied	The default value of 0.5 $tC{\cdot}tdm^{-1}$ is recommended by the methodology.
Purpose of Data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	**D_j**
Data unit	$tdm{\cdot}m^{-3}$
Description	Basic wood density of species j in $tdm{\cdot}m^{-3}$
Source of data	Must be chosen with priority from higher to lower preference as follows: a) National species-specific or group of species-specific values (e.g., from National GHG inventory); b) Species-specific or group of species-specific values from

	neighboring countries with similar conditions. When species-specific data from neighboring countries is of higher quality, being more representative of the species in the project scenario, it may be preferable to use these values than lower quality national data; c) Global species-specific or group of species-specific (e.g., IPCC 2006 INV GLs AFOLU Chapter 4 Tables 4.13 and 4.14). Species-specific wood densities may not always be available, and may be difficult to apply with certainty in the typically species rich forests of the humid tropics, hence it is acceptable practice to use wood densities developed for forest types or plant families or species groups. For the project activity, a) is adopted. The value from the GHG inventory of land use change and Forestry from the “the second national information notice on China’s climate change” is applied to the project activity.
Value applied	Dominant tree species: D_j Pinus: 0.490 Brich: 0.443
Justification of choice of data or description of measurement methods and procedures applied	The value from the national forestry GHG inventory is adopted.
Purpose of Data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	**BCEF**
Data unit	$tdm \cdot m^{-3}$
Description	Biomass conversion and expansion factor applicable to wood removals in the project area
Source of data	The source of data must be chosen with priority from higher to lower preference as follows: a) Existing local forest type-specific; b) National forest type-specific or eco-region-specific (e.g., from national GHG inventory); c) Forest type-specific or eco-region-specific from neighboring countries with similar conditions. Sometimes (c) might be preferable to (b); d) Global forest type or eco-region-specific (e.g., IPCC 2006

<table>
<tr><td></td><td>INV Ls AFOLU Chapter 4 Table 4.5).
Alternatively:
BCEFR = BEFR * D
Where BCEF values are not directly available, they can be calculated as Biomass Expansion Factor (BEF)* basic wood density (D).
Application of this equation requires caution because basic wood density and biomass expansion factors tend to be correlated. If the same sample of trees was used to determine D, BEF or BCEF, conversion will not introduce error, therefore, it is acceptable to use this equation. If, however, basic wood density is not known with certainty, transforming one into the other might introduce error, as BCEF implies a specific but unknown basic wood density, therefore, all conversion and expansion factors must be derived or their applicability checked locally.

For the project activity, b) is adopted. The value from the GHG inventory of land use change and Forestry from the “the second national information notice on China’s climate change” is applied to the project activity.</td></tr>
<tr><td>Value applied</td><td><table><tr><td>Dominant tree species</td><td>BEF</td><td>D</td><td>BCEF=(BEF*D)</td></tr><tr><td>Pinus</td><td>1.416</td><td>0.490</td><td>0.694</td></tr><tr><td>Brich</td><td>1.586</td><td>0.443</td><td>0.703</td></tr></table></td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>The value from the national forestry GHG inventory is adopted.</td></tr>
<tr><td>Purpose of Data</td><td>Calculation of baseline emissions and project emissions.</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	**OF, SLF, WW**
Data unit	Kg kg^{-1}
Description	OF = Fraction of wood products that will be emitted to the atmosphere between 3 and 100 years after production; SLF = Fraction of wood products that will be emitted to the atmosphere within 3 years of production; and WW = Fraction of extracted biomass effectively emitted to the atmosphere during production.

<table>
<tr><td></td><td>Wood waste fraction (WW):
Winjum et al 1998 indicate that the proportion of extracted biomass that is oxidized (burning or decaying) from the production of commodities to be equal to 19% for developed countries, 24% for developing countries.
Short-lived fraction (SLF)
Winjum et al 1998 give decay rates for proportions of wood products, which were converted to with short-term (<3 yr) uses (applicable internationally) as below:
Sawnwood 0.12
Woodbase panels 0.06
Other industrial roundwood 0.18
Paper and Paperboard 0.24
Additional oxidized fraction (OF)
Winjum et al 1998 gives annual oxidation fractions for each class of wood products split by forest region (boreal, temperate and tropical).
This methodology projects these fractions over 95 years to give the additional proportion that is oxidized between the 3rd and 100th years after initial harvest:
<table>
<tr><th rowspan="2">Wood Product Class</th><th colspan="3">OF</th></tr>
<tr><th>Boreal</th><th>Temperate</th><th>Tropical</th></tr>
<tr><td>Sawnwood</td><td>0.39</td><td>0.62</td><td>0.86</td></tr>
<tr><td>Woodbase panels</td><td>0.62</td><td>0.86</td><td>0.98</td></tr>
<tr><td>Other industrial roundwood</td><td>0.86</td><td>0.98</td><td>0.99</td></tr>
<tr><td>Paper and paperboard</td><td>0.39</td><td>0.62</td><td>0.99</td></tr>
</table>
</td></tr>
<tr><td>Source of data</td><td>The source of data is published paper of Winjum et al .1998.</td></tr>
<tr><td>Value applied</td><td>WW:24%
SLF: 0.12
OF: 0.62</td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>The default value is applied as recommended by the methodology.</td></tr>
<tr><td>Purpose of Data</td><td>Calculation of baseline emissions.</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	$V_{EX,j,I,BSL}$
Data unit	$M^3\ ha^{-1}$
Description	Mean volume of extracted timber per unit area for species j in stratum i
Source of data	The timber harvest plan sets the allowable mean extracted volume from the merchantable volume of timber in the forest inventory ($V_{j,i\|BSL}$), based on legal limits.
Value applied	Please refer to the ER calculation spreadsheet for details.
Justification of choice of data or description of measurement methods and procedures applied	$V_{EX,j,I,BSL}$=$V_{j,I,BSL}$*Extrated Rate
Purpose of Data	Calculation of baseline emissions.
Comments	-

Data / Parameter	$A_{i,P}$
Data unit	Ha
Description	Area covered by stratum I over land parcel P
Source of data	Geodetic coordinates and/or Remote Sensing data and/or legal parcel records
Value applied	Please refer to the ER calculation sheet for details.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions and project emissions.
Comments	-Be assumed ex-ante that land parcel boundaries and strata areas must not change over time.

Data / Parameter	$A_{1,i,P}$
Data unit	Ha
Description	The area of stratum i in land parcel p that was harvested 1 year ago
Source of data	Geodetic coordinates, GIS Files or legal parcel records
Value applied	Please refer to the ER calculation spreadsheet for details.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	$A_{2\text{-}10,i,P}$
Data unit	Ha
Description	The area of stratum i in land parcel p that was harvested between 2 and 10 year ago
Source of data	Geodetic coordinates, GIS Files or legal parcel records
Value applied	Please refer to the ER calculation spreadsheet for details.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	$A_{11\text{-}20,i,P}$
Data unit	Ha
Description	The area of stratum i in land parcel p that was harvested

	between 11 and 20 year ago
Source of data	Geodetic coordinates, GIS Files or legal parcel records
Value applied	Please refer to the ER calculation spreadsheet for details.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	$\mathbf{A_{t^*}}$
Data unit	Ha
Description	Cumulative area harvested until time t*
Source of data	Geodetic coordinates, GIS Files or legal parcel records
Value applied	Please refer to the ER calculation spreadsheet for details.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	$\mathbf{A_{s,p}}$
Data unit	Ha
Description	area of sample plot sp
Source of data	Recording and archiving of size of sample plots
Value applied	0.06ha

Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of project emissions.
Comments	-

Data / Parameter	$\mathbf{G_{gi}}$
Data unit	g kg-1 dry matter burnt
Description	Emission factor for stratum I for gas g
Source of data	Defaults can be found in Volume 4, Chapter2, of the IPCC 2006 Inventory Guidelines in table 2.5
Value applied	Not applicable to the project activity, as no fire occurs during the monitoring period.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of project emissions.
Comments	-

Data / Parameter	$\mathbf{t_{VAL}}$
Data unit	Dimensionless
Description	Two-sided Student. s t-value, at infinite degrees of freedom in the first iteration and at degrees of freedom equal to (n-1) in subsequent iterations, for the required confidence level; dimensionless
Source of data	Student's t-distribution table
Value applied	<table><tr><th colspan="2">Confidence level</th></tr><tr><td>Df</td><td>95%</td></tr><tr><td>∞</td><td>1.960</td></tr></table> Df-degree of freedom

Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of project emissions.
Comments	95% confidence level is prescribed in methodology VM0010 version 1.2.

Data / Parameter	**E**
Data unit	Td.m. ha^{-1}
Description	Acceptable margin of error (i.e. one-half the confidence interval in estimation of biomass stock within the project boundary; in units used for Si)
Source of data	A default value equal to 10% of the mean biomass stock within the project boundary.
Value applied	0.9960
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of Data	Calculation of project emissions.
Comments	

Data / Parameter	**f_j (X, Y)**
Data unit	t d.m./tree
Description	Allometric equation(s) for species j linking measured tree variable(s) to aboveground biomass of living trees
Source of data	Equations must have been derived using a wide range of measured variables (e.g., DBH, Height, etc.) based on datasets that comprise at least 30 trees. Equations must be based on statistically significant regressions and must have an r2 that is ≥ 0.8. The source of equation(s) must be chosen with priority from higher to lower preference, as available, as follows: a) National species-, genus-, family-specific; b) Species-, genus-, family-specific from neighboring countries with similar conditions (i.e., broad continental regions); c) National forest-type specific;

	d) Forest-type specific from neighboring countries with similar conditions (ie, broad continental regions); e) Forest type-specific such as those provided Tables 4.A.1 to 4.A.3 of the GPG-LULUCF (IPCC 2003); or in Pearson, T., Walker, S. and Brown, S. 2005. Sourcebook for Land Use, Land-Use Change and Forestry Projects. Winrock International and the World Bank Biocarbon Fund. 57pp.; or in Chave, J., C. Andalo, S. Brown, M. A. Cairns, J. Q. Chambers, D. Eamus, H. Folster, F. Fromard, N. Higuchi, T. Kira, J.-P. Lescure, B. W. Nelson, H. Ogawa, H. Puig, B. Riera, T. Yamakura. 2005. Tree allometry and improved estimation of carbon stocks and balance in tropical forests. Oecologia 145: 87-99. Species-, genus- and family-specific allometric equations may not always be available, and may be difficult to apply with certainty in the typically species rich forests of the humid tropics. Hence it is acceptable practice to use equations developed for regional forest types, provided that their accuracy has been validated with direct site-specific data following guidance given below. If a forest-type specific equation is used, it should not be used in combination with species-specific equation(s) (i.e., it must be used for all tree species).
Value applied	Referred to the spreadsheet
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions
Comments	It is necessary to validate the applicability of equations used. Source data from which equation(s) was derived should be reviewed and confirmed to be representative of the forest type/species and conditions in the project and covering the range of potential independent variable values. Allometric equations can be validated either by: 1. Limited Measurements • select at least 30 trees (if validating forest type-specific equation, selection should be representative of the species composition in the project area, i.e., species representation in roughly in proportion to relative basal area). Minimum diameter of measured trees must be 20cm and maximum diameter must reflect the largest trees present or potentially present in the future in the project area (and/or leakage belt); • measure DBH, and height to a 10 cm diameter top or to the first branch; • calculate stem volume from measurements and multiplying by species-specific density to gain biomass of bole;

	• apply a biomass expansion factor to estimate total aboveground biomass from stem biomass40; and • plot the estimated biomass of all the measured trees along with the curve of biomass against diameter as predicted by the allometric equation. If the estimated volume of the measured trees is distributed both above and below the curve (as predicted by the allometric equation) the equation may be used. The equation may also be used if the measured individuals have a biomass consistently higher than predicted by the equation. If >75% of the measured trees have a biomass lower than the predicted curve, destructive sampling must be undertaken or another equation must be selected. 2. Destructive Sampling • select at least 5 trees (if validating forest type-specific equation, selection should be representative of the species composition in the project area, ie, species representation in roughly in proportion to relative basal area) at the upper end of the range of independent variable values existing in the project area; • measure DBH and commercial height and calculate volume using the same procedures/equations used to generate commercial volumes to which BCEFs will be applied; • fell and weigh the aboveground biomass to determine the total (wet) mass • of the stem, branch, twig, leaves, etc. Extract and immediately weigh subsamples from each of the wet stem and branch components, followed by oven drying at 70 degrees C to determine dry biomass; • determine the total dry weight of each tree from the wet weights and the averaged ratios of wet and dry weights of the stem and branch components; and • plot the estimated biomass of all the measured trees along with the curve of biomass against diameter as predicted by the allometric equation. If the estimated volume of the measured trees are distributed both above and below the curve (as predicted by the allometric equation) the equation may be used. The equation may also be used if the measured individuals have a biomass consistently higher than predicted by the equation. If >75% of the measured trees have a biomass lower than the predicted curve another equation must be selected. Details of destructive sampling measurements are given in: Brown, S. 1997. Estimating biomass and biomass change of tropical forests: a primer. FAO Forestry Paper 134, Rome, Italy. Available at http://www.fao.org/docrep/W4095E/W4095E00.htm If using species-specific equations, and new species are encountered in the course of monitoring, new allometric equations must be sourced from the literature and validated, if necessary, as per requirements and procedures above. Default values must be updated whenever new guidelines are produced by the IPCC

4.2 Data and Parameters Monitored

Data / Parameter	**Illegal Logging PRA Results**
Data unit	/
Description	A participatory rural appraisal (PRA) of the communities surrounding the project area must be completed to determine if there is the potential for illegal extraction of trees from the project area.
Source of data	PRA
Description of measurement methods and procedures to be applied	The PRA must evaluate whether timber harvest may be occurring in the project area and must consist of semi-structured interviews / questionnaires. If ≥ 10% of those interviewed/surveyed believe that illegal logging may be occurring within the project boundary then the limited on- the-ground illegal logging survey must be triggered An additional output of the PRA must be a depth of penetration of illegal logging pressure. A maximum distance must be recorded for penetration into the forest from access points (such as roads, rivers, already cleared areas) for the purpose of harvesting timber.
Frequency of monitoring/recording	Every two years
Value monitored	No illegal logging occurs during the monitoring period within the project boundary.
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable.
Purpose of the data	For the calculation of project emissions.
Calculation method	Interview/Survey.
Comments	Ex ante estimation must be made of illegal logging in the with-project case. If the belief is that zero illegal logging will occur within the project boundaries then this parameter may be set to zero if clear infrastructure, hiring and policies are in place to prevent illegal logging.

Data / Parameter	**Results of the limited Illegal Logging Survey**
Data unit	/
Description	/
Source of data	Limited on-the-ground illegal logging Survey
Description of measurement methods and procedures to be applied	Sampled by surveying multiple transects of known length and width across the access-buffer area to check whether new tree stumps are evident or not. The access-buffer area shall be equal in area to at least 1% of $A_{DIST\_IL,i}$.
Frequency of monitoring/recording	Must be repeated each time the PRA indicates a potential for illegal logging.
Value monitored	N/A (According to the PRA during these monitoring period, there is not a potential for illegal logging activities, therefore, this parameter does not needed during this monitoring period)
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	For the calculation of project emissions.
Calculation method	-
Comments	Ex ante an estimation must be made of illegal logging in the with-project case. If the belief is that zero illegal logging will occur within the project boundaries then this parameter may be set to zero if clear infrastructure, hiring and policies are in place to prevent illegal logging.

Data / Parameter	$\mathbf{A_{burn,l,t}}$
Data unit	Ha
Description	Area burnt in stratum I at time t
Source of data	Geodetic coordinates and/or Remote Sensing data
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	At least every five years

Value monitored	0 (As indicated in the decision notice to reward the subordinate units with 10-year or 1-year smooth operation without fire accident issued by the Chao'er Forest industrial Cooperation in 2019, 2 forestry centers, including Wuyi forestry center was awarded ¥20,000 Yuan for their continuous 10 years' distinguished forest operation& management without any fire accident. Other 5 units was awarded for ¥3,000 for the last year.)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or form the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable, as no fires accrued during the monitoring period.
Comments	Ex-ante estimation of areas burned must be based on historic incidence of fire in the Project region.

Data / Parameter	$A_{dist,i,\ t}$
Data unit	Ha
Description	Area disturbed in stratum I at time t
Source of data	Geodetic coordinates and/or Remote Sensing data
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	At least every five years
Value monitored	0 (As indicated in the statement issued by the local forestry authority at the end of 2019, not any non-fire natural disturbance occurred from Jan 2015 to Dec 2019.)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest inventory including field data collection

	and data management must be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or form the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable, as not any non-fire disturbance occurred during this monitoring period.
Comments	Ex-ante estimations of areas disturbed must be based on historic incidence of natural disturbance in the Project region.

Data / Parameter	$A_{Dist\_IL,i}$
Data unit	Ha
Description	Area potentially impacted by illegal logging in stratum i
Source of data	GIS delineation and ground truthing
Description of measurement methods and procedures to be applied	$A_{DIST\_IL,i}$ must be composed of a buffer from all access points(access buffer), such as roads and rivers or previously cleared areas. The width of the buffer must be determined by the depth of degradation penetration as defined as a PRA output.
Frequency of monitoring/recording	At least every five years
Value monitored	0 (The results of the participatory rural appraisal (PRA) of the communities in and surrounding the project area, as well as the statement issued by the Forest protection brigade of Chao'er Forest Public Security Bureau indicate that no significant illegal logging occurred in Wuyi forestry center from Jan 2015 to Dec 2019.)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	$A_{DIST\_IL,i}$ must be composed of a buffer from all access points (access buffer),such as roads and rivers or previously cleared areas. The width of the buffer must be determined by the depth of degradation penetration as defined as a PRA output.
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable, as no illegal logging occurred during the monitoring period.
Comments	Ex ante a limited survey can be used to determine a likely depth of degradation penetration.

Data / Parameter	$C_{DIST\_IL,i,t\|PRJ}$
Data unit	tCO_2e
Description	biomass carbon of trees cut and removed through illegal logging in stratum i at time t
Source of data	Field measurements in sample plots
Description of measurement methods and procedures to be applied	The sampling plan must be designed using plots systematically placed over the buffer zone so that they sample at least 3% of the area of the buffer zone ($AD_{IST\_IL,i}$). The diameter of all tree stumps will be measured and conservatively assumed to be the same as the DBH. Where the stump is a large buttress, several individuals of the same species nearby must be located and a ratio of the diameter at DBH to the diameter of buttress at the same height above ground as the measured stumps must be determined. This ratio will be applied to the measured stumps to estimate the likely DBH of the cut tree. The aboveground carbon stock of each harvested tree will be estimated using the allometric regression equations chosen for forest growth in the project scenario. The mean aboveground carbon stock of the harvested trees is conservatively estimated to be the total emissions and to all enter the atmosphere.
Frequency of monitoring/recording	Repeated each time limited sampling of A_{DIST_IL}, indicates illegal logging
Value monitored	0 (The results of the participatory rural appraisal (PRA) of the communities in and surrounding the project area, as well as the statement issued by the Forest protection brigade of Chao'er Forest Public Security Bureau indicate that no significant illegal logging occurred in Wuyi forestry center from Jan 2015 to Dec 2019.)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or form the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable, as no illegal logging occurred during the monitoring period.

Comments	If species-specific equations are used and species cannot be identified from stumps then it must be assumed that the harvested species is the species most commonly harvested. A PRA must be used to determine the most commonly harvested species.

Data / Parameter	A_{Pi}
Data unit	Ha
Description	Total area of illegal logging sample plots in stratum i
Source of data	Ground measurement
Description of measurement methods and procedures to be applied	A sampling plan must be designed using multiple sample plots systematically placed across the buffer zone so that they sample at least 3% of the area of the buffer zone.
Frequency of monitoring/recording	Not more than five years.
Value monitored	0 (The results of the participatory rural appraisal (PRA) of the communities in and surrounding the project area, as well as the statement issued by the Forest protection brigade of Chao'er Forest Public Security Bureau indicate that no significant illegal logging occurred in Wuyi forestry center from Jan 2015 to Dec 2019.)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or form the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions
Calculation method	Not applicable, as no illegal logging occurred during the monitoring period.
Comments	Ex ante estimation should be made of area of plots. This should beset to exactly 3% of the buffer zone ADIST_IL,i

Data / Parameter	PMP_i
Data unit	%

Description	Merchantable biomass as a proportion of total above ground tree biomass for stratum I within the project boundaries.
Source of data	Within each stratum divide the summed merchantable biomass (defined as total gross biomass of a tree 15 cm DBH or larger) by the summed total of above ground three biomass.
Description of measurement methods and procedures to be applied	Not applicable, as the leakage factor of this project is zero, it is unnecessary to calculate PMP_i .
Frequency of monitoring/recording	Not more than five years.
Value monitored	Not applicable, as the leakage factor of this project is zero, it is unnecessary to calculate PMP_i .
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest inventory including field data collection and data management must be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or form the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	For the calculation of the project emissions.
Calculation method	Not applicable.
Comments	Ex-ante a time zero measurement must be made of this factor. The timber harvest plan sets the allowable mean extracted volume from the merchantable volume of timber in the forest inventory ($V_{j,i\|BSL}$), based on legal limits.

Data / Parameter	**A_i**
Data unit	Ha
Description	Area covered by stratum i
Source of data	Geodetic coordinates and/or Remote Sensing data and/or legal parcel records.
Description of measurement methods and procedures to be applied	/

Frequency of monitoring/recording	The data is from the national second class forest investigation, which is updated every 10 years.
Value monitored	Please refer to the ER spreadsheet for details.
Monitoring equipment	N/A
QA/QC procedures to be applied	/
Purpose of the data	Calculation of baseline and project emissions
Calculation method	The value is from the national second class forest investigation, which is design and implemented by the designated qualified entities.
Comments	In the baseline scenario strata areas must not change through time. In the project scenario it must be assumed ex-ante that stand boundaries and strata areas must not change through time. Ex post adjustments of the project scenario strata may be needed if unexpected disturbances occur during the project crediting period, severely affecting different parts of an originally homogenous stratum. This disturbance will be delineated as a separate stratum for the purpose of monitoring the carbon stock changes.

4.3 Monitoring Plan

The organizational structure, responsibilities and competencies of the personnel that carried out the monitoring activities.

The methods used for generating/measuring, recording, storing, aggregating, collating and reporting the data on monitored parameters.

The procedures used for handling any internal auditing performed and any non-conformities identified.

The implementation of sampling approaches, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures. Where applicable, demonstrate whether the required confidence level or precision has been met.

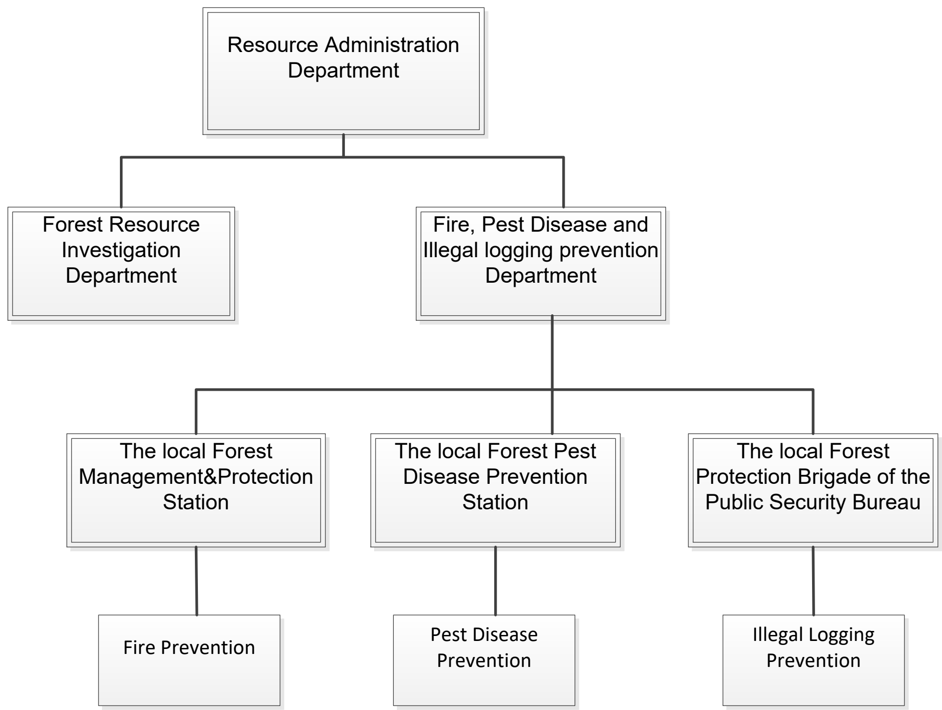
The resources administration department is assigned to be fully responsible for the carbon sequestration. They will coordinate with other departments (such as forest resource investigation department and fire, pest disease & illegal logging prevention) to provide all the necessary supports for the monitoring.

The forest investigation department will implement the sample monitoring with their professional skills.

The forest volume of the samples will be calculated by the table volume issued by the local forest authority based on the DBH.

Also, the prevention of fire, pest disease and illegal logging will be carried out by separate organizations.

The structure diagram is listed in the following:



All data collected as part of monitoring are archived electronically and kept at least for 2 years after the end of the project crediting period. All the forest investigation is implemented according to the primary technical code for the forest resource planning, design and investigation issued by the State Forestry Administration in 2003.

Data archiving took both electronic and paper forms, and copies of all data are available to be provided to each project participant.

This archives include:

Copies of all original sample spots recording sheet (includes the detailed information of the spot location, latitude), forest volume table,

Estimates of the carbon stock changes in all pools and non-CO_2 GHG and corresponding calculation spreadsheets;

GIS products; and

Copies of the measuring and monitoring reports.

Carbon stocks are measured according to the volume table equations with field sampling based on forest inventory methods. Various sources exist to assist with the design of a verifiable forest field inventory based on best practice for sampling, data management and analysis.

In the project area the inventory plan is specified as below:

The design of a verifiable forest field inventory based on best practice for sampling, data management and analysis are selected from the Box 3 of the methodology. The sample size estimation methods, allocation among strata and uncertainty consideration is based on the most recent version of the tool for the "Calculation of the number of sample plots for measurements within A/R CDM project activities" (version 02.1.0) approved by the CDM Executive Board. The calculation process is shown below:

Parameter	Unit	Description
n	dimensionless	Number of sample plots required for estimation of biomass stock within the project boundary
n_i	dimensionless	Number of sample plots allocated to stratum I for estimation of biomass stocks within the project boundary.

The sample plot is 0.06ha with the radius of 13.82m and at least 5 samples is selected in every stratum, As the sample size should be less than 100, then the total sample plot area should be less than 6 ha, which is small than 5% of the total project are(11,010*5%=550.5ha). Therefore, the following simplified equation can be used for estimating the number of sample plots:

$n = (\frac{t_{VAL}}{E})^2 * (\sum_i \omega_i * S_i)^2$ (1)

Where:

n: Number of sample plots required for estimation of biomass stocks within the project boundary dimensionless

$t_{VAL:}$ Two-sided Student's t-value at infinite degrees of freedom for the required confidence level; dimensionless

E: Acceptable margin of error (i.e. one-half the confidence interval) in estimation of biomass stock within the project boundary; td.m. (or td.m.ha^{-}1), i.e. in the units used for Si

ω_i: Relative weight of the area of stratum i (i.e. the area of the stratum i divided by the project area); dimensionless

S_i: estimated standard deviation of biomass stock in stratum i; t d.m. (or td.m.ha^{-1})

i1, 2, 3, …biomass stock estimation strata within the project boundary

After the estimation of total number of sample plots (n), allocation of number of sample plots among strata is calculated as:

$n_i = n * \frac{\omega_i * S_i}{\sum_i \omega_i * S_i}$ (2)

where:

$n_{i:}$ Number of sample plots allocated to stratum i; dimensionless

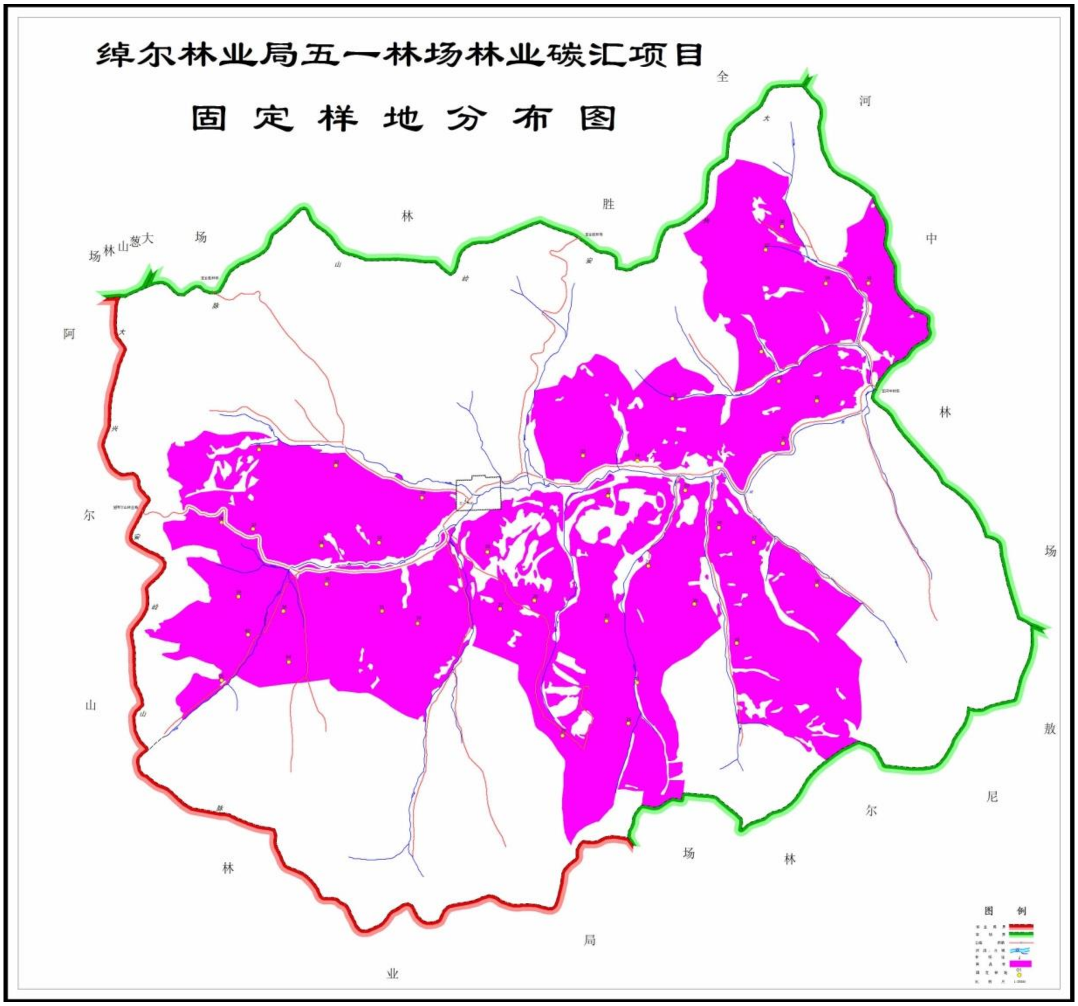
n: Number of sample plots required for estimation of biomass stocks within the project boundary;

dimensionless
ω_i: Relative weight of the area of stratum i (i.e. the area of the stratum i divided by the project area); dimensionless
S_i: Estimated standard deviation of biomass stock in stratum i; t d.m. (or t d.m.ha-1)
i1, 2, 3,⋯ biomass stock estimation strata within the project boundary
For the project activity:
Based on the data of biomass stocks in a carbon pool in the project scenario, the estimation of number of sample plots required is shown in the table below:

I.D	Stratum	Species	Area（ha）	Unit Carbon Stock（t CO_2e）	Deviation factor	s_i	w_i	w_i*s_i	n_i	Adjusted ni
1	PROJ-1	Brich	1,313	73.4176	0.6	44.05	12%	5.25	6.4	6
2	PROJ-2	Pinus	9,697	106.7008	0.3	32.01	88%	28.19	34.6	35

Where the confidence level is 95% as required in the methodology VM0010 Ver 1.2 and Df is ∞, therefore, t_{VAL} is 1.96.

As indicates in the table above, the total sample plots are 41, with brich and pinus of 6 and 35 respectively.
Then the 41sample plots are distributed at random in the project area, the details are listed in the following:



The following data analysis also shows that the precision level of the sample carbon stock is 91.1%, larger than 90%, there is no need to deduct the emissions.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The net carbon stock change to be converted to emissions is equal to the carbon stock change as a result of timber harvest plus the carbon stock change resulting from conversion and retirement of wood products minus carbon sequestration from forest regrowth after harvest.

In order to generate the annual carbon stock change in the baseline scenario, the total net change in carbon stocks for parcels within is multiplied by the area of forest in the particular age class (i.e., years since harvest in the baseline).

The annualized calculation varies between years 1,2-10;11-20; and all years since the start of the project activity, depending on which decay functions apply.

Therefore, the net change in carbon stock from wood products and logging slash across all

parcels within the first year of harvest in the baseline is calculated as:

$$\Delta C_{NET,BSL(1)} = \sum_{i=1}^{M}\sum_{p=1}^{p} A_{1,i,p} * (\left(\frac{\Delta C_{DWSLASH,i,p,BSL}}{10}\right) + \Delta C_{WP0,i,p,BSL} + (\Delta C_{WP100,i,p,BSL}/20)) \quad (3)$$

The net change in carbon stock from wood products and logging slash across all parcels in the years 2-10 since harvest in the baseline are calculated as:

$$\Delta C_{NET,BSL(2-10)} = \sum_{i=1}^{M}\sum_{p=1}^{p} A_{2-10,i,p} * (\left(\frac{\Delta C_{DWSLASH,i,p,BSL}}{10}\right) + (\Delta C_{WP100,i,p,BSL}/20)) \quad (4)$$

The net change in carbon stock from wood products across all parcels in the years 11-20 since harvest in the baseline are calculated as:

$$\Delta C_{NET,BSL(11-20)} = \sum_{i=1}^{M}\sum_{p=1}^{p} A_{11-20,i,p} * (\Delta C_{WP100,i,p,BSL}/20) \quad (5)$$

The net change (sequestration) in carbon stock due to forest regrowth across all parcels in all years since harvest in the baseline scenario are calculated as:

$$\Delta C_{NET,BSL(1+)} = \sum_{i=1}^{M}\sum_{p=1}^{p} A_{i,p,t^*} * (-\Delta C_{RG,i,p,BSL}) \quad (6)$$

Therefore, the net change in carbon stock across all parcels harvested over each year of the project crediting period in the baseline scenario since the start of the project activity is calculated as:

$$\Delta C_{NET,BSL,t^*} = \Delta C_{NET,BSL(1)} + \Delta C_{NET,BSL(2-10)} + \Delta C_{NET,BSL(11-20)} + \Delta C_{NET,BSL(1+)} \quad (7)$$

The net carbon stock change in the baseline scenario must be converted to net greenhouse gas emissions and is calculated as:

$$GHG_{NET,BSL,t^*} = \Delta C_{NET,BSL,t^*} * \frac{44}{12} \quad (8)$$

The baseline emission process has been demonstrated in the PD of the project, the outcome during this monitoring period is listed in the following:

Year	$\triangle C_{NET,BSL(1+)}$(tC)	$\triangle C_{NET,BSL,t}$(tC)	Conversion factor	$GHG_{NEt,BSL,t}$（tCO_2e）
1	1,045	4,103	3.67	15,045
2	2,090	3,822	3.67	14,013
3	3,135	3,540	3.67	12,980
4	4,180	3,259	3.67	11,948
5	5,225	2,977	3.67	10,916
6	6,270	2,695	3.67	9,883
7	7,315	2,414	3.67	8,851
8	8,360	2,132	3.67	7,819
9	9,405	1,851	3.67	6,786
10	10,450	1,569	3.67	5,754

Year 1-10	1 Jan 2010 to 31Dec2019	$GHG_{NEt,BSL,t2*}$（tCO_2e）	103,995
Year 1-5	1Jan 2010 to 31Dec2014	$GHG_{NEt,BSL,t1*}$（tCO_2e）	64,902

Note: Here t2* is 10 years for the time elapsed since the start of the project to 31/12/2019.

Here t1* is 5 years for the time elapsed since the start of the project to 31/12/2014.

5.2 Project Emissions

The net greenhouse gas emissions in the project scenario will be equal to emissions resulting from forest disturbance (both illegal logging and natural disturbances) minus carbon sequestration through ongoing forest growth.

$$\Delta C_{AB,t,PRJ} = \left(\sum_{i=1}^{M}\left(A_i * \frac{C_{AB,i,t2,PRJ} - C_{AB,i,t1,PRJ}}{T}\right)\right) * \frac{44}{12} \quad (9)$$

Based on the IPCC 2006 Inventory Guidelines, estimation of greenhouse gas emissions from biomass burning must be calculated as:

$$\Delta C_{DIST-FR,t,PRJ} = \sum_{i=1}^{M} A_{burn,i,t} * B_{i,t,PRJ} * COMF_i * G_{g,i} * 10^{-3} * GWP_{CH4} \quad (10)$$

As there is no fire occurred during the monitoring period, $\Delta C_{DIST-FR,t,PRJ}$ is equal to 0.

It is conservatively assumed that the natural disturbance is a stand-replacing disturbance, and that the biomass change as a result of the natural disturbance ($\Delta C_{DIST,t,PRJ}$) is emitted in the year of disturbance.

$$\Delta C_{DIST,t,PRJ} = \sum_{i=1}^{M}\left(A_{dist,i,t} * \sum_{j=1}^{J}\{C_{AB,j,i,BSL}\}\right) * \frac{44}{12} \quad (11)$$

As indicates by the relevant statement issued by the local authority, no natural disasters occurred during the monitoring period, $\Delta C_{DIST,t,PRJ}$ is equal to zero.

Illegal logging

A participatory rural appraisal (PRA) of the communities surrounding the project area must be completed to determine if there is the potential for illegal extraction of trees from the project area. If this assessment finds no potential pressure for these activities then illegal logging ($\Delta C_{DIST_{IL},i,t,PRJ}$) can be assumed to be zero and no monitoring is needed.

If the results of the PRA suggest that there is a potential for illegal logging activities, then limited field sampling must be undertaken.

Therefore, where the PRA or the limited sampling indicate no illegal logging occurring:

$$\Delta C_{DIST-IL,t,PRJ} = 0$$

Where the PRA and the limited sampling indicate degradation is occurring, net carbon stock change as a result of illegal logging must be calculated as:

$$\Delta C_{DIST-IL,t,PRJ} = \sum_{i=1}^{M}(A_{DIST-IL,j} * \frac{C_{DIST-IL,i,t,PRJ}}{AP_i}) \quad (12)$$

Therefore, net greenhouse gas emissions in the project scenario in year t, is calculated as:

$$\Delta C_{NET,t,PRJ} = (\Delta C_{DIST-FR,t,PRJ} + \Delta C_{DIST,t,PRJ} + \Delta C_{DIST-IL,t,PRJ}) - \Delta C_{AB,t,PRJ} \quad (13)$$

The net greenhouse gas emissions across in the project scenario since the start of the project activity is calculated as:

$$GHG_{NET,PRJ} = \sum_{t=1}^{t^*} \Delta C_{NET,t,PRJ} \quad (14)$$

$\triangle C_{DIST-FR,t,PRJ}$, $\triangle C_{DIST,t,PRJ}$, $\triangle C_{DIST\_IL,I,t,PRJ}$ are zero during the monitoring period, on-going growth rate is measured by the project owner based on the sample data, the details are listed below:

Year	Monitoring period	$\triangle C_{DIST-FR,t,PRJ}$ (tCO_2e)	$\triangle C_{DIST,t,PRJ}$ (tCO_2e)	$\triangle C_{DIST\_IL,I,t,PRJ}$ (tCO_2e)	$\triangle C_{AB,t,PRJ,}$ (tCO_2e)	$\triangle C_{NET,t,PRJ}$ (tCO_2e)
1-10	1Jan 2010 to 31Dec2019	0	0	0	1052210	-1052210
1-5	1Jan2010 to 31Dec2014	0	0	0	709082	-709082

$$GHG_{NET,PRJ,\ 2019} = \triangle C_{NET,PRJ,2019} = -1052210\ (tCO_2e)$$

$$GHG_{NET,PRJ,\ 2014} = \triangle C_{NET,PRJ,2014} = -709082\ (tCO_2e)$$

5.3 Leakage

Activity shifting leakage

The project does not involve in the activity shifting leakage due to the following reasons:

- It can be found from the historical records, that the trends in harvest volumes paired with records from the with- project time period showing no deviation from historical trends;

As indicates by the historical timber production completion records from 2008 to 2014, the total extracted volume of Chao'er Forestry Industrial Co., Ltd is decreasing paired with the plan from the with-project time period. In 2008, 2010 and 2014 the total timber production of Chao'er Forestry Industry Co., Ltd is 275,600 m^3, 225,500m^3, and 143,900m^3, with the drop rate of 44.42%.

In 2015, the timber production of Chao'er Forestry Industry Co., Ltd is 59,056m^3, with the drop rate of 58.96%, comparing with 2014. From then on, the commercial timber production has been completely cancelled, the timber production has become zero. Obviously, the project owner doesn't make up for the decrease of the project activity from other lands.

- Forest management plans prepared ≥24 months prior to the start of the project showing harvest plans on all owned lands paired with records from the with-project time period showing no deviation from management plans.

As indicates by the timber production plan issued by Chao'er Forestry Industrial Co., Ltd issued every year based on the overall national five-year-plan, the total timber production plan is decreasing. Take the plan of 2001, 2008, 2010,2014 for example, the figure dropped from 299,700, 275,600, 225,500 to 143,900, with a sharp drop rate of 47.79%.

The timber production plan of 2015 keeps the same with 2014 of 143,900m^3, from then on, no more production plan has been issued.

It is clear that the total timber production plan is decreasing till dying out instead of increasing, not affected by the reducing of the project activity.

Therefore, the timber plans and land-use designations of other lands controlled by the project owner have not changed as a result of the planned project (designating new lands as timber concessions or increasing harvest rates in lands already managed for timber).

Market leakage

Leakage due to market effects is equal to the net emissions from planned timber harvest activities in the baseline scenario multiplied by an appropriate leakage factor:

$$\mathrm{GHG_{LK,LtPF,t*}} = \mathrm{LF_{ME}} * \mathrm{GHG_{NET,BSL,t*}} \quad (15)$$

According to the methodology, the leakage factor is defined as considering where in the country logging will be increased as a result of the decreased supply of the timber caused by the project. If the areas liable to be logged have a higher ratio of merchantable biomass to total biomass higher than the project area it is likely that the proportional leakage is higher and vice versa:

Therefore,

LF_{ME} = 0

If it can be demonstrated that no market-effects leakage will occur within national boundaries, that is if no new concessions are being assigned AND annual extracted volumes cannot be increased within existing national concessions AND illegal logging is absent (or de minimis) in the host country.

For the project,

- According to the 12th Five-year plan issued by State Forest Bureau (Guofa [2011] No.3)[1], the annual extracted volume from 2011 to 2015 is 27,105.4*10^4 m^3.

- According to the 13th Five-year plan issued by State Forest Bureau (Guohan [2016] No.32)[2], the annual extracted volume from 2016 to 2020 is 25,403.6*10^4 m^3.

  Clearly, the annual extracted volumes dropped 6.28% within existing national concessions. The national logging doesn't increase as a result of the decreased timber supply of project implementation.

- In addition, Illegal logging is strictly forbidden and severely punished within the host country.

  In a word, it is obvious that no market-effects leakage occurs within national boundaries.

Therefore,

LF_{ME} = 0

$GHG_{LK,LtpF,t}$=0

5.4 Net GHG Emission Reductions and Removals

Therefore, the project GHG credits are calculated as:

$$GHG_{CREDITS,LTPF,t*} = GHG_{NET,BSL,t*} - GHG_{NET,PRJ,t*} - GHG_{LK,,LtPF,t*}$$

Year	Monitoring period	$GHG_{NET,BSL,t}$ (tCO_2e)	$GHG_{NET,PRJ,t}$ (tCO_2e)	$GHG_{LK,LtPF,t}$ (tCO_2e)	$GHG_{CREDITS,LtPF,t}$ (tCO_2e)
1-10	1Jan 2010 to 31Dec2019	103995	-1052210	0	1156205
1-5	1Jan 2010 to 31Dec2014	64902	-709082	0	773985

$GHG_{CREDITS,LtPF,2019}$=1156205 (tCO_2e)

$GHG_{CREDITS,LtPF,2014}$=773985 (tCO2e)

[1] http://www.gov.cn/zhengce/content/2018-06/27/content_5288689.htm

[2] http://www.gov.cn/gongbao/content/2016/content_5045985.htm

5.4.1 Adjusted for uncertainty

Estimated greenhouse gas emissions and emission reductions from IFM activities have uncertainties associated with parameters and coefficients including estimates of area, carbon stocks, regrowth and expansion factors. It is assumed that the uncertainties associated with input data are available, either as default uncertainty values given in most recent IPCC guidelines, or as statistical estimates based on sampling.

Uncertainty at all times is defined at the 95% confidence interval where the estimated variance exceeds +/- 15 percent from the mean. Procedures including stratification and the allocation of sufficient measurement plots will help ensure that low uncertainty results and ultimately full crediting can result.

Uncertainties arising from the measurement and monitoring of carbon pools and greenhouse gases shall always be quantified. Errors in each pool shall be weighted by the size of the pool so that projects may reasonably target a lower precision level in pools that only form a small proportion of the total stock.

For both the baseline and the with-project case the total uncertainty is equal to the square root of the sum of the squares of each component uncertainty and is calculated at the time of reporting through propagating the error in the baseline stocks and the error in the project stocks. Therefore, total uncertainty for the project is calculated as:

$$U_{TOTAL,\ LtPF} = \sqrt{U^2_{PRJ} + U^2_{BSL}} \quad (16)$$

If $U_{total|LtPF} \leq 0.15$ then no deduction will result for uncertainty.

If $U_{total|LtPF} > 0.15$ then the amount of greenhouse gas emission credits associated with IFM activities will be deducted as follows:

$$\mathrm{Credits}_{\mathrm{total,LtPF}} = \mathrm{GHG}_{\mathrm{credits,LtPF}} \cdot (1 - \mathrm{U}_{\mathrm{total,LtPF}}) \quad (17)$$

5.4.2 Uncertainty for the Baseline Scenario

According to the methodology, the uncertainty in the baseline scenario is associated with parameters and coefficients including estimates of area, carbon stocks, regrowth and expansion factors, the calculation process follows the two rules below:

Rule A: Where uncertainties are to be combined by addition, the standard deviation of the sum will be the square root of the sum of the squares of the standard deviations of the quantities that are added with the standard deviations all expressed in absolute terms (this rule is exact for uncorrelated variables).

Using this interpretation, a simple equation can be derived for the uncertainty of the sum, that when expressed in percentage terms becomes:

$$U_{total} = \frac{\sqrt{(U_1 * E_1)^2 + (U_2 * E_2)^2 + ... + (U_n * E_n)^2}}{E_1 + E_2 + ... + E_n} \quad (18)$$

Where:

U_{total} is the percentage uncertainty in the sum of the quantities (half the 95% confidence interval divided by the total (i.e. mean) and expressed as a percentage);

Ei and Ui are the uncertain quantities and the percentage uncertainties associated with them, respectively

Rule B: Where uncertain quantities are to be combined by multiplication, the same rule applies except that the standard deviations must all be expressed as fractions of the appropriate mean values (this rule is approximate for all random variables).

A simple equation can also be derived for the uncertainty of the product, expressed in percentage terms:

$$U_{total} = \sqrt{U_1^2 + U_2^2 + ... + U_n^2} \quad (19)$$

Where:

U_{total} is the percentage uncertainty in the product of the quantities (half the 95% confidence interval divided by the total and expressed as a percentage);

Ui are the percentage uncertainties associated with each of the quantities.

The uncertainty are calculated per stratum by dividing the 95% confidence interval by the mean value of the uncertainty quantities. The corresponding standard deviation is calculated over the measured plot values of the uncertainty quantities. The 95% confidence interval is calculated based on the standard deviation and the t-value for n-1 degree of freedom of plots per stratum.

As the uncertainty in the baseline scenario is associated with parameters and coefficients including estimates of area, carbon stocks, regrowth and expansion factors, the calculation of the 4 parameters and coefficients are shown below:

1) Uncertainty of Area:

In the baseline scenario, the area of every stratum is quoted from the second class forestry investigation and forest right certificate, so no data are from measurement and monitoring. Therefore, it is deemed as 0 in the period of validation. It will be monitored in the period of verification.

2) Uncertainty of expansion factors:

The Sample size, Sample mean and Standard error of expansion factors are quoted from Forestry Part of China's greenhouse gas emissions list divided as tree species, and the details is listed in the following table.

For brich

Parameters	Sample size	Stand deviation	Stand error	Mean	U
BEF	39	0.337	0.054	1.586	6.89%
D	189	0.013	0.001	0.443	0.45%
BCEF					6.91%

For Pinus

Parameters	Sample size	Stand deviation	Stand error	Mean	U
BEF	321	0.408	0.023	1.416	3.16%
D	13	0.039	0.011	0.49	4.81%
BCEF					5.76%

3) Uncertainty of carbon stock:

The calculation of uncertainty of carbon stock is based on the uncertainty of volume in every stratum multiply by the uncertainty of expansion factors.

Parameters	Species	Sample Size	Stand deviation	Stand Error	t	Mean	U
BEF	Brich	39	0.337	0.054	2.024	1.586	6.89%
	Pinus	321	0.408	0.023	1.967	1.416	3.16%
D(tdm/m3)	Brich	189	0.013	0.001	1.973	0.443	0.45%

Parameters	Species	Sample Size	Stand deviation	Stand Error	t	Mean	U
	Pinus	13	0.039	0.011	2.179	0.490	4.81%
BCEF	Brich					0.703	6.91%
	Pinus					0.694	5.76%
Volume (m^3/ha)	Brich	117	38.03	3.516	1.981	56.997	12.22%
	Pinus	795	30.52	1.082	1.963	83.882	2.53%
Carbon Stock (tC/ha)	Brich						14.03%
	Pinus						6.29%
RGR（m^3/ha/yr）	Brich					2.55	30%
	Pinus					3.75	30%

4) Uncertainty of regrowth

The uncertainty of regrowth is only associated with the parameter RGR_i, as for the value quoted from IPCC Guidelines for National Greenhouse Gas Inventories (2006), Table 4.9, the uncertainty for non-industrialized countries of 30% is regulated therefore the uncertainty of RGR_i regrowth is 30%. And this uncertainty is adopted for the project for conservative.

Baseline Emission Uncertainty calculation

Based on the calculation of the 4 parameters and coefficients above, the U_{total} is7.080%, the detailed calculation is listed as follows:

The baseline emission uncertainty has been listed in the PD of the project as 4.328%, the details for the project emission uncertainty is updated as:

Project Emission Uncertainty

Stratum	Parameter	Area (ha)	$V_{j,I,BSL,2014}$ (m3/ha)	BEF	D (tdm/m^3)	BCEF (tdm/m^3)	CF (tC/tdm)	$V_{j,i,BSL,2019}$ (m^3/ha)	$\triangle V_{AB,t,PRJ}$ (m^3/ha)	$\triangle C_{AB,t,PRJ}$ (tCO_2e)
		a	b	c	d	e=c*d	f	g	h=g-b	i=h*a*e*f*44/12
										$u_i = \sqrt{U_h{}^2 + U_e{}^2}$
Brich	E	1,313	71.515	1.586	0.443	0.703	0.5	77.287	5.772	9,762.351
	U	0	2.89%	6.893%	0.445%	6.907%		4.028%	2.510%	7.349%
Pinus	E	9,697	116.663	1.416	0.490	0.694	0.5	141.280	24.616	303,640.957
	U	0	0.63%	3.164%	4.810%	5.757%		0.729%	0.491%	5.778%
									U_{PRJ}	5.603%

Therefore, $U_{total} = \sqrt{U_{BSL}{}^2 + U_{PRJ}{}^2} = \sqrt{4.328\%^2 + 5.603\%^2} = 7.080\%$

According to the methodology, if $U_{total,LtPF} \leq 0.15$ then no deduction will result for uncertainty, therefore, it is unnecessary for the project to deduct for the uncertainty.

Year	Monitoring period	$GHG_{NET,BSL,t}$ (tCO_2e)	$GHG_{NET,PRJ,t}$ (tCO_2e)	$GHG_{LK,LtPF,t}$ (tCO_2e)	$GHG_{CREDITS,LtPF,t}$ (tCO_2e)	$U_{total,LtPF}$	$Credits_{total,LtPF,t}$ (tCO_2e)
1-10	1Jan 2010 to 31Dec2019	103995	-1052210	0	1156205	7.080%	1156205
1-5	1Jan 2010 to 31Dec2014	64902	-709082	0	773985	7.053%	773985

Note: $U_{total,LtPF,t1}$ is 7.053%, refer to p37 in MONIT_REP_1529_01JAN2010_31DEC2014.

$Credits_{total,LtPF,t2-t1}$= $Credits_{total,LtPF,t2}$ - $Credits_{total,LtPF,t1}$=1156205 -773985=382220 (tCO_2e)

Calculation of verified carbon units

The amount of greenhouse gas credits estimated at section 4.4 above shall be adjusted to account for risk.

They shall be subject to deductions based on application of the most recent version of the VCS Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination.

Therefore, the amount of VCUs that can be issued at time t=t2 (the date of verification) for monitoring period $T=t_2-t_1$, is calculated as:

$$VCU_{net,LtPF} = (\mathrm{Credits}_{total,\,t2,\,LtPF} - \mathrm{Credits}_{total,\,t1,\,LtPF}) - \mathrm{Bu}_{IFM-VCS} \qquad (20)$$

For the project activity, the second monitoring periods lasts from 01/01/2015 to 31/12/2019 with 5 years, for the convenience of VCU selling, it should be divided into every single year instead of for the whole monitoring period of 5 years. The VCU in every year is also calculated with buffering deducting. The whole VCU during the 5 years is the sum of VCU in every single year. In a word, the results of VCU issued during the second monitoring period is the same as the sum of the VCU in every year.

Based on the analysis in NON-PERMANENCE RISK REPORT (please refer to the appendix), the overall risk rating is 10, then 10% of the total emission reductions shall be deducted.

Therefore, the emission reduction detail is listed:

$\mathrm{Credits}_{total,LtPF,t2-t1}$ (tCO_2e)	Risk Score	$\mathrm{Bu}_{IFM-VCS}$ (tCO_2e)	$VCU_{net,LtPF}$ (tCO_2e)
382220	10	38222	343998

$VCU_{net,,LtPF}$=382220-38222=343998 (tCO_2e)

Therefore, the $VCU_{net,LtPF}$ of the project is listed in the following:

Year	Monitoring period	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)	Buffer pool allocation (tCO_2e)	VCUs eligible for issuance (tCO_2e)
6	01/01/2015-31/12/2015	9883	-68625	0	78509	7851	70658
7	01/01/2016-31/12/2016	8851	-68625	0	77476	7748	69728
8	01/01/2017-31/12/2017	7819	-68625	0	76444	7644	68800
9	01/01/2018-31/12/2018	6786	-68625	0	75412	7541	67871
10	01/01/2019-31/12/2019	5754	-68625	0	74379	7438	66941

	Total	39093	-343127	0	382220	38222	343998
	Average	7819	-68625	0	76444	7644	68800