



# Verified Carbon Standard

## INNER MONGOLIA KEYIHE IFM (CONVERSION OF LOGGED TO PROTECTED FOREST) PROJECT



Beijing Shengdahuitong Carbon Management Co., Ltd.

Add: Room 1006, Tower B, Juanshi Tiandi Mansion, No.502 Wangjing West Street, ChaoYang District, Beijing, P.R.China

Tel: +86 10 51994158

Project Title	Inner Mongolia Keyihe IFM (conversion of logged to protected forest) Project
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Prepared By	Beijing Shengdahuitong Carbon Management Co., Ltd.
Contact	Room 1006, Tower B, Juanshi Tiandi Mansion, No.502 Wangjing West Street, ChaoYang District, Beijing, P.R.China Tel:+86 10 51994158, Email: <a href="mailto:taoyun@zcenergy.net">taoyun@zcenergy.net</a>

# CONTENTS

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<b>1</b>	<b>PROJECT DETAILS.....</b>	<b>3</b>
1.1	Summary Description of the Implementation Status of the Project .....	3
1.2	Sectoral Scope and Project Type .....	3
1.3	Project Proponent .....	4
1.4	Other Entities Involved in the Project .....	4
1.5	Project Start Date .....	4
1.6	Project Crediting Period .....	4
1.7	Project Location .....	5
1.8	Title and Reference of Methodology .....	6
1.9	Participation under other GHG Programs.....	7
1.10	Other Forms of Credit.....	7
1.11	Sustainable Development.....	7
<b>2</b>	<b>SAFEGUARDS .....</b>	<b>7</b>
2.3	AFOLU-Specific Safeguards .....	8
<b>3</b>	<b>IMPLEMENTATION STATUS .....</b>	<b>9</b>
3.1	Implementation Status of the Project Activity .....	9
3.2	Deviations .....	10
3.3	Grouped Projects .....	10
<b>4</b>	<b>DATA AND PARAMETERS.....</b>	<b>10</b>
4.1	Data and Parameters Available at Validation .....	10
4.2	Data and Parameters Monitored.....	21
4.3	Monitoring Plan.....	30
<b>5</b>	<b>QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS .....</b>	<b>35</b>
5.1	Baseline Emissions .....	35
5.2	Project Emissions .....	36
5.3	Leakage.....	38
5.4	Net GHG Emission Reductions and Removals.....	39
	<b>APPENDIX X: &lt;TITLE OF APPENDIX&gt; .....</b>	<b>43</b>

# 1 PROJECT DETAILS

## SUMMARY DESCRIPTION OF THE IMPLEMENTATION STATUS OF THE PROJECT

The **Inner Mongolia Keyihe IFM (conversion of logged to protected forest) Project** (hereafter “the project activity”) is implemented in Oroqen Autonomous Banner, Hulun Buir City, Inner Mongolia Autonomous Region of China, by Inner Mongolia Keyihe Forest Industry LLC., the geo-coordinate of the project is 122°13'00"E~123°00'30"E and 50°09'00"N~50°46'52"N, the total area is 214,078 ha, which includes the Improved Forest Management (IFM) of the forests from the conversion of logged to protected forest.

The area of the project activity is 20,526 ha, including 1,969 subcompartments spreading over Kuya department, Molengge department, Suotuhan department, Tele department, Tuohe department of Inner Mongolia Keyihe Forest Industry LLC. All these departments are state-owned forests and have the legal right to forest ownership. The species involved in the project are Birch (*Betula platyphylla*) and Larch (*Larix gmelinii*).

Before the implementation of the project activity, the trees are logged based on a valid and verifiable government-approved timber management plan for harvesting the project area. The implementation of the project activity converts the trees to protected forest to reduce the GHG emissions for about 3,856,915 tCO<sub>2</sub>e, the average annual emission reduction is 128,563 tCO<sub>2</sub>e and Verified Carbon Units with buffer deduction is about 3,008,381 tCO<sub>2</sub>e in 30 years, the average annual VCU with buffer deduction is 100,279 tCO<sub>2</sub>e. The project generates 631,789 tCO<sub>2</sub>e emission reductions within the crediting period from 01/07/2017 to 30/06/2020 with the average annual emission reductions of 210,596 tCO<sub>2</sub>e. And total GHG emission reductions or removals with buffer deduction is about 492,793 tCO<sub>2</sub>e within the crediting period from 01/07/2017 to 30/06/2020, the average annual GHG emission reductions or removals with buffer deduction is 164,264 tCO<sub>2</sub>e.

The project activity will contribute to the environment (biodiversity conservation and soil erosion control), thus contribute to sustainable development.

From 01/01/2013, the project has strictly cancelled the once annual commercial timber harvest and only allowed the tending and managing. The forest growth amount and forest second class investigation is monitored by local forestry bureau periodically.

### 1.1 SECTORAL SCOPE AND PROJECT TYPE

Sectoral scope 14 (AFOLU)

Improved Forest Management: Logged to Protected Forest (LtPF)

## 1.2 PROJECT PROPONENT

<b>Organization name</b>	Inner Mongolia Keyihe Forest Industry LLC.
<b>Contact person</b>	Cheng Jiang
<b>Title</b>	General Manager
<b>Address</b>	Keyihe County, Oroqen Autonomous Banner, Hulun Buir City, Inner Mongolia Autonomous Region of China
<b>Telephone</b>	+86 470 2399006
<b>Email</b>	<a href="mailto:Kyhzyk7484554@126.com">Kyhzyk7484554@126.com</a>

## 1.3 OTHER ENTITIES INVOLVED IN THE PROJECT

<b>Organization name</b>	Beijing Shengdahuitong Carbon Management Co., Ltd.
<b>Role in the Project</b>	Advisory
<b>Contact person</b>	<i>Tao yun</i>
<b>Title</b>	General Manager
<b>Address</b>	Room 1006, Tower B, Juanshi Tiandi Mansion, No.502 Wangjing West Street, ChaoYang District, Beijing, P.R.China
<b>Telephone</b>	+86 10 51994158
<b>Email</b>	<a href="mailto:taoyun@zcenergy.net">taoyun@zcenergy.net</a>

## 1.4 PROJECT START DATE

The project start date is 01/01/2013<sup>1</sup>, which is announced by the Local Forestry Bureau.

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<sup>1</sup> The date in "Approval of application for cutting suspension"

## 1.5 PROJECT CREDITING PERIOD

The project crediting period is from 01/01/2013 to 31/12/2042 with the total length of 30 years.

## 1.6 PROJECT LOCATION

The project is located in Oroqen Autonomous Banner, Hulun Buir City, Inner Mongolia Autonomous Region of P. R.China. The geo-coordinate range of the project is 122°13'00"E~123°00'30"E and 50°09'00"N~50°46'52"N. There are 1,969 subcompartments spreading over Kuya department, Molengge department, Suotuhan department, Tele department, Tuohe department of Inner Mongolia Keyihe Forest Industry LLC.

The schematic diagram of the location of the project is shown in figure 1 below:



- *VCS methodology VM0003 Methodology for Improved Forest Management through Extension of Rotation Age, v1.2*
- *VCS methodology VM0005 Methodology for Conversion of Low-Productive Forests to High-Productive Forests, v1.2*
- *VCS methodology VM0007 REDD+ Methodology Framework (REDD-MF) ,v1.5*
- *VCS methodology VM0011 Methodology for Improved Forest Management: Calculating GHG Benefits from Logged to Protected Forest, v1.0*
- *VCS tool VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, v3.0*

## 1.8 PARTICIPATION UNDER OTHER GHG PROGRAMS

The project has not been registered, or is seeking registration under any other GHG programs.

## 1.9 OTHER FORMS OF CREDIT

The project has neither intends to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program, nor any such credit has been or will be cancelled from the relevant program.

## 1.10 SUSTAINABLE DEVELOPMENT

As one of the most precious ecological resources, forest is the 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). The project activity will result in significant carbon sequestration and contribute to the environment (e.g. biodiversity conservation and soil erosion control), thus contribute to sustainable development.

# 2 SAFEGUARDS

## 2.1 No Net Harm

There is no potential negative environmental or socio-economic impact due to the project.

## 2.2 Local Stakeholder Consultation

Questionnaires were distributed by the project proponent to the residents who lives in the community and closely related to the project. The questions aimed to find out their concerns and opinions about the project. The questionnaires covered areas of economic,

social benefit and environmental effect etc. The content of the questionnaire includes the following information :

1. The purpose of the questionnaire
2. Basic information of the participants
3. Questions
  - 1) Do you know the proposed project?
  - 2) What do you think the proposed project will bring to you?
  - 3) Do you support the implementation of the proposed project?
  - 4) What is your concern about the proposed project?
  - 5) What is your opinion and suggestion regarding the proposed project?

The Survey was conducted through distributing and collecting responses to a questionnaire in Dec 2012. Totally 40 questionnaires returned out of 40 with 100% response. The following is a summary of the key findings based on returned questionnaires.

#### 1. Attitude towards the proposed project

All of them support the implementation of the project, they think the protection of forest instead of cutting is good the environment, and will benefit the sustainable development.

#### 2. The concern about the proposed project

The participants particularly hoping that the proposed project can improve local environmental situation and increase employment opportunities at the same time.

#### 3. Conclusion

The survey shows that the proposed project is 100% supported by local people. It is because they believe the implementation of the project will bring multiple benefits.

### 2.3 AFOLU-SPECIFIC SAFEGUARDS

- *Local stakeholder identification process and a description of results.*

The local stakeholder mainly include the local households lives near by the project and the local government, .Before start construction, project owner had distributed questionnaires for local stakeholder to investigate the suggestion of them on the construction of the project, including the impact on society, economy and life. 40 investigation questionnaires have been returned,of which, 22% are women, 60% are graduated from high school or inferior school, 100% are elder than twenty years old.

- *Risks to local stakeholders due to project implementation and how the project will mitigate such risks.*

There is no risk to local stakeholders due to the project implementation.

- *Risks to local stakeholder resources due to project implementation and how the project will mitigate such risks, including the plans to ensure the project will not impact local stakeholder's property rights without the free, prior and informed consent.*

When the project implement, the local stakeholder could not living for selling the tree. The PP applied the project to VCS project and the local stakeholder could living for selling the VCU, so the project will not impact local stakeholder's property rights without the free, prior and informed consent.

- *Processes to ensure ongoing communication and consultation with local stakeholders, including a grievance redress procedure to resolve any conflicts which may arise between the project proponent and local stakeholders.*

PRA (Participatory Rural Appraisal ) will be done every two years, and the office named Xinfangban which belongs to local government resolves any conflicts which may arise between the PP and local stakeholder according to the relevant law.

## 3 IMPLEMENTATION STATUS

### 3.1 IMPLEMENTATION STATUS OF THE PROJECT ACTIVITY

- From 01/01/2013, the forests owner decided to converse the forest from logged to protected forest to improve the carbon stock. In the subsequent implementation, the forests are well protected without any harvest and disturbance.
- As the project activity area contains different forest types or forests with different carbon density, stratification is carried out in order to improve the accuracy and precision of carbon stock estimates. Based on the availability of data regarding the nature and composition of forest stocks in the project area, stratification is developed on the basis of existing vegetation stratification, where these are documented in the legal right to harvest. In the VCS-PD, 2 strata with the total area of 20,526 ha are specified according to the tree species.
- For the Non-permanence Risk, according to AFOLU Non-Permanence Risk Tool: VCS Version 4.0, the risks are analyzed in Non-permanence Risk Report. The risk value is 22.

## 3.2 DEVIATIONS

### 2.3.1 Methodology Deviations

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

### 2.3.2 Project Description Deviations

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

## GROUPED PROJECTS

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

# 4 DATA AND PARAMETERS

## DATA AND PARAMETERS AVAILABLE AT VALIDATION

<b>Data / Parameter</b>	$V_{l,j,i,sp}$																		
<b>Data unit</b>	m <sup>3</sup>																		
<b>Description</b>	Merchantable volume for tree <i>l</i> of species <i>j</i> in sample plot <i>sp</i> in stratum <i>i</i>																		
<b>Source of data</b>	<p>Calculated from volume tables or equations linking diameter at breast height (DBH, at typically 1.3 m aboveground level), and merchantable height (MH), to commercial (merchantable) volume of trees in the sample plots above the minimum DBH set in the timber harvest plan.</p> <p>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).</p>																		
<b>Value applied</b>	<table border="1"> <thead> <tr> <th>DBH (cm)</th> <th>V<sub>birch</sub>(m<sup>3</sup>)</th> <th>V<sub>larch</sub>(m<sup>3</sup>)</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>0.0001</td> <td>0.0006</td> </tr> <tr> <td>6</td> <td>0.0060</td> <td>0.0057</td> </tr> <tr> <td>8</td> <td>0.0189</td> <td>0.0160</td> </tr> <tr> <td>10</td> <td>0.0392</td> <td>0.0322</td> </tr> <tr> <td>12</td> <td>0.0671</td> <td>0.0544</td> </tr> </tbody> </table>	DBH (cm)	V <sub>birch</sub> (m <sup>3</sup> )	V <sub>larch</sub> (m <sup>3</sup> )	4	0.0001	0.0006	6	0.0060	0.0057	8	0.0189	0.0160	10	0.0392	0.0322	12	0.0671	0.0544
DBH (cm)	V <sub>birch</sub> (m <sup>3</sup> )	V <sub>larch</sub> (m <sup>3</sup> )																	
4	0.0001	0.0006																	
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8	0.0189	0.0160																	
10	0.0392	0.0322																	
12	0.0671	0.0544																	

	14	0.1026	0.0828
	16	0.1457	0.1175
	18	0.1964	0.1584
	20	0.2544	0.2055
	22	0.3196	0.2588
	24	0.3920	0.3182
	26	0.4713	0.3836
	28	0.5575	0.4551
	30	0.6505	0.5325
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	<p>It is necessary to verify the applicability of equations used. Allometric equations can be verified by both:</p> <ol style="list-style-type: none"> <li>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 <math>r^2</math> value of greater than 0.5 (50%) and a p value that is significant (<math>&lt;0.05</math> at the 95% confidence level).</li> <li>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 <math>&gt;75\%</math> of the measured trees have a volume lower than the predicted curve. In this instance another equation must be selected.</li> </ol>		
<b>Purpose of Data</b>	Calculation of baseline emissions and project emissions		
<b>Comments</b>	N/A		

Data / Parameter	$CF_j$
Data unit	$tC \cdot t.d.m.^{-1}$
Description	Carbon fraction of dry matter for species j
Source of data	According to VM0010 version 1.3, the default value $0.5 tC \cdot t.d.m.^{-1}$ is used and the same value is used in all instances where this parameter is used.
Value applied	0.5
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	N/A

Data / Parameter	$D_j$						
Data unit	$t d.m. m^{-3}$						
Description	Basic wood density of species j in $t d.m. m^{-3}$						
Source of data	<p>According to VM0010 version 1.3, it must be chosen with priority from higher to lower preference as follows:</p> <p>National species-specific or group of species-specific values (eg, from National GHG inventory);</p> <p>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;</p> <p>c) Global species-specific or group of species-specific (eg, IPCC 2006 AFOLU Chapter 4 Tables 4.13 and 4.14).</p> <p>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.</p> <p>"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change" matches the first choice.</p>						
Value applied	<table border="1"> <thead> <tr> <th>Tree species</th> <th><math>D_j</math></th> </tr> </thead> <tbody> <tr> <td>Birch</td> <td>0.541</td> </tr> <tr> <td>Larch</td> <td>0.490</td> </tr> </tbody> </table>	Tree species	$D_j$	Birch	0.541	Larch	0.490
Tree species	$D_j$						
Birch	0.541						
Larch	0.490						

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	N/A

Data / Parameter	$f_j(X, Y...)$
Data unit	t d.m. tree <sup>-1</sup>
Description	Allometric equation(s) for species j linking measured tree variable(s) to aboveground biomass of living trees
Source of data	<p>Equations must have been derived using a wide range of measured variables (eg, 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 <math>\geq 0.8</math>.</p> <p>The source of equation(s) must be chosen with priority from higher to lower preference, as available, as follows:</p> <ul style="list-style-type: none"> <li>a) National species-, genus-, family-specific;</li> <li>b) Species-, genus-, family-specific from neighbouring countries with similar conditions (ie, broad continental regions);</li> <li>c) National forest-type specific;</li> <li>d) Forest-type specific from neighbouring countries with similar conditions (ie, broad continental regions);</li> <li>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. <i>Oecologia</i> 145: 87-99.</li> </ul> <p>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) (ie, it must be used for all tree species).</p>
Value applied	N/A

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	<p>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.</p> <p>Allometric equations can be validated either by:</p> <p>1. Limited Measurements</p> <p>select at least 30 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). 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);</p> <p>measure DBH, and height to a 10 cm diameter top or to the first branch;</p> <p>calculate stem volume from measurements and multiplying by species-specific density to gain biomass of bole;</p> <p>apply a biomass expansion factor to estimate total aboveground biomass from stem biomass<sup>37</sup>; and</p> <p>plot the estimated biomass of all the measured trees along with the curve of biomass against diameter as predicted by the allometric equation.</p> <p>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 &gt;75% of the measured trees have a biomass lower than the predicted curve, destructive sampling must be undertaken or another equation must be selected.</p> <p>2. Destructive Sampling</p> <p>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;</p> <p>measure DBH and commercial height and calculate volume using the same procedures/equations used to generate</p>

	<p>commercial volumes to which BCEFs will be applied;</p> <p>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;</p> <p>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</p> <p>plot the estimated biomass of all the measured trees along with the curve of biomass against diameter as predicted by the allometric equation.</p> <p>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 &gt;75% of the measured trees have a biomass lower than the predicted curve another equation must be selected.</p> <p>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 <a href="http://www.fao.org/docrep/W4095E/W4095E00.htm">http://www.fao.org/docrep/W4095E/W4095E00.htm</a></p> <p>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.</p> <p>Default values must be updated whenever new guidelines are produced by the IPCC</p>
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<b>Data / Parameter</b>	BCEF <sub>R</sub>
<b>Data unit</b>	t d.m. m <sup>-3</sup>
<b>Description</b>	Biomass conversion and expansion factor applicable to wood removals in the project area
<b>Source of data</b>	<p>The source of data must be chosen with priority from higher to lower preference as follows:</p> <p>Existing local forest type-specific;</p> <p>National forest type-specific or eco-region-specific (eg, from national GHG inventory);</p> <p>Forest type-specific or eco-region-specific from neighboring countries with similar conditions. Sometimes (c) might be preferable to (b);</p> <p>Global forest type or eco-region-specific (eg, IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.5).</p>

	<p>Alternatively:  <math>BCEFR = BEFR * D</math>                  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.                  The value from the GHG inventory of "Land Use Change and Forestry GHG Inventory (2013)" of "Second National Information Notification on China Climate Change" matches the second choice.</p>						
Value applied	<table border="1" data-bbox="696 835 1206 1016"> <thead> <tr> <th data-bbox="696 835 924 888">Tree species</th> <th data-bbox="924 835 1206 888">BCEFR<sub>R</sub></th> </tr> </thead> <tbody> <tr> <td data-bbox="696 888 924 951">Birch</td> <td data-bbox="924 888 1206 951">0.741</td> </tr> <tr> <td data-bbox="696 951 924 1016">Larch</td> <td data-bbox="924 951 1206 1016">0.686</td> </tr> </tbody> </table>	Tree species	BCEFR <sub>R</sub>	Birch	0.741	Larch	0.686
Tree species	BCEFR <sub>R</sub>						
Birch	0.741						
Larch	0.686						
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	<p>The combustion factor is a measure of the proportion of the fuel that is actually combusted, which varies as a function of the size and architecture of the fuel load (ie, a smaller proportion of large, coarse fuel such as tree stems will be burnt compared to fine fuels, such as grass leaves), the moisture content of the fuel and the type of fire (ie, intensity and rate of spread).                  Default values must be updated whenever new guidelines are produced by the IPCC</p>						

Data / Parameter	G <sub>gi</sub>
Data unit	g kg <sup>-1</sup> dry matter burnt
Description	Emission factor for stratum i for gas g
Source of data	Defaults can be found in Volume 4, Chapter 2, of the IPCC 2006 Inventory Guidelines in table 2.5
Value applied	Please refer 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	Default values shall be updated whenever new guidelines are produced by the IPCC

Data / Parameter	OF, SLF, WW																							
Data unit	Kg kg <sup>-1</sup>																							
Description	<p>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</p> <p>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.</p> <p>Short-lived fraction (SLF)                      Winjum et al 1998 give decay rates for proportions of wood products, which were converted to with short-term (&lt;3yr) uses (applicable internationally) as below:                      Sawnwood 0.12                      Woodbase panels 0.06                      Other industrial roundwood 0.18                      Paper and Paperboard 0.24</p> <p>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 the 100th year after initial harvest:</p> <table border="1" data-bbox="634 1497 1365 1772"> <thead> <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> </thead> <tbody> <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> </tbody> </table>	Wood Product Class	OF			Boreal	Temperate	Tropical	Sawnwood	0.39	0.62	0.86	Woodbase panels	0.62	0.86	0.98	Other industrial roundwood	0.86	0.98	0.99	Paper and paperboard	0.39	0.62	0.99
Wood Product Class	OF																							
	Boreal	Temperate	Tropical																					
Sawnwood	0.39	0.62	0.86																					
Woodbase panels	0.62	0.86	0.98																					
Other industrial roundwood	0.86	0.98	0.99																					
Paper and paperboard	0.39	0.62	0.99																					
Source of data	According to VM0010 version 1.3, the default values are chosen.																							

Value applied	Parameters	Species	Value
	OF	Birch/Larch	0.62
	SLF	Birch/Larch	0.12
	WW	Birch/Larch	24%
Justification of choice of data or description of measurement methods and procedures applied	N/A		
Purpose of Data	Calculation of baseline emissions		
Comments	N/A		

Data / Parameter	RGR <sub>i</sub>		
Data unit	tC.ha <sup>-1</sup> .yr <sup>-1</sup>		
Description	Forest regrowth rate post timber harvest for stratum <i>i</i>		
Source of data	Regrowth rate must be calculated from either a) data generated in a reference area using measurements of timber volume in a chronosequence of replicated sample plots; or b) published data on forest growth after timber harvest of the same forest type within the same region as the project; or c) the IPCC default values for aboveground net biomass growth in natural forests.		
Value applied	Species	Value	Unit
	Birch	1.56	m <sup>3</sup> .ha <sup>-1</sup> .yr <sup>-1</sup>
	Larch	1.83	m <sup>3</sup> .ha <sup>-1</sup> .yr <sup>-1</sup>
Justification of choice of data or description of measurement methods and procedures applied	Method b is applied. The average annual regrowth is confirmed by local forestry survey and design institute based on their expertise.  And the RGR <sub>i</sub> can therefore be calculated by the biomass expansion factor, density and carbon fraction of the separate species.		
Purpose of Data	Calculation of baseline emissions		
Comments	N/A		

Data / Parameter	V <sub>EX,j,i BSL</sub>
Data unit	m <sup>3</sup> .ha <sup>-1</sup>

<b>Description</b>	Mean volume of extracted timber per unit area for species $j$ in stratum $i$
<b>Source of data</b>	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.
<b>Value applied</b>	please refer to ER sheet
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	The measurement method is from academic paper and equations developed for regional forest types. Please refer to ER sheet
<b>Purpose of Data</b>	Calculation of baseline emissions
<b>Comments</b>	N/A

<b>Data / Parameter</b>	$A_{i,p}$
<b>Data unit</b>	Ha
<b>Description</b>	Area covered by stratum $i$ over land parcel $p$
<b>Source of data</b>	Geodetic coordinates and/or Remote Sensing data and/or legal parcel records
<b>Value applied</b>	please refer to ER sheet
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	N/A
<b>Purpose of Data</b>	Calculation of baseline emissions and project emissions
<b>Comments</b>	It must be assumed ex-ante that land parcel boundaries and strata areas must not change through time

<b>Data / Parameter</b>	$A_{1,i,p}$
<b>Data unit</b>	Ha
<b>Description</b>	The area of stratum $i$ in land parcel $p$ that was harvested 1 year ago
<b>Source of data</b>	Geodetic coordinates, GIS Files or legal parcel records
<b>Value applied</b>	please refer to ER sheet
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	N/A

Purpose of Data	Calculation of baseline emissions and project emissions
Comments	N/A

Data / Parameter	$A_{2-10,i,p}$
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 ER sheet
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	N/A

Data / Parameter	$A_{11-20,i,p}$
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 ER sheet
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	N/A

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 ER sheet
Justification of choice of	N/A

<b>data or description of measurement methods and procedures applied</b>	
<b>Purpose of Data</b>	Calculation of baseline emissions and project emissions
<b>Comments</b>	N/A

<b>Data / Parameter</b>	$A_{s,p}$
<b>Data unit</b>	Ha
<b>Description</b>	Area of sample plot $sp$
<b>Source of data</b>	Recording and archiving of size of sample plots
<b>Value applied</b>	please refer to ER sheet
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	Standard procedures for plot delineation in forest timber inventory surveys shall be used
<b>Purpose of Data</b>	Calculation of project emissions
<b>Comments</b>	Ex-ante the size of the plots shall be defined and recorded in the monitoring plan.

## DATA AND PARAMETERS MONITORED

<b>Data / Parameter</b>	Illegal Logging PRA Results
<b>Data unit</b>	Dimensionless
<b>Description</b>	N/A
<b>Source of data</b>	PRA
<b>Description of measurement methods and procedures to be applied</b>	<p>The PRA must evaluate whether timber harvest may be occurring in the project area and shall consist of semi-structured interviews / questionnaires.</p> <p>If <math>\geq 10\%</math> of those interviewed/surveyed believe that illegal logging may be occurring within the project boundary then the limited on-the-ground illegal logging survey shall be triggered.</p> <p>An additional output of the PRA shall be a depth of penetration of illegal logging pressure. A maximum distance shall be recorded for penetration into the forest from access points (such as roads, rivers, already cleared areas) for the purpose of harvesting timber.</p>

Frequency of monitoring/recording	Every two years
Value monitored	No illegal logging occurs during the monitoring period within the project boundary.
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	Ex ante estimation shall 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	Result of Limited Illegal Logging Survey
Data unit	Dimensionless
Description	N/A
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 to be repeated each time the PRA indicates a potential for illegal logging.
Value monitored	N/A
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A

Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	Ex ante estimation shall 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	Areas burnt must be monitored at least every five years
Value monitored	0
Monitoring equipment	N/A
QA/QC procedures to be applied	Standard quality control/quality assurance (QA/QC) procedures for forest inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	Ex ante estimations of areas burned shall be based on

	historic incidence of fire in the Project region
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<b>Data / Parameter</b>	$A_{dist,i,t}$
<b>Data unit</b>	Ha
<b>Description</b>	Area disturbed in stratum i at time t
<b>Source of data</b>	Geodetic coordinates and / or Remote Sensing data
<b>Description of measurement methods and procedures to be applied</b>	N/A
<b>Frequency of monitoring/recording</b>	Areas disturbed shall be monitored at least every five years
<b>Value monitored</b>	0
<b>Monitoring equipment</b>	N/A
<b>QA/QC procedures to be applied</b>	Standard quality control/quality assurance (QA/QC) procedures for forest inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
<b>Purpose of the data</b>	Calculation of project emissions
<b>Calculation method</b>	N/A
<b>Comments</b>	Ex ante estimations of areas burned must be based on historic incidence of fire in the Project region

<b>Data / Parameter</b>	$A_{DIST\_IL,i}$
<b>Data unit</b>	Ha
<b>Description</b>	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	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 shall be determined by the depth of degradation penetration as defined as a PRA output
Frequency of monitoring/recording	Repeated each time the PRA indicates a potential for degradation
Value monitored	0
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of the data	Calculation of project emissions
Calculation method	N/A
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 <sub>2</sub> -e
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 ( $A_{DIST\_IL,i}$ ). 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 shall 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 shall 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
Monitoring equipment	N/A
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 from the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	If species-specific equations are used and species cannot be identified from stumps then it shall be assumed that the harvested species is the species most commonly harvested. A PRA shall be used to determine the most commonly harvested species.

Data / Parameter	$AP_i$
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	A sampling plan must be designed using multiple sample plots systematically placed across the buffer zone so that they

applied	sample at least 3% of the area of the buffer zone.
Frequency of monitoring/recording	Not more than five years
Value monitored	0
Monitoring equipment	N/A
QA/QC procedures to be applied	Standard quality control/quality assurance (QA/QC) procedures for forest inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions
Calculation method	N/A
Comments	Ex ante estimation should be made of area of plots. This should be set to exactly 3% of the buffer zone $A_{DIST\_IL,i}$

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 15cm DBH or larger) by the summed total of aboveground tree biomass.
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Not more than five years
Value monitored	N/A

Monitoring equipment	N/A
QA/QC procedures to be applied	Standard quality control/quality assurance (QA/QC) procedures for forest inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of project emissions and leakage.
Calculation method	N/A
Comments	Ex-ante a time zero measurement shall 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	Every ten years.												
Value monitored	<table border="1"> <thead> <tr> <th>Serial number of strata</th> <th>Area (ha)</th> <th>Tree species</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>10,454</td> <td>Birch</td> </tr> <tr> <td>2</td> <td>10,072</td> <td>Larch</td> </tr> <tr> <td>Total</td> <td>20,526</td> <td></td> </tr> </tbody> </table>	Serial number of strata	Area (ha)	Tree species	1	10,454	Birch	2	10,072	Larch	Total	20,526	
Serial number of strata	Area (ha)	Tree species											
1	10,454	Birch											
2	10,072	Larch											
Total	20,526												

<b>Monitoring equipment</b>	Tape Measure
<b>QA/QC procedures to be applied</b>	Standard quality control / quality assurance (QA/QC) procedures for forest inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
<b>Purpose of the data</b>	For the calculation of the baseline and project emissions.
<b>Calculation method</b>	N/A
<b>Comments</b>	<p>In the baseline scenario strata areas must not change through time.</p> <p>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 delineate as a separate stratum for the purpose of monitoring the carbon stock changes.</p>

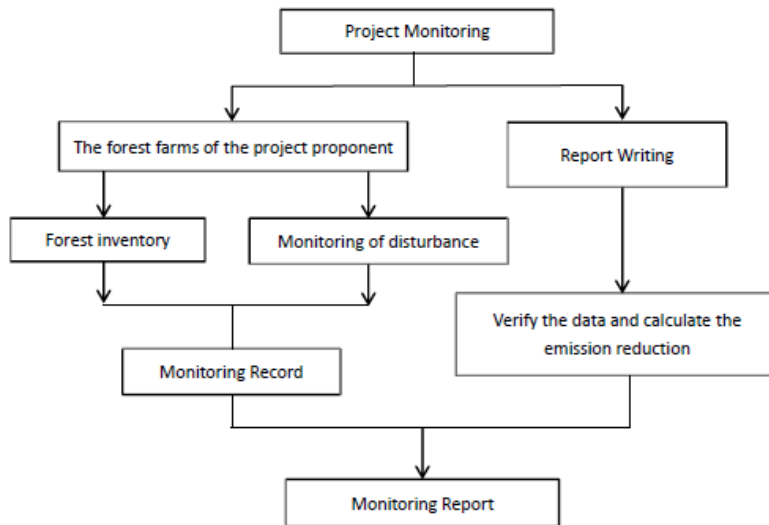
<b>Data / Parameter</b>	DBH
<b>Data unit</b>	cm
<b>Description</b>	Diameter at breast height of tree
<b>Source of data</b>	On site measuring on the sample spot.
<b>Description of measurement methods and procedures to be applied</b>	The National Forest Resource Continuous Investigation Technical Regulation issued by the State Forestry Bureau has detailed requirement of the measurement method.
<b>Frequency of monitoring/recording</b>	Not more than five years
<b>Value monitored</b>	See the MR-ER calculation sheet

Monitoring equipment	Tape Measure
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Purpose of the data	Calculation of tree volume, then to carbon stock change further to the project emissions.
Calculation method	N/A
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.

## MONITORING PLAN

The project proponent and consultant have set up a team together to conduct the monitoring. The team is in charge of collecting, monitoring and verifying the data, while the project manager is assisted by the consultant company. The findings are reported to the project manager and work out a solution.

The structure of monitoring system is listed below:



Monitoring is required to

- a) determine changes in forest carbon stocks and greenhouse gas emissions from project activity;
- b) confirm project activity; and
- c) determine changes in forest carbon stocks and greenhouse gas emissions from disturbance and illegal logging.

In some cases monitoring may also be implemented to update stratification.

The monitoring plan addresses the monitoring of project implementation, the monitoring of actual carbon stock changes from project activity, and estimation of ex-post net carbon stock changes from the conversion of logged to protected forest.

All data collected as part of monitoring were 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.

All electronic data and reports are copied on hard disk and stored in multiple locations.

The archives include:

Copies of all sample spots recording sheet (including the detailed information of the spot location), forest volume table;

Estimates of the carbon stock changes in all pools and non-CO<sub>2</sub> GHG and corresponding calculation spreadsheets;

GIS products; and

Copies of the measuring and monitoring reports.

The geographic position of the project boundary is recorded for all areas of land;

The geographic coordinates of the project boundary (and any stratification inside the boundary) are established, recorded, archived and achieved by using geo-referenced spatial data of maps.

Principles of forest inventory and management are implemented;

Standard operating procedures (SOPs) and quality control/quality assurance (QA/QC) procedures for forest inventory including field data collection and data management is applied. SOPs already applied in national forest monitoring or available from published handbooks or from the IPCC GPG LULUCF 2003 is used.

The project plan, together with a record of the plan as actually implemented during the project, is available for validation or verification as appropriate.

Based on the availability of data regarding the nature and composition of forest stocks in the project area, stratification is developed on the basis of existing vegetation stratification, where these are documented in the legal right to harvest. In the VCS-PD, 2 strata are specified according to the tree species.

Carbon stocks are measured according to the stock assessment 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:

a) adequate forest stratification, sample size estimation methods and consider uncertainty:

The forest stratification is based on the species, which is adequate according to the methodology. The sample size estimation methods, allocation among strata and uncertainty consideration is according to 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.

b) a sampling framework including sample size, plot size, plot shape and information to determine plot location:

The sample size estimation methods, allocation among strata and uncertainty consideration is according to 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 stocks 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 will be 0.04 ha and at least 3 sample plots will be selected in 1 stratum. Approximate value of the standard deviation of biomass stock in each stratum at the time of estimation is either known from existing data applicable to the project area or existing data related to a similar area, or is estimated on the basis of a preliminary sample or an expert judgement. Number of sample plots required for estimation of biomass stocks within the project boundary is calculated iteratively

Therefore, the following simplified equation can be used for estimating the number of sample plots according to the CDM tool:

$$n = \frac{N * t_{VAL}^2 * (\sum_i w_i * s_i)^2}{N * E^2 + t_{VAL}^2 * \sum_i w_i * s_i^2} \quad (1)$$

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; t d.m. (or t d.m. ha<sup>-1</sup>), i.e. in the units used for  $S_i$
- $\omega_i$  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<sup>-1</sup>)
- $i$  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
- $\omega_i$  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<sup>-1</sup>)
- $i$  1, 2, 3, ... biomass stock estimation strata within the project boundary

Based on the data of biomass stocks in a carbon pool in the baseline scenario, the estimation of number of sample plots required is shown in the VCS-PD:

Strata No	Stratum Name	Area (ha)	Mean tonnes C/ha	Standard Deviation (t C/ha)	Plot size (ha)	Wi	Wi * Si
Strata 1	Birch	10454.00	64.83	22.23	0.04	0.51	11.32
Strata 2	Larch	10072.00	54.47	40.98	0.04	0.49	20.11

STRATA NO	Stratum Name	Number of Plots	
		Plot Quantity	Rounded Plot Quantity
Total Sample Size		106.31	
Strata 1	Birch	38.29	39
Strata 2	Larch	68.01	69
<b>TOTAL NUMBER OF PLOTS</b>			<b>108</b>

\* Where the confidence level is 95% as required in the methodology VM0010 version 1.3 and  $D_f$  is  $\infty$ . Therefore,  $t_{VAL}$  is 1.96.

The number of years between the second monitoring intervals in Jul. 2017 and Jun. 2019 is 3 years.

The monitoring campaign includes the ages, species, DBH and any parameters the needed.

# 5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## BASELINE EMISSIONS

Baseline projections are calculated ex-ante and are not adjusted through-out the project lifetime.

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.

The annualized calculations vary between years 1, 2-10; 10-20; 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:

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

The net change in carbon stock from wood products and logging slash across all parcels 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 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 according to equation 6

below. Note that there will be no more emissions quantified from decay of logging slash or wood products.

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

Therefore, 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 since the start of the project activity 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 crediting period is listed in the following:

Period	GHG <sub>NET,BSL,t</sub> (tCO <sub>2</sub> e )
01/07/2017-31/12/2017	5,536
01/01/2018-31/12/2018	67,070
01/01/2019-31/12/2019	95,520
01/01/2020-30/06/2020	46,605
<b>Total</b>	<b>214,731</b>
<b>Average annual GHG<sub>NET BSL</sub></b>	<b>71,577</b>

## 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.

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

Therefore, based on the IPCC 2006 Inventory Guidelines, estimation of greenhouse gas emissions from biomass burning shall 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.

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

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 ( $\Delta C_{DISTLI,i,t,PRJ}$ ) 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 changes as a result of illegal logging shall 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:

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

$\Delta C_{DIST-FR,t,PRJ}$ ,  $\Delta C_{DIST,t,PRJ}$ ,  $\Delta C_{DIST-IL,t,PRJ}$  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:

Period	$\Delta C_{DIST-FR,t,PRJ}$ (tCO <sub>2</sub> e)	$\Delta C_{DIST,t,PRJ}$ (tCO <sub>2</sub> e)	$\Delta C_{DIST-IL,t,PRJ}$ (tCO <sub>2</sub> e)	$\Delta C_{AB,t,PRJ}$ (tCO <sub>2</sub> e)	$\Delta C_{NET,t,PRJ}$ (tCO <sub>2</sub> e)
01/07/2017-31/12/2017	0	0	0	69,510	-69,510
01/01/2018-31/12/2018	0	0	0	139,019	-139,019
01/01/2019-31/12/2019	0	0	0	139,019	-139,019
01/01/2020-30/06/2020	0	0	0	69,510	-69,510
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>417,058</b>	<b>-417,058</b>
<b>Average annual value</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>139,020</b>	<b>-139,020</b>

## LEAKAGE

### 5.1.1 Activity shifting leakage

The project does not consider the activity shifting leakage because:

In China, the forest timber harvest is strictly controlled by the authority. Also, the China Forest Law also clearly stipulates the punishment for the illegal logging, which not only requires 5-10 times compensation of replanting, but also 2-10 times economic penalty. In China, the timber harvest is tightly controlled by the forestry authority, the illegal logging is severely punished.

Therefore, the PP have no right to harvest more in other parcels outside the project activity.

### 5.1.2 Market leakage

According to the VM0010 version 1.3, 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,

$$\text{LFME} = 0$$

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 12<sup>th</sup> Five-year plan issued by the State Forest Bureau (Guofa [2011] No.3)<sup>2</sup>, the annual extracted volume from 2011 to 2015 is  $27,105.4 \times 10^4 \text{ m}^3$ ;
- According to the 13<sup>th</sup> Five-year plan issued by the State Forest Bureau (Guohan [2016] No.32)<sup>3</sup>, the annual extracted volume from 2016 to 2020 is  $25,403.6 \times 10^4 \text{ m}^3$ ;

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,

$$\text{LFME} = 0$$

## NET GHG EMISSION REDUCTIONS AND REMOVALS

According to the equation (28) in VCS-PD, the Net Project Greenhouse Gas Emission Reductions are calculated as:

<sup>2</sup> [http://www.gov.cn/zhengce/content/2018-06/27/content\\_5288689.htm](http://www.gov.cn/zhengce/content/2018-06/27/content_5288689.htm)

<sup>3</sup> [http://www.gov.cn/gongbao/content/2016/content\\_5045985.htm](http://www.gov.cn/gongbao/content/2016/content_5045985.htm)

$$GHG_{CREDITS,LTPF,t*} = GHG_{NET,BSL,t*} - GHG_{NET,PRJ,t*} - GHG_{LK,,LTPF,t*} \quad (15)$$

$GHG_{NET|BSL}$  and  $GHG_{NET|PRJ}$  is calculated in section 5.1 and 5.2 of the monitoring report.  $GHG_{LK|LTPF}$  is demonstrated in section 5.3. Therefore, table 7 shows a summary of  $GHG_{CREDITS|LTPF}$  for the monitoring period from 2017-2020. Detailed calculation could be seen in the excel version of emission calculation.

Table 7 Summary of total net GHG emission reductions for 01/03/2015-31/12/2019

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
<b>01/07/2017-31/12/2017</b>	5,536	-69,510	0	75,046
<b>01/01/2018-31/12/2018</b>	67,070	-139,019	0	206,089
<b>01/01/2019-31/12/2019</b>	95,520	-139,019	0	234,539
<b>01/01/2020-30/06/2020</b>	46,605	-69,510	0	116,115
<b>Total</b>	214,731	-417,058	0	631,789
<b>Average annual value</b>	71,577	-139,020	0	210,596

### 5.1.3 Adjustment 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:

$$U_{\text{Total|LTPF}} = \sqrt{U_{\text{PRJ}}^2 + U_{\text{BSL}}^2} \quad (16)$$

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

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

$$Credits_{\text{total|LTPF}} = GHG_{\text{Credits|LTPF}} \cdot (1 - U_{\text{total|LTPF}}) \quad (17)$$

**For the baseline scenario:**

As ex-ante calculated in the VCS-PD, the  $U_{\text{BSL}}$  is 1.12% for the baseline scenario.

**For the project scenario:**

According to IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories<sup>4</sup>, the uncertainty in the baseline scenario is associated with parameters and coefficients including estimates of area, carbon stocks, 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:

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

Where:

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<sup>4</sup> IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, Chapter 6, Quantifying Uncertainties in Practice.

$U_{total}$  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);

$E_i$  and  $U_i$  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:

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

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);

$U_i$  is the percentage uncertainties associated with each of the quantities.

The uncertainty of each stratum is calculated 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 and project scenario, the area of every stratum are quoted from the field survey inventory data and legal right of harvest, 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 uncertainty of expansion factors are calculated as below:

For Birch :

Uncertainty of BCEF- Birch		5.72%	
Uncertainty of BEF- Birch	5.66%	Uncertainty of D- Birch	0.84%
BEF		D	
Sample size	15	Sample size	62
Sample mean (BEF)	1.370	Sample mean (D)	0.541
Standard deviation	0.140	Standard deviation	0.018
Average error	0.036	Average error	0.002
Confidence level	0.950	Confidence level	0.950
Degree of freedom	14	Degree of freedom	61
Two-sided Student's t-value	2.145	Two-sided Student's t-value	2.000
Allowable error	0.078	Allowable error	0.005
Lower confidence limit	1.292	Lower confidence limit	0.536
Upper confidence limit	1.448	Upper confidence limit	0.546
Confidence interval	0.078	Confidence interval	0.005

For Larch:

Uncertainty of BCEF- Larch		5.70%	
Uncertainty of BEF- Larch	3.06%	Uncertainty of D- Larch	4.81%
BEF		D	
Sample size	86	Sample size	13
Sample mean (BEF)	1.400	Sample mean (D)	0.490

Standard deviation	0.200	Standard deviation	0.039
Average error	0.022	Average error	0.011
Confidence level	0.950	Confidence level	0.950
Degree of freedom	85	Degree of freedom	12
Two-sided Student's t-value	1.988	Two-sided Student's t-value	2.179
Allowable error	0.043	Allowable error	0.024
Lower confidence limit	1.357	Lower confidence limit	0.466
Upper confidence limit	1.443	Upper confidence limit	0.514
Confidence interval	0.043	Confidence interval	0.024

1) 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 using formula (21) in the VCS-PD:

For year 2013:

Uncertainty of carbon stock- Birch	5.79%
Uncertainty of volume- Birch	0.90%
carbon stock- Birch	677734.22
Area(ha)	10454.00
Sample size	830
Sample mean (m <sup>3</sup> /ha)	168.31
Standard deviation	22.23
Average error	0.77
Confidence level	0.95
Degree of freedom	829
Two-sided Student's t-value	1.96

Allowable error	1.51
Lower confidence limit	166.79
Upper confidence limit	169.82
Confidence interval	1.51

Uncertainty of carbon stock- Larch	5.90%
Uncertainty of volume- Larch	1.52%
carbon stock- Larch	548648.87
Area(ha)	10072.00
Sample size	1139
Sample mean (m <sup>3</sup> /ha)	157.02
Standard deviation	40.98
Average error	1.21
Confidence level	0.95
Degree of freedom	1138
Two-sided Student's t-value	1.96
Allowable error	2.38
Lower confidence limit	154.64
Upper confidence limit	159.40
Confidence interval	2.38

For year 2020:

Uncertainty of carbon stock- Birch	7.73%
Uncertainty of volumn- Birch	5.20%
carbon stock- Birch	62.88

Area(ha)	1.56
Sample size	39
Sample mean (m3/ha)	108.77
Standard deviation	17.44
Average error	2.79
Confidence level	0.95
Degree of freedom	38
Two-sided Student's t-value	2.02
Allowable error	5.65
Lower confidence limit	103.12
Upper confidence limit	114.43
Confidence interval	5.65

Uncertainty of carbon stock- Larch	9.33%
Uncertainty of volumn- Larch	7.38%
carbon stock- Larch	130.81
Area(ha)	2.76
Sample size	69
Sample mean (m3/ha)	138.17
Standard deviation	42.45
Average error	5.11
Confidence level	0.95
Degree of freedom	68
Two-sided Student's t-value	2.00
Allowable error	10.20
Lower confidence limit	127.98

Upper confidence limit	148.37
Confidence interval	10.20

The baseline emission uncertainty has been listed in the PD is 1.12%, the detailed calculation is listed as follows:

Based on the calculation of the parameters and coefficients above, the calculation of  $U_{PRJ}$  is shown below

**Baseline Emission Uncertainty:**

Stratum	Parameter	Area(Ha)	$V_{EX,i,j BSL}$ (m <sup>3</sup> /ha)	BEF	D(tdm/m <sup>3</sup> )	BCEFR (tdm/m <sup>3</sup> )	CFj(t c/tdm )	$C_{HB,i,j BSL}$ (tC /ha)	$C_{EX,i,j BSL}$ (tC ha <sup>-1</sup> )	$\Delta C_{DW,i,p BSL}$
		a	b	c	d	e=c*d	f	g=b*e*f	h=b*d*f	i=g-h
								$U_g = \sqrt{U_b^2 + U_e^2}$	$U_h = \sqrt{U_b^2 + U_d^2}$	$U_i = \frac{\sqrt{(E_g * U_g)^2 + (E_h * U_h)^2}}{(E_g + E_h)}$
Birch	E	10454.00	114.54	1.424	0.541	0.770	0.5	44.12	30.98	13.14
	U		0.90%	5.89%	0.84%	5.95%		6.02%	1.23%	3.57%
Larch	E	10072.00	118.26	1.416	0.490	0.694	0.5	41.03	28.97	12.05
	U		1.52%	3.16%	4.81%	5.76%		5.95%	5.04%	4.07%

Stratum	Parameter	WW <sub>k</sub>	SLF <sub>k</sub>	$C_{wp,0 BSL}$ (tc/ha)	$C_{WP,i BSL}$ (tc/ha)	OF <sub>k</sub>	$\Delta C_{Wp,100 BSL}$ (tc/ha)	A <sub>i,p</sub> (ha)	$\Delta C_{NET BSL(1)}$ (tC)
		j	k	l=h*(j+k)	m=h-l	n	o=m*n	p	q=(i/10+l+o/20)*p
				$U_l = U_h$	$U_m = \frac{\sqrt{(E_h * U_h)^2 + (E_i * U_i)^2}}{(E_h + E_i)}$		$U_o = U_m$	$U_p = 0$	$U_q = \frac{\sqrt{(E_i * U_i)^2 + (E_l * U_l)^2 + (E_o * U_o)^2}}{(E_i + E_l + E_o)}$
Birch	E	24%	0.12	11.15	19.83	0.62	12.29	2116.60	27688.84
	U			1.23%	0.96%		0.96%		1.37%
Larch	E	24%	0.12	10.43	18.54	0.62	11.50	1562.42	19078.64

U		5.04%	3.94%	3.94%	2.50%
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Stratum	Parameter	$\Delta C_{NET BSL(2-10)}(tC)$	$\Delta C_{NET BSL(11-20)}(tC)$	regrowth rate (m3/ha/yr)	$\Delta C_{NET BSL,t}(tC)$	$\Delta C_{NET, i,P BSL}$
		$r=(i/10+o/20)*p$	$s=o/20*p$	t	$v=e*f*p*t$	$w=q+r+s-v$
		$U_r = \frac{\sqrt{(E_r * U_r)^2 + (E_o * U_o)^2}}{(E_r + E_o)}$	$U_s = U_o$	$U_t = 10\%$	$U_v = \sqrt{U_s^2 + U_t^2}$	$U_w = \frac{\sqrt{(E_o * U_o)^2 + (E_r * U_r)^2 + (E_s * U_s)^2 + (E_t * U_t)^2}}{(E_o + E_r + E_s + E_t)}$
Birch	E	4081.45	1301.03	1.56	1271.86	31799.46
	U	1.90%	0.96%	10.00%	11.64%	1.21%
Larch	E	2781.40	898.16	1.83	991.92	21766.27
	U	2.83%	3.94%	10.00%	11.54%	2.10%
					$U_{BSL}$	1.12%

## Project Emission Uncertainty:

Stratum	Parameter	Area(Ha)	$V_{AB,i,2017}$ (m <sup>3</sup> ha <sup>-1</sup> )	BEF	D(tdm/m3)	BCEFR (tdm/m <sup>3</sup> )	CFj (tc/tdm)	$V_{AB,i,2020}$ (m <sup>3</sup> ha <sup>-1</sup> )	$\Delta V_{AB,i PRJ}$ (m <sup>3</sup> ha <sup>-1</sup> )	$\Delta C_{AB,i PRJ}$ (tCO2)
		a	b	c	d	e=c*d	f	g	h=g-b	i=h*a*e*f*44/12
									$U_h = \frac{\sqrt{(E_b * U_b)^2 + (E_g * U_g)^2}}{(E_b + E_g)}$	$U_i = \sqrt{U_h^2 + U_e^2}$
Birch	E	10454.00	94.38	1.37	0.541	0.741	0.5	108.77	14.39	204472.12

	U	0.00	4.99%	5.66%	0.84%	5.72%		5.20%	3.62%	6.77%
Larch	E	10072.00	121.39	1.40	0.490	0.686	0.5	138.17	16.78	212587.14
	U	0.00	7.68%	3.06%	4.81%	5.70%		7.38%	5.32%	7.80%
								U <sub>PRJ</sub>	5.18%	

### Total uncertainty

Total uncertainty for LtPF project is calculated according to the equation (29) in VCS-PD:

$$U_{Total|LtPF} = \sqrt{U_{PRJ}^2 + U_{BSL}^2} = \sqrt{5.18\%^2 + 1.12\%^2} = 5.30\% = 0.053$$

As  $U_{total} < 0.15$ , then no deduction will result from uncertainty.

#### 5.1.4 Calculation of verified carbon units

The amount of greenhouse gas credits estimated at Step 5.4.1 above should be adjusted to account for risk.

Based on the VCS Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination version 4.0, the amount of VCUs that can be issued at time  $t=t_2$  (the date of verification) for monitoring period  $T=t_2-t_1$ , is calculated as the equation (31) in VCS-PD:

$$VCU_{net|LtPF} = (Credits_{total,t2|LtPF} - Credits_{total,t1|LtPF}) - Bu_{IFM-VCS} \quad (20)$$

Based on the analysis in section 2.1, the overall risk rating of 22 is converted to a percentage as 22%. This percentage is multiplied by the net change in the project's carbon stock.

Therefore, the amount of verified carbon units of this crediting period is:

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Project emissions or removals (tCO <sub>2</sub> e)	Leakage emissions (tCO <sub>2</sub> e)	Greenhouse Gas Credits (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
01/07/2017-31/12/2017	5,536	-69,510	0	75,046	58,535
01/01/2018-31/12/2018	67,070	-139,019	0	206,089	160,749
01/01/2019-31/12/2019	95,520	-139,019	0	234,539	182,940
01/01/2020-30/06/2020	46,605	-69,510	0	116,115	90,569
<b>Total</b>	<b>214,731</b>	<b>-417,058</b>	<b>0</b>	<b>631,789</b>	<b>492,793</b>
<b>Average annual value</b>	<b>71,577</b>	<b>-139,020</b>	<b>0</b>	<b>210,596</b>	<b>164,264</b>

## APPENDIX 1: &lt; GEOGRAPHICAL COORDINATES OF SAMPLE PLOTS &gt;

## GEOGRAPHICAL COORDINATES OF SAMPLE PLOTS

ID	department	compartment number	subcompartment	coordinate X	coordinate Y	coordinate X	coordinate Y	coordinate X	coordinate Y	coordinate X	coordinate Y
BH-TH-1	Tuohe	2	16	479039	5595027	479048	5595009	479066	5595018	479057	5595036
BH-TH-2	Tuohe	14	1	479497	5590929	479506	5590911	479524	5590920	479515	5590938
BH-TH-3	Tuohe	21	2	474712	5586873	474721	5586855	474739	5586864	474730	5586882
BH-TH-4	Tuohe	24	18	473899	5586459	473908	5586441	473926	5586450	473917	5586468
BH-TH-5	Tuohe	24	19	474372	5586080	474381	5586062	474399	5586071	474390	5586089
BH-TH-6	Tuohe	26	3	474281	5585784	474290	5585766	474308	5585775	474299	5585793
BH-TH-7	Tuohe	32	2	471625	5587636	471634	5587618	471652	5587627	471643	5587645
BH-TH-8	Tuohe	34	28	472357	5586605	472366	5586587	472384	5586596	472375	5586614
BH-TH-9	Tuohe	42	8	481855	5584326	481864	5584308	481882	5584317	481873	5584335
BH-TH-10	Tuohe	70	14	471508	5584308	471517	5584290	471535	5584299	471526	5584317
BH-TH-11	Tuohe	75	31	473240	5583985	473249	5583967	473267	5583976	473258	5583994
BH-TH-12	Tuohe	80	17	472704	5582278	472713	5582260	472731	5582269	472722	5582287
BH-TH-13	Tuohe	83	15	472409	5583957	472418	5583939	472436	5583948	472427	5583966
BH-STH-1	Suotuhan	6	8	491553	5620250	491562	5620232	491580	5620241	491571	5620259
BH-STH-2	Suotuhan	48	17	492788	5607194	492797	5607176	492815	5607185	492806	5607203
BH-STH-3	Suotuhan	48	19	493119	5606804	493128	5606786	493146	5606795	493137	5606813
BH-STH-4	Suotuhan	58	6	479103	5609279	479112	5609261	479130	5609270	479121	5609288
BH-STH-5	Suotuhan	69	19	474911	5606191	474920	5606173	474938	5606182	474929	5606200
BH-STH-6	Suotuhan	77	5	476508	5605751	476517	5605733	476535	5605742	476526	5605760
BH-STH-7	Suotuhan	77	19	476900	5604521	476909	5604503	476927	5604512	476918	5604530
BH-STH-8	Suotuhan	94	5	480067	5603720	480076	5603702	480094	5603711	480085	5603729
BH-STH-9	Suotuhan	95	11	480022	5603032	480031	5603014	480049	5603023	480040	5603041
BH-STH-10	Suotuhan	96	19	482081	5603892	482090	5603874	482108	5603883	482099	5603901
BH-STH-11	Suotuhan	114	24	487827	5600282	487836	5600264	487854	5600273	487845	5600291
BH-STH-12	Suotuhan	132	20	484310	5597216	484319	5597198	484337	5597207	484328	5597225

BH-KY-1	Kuya	6	11	455295	5602035	455304	5602017	455322	5602026	455313	5602044
BH-KY-2	Kuya	6	12	455015	5601766	455024	5601748	455042	5601757	455033	5601775
BH-KY-3	Kuya	6	15	455250	5601353	455259	5601335	455277	5601344	455268	5601362
BH-KY-4	Kuya	6	16	455179	5601255	455188	5601237	455206	5601246	455197	5601264
BH-KY-5	Kuya	6	17	455253	5601156	455262	5601138	455280	5601147	455271	5601165
BH-KY-6	Kuya	10	4	460319	5604035	460328	5604017	460346	5604026	460337	5604044
BH-KY-7	Kuya	10	5	459615	5603705	459624	5603687	459642	5603696	459633	5603714
BH-KY-8	Kuya	14	3	461344	5603156	461353	5603138	461371	5603147	461362	5603165
BH-KY-9	Kuya	14	8	461005	5603355	461014	5603337	461032	5603346	461023	5603364
BH-KY-10	Kuya	28	17	461305	5598463	461314	5598445	461332	5598454	461323	5598472
BH-MLG-1	Molengge	20	17	483778	5620578	483787	5620560	483805	5620569	483796	5620587
BH-MLG-2	Molengge	34	6	486816	5619073	486828	5619061	486820	5619079	486834	5619072
BH-TL-1	Tele	32	10	453836	5588108	453845	5588090	453863	5588099	453854	5588117
BH-TL-2	Tele	33	18	454197	5587313	454206	5587295	454224	5587304	454215	5587322
LYS-TH-1	Tuohe	5	7	487027	5582841	487036	5582823	487054	5582832	487045	5582850
LYS-TH-2	Tuohe	13	6	484172	5582451	484181	5582433	484199	5582442	484190	5582460
LYS-TH-3	Tuohe	19	15	484179	5580886	484188	5580868	484206	5580877	484197	5580895
LYS-TH-4	Tuohe	21	10	463318	5579087	463327	5579069	463345	5579078	463336	5579096
LYS-TH-5	Tuohe	21	13	476284	5580053	476293	5580035	476311	5580044	476302	5580062
LYS-TH-6	Tuohe	21	15	476024	5579985	476033	5579967	476051	5579976	476042	5579994
LYS-TH-7	Tuohe	22	17	476401	5578924	476410	5578906	476428	5578915	476419	5578933
LYS-TH-8	Tuohe	22	18	474377	5578206	474386	5578188	474404	5578197	474395	5578215
LYS-TH-9	Tuohe	26	10	476227	5578989	476236	5578971	476254	5578980	476245	5578998
LYS-TH-10	Tuohe	26	35	478250	5579108	478259	5579090	478277	5579099	478268	5579117
LYS-TH-11	Tuohe	26	28	477865	5579118	477874	5579100	477892	5579109	477883	5579127
LYS-TH-12	Tuohe	29	22	479792	5580119	479801	5580101	479819	5580110	479810	5580128
LYS-TH-13	Tuohe	29	25	481474	5580321	481483	5580303	481501	5580312	481492	5580330
LYS-TH-14	Tuohe	41	10	467607	5576167	467616	5576149	467634	5576158	467625	5576176
LYS-TH-15	Tuohe	59	20	467121	5574075	467130	5574057	467148	5574066	467139	5574084
LYS-TH-16	Tuohe	66	19	469759	5574286	469768	5574268	469786	5574277	469777	5574295
LYS-TH-17	Tuohe	66	52	480309	5575962	480318	5575944	480336	5575953	480327	5575971

LYS-TH-18	Tuohe	66	34	478630	5575779	478639	5575761	478657	5575770	478648	5575788
LYS-TH-19	Tuohe	66	38	479754	5575377	479763	5575359	479781	5575368	479772	5575386
LYS-TH-20	Tuohe	66	50	479844	5576020	479853	5576002	479871	5576011	479862	5576029
LYS-TH-21	Tuohe	68	29	478590	5575914	478599	5575896	478617	5575905	478608	5575923
LYS-TH-22	Tuohe	68	30	479461	5576165	479470	5576147	479488	5576156	479479	5576174
LYS-TH-23	Tuohe	69	10	479516	5575603	479525	5575585	479543	5575594	479534	5575612
LYS-TH-24	Tuohe	69	11	480874	5575528	480883	5575510	480901	5575519	480892	5575537
LYS-TH-25	Tuohe	69	14	480928	5575547	480937	5575529	480955	5575538	480946	5575556
LYS-TH-26	Tuohe	69	23	478732	5575454	478741	5575436	478759	5575445	478750	5575463
LYS-TH-27	Tuohe	81	12	470793	5569640	470802	5569622	470820	5569631	470811	5569649
LYS-TH-28	Tuohe	81	22	471650	5570249	471659	5570231	471677	5570240	471668	5570258
LYS-TH-29	Tuohe	81	34	471166	5569628	471175	5569610	471193	5569619	471184	5569637
LYS-TH-30	Tuohe	88	29	477026	5570936	477035	5570918	477053	5570927	477044	5570945
LYS-TH-31	Tuohe	92	9	476416	5570520	476425	5570502	476443	5570511	476434	5570529
LYS-TH-32	Tuohe	92	13	476860	5569892	476869	5569874	476887	5569883	476878	5569901
LYS-TH-33	Tuohe	92	29	472254	5569564	472263	5569546	472281	5569555	472272	5569573
LYS-TH-34	Tuohe	96	18	471816	5569058	471825	5569040	471843	5569049	471834	5569067
LYS-STH-1	Suotuhan	6	24	491407	5618309	491416	5618291	491434	5618300	491425	5618318
LYS-STH-2	Suotuhan	11	45	488465	5615684	488474	5615666	488492	5615675	488483	5615693
LYS-STH-3	Suotuhan	45	25	490603	5607146	490612	5607128	490630	5607137	490621	5607155
LYS-STH-4	Suotuhan	46	16	491031	5607928	491040	5607910	491058	5607919	491049	5607937
LYS-STH-5	Suotuhan	47	5	491781	5609106	491790	5609088	491808	5609097	491799	5609115
LYS-STH-6	Suotuhan	47	8	492152	5609126	492161	5609108	492179	5609117	492170	5609135
LYS-STH-7	Suotuhan	47	9	492323	5609145	492332	5609127	492350	5609136	492341	5609154
LYS-STH-8	Suotuhan	48	7	492703	5608692	492712	5608674	492730	5608683	492721	5608701
LYS-STH-9	Suotuhan	48	20	493576	5607189	493585	5607171	493603	5607180	493594	5607198
LYS-STH-10	Suotuhan	50	11	493383	5610434	493366	5610460	493374	5610441	493388	5610449
LYS-STH-11	Suotuhan	78	1	479273	5605934	479282	5605916	479300	5605925	479291	5605943
LYS-STH-12	Suotuhan	80	1	484639	5605955	484648	5605937	484666	5605946	484657	5605964
LYS-STH-13	Suotuhan	108	13	478431	5599377	478440	5599359	478458	5599368	478449	5599386
LYS-STH-14	Suotuhan	108	14	478758	5599365	478767	5599347	478785	5599356	478776	5599374

LYS-STH-15	Suotuhan	113	18	485230	5601003	485239	5600985	485257	5600994	485248	5601012
LYS-STH-16	Suotuhan	113	25	485376	5600473	485385	5600455	485403	5600464	485394	5600482
LYS-KY-1	Kuya	42	12	459991	5594973	460000	5594955	460018	5594964	460009	5594982
LYS-KY-2	Kuya	42	15	461063	5595099	461072	5595081	461090	5595090	461081	5595108
LYS-MLG-1	Molengge	34	28	485791	5617203	485800	5617185	485818	5617194	485809	5617212
LYS-MLG-2	Molengge	41	21	486965	5615491	486974	5615473	486992	5615482	486983	5615500
LYS-MLG-3	Molengge	41	33	486288	5615521	486297	5615503	486315	5615512	486306	5615530
LYS-MLG-4	Molengge	41	9	485347	5615628	485356	5615610	485374	5615619	485365	5615637
LYS-MLG-5	Molengge	41	18	486581	5615694	486590	5615676	486608	5615685	486599	5615703
LYS-MLG-6	Molengge	41	26	486108	5615620	486117	5615602	486135	5615611	486126	5615629
LYS-MLG-7	Molengge	41	15	486969	5615282	486978	5615264	486996	5615273	486987	5615291
LYS-MLG-8	Molengge	41	42	485427	5615112	485436	5615094	485454	5615103	485445	5615121
LYS-MLG-9	Molengge	41	44	485163	5614614	485172	5614596	485190	5614605	485181	5614623
LYS-MLG-10	Molengge	41	36	485274	5614915	485283	5614897	485301	5614906	485292	5614924
LYS-MLG-11	Molengge	41	49	485051	5613826	485060	5613808	485078	5613817	485069	5613835
LYS-TL-1	Tele	4	14	462550	5587211	462559	5587193	462577	5587202	462568	5587220
LYS-TL-2	Tele	7	4	469979	5588427	469988	5588409	470006	5588418	469997	5588436
LYS-TL-3	Tele	7	15	453741	5586705	453750	5586687	453768	5586696	453759	5586714
LYS-TL-4	Tele	14	2	468094	5587182	468103	5587164	468121	5587173	468112	5587191
LYS-TL-5	Tele	32	6	463802	5585959	463811	5585941	463829	5585950	463820	5585968
LYS-TL-6	Tele	32	22	464232	5585120	464241	5585102	464259	5585111	464250	5585129