FUJIAN YONG'AN IMPROVED FOREST MANAGEMENT PROJECT

中信环境投资集团有限公司
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Project Title	Fujian Yong'an Improved Forest Management Project
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Monitoring Period	01-07-2011 to 30-06-2016
Prepared By	CITIC Environment Investment Group CO., Ltd.
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Table of Contents

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Fujian Yong'an Improved Forest Management Project (hereafter "the project") is located in Yong'an City, Fujian Province, P.R.C. It is implemented by Yong'an Forestry Bureau of Fujian province (hereafter "project owner") to protect the once logging forest.

The geographic coordinate of Yong'an city is 116° 56' ~117° 47' E and 25° 33' ~26° 12' N, the total area is 292,995ha, of which 251,800 ha is the forestry area, accounting 85.94% of the total area. The forest land area is 230,600 ha, and the forest coverage rate is 78.58%, mainly composed by mountainous regions, the project area has a complex geomorphologic characteristic. The elevation level of the region is ranged from 200~750m and the climate feature is subtropical humid monsoon climate. The dominant tree species within the project area are Chinese Fir, Masson pine and Broad-leaf trees. Prior to the implementation of the project, the forest was loged annually according to the timber logging and managing plan issued by local Forestry authority. In order to protect the ecological system, the local government has tried to reduce the annual forest timber volume within the project area, which can be seen from the timber logging and managing plan, the commercial harvest is cancelled and only tending and managing is permitted.

The project is implemented in the key location commercial forest of Yong'an city, which distributes in the 11 towns and 3 agencies. And the forest right belongs to Fujian Yong'an Forestry (Group) Co., Ltd. (hereafter refers to as Yonglin), Fujian Yonghui Foresty Co., Ltd. (hereafter refers to as Yonghui), Yong'an Senfa Technology and Trade Co., Ltd. (hereafter refers to as Senfa) and the Yong'an Forestry Bureau (They bought the forest right from the farmers, hereafter refers to as Forestry Bureau). For the convenient of VCU registration and issuance application, they selected the Forestry Bureau to represent them as Project Proponent to implement the GHG related work.

The project has approximately 7,186 ha commercial forest, whose ages ranging from sapling, middle age to mature forest, most of the broad-leaf trees are nearly mature or mature. 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 logging and managing plan issued by the local forest authority. 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 is expected to generate 263,328 tCO_2e emission reductions within the monitoring period from 01/07/2011 to 30/06/2016 with the average annual emission reductions of 52,666 t CO_2e, without buffer deduction, the annual and the total emission reductions are 70,221 and 351,104 tCO_2e respectively.

From 2011, 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 government, and strictly executed by the project owner. 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.

It is not a grouped project.

1.3 Project Proponent

Organization name	Yong'an Forestry Bureau of Fujian province, P.R.China
Contact person	Xinbiao Zhan
Title	Director of Carbon Sink Office
Address	No. 909, Baxi Road, Yong'an City, Fujian Province, P.R. China
Telephone	+86-598-3614180 +86-13859139320
Email	zxblyj@163.com

1.4 Other Entities Involved in the Project

Organization name	CITIC Environment Investment Group CO., Ltd.
Role in the project	Project Consultant
Contact person	Yapeng Zhang
Title	Project Manager
Address	Room 3202, Jingcheng Mansion, 6 Xinyuan Nanlu, Chaoyang District, Beijing, China.
Telephone	+86-10-84661887 +86-139 1088 4161
Email	zhangyp5@citic.com

Organization name	China Green Carbon Foundation
Role in the project	Partner of the PP

Contact person	Jinliang Li
Title	Chief Engineer
Address	No. 18 Hepingli Dong jie, Dongcheng District, Beijing 100714, P.R. China.
Telephone	+86-10-8423 9419 +86-139 1132 3810
Email	603464047@sina.com

1.5 Project Start Date

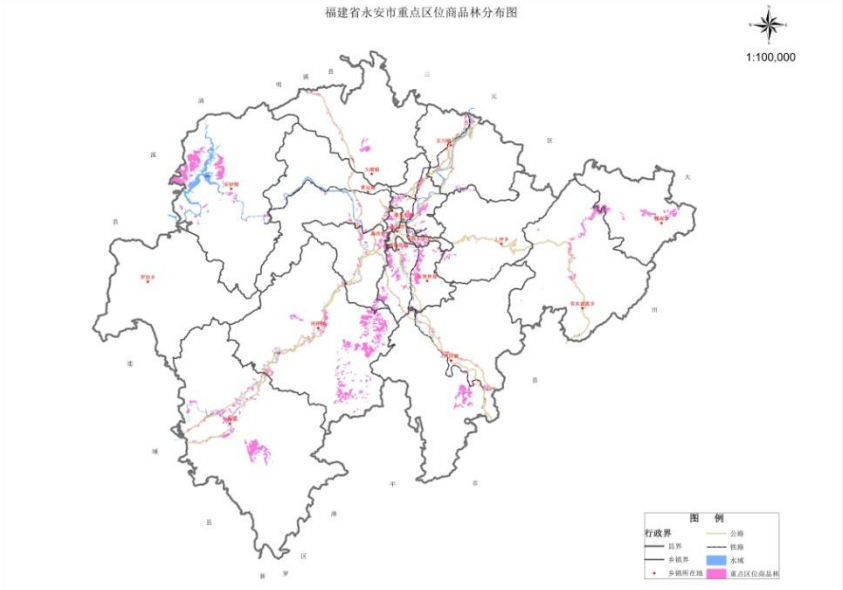
The Project Start Date is represented by the implementation of the forest protection project on 01/07/2011.

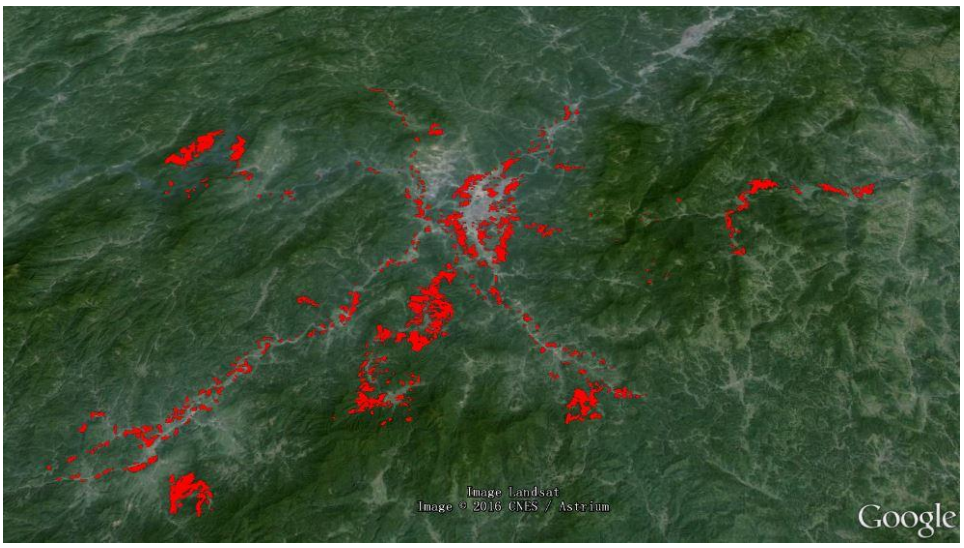
1.6 Project Crediting Period

The total length of the crediting period is 20 years, which starts from 01/07/2011, ends on 30/06/2031.

1.7 Project Location

The emission reduction of the project is from all the key location commercial forest of Yong'an city, which distributes in the 11 towns and 3 agencies. The location diagram of the project is listed in the following:





1.8 Title and Reference of Methodology

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

This methodology uses all VCS approved definitions from the most recent VCS version and the VCS Tool for AFOLU Methodological Issues as listed:

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

1.9 Other Programs

- The project activity is not involved in any other emission trading program or mechanism that includes GHG allowance trading.
- The project has not sought or received another form of GHG related environmental credit.
- The project has not registered under any other GHG programs.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project starts from 01/07/2011, this monitoring period ended on 30/06/2016. During this monitoring period, the project activity operates smoothly without any events that may impact the GHG emission reductions or removals and monitoring.

As for the non-permanence risk, please refer to the separate annex of "Fujian Yong'an Liangqu Improved Forest Management Project Non-Permanence Risk Report".

2.2 Deviations

2.2.1 Methodology Deviations

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

2.2.2 Project Description Deviations

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

2.3 Grouped Project

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

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	$V_{l,j,l,sp}$
Data unit	m^3
Description	Merchantable volume for tree l of species j in sample plot sp in straum i
Source of data	Calculated from volume tables or equations linking diameter at breast height (DBH, at typically 1.3 m aboveground level), and/or merchantable height (MH), to commercial (merchantable) volume of trees in the sample plots above the minimum DBH set in the timber harvest and management plan. If locally derived equations or yield tables are not available use relevant regional, national or default equations from IPCC literature, national inventory reports or published peer-reviewed studies– such as those provided in Tables 4.A.1 to 4.A.3 of the GPG-LULUCF (IPCC 2003).
Value applied:	The local second forest inventory issued by the qualified investigation institute give all the detailed information including the area and volume of every spot.
Justification of choice of data or description of measurement methods and procedures applied	It is necessary to verify the applicability of equations used. Allometric equations can be verified by both: 1. Verification of equation conditions Justification should be provided for the applicability of the equation to the project locations. Such justification should include identification of climatic, edaphic, geographical and taxonomic similarities between the project location and the location in which the equation was derived. Any equation used should have an r2 value of greater than 0.5 (50%) and a p value that is significant (<0.05 at the 95% confidence level). 2. Additional field verification The following limited measures method must be used for field

	verification: • select at least 10 trees per species distributed across the age range (but excluding trees less than 15 years old for which there is rarely a great relative inaccuracy in equations) ; • measure DBH, and height to a 10 cm diameter top or to the first branch; • calculate stem volume from measurements; and • plot the estimated volume of all the measured trees along with the curve of volume 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 volume consistently higher than predicted by the equation. The equation may not be used if >75% of the measured trees have a volume lower than the predicted curve. In this instance another equation must be selected.
Purpose of the data	Calculation of baseline emissions
Comments	The value can adopt the local second forest inventory issued by the qualified investigation institute.

Data / Parameter	CF_j
Data unit	$tc \cdot tdm^{-1}$
Description	Carbon fraction of dry matter for species j
Source of data	Either the default value 0.5 $tC \cdot t\ d.m^{-1}$ 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 $tC \cdot t\ d.m^{-1}$ 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 the 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

<table>
<tr><td></td><td>follows:
a) National species-specific or group of species-specific values (eg, from National GHG inventory);
b) Species-specific or group of species-specific values from neighbouring countries with similar conditions. When species-specific data from neighbouring 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 (eg, 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.</td></tr>
<tr><td>Value applied:</td><td><table>
<tr><td>Species</td><td>D(tdm/m^3)</td><td>Data Source</td></tr>
<tr><td>Chinese Fir</td><td>0.307</td><td rowspan="3">Chapter "Land Use Change and Forestry GHG Inventory (2013)" of "Second national information notification on China Climate Change"</td></tr>
<tr><td>Masson Pine</td><td>0.38</td></tr>
<tr><td>Broad-leaf Tree Mixture</td><td>0.482</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 the data</td><td>Calculation of baseline emissions and project emissions.</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	BCEF
Data unit	tdm • 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 (eg, from national GHG inventory); c) Forest type-specific or eco-region-specific from neighbouring countries with similar conditions. Sometimes (c) might be referable to (b);

<table>
<tr><td></td><td>d) Global forest type or eco-region-specific (eg, IPCC 2006 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><th>Speices</th><th>BEF</th><th>D(tdm/m^3)</th><th>BCEF(tdm/m^3)</th></tr>
<tr><td>Chinese Fir</td><td>1.634</td><td>0.307</td><td>0.502</td></tr>
<tr><td>Masson Pine</td><td>1.472</td><td>0.38</td><td>0.559</td></tr>
<tr><td>Broad-leaf Tree Mixture</td><td>1.514</td><td>0.482</td><td>0.730</td></tr>
<tr><td colspan="4">Data source of BEF and D is from Chapter "Land Use Change and Forestry GHG Inventory (2013)" of "Second national information notification on China Climate Change"</td></tr>
</table>

Data source of BEF and D is from Chapter "Land Use Change and Forestry GHG Inventory (2013)" of "Second national information notification on China Climate Change".</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 the 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}

<table>
<tr><td>Description</td><td>
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
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><td rowspan="2">Wood Product Class</td><td colspan="3">OF</td></tr>
<tr><td>Boreal</td><td>Temperate</td><td>Tropical</td></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 the 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 and management plan sets the allowable mean extracted volume from the merchantable volume of timber in the forest second class investigation (*Vj,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	N/A
Purpose of the 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 the 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 the 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 the 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 the data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	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 the data	Calculation of baseline emissions and project emissions.
Comments	-

Data / Parameter	$A_{s,p}$
Data unit	ha
Description	area of sample plot sp
Source of data	Recording and archiving of size of sample plots
Value applied:	0.06 ha
Justification of choice of data or description of measurement methods and procedures applied	Standard procedure for plot delineation in forest timber inventory surveys must be used (see reference in Box 3 for example procedures)
Purpose of the data	Calculation of baseline emissions
Comments	Ex-ante the size of the plots must be defined and recorded in the monitoring plan.

Data / Parameter	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 activiey, 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 the data	Calculation of project emissions.
Comments	-

Data / Parameter	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:	Confidence level Df: 95% ∞: 1.960 Df-degree of freedom
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of the data	Calculation of sample size.
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:	0.3657
Justification of choice of data or description of measurement methods and procedures applied	-
Purpose of the data	Calculation sample size.
Comments	

3.2 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 applied:	Ex-ante zero. In addition to the national and local law and policy to prevent the illegal logging, the project proponent has also taken comprehensive prevention

	measures. The actual situation will be confirmed by the forest authority during the monitoring period.
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	Not applicable.
Purpose of 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. For the project activity, the forest is managed by the forestry authority, the illegal logging is strictly prohibited and severely punished. It is impossible to happen.

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 applied:	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 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	$A_{burn,I,t}$
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
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	-

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 authority at the end of 2015, not any non-fire natural disturbance occurred during this monitoring period.)
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	-

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	ASIST_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 (As specified in the statement issued by the local forest authority in 2015, no significant illegal logging occurred in the project area during the last 7 years.)
Monitoring equipment	Not applicable.
QA/QC procedures to be applied	ADIST_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 (ADIST_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 ADIST_IL, indicates illegal logging
Value monitored:	0 (As specified in the statement issued by the local forest authority in 2015, no significant illegal logging occurred in the project area during the last 7 years.)
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 (As specified in the statement issued by the local forest authority in 2015, no significant illegal logging occurred in the project area during the last 7 years.)
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	-

Data / Parameter	PMP_i
Data unit	%
Description	Merchantable biomass as a proportion of total aboveground 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 aboveground 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 applied:	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 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	The stratum is from the second class forestry inventory.
Frequency of monitoring/recording	The data is from the national second class forest investigation, which is updated every 10 years.
Value monitored:	<table><tr><td>Species</td><td>Area(ha)</td></tr><tr><td>Chinese Fir</td><td>1,986.20</td></tr><tr><td>Masson Pine</td><td>1,996.33</td></tr><tr><td>Broad-leaf Tree Mixture</td><td>3,203.40</td></tr></table>
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.

Data / Parameter	DBH
Data unit	cm
Description	Diameter at breast height of tree
Source of data	On site measuring on the sample spot.
Description of measurement methods and procedures to be applied	The National Forest Resource Continuous Investigation Technical Regulation issued by the State Forestry Bureau has detailed requirement of the measurement method.
Frequency of monitoring:	Not more than five years
Monitoring Equipment:	Tape Measure
Purpose of Data	Calculation of tree volume, then to carbon stock change further to the project emissions.
Comments	As for the project tree species, there are no allometric equation applied in the project area, the average annual growth and biomass expansion method is adopted for the estimated calculation of carbon stock change. Based on the DBH.and local volume table, the volume can be calculated, combined by the BCEF and CF, the carbon stock can be obtained.

3.3 Monitoring Plan

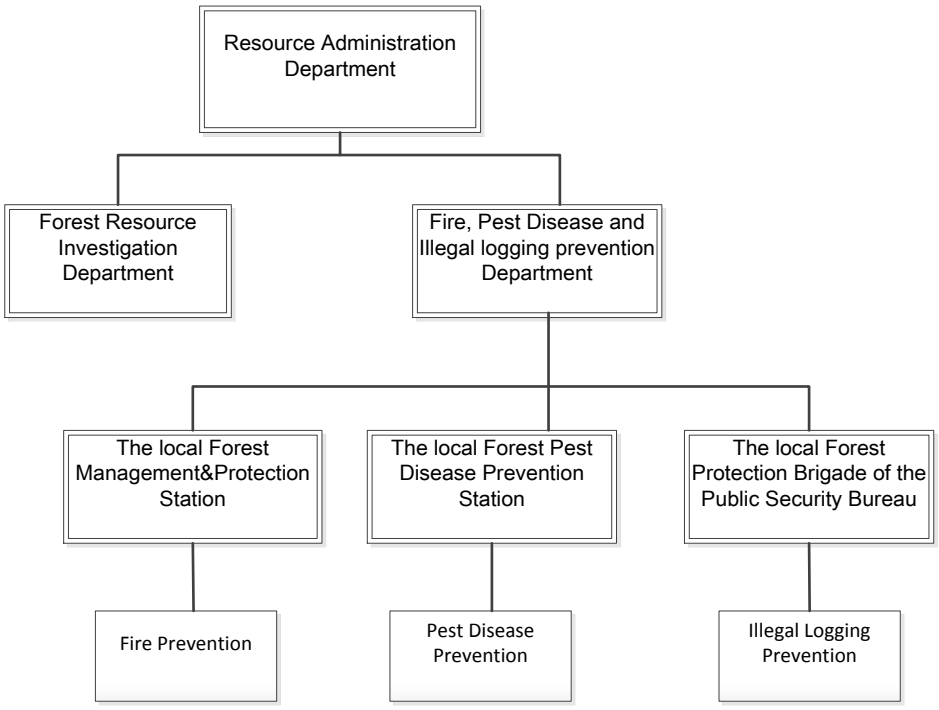
The resources administration department is assigned to be fully responsible for the carbon sequestration. They will coordinate with other departments (such as forest resource investigation department and fire, pest disease & illegal logging prevention) to provide all the necessary supports for the monitoring.

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

The forest volume of the samples will be calculated by the volume table 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 (Box 3). 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(7,185.9*5%=359.3 ha). Therefore, the following simplified equation can be used for estimating the number of sample plots:

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

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; tdm (or tdm • ha-1), i.e. in the units used for S_i

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 tdm • ha^{-1})

i 1, 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:

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

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)	Carbon Stock (t CO_2)	Deviation factor	s_i	w_i	w_i*s_i	n_i	Adjusted n_i
1	PROJ-1	Chinese Fir	1,986.20	131,618.06	0.3	19.88	0.28	5.49	5.1	5.0
2	PROJ-2	Masson Pine	1,996.33	299,831.69	0.2	30.04	0.28	8.34	7.7	8.0
3	PROJ-3	Broad-leaf Tree	3,203.40	531,106.29	0.4	66.32	0.45	29.56	27.2	27.0

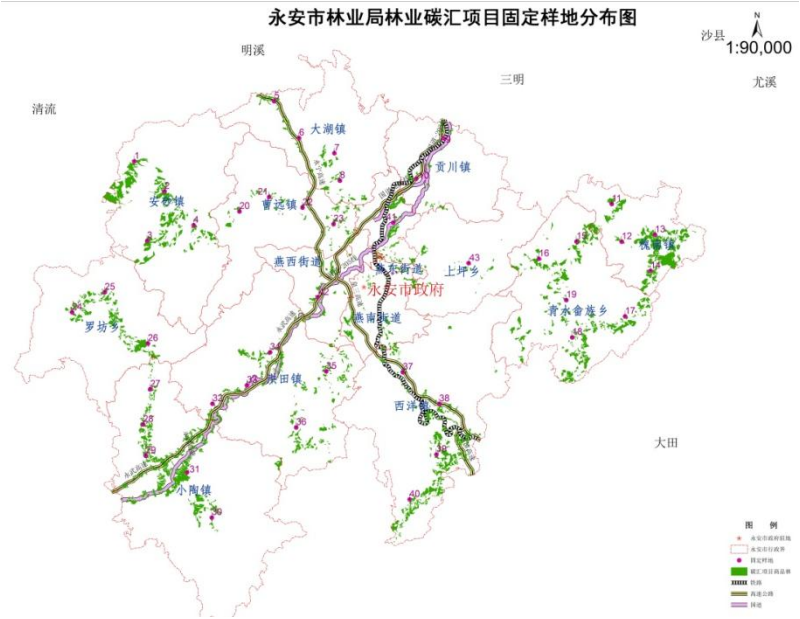
As the forest right of the project belongs to Yonglin, Yonghui, Senfa and the Forestry Bureau, the sample plots is distributed in the four organizations according to the area proportion. The distribution is listed in the following:

Stratum	Area					Fraction			
	Yonglin	Yonghui	Senfa	Forestry Bureau	Sum	Yonglin	Yonghui	Senfa	Forestry Bureau
PROJ-1	15.00	17.33	0.00	1,953.87	1,986.20	0.76%	0.87%	0.00%	98.37%
PROJ-2	739.13	280.53	249.80	726.87	1,996.33	37.02%	14.05%	12.51%	36.41%
PROJ-3	2,168.13	680.87	316.47	37.93	3,203.40	67.68%	21.25%	9.88%	1.18%

Stratum	N_i based on area fraction				Adjusted n_i				Sum
	Yonglin	Yonghui	Senfa	Forestry Bureau	Yonglin	Yonghui	Senfa	Forestry Bureau	
PROJ-1	0.04	0.04	0.00	4.92	1	1	0	5	7
PROJ-2	2.96	1.12	1.00	2.91	3	1	1	3	8
PROJ-3	18.27	5.74	2.67	0.32	18	6	3	1	28
Sum					22	8	4	9	43

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 is adjusted to 43 based on the sample distribution, with Chinese Fir, Masson Pine and Broad-leaf tree of 7,8 and 28 respectively.
Then the 43 sample plots are distributed at random in the project area, the details is listed in the following:



The following data analysis also shows that the precision level of the sample carbon stock is 90.08%, larger than 90%, there is no need to deduct the emissions.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 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 (ie, years since harvest in the baseline).

The annualized calculation vary 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:

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

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:

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

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)	$\triangle C_{NET,BS,t}$(tc)	Conversion factor	[1]$GHG_{NET,BSL,t}$（tCO_2）
1	460.32	2,680.68	3.67	9,829.17
2	920.63	2,788.29	3.67	10,223.72
3	1,380.95	2,895.89	3.67	10,618.28
4	1,841.27	3,003.50	3.67	11,012.83
5	2,301.58	3,111.10	3.67	11,407.38

[1]As stated in the methodology, the baseline projections are calculated ex-ante and not adjust through-out the project lifetime. During this monitoring period, the project activity operates smoothly without any events that may impact the GHG emission reductions or removals and monitoring, therefore, the baseline emissions keep constant, the same as in the PD.

4.2 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:

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

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

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

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

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

$\triangle C_{DIST\text{-}FR,t,PRJ}$,$\triangle C_{DIST,t,PRJ}$,$\triangle C_{DIST\_IL,I,t,PRJ}$ 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	$^{\triangle}C_{DIST\text{-}FR,t,PRJ}(tCO_2)$	$^{\triangle}C_{DIST,t,PRJ}(tCO_2)$	$^{\triangle}C_{DIST\_IL,I,t,PRJ}(tCO_2)$	$^{\triangle}C_{AB,t,PRJ}(tCO_2)$	$^{2}{}^{\triangle}C_{NET,t,PRJ}(tCO_2)$
1	0	0	0	59,565.55	-59,565.55
2	0	0	0	59,565.55	-59,565.55
3	0	0	0	59,565.55	-59,565.55
4	0	0	0	59,565.55	-59,565.55
5	0	0	0	59,565.55	-59,565.55

[2] Actually, the total carbon stock change and total GHG emissions from 2011 to 2016 is calculated based on the monitored growth during these five years from 2011 to 2016. In order to calculate the annual carbon stock change and annual GHG emission, the total carbon stock change is averaged by these five years. This method is also commonly accepted in forestry. As stated in P169-171 of the professional college textbook "forest resource operation and management" published by Chinese Forest Press in 2001,the forest growth is divided into average growth and current annual increment, the latter is usually difficult to measure and have a high error, therefore, the former is commonly used to determine the forest growth. The results of carbon stock change are the same if calculated by these two methods, but the current annual increment is unavailable for the project, so the total carbon stock change is averaged to obtain the annual carbon stock change.

4.3 Leakage

Activity shifting leakage

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

In China, the forest timber harvest is strictly controlled by the authority. The stated council issued the annual timber harvest volume limit to each provinces every fives at the beginning of every national 5-year plan. And the provincial forestry authority issued the timber harvest approval and restrictions to its subordinate based on its limit. And its subordinate forestry authority did the same way for the timber harvest and transportation approval as its superior issued.

Also, the China Forest Law also clearly stipulate the punishment for the illegal logging, which not only requires 5-10 times compensation of replanting, but also 2-10 times economic penalty.

Definitely, in China, the timber harvest is tightly controlled by the forestry authority, the illegal logging is severely punished.

Therefore, for the project activity, even if the project proponent has more than one commercial forest parcels, the timber harvest limit is planned in advance by the forestry authority, they have no right to harvest more in other parcels outside the project activity.

In fact, Yong'an forestry authority also summarized the timber harvest volume since 2010, the details are listed as:

Timber harvest volume in Yong'an City in recent years						Unit:m^3
	2010	2011	2012	2013	2014	2015
Total	723,871	406,187	405,037	330,792	262,974	207,646

Prior to the implementation of the project activity in 2010, the commercial harvest in Yong'an City is 723,871 m^3, since the implementation of the project activity, the timber harvest has been decreasing steadily. In 2011, the timber harvest volume dropped to 406,187 m^3, with a sharp falling rate of 43.89%. Take the example of 2013 and 2015, the timber harvest volume were 330,792 and 207,646 m^3, with the falling rate of 18.56% and 48.88% comparing with 2011, falling rate of 54.30% and 71.31% comparing with 2010.

Clearly, the total timber harvest has been decreasing sharply since the implementation of the project activity, considering that other lands owned by the project proponent are all located in Yong'an City, the hypothesis that the PP might have designated new lands as timber concessions or increasing harvest rates in lands already managed for timber is impossible to occur.

In conclusion, the implementation of the project activity could not lead to the reductions in carbon stocks or increases in GHG emissions of Yong'an City.

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:

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

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 11th Five-year plan issued by State Forest Bureau (Guofa[2005]No.41), the annual extracted volume from 2006 to 2009 is $24{,}815.5*10^4$ m^3, and the extracted volume of the project is $30.05*10^4$ m^3, accounting 0.12% of the national extracted volume, which will not result in the significant national concession and illegal logging;
- The *Notice of the Review Opinion* published by the State Council, the extracted volume could not be increased within existing national concessions AND, Illegal logging is strictly forbidden and severely punished.

Therefore,

$LF_{ME} = 0$

4.4 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	Baseline emissions or removals	Project emissions or removals	Leakage emissions (tCO_2e)	Net GHG emission reductions or

	(tCO_2e)	(tCO_2e)		removals (tCO_2e)
Year 1	9,829.17	-59,602.44	0.00	69,431.61
Year 2	10,223.72	-59,602.44	0.00	69,826.16
Year 3	10,618.28	-59,602.44	0.00	70,220.71
Year 4	11,012.83	-59,602.44	0.00	70,615.27
Year 5	11,407.38	-59,602.44	0.00	71,009.82
Total	53,091.39	-298,012.18	0.00	351,103.57
Average	10,618.28	-59,602.44	0.00	70,220.71

4.4.1 **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:

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

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:

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

4.4.2 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:

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

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:

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

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 are 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 Chinese fir:

Parameters	Sample size	Stand deviation	Stand error	Mean	U
BEF	860	0.605	0.021	1.634	2.52%
D	54	0.009	0.001	0.307	0.80%
BCEF					2.65%

For Masson Pine:

Parameters	Sample size	Stand deviation	Stand error	Mean	U
BEF	404	0.45	0.022	1.218	3.61%

D	43	0.019	0.003	0.380	1.59%
BCEF					2.65%

For Broad-leaf Tree:

Parameters	Sample size	Stand deviation	Stand error	Mean	U
BEF	153	0.283	0.023	1.514	3.00%
D	482	0.012	0.001	0.598	0.18%
BCEF					3.01%

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(m3/ha)	U
BEF	Chinese fir	860	0.605	0.021	1.963	1.634	2.52%
	Masson Pine	404	0.45	0.022	1.966	1.218	3.61%
	Broad-leaf tree	153	0.283	0.023	1.976	1.514	3.00%
D(tdm/m3)	Chinese fir	54	0.009	0.001	2.006	0.307	0.80%
	Masson Pine	43	0.019	0.003	2.018	0.380	1.59%
	Broad-leaf tree	482	0.012	0.001	1.965	0.598	0.18%
BCEF	Chinese fir					0.502	2.65%
	Masson Pine					0.463	3.95%
	Broad-leaf tree					0.905	3.01%

4) Uncertainty of regrowth

The uncertainty of regrowth is only associated with the parameter RGR_i, as for the value quoted from the expertise of the local forest authority, the uncertainty of 10% is adopted from the National Forest Resource Continuous Investigation Technical Regulation issued by the State Forestry Bureau . 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} is 12.669%, the detailed calculation is listed as follows:

The baseline emission uncertainty has been listed in the PD of the project as 6.526%, the details for the project emission uncertainty is updated as:

Baseline Emission Uncertainty

Stratum	Parameter	Area(ha)	$V_{EX,j,l,BSL}$(m3/ha)	BEF	D(tdm/m3)	BCEF(tdm/m3)	CF(tc/tdm)	$C_{HB,J,l,BSL}$(tc/ha)	$C_{EX,j,l,BSL}$(tc/ha)	$C_{DW,slash,l,p,BSL}$(tc/ha)
		a	b	c	d	e=c*d	f	g=b*e*f	h=b*d*f	i=g-h
								$U_g = \sqrt{U_b^2 + U_e^2}$	$U_h = \sqrt{U_b^2 + U_d^2}$	$U_i = \frac{\sqrt{(E_g * U_g)^2 + (E_h * U_h)^2}}{(E_g + E_h)}$
Chinese Fir	E	1,986	72.070	1.634	0.307	0.502	0.5	18.077	11.063	7.014
	U	0	84.84%	2.522%	0.800%	2.646%		84.885%	84.847%	61.730%
Masson Pine	E	1,996	146.560	1.218	0.380	0.463	0.5	33.917	27.846	6.071
	U	0	43.57%	3.614%	1.593%	3.949%		43.748%	43.599%	31.041%
Broad-leaf tree	E	3202.4	123.870	1.514	0.598	0.905	0.5	56.074	37.037	19.037
	U	0	13.00%	3.001%	0.180%	3.007%		13.339%	12.997%	9.553%

Stratum	Parameter	WW_k	SLF_k	$C_{WP,0,l,BSL}$(tc/ha)	$C_{WP,l,BSL}$(tc/ha)	OFk	$C_{WP,100,BSL}$(tc/ha)	Ai,p(ha)	$\triangle C_{NET,BSL(1)}$(tc)	WW_k
		j	k	l=h*(j+k)	m=h-l	n	o=m*n	p	q=(i/10+l+o/20)*p	j
				Ul=Uh	$U_m = \frac{\sqrt{(E_h * U_h)^2 + (E_l * U_l)^2}}{(E_h + E_l)}$		Uo=Um	Up=0	$U_q = \frac{\sqrt{(U_l * E_l)^2 + (U_m * E_m)^2 + (U_o * E_o)^2}}{(E_l + E_m + E_o)}$	
Chinese Fir	E	24%	0.12	3.983	7.080	0.62	4.390	99.270	486.766	24%
	U			84.847%	66.307%		66.307%	0.000%	40.399%	
Masson Pine	E	24%	0.12	10.025	17.822	0.62	11.049	79.800	892.501	24%
	U			43.599%	34.072%		34.072%	0.000%	22.356%	
Broad-leaf tree	E	24%	0.12	13.333	23.704	0.62	14.696	128.200	2,047.597	24%
	U			12.997%	10.157%		10.157%	0.000%	6.209%	

Stratum	Parameter	$\triangle C_{NET,BSL(2\text{-}10)}$(tc)	$\triangle C_{NET,BSL(11\text{-}20)}$(tc)	regrowth amount(tdm/ha/year)	$\triangle C_{NET,BSL(1+)}$(tc)	$\triangle$CNET,BSL,t,BSL(tc)
		r=(i/10+o/20)*p	s=o/20*p	t	v=e*f*p*t	w=q+r+s-v
		$U_r = \frac{\sqrt{(U_m * E_m)^2 + (U_o * E_o)^2}}{(E_m + E_o)}$	Us=Uo	Ut=30%	$U_v = \sqrt{U_e{}^2 + U_t{}^2}$	$U_w = \frac{\sqrt{(U_q * E_q)^2 + (U_r * E_r)^2 + (U_s * E_s)^2 + (U_v * E_v)^2}}{(E_q + E_r + E_s + E_v)}$
Chinese Fir	E	91.414	21.788	6	149.393	450.575
	U	45.749%	66.307%	10%	10%	26.977%
Masson Pine	E	92.530	44.087	4.5	83.103	946.016
	U	24.591%	34.072%	10%	11%	18.124%
Broad-leaf tree	E	338.259	94.203	4.5	261.155	2,218.904
	U	6.975%	10.157%	10%	10%	4.833%

U_{BSL}=6.526%

Project Emission Uncertainty

2011 2016

Stratum	Parameter	Area(ha)	$V_{j,I,BSL,2011}$(m3/ha)	BEF	D(tdm/m3)	BCEF(tdm/m3)	CF(tc/tdm)	Vj,i,BSL,2016(m3/ha)	△VAB,t,PRJ(m3/ha)	△CAB,t,PRJ(tCO2)
		a	b	c	d	e=c*d	f	g	h=g-b	i=h*a*e*f*44/12
									$U_h = \sqrt{(U_g * E_g)^2 + (U_b * E_b)^2} / (E_g + E_b)$	$u_i = \sqrt{U_h{}^2 + U_e{}^2}$
Chinese Fir	E	1,986	78.070	1.634	0.307	0.502	0.5	130.262	10.438	19,067.160
	U	0	84.84%	2.522%	0.800%	2.646%		1.664%	31.811%	31.921%
Masson Pine	E	1,996	106.130	1.218	0.380	0.463	0.5	143.120	7.398	12,531.959
	U	0	43.57%	3.614%	1.593%	3.949%		1.297%	18.567%	18.982%
Broad-leaf tree	E	3202.4	122.180	1.514	0.598	0.905	0.5	151.813	5.927	31,503.193
	U	0	13.00%	3.001%	0.180%	3.007%		0.68%	5.808%	6.540%

U_{PRJ}=10.858%

Therefore, $U_{total} = \sqrt{U_{BSL}{}^2 + U_{PRJ}{}^2} = \sqrt{6.526\%^2 + 10.858\%^2} = 12.669\%$

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

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:

$$VCU_{net,\,LtPF} = (\text{Credits}_{\text{total, t 2, LtPF}} - \text{Credits}_{\text{total, t 1, LtPF}}) - \text{Bu}_{\text{IFM}-\text{VCS}} \quad (20)$$

Based on the analysis in NON-PERMANENCE RISK REPORT (please refer to the appendix), the overall risk rating is 25, then 25% of the total emission reductions shall be deducted.

Therefore, the emission reduction detail is listed:

Year	$GHG_{NET,BSL,t}$	$GHG_{NET,PRJ,t}$	$GHG_{LK,LtPF,t}$	$GHG_{CREDITS,LtPF,t}$	$U_{total,LtPF}$	$Credits_{total,LtPF}$	Risk Scroe	$BU_{IFM,VCS}$	VCUnet,IFM
1	9,829.00	-59,603.00	0	69,432.00	12.67%	69,432.00	25	17,358.00	52,074.00
2	10,223.00	-59,603.00	0	69,826.00	12.67%	69,826.00	25	17,456.50	52,369.00
3	10,618.00	-59,603.00	0	70,221.00	12.67%	70,221.00	25	17,555.25	52,665.00
4	11,012.00	-59,603.00	0	70,615.00	12.67%	70,615.00	25	17,653.75	52,961.00
5	11,407.00	-59,603.00	0	71,010.00	12.67%	71,010.00	25	17,752.50	53,257.00
Total	53,089.00	-298,015.00	0	351,104.00		351,104.00		87,776.00	263,328.00
Average				70,220.80					52,666.00

In order to issue the credits separately for each vintage, the credits during the whole monitoring period in every calendar year is calculated based on days proportion as listed in the following:

Year	$GHG_{NET,BSL,t}$	$GHG_{NET,PRJ,t}$	$GHG_{LK,LtPF,t}$	$GHG_{CREDITS,LtPF,t}$	$U_{total,LtPF}$	$Credits_{total,LtPF}$	Risk scroe	$BU_{IFM,VCS}$	$VCU_{net,IFM}$
01/07/2011-31/12/2011	4,941	-29,964	-	34,906	12.67%	34,906	25	8,726	26,180
01/01/2012-31/12/2012	10,027	-59,603	-	69,630	12.67%	69,630	25	17,408	52,222
01/01/2013-31/12/2013	10,422	-59,603	-	70,025	12.67%	70,025	25	17,506	52,519
01/01/2014-31/12/2014	10,816	-59,603	-	70,419	12.67%	70,419	25	17,605	52,814
01/01/2015-31/12/2015	11,211	-59,603	-	70,814	12.67%	70,814	25	17,703	53,111
01/01/2016-30/06/2016	5,672	-29,639	-	35,311	12.67%	35,311	25	8,828	26,483
Total	53,089	-298,015	-	351,104		351,104		87,776	263,328
Average									52,666