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

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1. PROJECT DETAILS

1.1 Summary Description 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 Mongollia Autonomous Region of China, which includes the Improved Forest Management (IFM) of the forests in 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 Keyihe Forestry Company. 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 converses the trees to protected forest to reduce the GHG emissions for about 3,539,767 tCO_2e and Verified Carbon Units with buffer deduction is about 2,725,605 tCO_2e in 30 years, the average annual VCUs is 90,853 tCO_2e.

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

1.2 Sectoral Scope and Project Type

Sectoral scope 14 (AFOLU)

Improved Forest Management: Logged to Protected Forest (LtPF)

1.3 Project Proponent

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1.4 Other Entities Involved in the Project

N/A

1.5 Project Start Date

The project start date is 01/01/2013, which is effective date of the Forest management and protected agreement.

1.6 Project Crediting Period

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

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Years	Estimated GHG emission reductions or removals (tCO_2e)	Estimated GHG emission reductions or removals with buffer deduction (tCO_2e)
Year 2013	80,658	62,106
Year 2014	77,821	59,922
Year 2015	74,452	57,328
Year 2016	86,989	66,981
Year 2017	78,893	60,747
Year 2018	114,184	87,921
Year 2019	138,645	106,756
Year 2020	137,683	106,015
Year 2021	184,318	141,924
Year 2022	131,389	101,169
Year 2023	149,848	115,382
Year 2024	159,937	123,151

Year 2025	140,225	107,973
Year 2026	150,116	115,589
Year 2027	138,580	106,706
Year 2028	150,341	115,762
Year 2029	139,588	107,482
Year 2030	142,140	109,447
Year 2031	132,109	101,723
Year 2032	129,441	99,669
Year 2033	127,568	98,227
Year 2034	112,414	86,558
Year 2035	117,989	90,851
Year 2036	113,401	87,318
Year 2037	108,693	83,693
Year 2038	101,478	78,138
Year 2039	93,021	71,626
Year 2040	82,303	63,373
Year 2041	78,943	60,786
Year 2042	66,600	51,282
Total estimated ERs	3,539,767	2,725,605
Total number of crediting years	30	
Average annual ERs	117,992	90,853

1.8 Description of the Project Activity

The Improved Forest Management (IFM) project activity is located in Oroqen Autonomous Banner,Hulun Buir City, Inner Mongollia Autonomous Region of China. The annual average temperature is −4.7℃ and the annual average precipitation is 455.5 mm.

The project activity includes the Improved Forest Management (IFM) of the forests in 1,969 subcompartments spreading over Kuya department, Molengge department, Suotuhan department, Tele department, Tuohe department of Inner Mongolia Keyihe Forest Industry LLC. by the conversion of logged to protected forest. All the subcompartments had the legal right to harvest issued by local forest bureau before the implementation of the project activity. Before 2013, they were all forest farms which the trees could be logged and sold once reached the cutting rotation age based on a timber harvest plan. After 2013, they are all converted to protected forests. All the subcompartments are divided into 2 strata based on the tree species and tree ages.

The implementation of the project activity includes the conversion from logged to protected forests in the parcels mentioned above. After the activity, trees could be avoided to be logged and then the carbon stocks could be increased. Therefore, net GHG emission reductions/removals resulting from the implementation of IFM projects aimed at the protection of forests that would be logged in the absence of carbon finance could be earned by the project activity.

1.9 Project Location

The project is located in Oroqen Autonomous Banner, Hulun Buir City, Inner Mongollia 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:

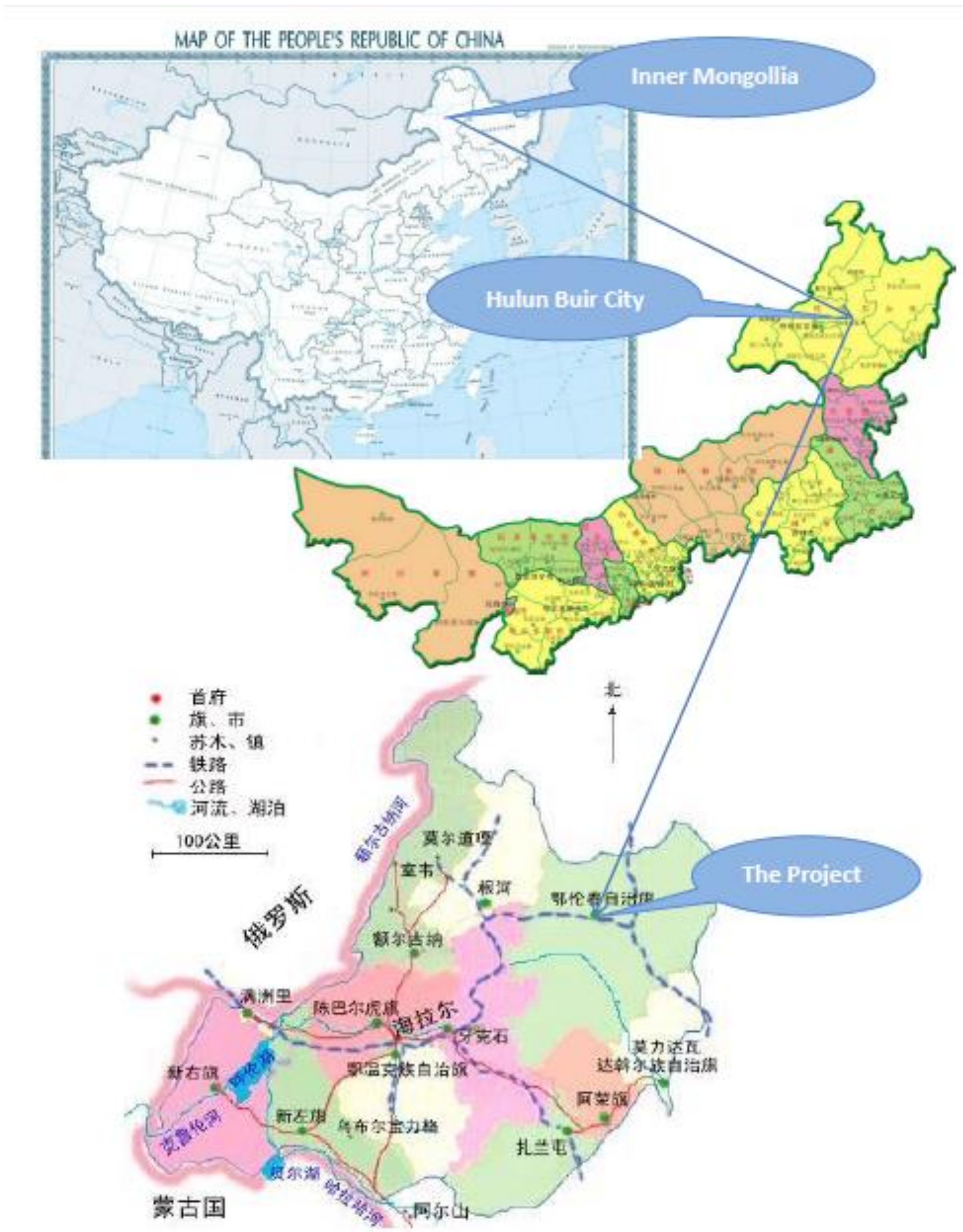


Figure 1: The project location

1.10 Conditions Prior to Project Initiation

Prior to the implementation of the project, the forest within the project area was logged annually according to the timber production plan.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project activity is in line with the Forest Law of People's Republic of China and Inner Mongolia Autonomous Region ecological public welfare forest management approach.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

The Inner Mongolia Keyihe Forest Industry LLC.(hereafter "the project proponent"), established in July 1998.

1.12.2 Emissions Trading Programs and Other Binding Limits

N/A

1.12.3 Other Forms of Environmental 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.

1.12.4 Participation under Other GHG Programs

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

1.12.5 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

N/A

Leakage Management

N/A

Commercially Sensitive Information

There are no commercially sensitive information been excluded from the public version of the project description.

Sustainable Development

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

Further Information

There is no additional relevant legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2. APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

VM0010 version 1.3: Methodology for Improved Forest Management: Conversion of Logged to Protected Forest

This methodology uses the latest versions of the following methodologies, modules and tools:

- *CDM Tool for Calculation of the Number of Sample Plots for Measurements within A/R CDM Project Activities*
- *CDM Tool for testing significance of GHG emissions in A/R CDM project activities*
- *VCS methodology VM0003 Methodology for Improved Forest Management through Extension of Rotation Age*
- *VCS methodology VM0005 Methodology for Conversion of Low-Productive Forests to High-Productive Forests*
- *VCS methodology VM0007 REDD+ Methodology Framework (REDD-MF)*
- *VCS methodology VM0011 Methodology for Improved Forest Management: Calculating GHG Benefits from Logged to Protected Forest*
- *VCS tool VT0001 Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities*

2.2 Applicability of Methodology

According to VM0010 version 1.3, Projects must fall within the AFOLU project category "IFM Logged to Protected Forest" as defined in the most recent version of the VCS AFOLU Guidance document. Therefore, specific conditions which can be applicable to the methodology are shown below:

- *Forest management in the baseline scenario must be planned timber harvest;*

  There is a planned timber harvest before the conversion of Logged to Protected Forest as the baseline scenario.

- *Under the project scenario, forest use is limited to activities that do not result in commercial timber harvest or forest degradation;*

  Under the project scenario, there is no forest use for commercial timber harvest or forest degradation.

- *Planned timber harvest must be estimated using forest inventory methods that determine allowable offtake as volume of timber (m^3 ha^{-1});*

  There are regular forest inventory taken to estimate the planned timber harvest and then to determine allowable offtake as volume of timber (m^3 ha^{-1})

- *The boundaries of the forest land must be clearly defined and documented;*

  The boundaries of the forest land could be clearly defined and documented through the maps and the forest inventory data.

- *Baseline scenario cannot include conversion to managed plantations;*

  The project baseline scenario is planned timber harvest, which doesn't include conversion to managed plantations.

- *Baseline scenario, project scenario and project case cannot include wetland or peatland*

  The project baseline scenario, project scenario and project case don’t include wetland or peatland.

- *All applicability conditions of VCS and CDM tools used in conjunction with this methodology must be met.*

  The project meets all applicability conditions of VCS and CDM tools used in conjunction with this methodology.

2.3 Project Boundary

According to VM0010 version 1.3, the spatial boundaries of the project activity so as to facilitate accurate measuring, monitoring, accounting, and verifying of the project’s emissions reductions and removals is defined below:

2.3.1 Geographical Boundaries

When describing physical project boundaries, the information is shown in Figure 1 above.

The geographic boundaries of the project activity are fixed and thus do not change over the project lifetime.

Following the VCS definition of market leakage the geographic boundaries for leakage from market effects are those of the country in which the project area occurs.

2.3.2 Temporal Boundaries

The following temporal boundaries shall be defined:

The temporal boundaries are defined by the project start date and length of the project crediting period

According to VCS standard version 3.3, the start date of the project activity is 01/01/2013. The length of the project crediting period is 30 years.

The minimum duration of a monitoring period is one year and the maximum duration is 10 years.

The project proponent decides the periodicity of verifications every 5 years.

2.3.3 Carbon Pools

The carbon pools included or excluded from the project boundary are shown in the table below:

Carbon pools	Included/Optional/ Excluded	Justification / Explanation of choice
Aboveground trees	Included	The stock change in the aboveground tree biomass is estimated
Aboveground non-tree	Excluded	Exclusion is always conservative when forests remains as forest
Belowground	Excluded	Unlikely to change significantly in forests remaining as forests and is difficult to measure - omission is conservative
Dead wood (logging slash)	Included in the baseline	The dead wood (logging slash) carbon pool is expected to be larger in the baseline than in the project scenario, and therefore this pool must be included
Dead wood (naturally accumulated)	Excluded	Following IPCC guidelines, it is assumed that carbon stocks in the naturally occurring dead wood pool (both standing and lying) are equivalent in both the project and baseline scenario, and therefore this pool is conservatively excluded.
Harvested wood products	Included	Will be greater in baseline than project scenario and significant
Litter	Excluded	Insignificant and exclusion is conservative
Soil organic carbon	Excluded	Exclusion is always conservative when forests remains as forest

2.3.4 Greenhouse Gases

The emissions sources included in or excluded from the project boundary are shown in the table below.

The project proponent has chosen to exclude to account for GHG emissions related to the combustion of fossil fuels, which is conservative.

Source		Gas	Included?	Justification/Explanation
Baseline	Combustion of fossil fuels (in vehicles, machinery and equipment)	CO_2	Excluded	Conservative as emissions will be greater in the baseline scenario than in the project scenario.
		CH_4	Excluded	Conservative as emissions will be greater in the baseline scenario than in the project scenario.
		N_2O	Excluded	Conservative as emissions will be greater in the baseline scenario than in the project scenario.
	Burning of Biomass	CH_4	Included	Included as CO_2 equivalent emission
		N_2O	Excluded	Potential emissions are negligible
Project	Combustion of fossil fuels (in vehicles, machinery and equipment)	CO_2	Excluded	Conservative as emissions will be greater in the baseline scenario than in the project scenario.
		CH_4	Excluded	Conservative as emissions will be greater in the baseline scenario than in the project scenario.
		N_2O	Excluded	Conservative as emissions will be greater in the baseline scenario than in the project scenario.
	Burning of Biomass	CH_4	Included	Included as CO_2 equivalent emission
		N_2O	Excluded	Potential emissions are negligible

2.4 Baseline Scenario

2.4.1 Selection of baseline

According to VM0010, the “Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities” (version 3.0), all the alternatives are as follow:

i) Continuation of the pre-project land use as the timber harvest plan;

ii) Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project;

iii) If applicable, activities similar to the proposed project activity on at least part of the land within the project boundary of the proposed VCS AFOLU project at a rate resulting from:

● Legal requirements; or

● Extrapolate similar activities in the geographical area under similar socioeconomic and ecological conditions to the proposed VCS AFOLU project activity which cover a period began a decade earlier than the project start date.

For (ii), the NPV under this scenario is obviously not financially attractive compared to the scenario of logging.

For (iii), the lands within the project boundary of the proposed VCS AFOLU project are all with the same legal requirements and are existed as forests more than ten years prior to the project start date. So (iii) is not applicable.

Therefore, the baseline scenario is continuation of the pre-project land use as the timber harvest plan.

2.4.2 Modelling the baseline scenario

According to VM0010 version 1.3, a historical baseline scenario is used for determining how to model the baseline management scenario as:

1. Historical records of forest management exist for 5 years preceding the project start date;

2. Historical records indicate that the management practices have surpassed the legal requirements provided by conforming to all local and regional forest legislation;

3. Historical records that indicate that the historical management surpasses financial barriers by providing above average financial returns.

Box 1. Timber Harvest Plan

The description of harvesting in the form of a timber harvest plan forms the basis of the baseline scenario for greenhouse gas accounting.

The timber harvest plan describes the harvest of timber products:

a) reference the forest volume inventory (see Section 8.1.1 – parameter $V_{j,i|BSL}$) to identify the relative number of trees per hectare potentially available for harvest by species in each stratum;

b) demarcate all non-harvest areas within the forest based on legally required exclusions for environmental features such as slope, swamp areas or conservation buffers;

c) divide the harvestable forest into annual operating areas (referred to throughout this methodology as land parcels) using common practice;

d) include a design and presentation of the forestry infrastructure to harvest, skid/haul, store and move harvested timber products from the land parcels to downstream processing or market entry points. Where the project proponent accounts for emissions from forestry infrastructure, the design and presentation must include all forest roads, skidtrails and log landings that would be established under the baseline scenario as a georeferenced layer (shapefile or equivalent), and must list necessary harvest and transport machinery.

e) the timber harvest plan must follow local best practice for timber harvest practices, including planning of roads, skidtrails and log landings-and the timber resource volume and extraction quotas defined in any legal requirements.

For the purpose of estimating the net annual changes in carbon stocks resulting from planned timber harvest in the baseline scenario a detailed planned timber harvesting schedule will be developed from the timber harvest plan, setting out details of harvest and forestry infrastructure establishment for each land parcel in the project area in terms of the following:

a) the species to be harvested;

b) the year (1,2,3...) in which timber harvest and/or forestry infrastructure establishment of each land parcel is scheduled to occur;

c) the number of years each land parcel is in a post-harvest and/or forestry infrastructure establishment state during the project crediting period;

d) the maximum and minimum diameters at breast height (DBH), at stump and at top for tree harvesting;

e) the planned harvesting regime (clearfelling, specie/stratum-selective logging, area-selective logging);

f) the fraction of merchantable timber volume from clearing of forest roads, skidtrails and log landings that is to be processed into wood products ($F_{V,INF,HWP}$). Based on this fraction, as well as forest inventory and forestry infrastructure data, $V_{EX,INF,j,i|BSL}$ and $V_{notEX,INF,j,i|BSL}$ (see points 2 and 3 below) will be calculated.

g) technical specifications for the categories of wood products to be harvested; and

h) the total volumes or fractions to be harvested, broken down by categories of wood products defined as sawnwood, wood-based panels, other industrial roundwood, paper and paper board, and other.

The planned timber harvest schedule is determined ex ante to reflect the timber harvesting plan as stipulated in the legal right to harvest. The planned timber harvesting schedule will be developed for the Project Area to include all land parcels within the project boundary for the proposed IFM activity.

The output of the timber harvest plan and timber harvesting schedule must be:

1) The mean extracted volume of extracted merchantable timber per unit area by species in each stratum in each year ($V_{EX,j,i|BSL}$).

2) Where the project proponent accounts for forestry infrastructure, the mean volume of merchantable timber extracted for wood processing that is harvested during the process of forestry infrastructure establishment per unit area by species in each stratum in each year ($V_{EX,INF,j,i|BSL}$).

3) Where the project proponent accounts for forestry infrastructure, the mean volume of merchantable timber that is cleared during the process of forestry infrastructure establishment and NOT extracted for wood processing per unit area by species in each stratum in each year ($V_{notEX,INF,j,i|BSL}$).

The planned timber harvesting schedule will be submitted by the project proponent as part of the project documents.

2.4.3 Stratification

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.

Table 2 shows the 2 strata specified based on the tree species.

Table 2: Tree strata

Serial number of strata	Area (ha)	Tree species
1	10,454	Birch
2	10,072	Larch
Total	**20,526**	

2.5 Additionality

According to VM0010 version 1.3, the additionality of the project is demonstrated using the VCS “Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities” version 3.0.

The following four sections are applied for the project:

2.5.1 Identification of alternative land use scenarios to the AFOLU project activity;

2.5.1.1 Identify credible alternative land use scenarios to the proposed VCS AFOLU project activity

a) Identify realistic and credible land-use scenarios that would have occurred on the land within the proposed project boundary in the absence of the AFOLU project activity under the VCS. The scenarios should be feasible for the project area taking into account relevant national and/or sectoral policies and circumstances, such as historical land uses, practices and economic trends. The identified land use scenarios shall at least include:

i) Continuation of the pre-project land use as the timber harvest plan as analysed in section 2.4;

ii) Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project.

iii) If applicable, activities similar to the proposed project activity on at least part of the land within the project boundary of the proposed VCS AFOLU project at a rate resulting from:

- Legal requirements; or

- Extrapolate similar activities in the geographical area under similar socioeconomic and ecological conditions to the proposed VCS AFOLU project activity which cover a period began a decade earlier than the project start date.

For (iii), the lands within the project boundary of the proposed VCS AFOLU project are all with the same legal requirements and are existed as forests more than ten years prior to the project start date. So (iii) is not applicable.

Pre-project land use scenario is the timber forest which is the common practice in China, it is feasible for the project area taking into account Forest Law of People's Republic of China. And there is no land within the Project boundary performed being registered as the VCS AFOLU project.

b) All identified land use scenarios must be credible. All land-uses within the boundary of the proposed VCS AFOLU project that are currently existing or that existed at some time in the period beginning ten years prior to the project start date but no longer exist, may be deemed realistic and credible. For all other land use scenarios, credibility shall be justified. The justification shall include elements of spatial planning information (if applicable) or legal requirements and may include assessment of economic feasibility of the proposed land use scenario.

The (i) and (ii) identified land-use scenarios that would have occurred on the land within the proposed project boundary in the absence of the AFOLU project activity under the VCS are realistic and credible, as all land-uses within the boundary of the project activity that existed in the period beginning ten years prior to the project start date but no longer exist. Therefore, it is deemed realistic and credible. Outcome of Section 2.5.1.1:

The identified land use scenarios include the two below:

i) Continuation of the pre-project land use as the timber harvest plan as analysed in section 2.4;

ii) Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project.

2.5.1.2 Consistency of credible land use scenarios with enforced mandatory applicable laws and regulations

The scenarios are feasible for the project area taking into account Forest Law of People's Republic of China, *Inner Mongolia Autonomous Region* ecological public welfare forest management approach. Therefore, the 2 identified realistic and credible alternative land used scenarios that could have occurred on the land within the project boundary of the VCS AFOLU project are listed below.

Outcome of Section 2.5.1.2:

The identified land use scenarios include the two below:

i) Continuation of the pre-project land use as the timber harvest plan as analysed in section 2.4;

ii) Project activity on the land within the project boundary performed without being registered as the VCS AFOLU project.

2.5.1.3 Investment analysis to determine that the proposed project activity is not the most economically or financially attractive of the identified land use scenarios; or

This section will determine whether the proposed project activity, without the revenue from the sale of GHG credits is economically or financially less attractive than at least one of the other land use scenarios. To conduct the investment analysis, use the following sections.

2.5.1.4 Determine appropriate analysis method

According to the *TOOL FOR THE DEMONSTRATION AND ASSESSMENT OF ADDITIONALITY IN VCS AGRICULTURE, FORESTRY AND OTHER LAND USE (AFOLU) PROJECT ACTIVITIES* (version 3.0), there are three options can be applied for investment analysis, namely simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

For this project activity, the simple cost analysis is not applicable as the project activity will earn subsidies from the protected forest fund other than VCS related income.

Therefore, the project will use the investment comparison analysis (Option II) since the 2 alternatives identified in section 2.5.1 both have cost and benefit separately.

2.5.1.5 Option II. Apply investment comparison analysis

As the PP should compare to determine which one is more economic attractive in the 2 scenarios identified in section 2.5.1.1, NPV will be used as the financial indicator to calculate the discounting in 30 years for decision-making context.

2.5.1.6 Calculation and comparison of financial indicators (only applicable to options II and III):

a) Calculate the suitable financial indicator for the proposed VCS AFOLU project without the financial benefits from the VCS for the 2 alternatives identified in section 2.5.1.

b) Present the investment analysis in a transparent manner and provide all the relevant assumptions in the VCS AFOLU project description

The NPV before and after the conversion of logged to protected forest is shown in the table below. The NPV under the scenario of logging is ¥16,299*10^4 Yuan with the discount rate of 8%. However, the NPV under the scenario of protected forest is only ¥-1,528*10^4 Yuan with the discount rate of 8%, which is lower than the scenario of logging. Therefore, the NPV under the scenario of protected forest is obviously not financially attractive compared to the scenario of logging. By taking into account the VCUs revenue, the NPV under the scenario of protected forest is increased to be ¥510*10^4 Yuan. With revenue from VCS at the assumed price level, the project would be more financially attractive. Table 3 shows the comparison of the NPV between project and baseline scenario.

Table 3: Comparison of NPV at different scenarios

	NPV (10^4 Yuan)
Scenario of Logging	¥16,299
Scenario of protected	¥-1,528

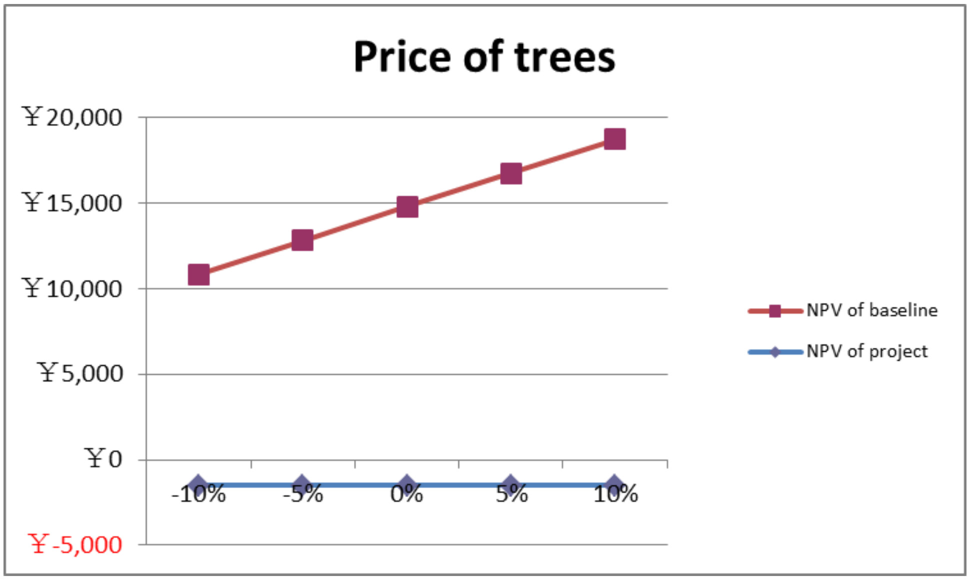
2.5.1.7 Sensitivity analysis

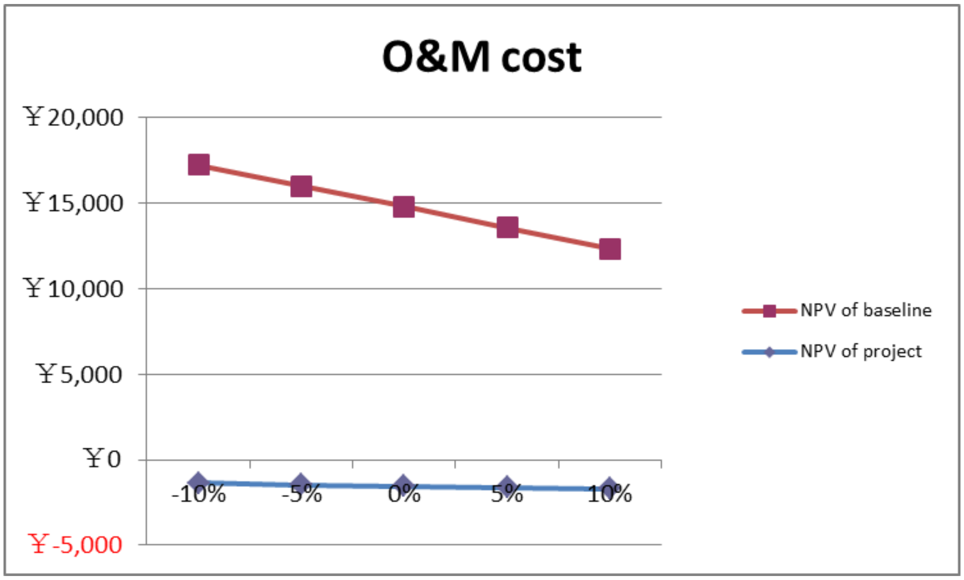
The objective of the sensitivity analysis is to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the proposed VCS AFOLU project without the financial benefits from the VCS is unlikely to be financially attractive.

For the project, the key parameters of Price of the trees, the O&M cost, and the volume of the extracted trees will be taken into account of the sensitivity analysis. Results of the 3 parameters are shown in the table 4 and figure 2 below:

Table 4: NPV comparison sensitivity analysis of the project

Key parameters	**NPV of project scenario (10^4 Yuan)**					**NPV of baseline scenario (10^4 Yuan)**				
	-10%	**-5%**	**0%**	**5%**	**10%**	**-10%**	**-5%**	**0%**	**5%**	**10%**
Price of the trees	-1,528	-1,528	-1,528	-1,528	-1,528	12,365	14,332	16,299	18,266	20,233
O&M cost	-1,376	-1,452	-1,528	-1,605	-1,681	18,603	17,451	16,299	15,147	13,995
Volume of the extracted trees	-1,528	-1,528	-1,528	-1,528	-1,528	18,068	17,184	16,299	15,415	14,530


Price of trees
￥20,000
￥15,000
￥10,000
￥5,000
￥0
￥-5,000
-10%
-5%
0%
5%
10%
NPV of baseline
NPV of project


O&M cost
￥20,000
￥15,000
￥10,000
￥5,000
￥0
￥-5,000
-10%
-5%
0%
5%
10%
NPV of baseline
NPV of project

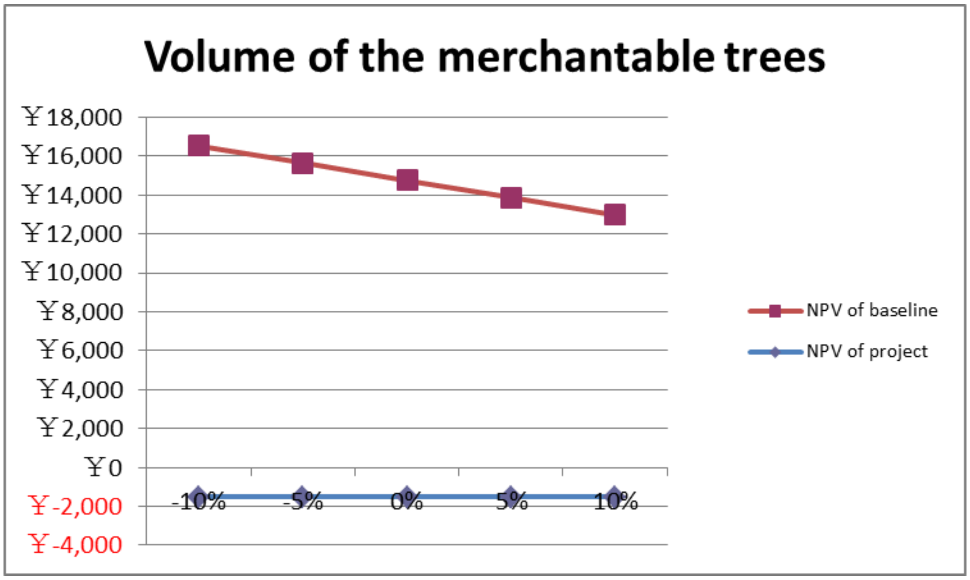


Figure 2: Sensitivity analysis of the project

By referring the Figures above, the NPV under protected scenario will not exceed the NPV under logged scenario if the price of the trees, the O&M cost, and the volume of the extracted trees varies within 10%.

Therefore, the result of the sensitivity analysis confirms that the project is financially unattractive.

2.6 Methodology Deviations

N/A

3. QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

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

The baseline net greenhouse gas emissions are determined from calculation of deadwood generated in the process of timber harvest, the emissions resulting from production and subsequent retirement of wood products derived from the timber harvesting, minus the rates of forest regrowth post timber harvest.

Baseline commercial timber volumes must be derived for development of the timber harvest plan and for ex-post accounting of emissions resulting from natural forest disturbance.

The equations calculate the total emissions across the project crediting period for each emission source. Total emissions are averaged across the crediting period to give annual emissions and are multiplied by t*, time elapsed since the start of project activity. EX-post, t* is updated so baseline projections are available for each proposed future verification date.

Data for input into these carbon stock change calculations for the baseline scenario shall be established from the same data used to create the timber harvesting plan.

According to VM0010 version 1.3, the baseline emissions are calculated in the sections below:

3.1.1 Calculation of carbon stocks in commercial timber volumes

This section calculates $C_{HB,j,i|BSL}$, the mean carbon stock in total harvested biomass in tC·ha^{-1} and $C_{EX,j,i|BSL}$, the mean carbon stock in extracted timber (merchantable timber that leaves the forest) in tC·ha^{-1} .

The pre-existing forest inventory data are used for this purpose provided that the pre-existing data:

a) represents the project strata;

b) is not more than 10 years old.

These inventory data used the method of sample plot inventory. These data were carried out through field surveys which were finished at the end of 2013 by local forest bureau. The project involves 2 strata and 1,969 subcompartments. For each stratum, mean volume is estimated from sample plot size of 0.04 ha and at least 1 sample plot will be selected in 1 subcompartment within the project area using standard forest inventory assessment methods, which satisfies the number of sample plots required by the Tool for Calculation of the Number of Sample Plots for Measurements within A/R CDM Project Activities (version 02.1.0) as stated in section 5.3.5.

The estimate of merchantable volume for each species j at the sample plot level will be calculated as:

$$V_{j,i,sp} = \sum_{l=1}^{L} V_{l,j,i,sp} \quad (1)$$

Where:

错误!未找到引用源。	merchantable volume for species j in stratum i in sample plot sp, m^3;
$V_{l,j,i,sp}$	merchantable volume for tree l of species j in stratum i in sample plot sp, m^3;
l	1, 2, 3 …L sequence of individual trees in sample plot;
i	1, 2, 3 …M strata;
sp	1, 2, 3 …SP sample plots; and
j	1, 2, 3 …J tree species.

Therefore, the merchantable volume per unit area of species j in stratum i will be calculated as the mean merchantable volume in all sample plots in stratum i:

$$V_{j,i|BSL} = \frac{1}{SP} * \sum_{sp=1}^{SP} \frac{V_{j,i,sp}}{A_{sp}}$$

(2)

Where:

$V_{j,i|BSL}$ mean merchantable volume per unit area of species j in stratum i in the baseline scenario, $m^3 \cdot ha^{-1}$;

$V_{j,i,sp}$ merchantable volume for species j in stratum i in sample plot *sp*; m^3;

A_{sp} area of sample plot *sp*, ha;

i 1, 2, 3 …M strata;

sp 1, 2, 3 …SP sample plots; and

j 1, 2, 3 …J tree species.

Therefore, the carbon stock of timber harvested per unit area for species j in stratum i will be calculated from this mean volume of extracted timber:

$$C_{HB,j,i|BSL} = V_{EX,j,i|BSL} * BCEF_R * C_j$$

(3)

Where:

$C_{HB,j,i|BSL}$ mean carbon stock of harvested biomass per unit area for species j in stratum i, $tC \cdot ha^{-1}$;

$V_{EX,j,i|BSL}$ mean volume of extracted timber per unit area for species j in stratum i, $m^3 \cdot ha^{-1}$;

$BCEF_R$ biomass conversion and expansion factor applicable to wood removals in the project area, t.d.m m^{-3};

CF_j carbon fraction of biomass for species j, tC t $d.m^{-1}$;

i 1, 2, 3 …M strata; and

j 1, 2, 3 …J tree species.

Not all of the harvested biomass leaves the forest because the timber harvested has two components: 1) wood removed to market (extracted timber) and, 2) wood remaining in the forest as a result of harvest.

Therefore, the mean carbon stock of extracted timber per unit area for species j in stratum i will be calculated from the mean volume of extracted timber multiplied by density and carbon fractions:

$$C_{EX,j,i|BSL} = V_{EX,j,i|BSL} * D_j * CF_j \quad (4)$$

Where:

$C_{EX,j,i|BSL}$ mean carbon stock of extracted timber per unit area for species j in stratum i; $tC \cdot ha^{-1}$;

$V_{EX,j,i|BSL}$ mean volume of extracted timber per unit area for species j in stratum i, $m^3 \cdot ha^{-1}$;

D_j basic wood density of species j; t d.m. m^{-3};

CF_j carbon fraction of biomass for species j, tC t d.m^{-1};

i 1, 2, 3 …M strata; and

j 1, 2, 3 …J tree species.

3.1.2 Calculation of dead wood (logging slash) generated in the process of timber harvest

This section calculates $\Delta C_{DWSLASH,i,p|BSL}$, the change in carbon stock in dead wood resulting from timber harvest in stratum i in land parcel p, using $C_{EX,j,i|BSL}$ and $C_{HB,j,i|BSL}$ as calculated in section 3.1.1.

The simplifying assumption is made that dead wood created during timber harvest is emitted in the year of harvest.

Therefore, the change in carbon stock in the dead wood pool in stratum i in land parcel p will be calculated as the difference between the total carbon stock of the harvested biomass and the carbon stock of the extracted timber:

$$\Delta C_{DWSLASH,i,p|BSL} = \left[\sum_{j=1}^{J}\left(C_{HB,j,i|BSL} - C_{EX,j,i|BSL}\right)\right] \quad (5)$$

Where:

$\Delta C_{DWSLASH,i,p\|BSL}$	change in carbon stock of dead wood as logging slash resulting from timber harvest per unit area in stratum i in land parcel p, in $tCha^{-1}$;
$C_{HB,j,i\|BSL}$	mean carbon stock of harvested biomass per unit area for species j in stratum i, $tC \cdot ha^{-1}$;
$C_{EX,j,i\|BSL}$	mean carbon stock of extracted timber per unit area for species j in stratum i, $tC \cdot ha^{-1}$;
i	1, 2, 3 …M strata; and
j	1, 2, 3 …J tree species.
p	1, 2, 3 ...P land parcels.

3.1.3 Calculation of baseline carbon sequestered in wood products

The carbon stock of extracted timber across species is calculated as:

$$C_{EX,i|BSL} = \sum_{j=1}^{J} C_{EX,j,i|BSL} \quad (6)$$

Where:

$C_{EX,i\|BSL}$	change in carbon stock of extracted wood products resulting from timber harvest per unit area in stratum i in land parcel p, $tC \cdot ha^{-1}$;
$C_{EX,j,i\|BSL}$	mean carbon stock of extracted timber per unit area for species j in stratum i, $tC \cdot ha^{-1}$;
i	1, 2, 3 …M strata; and
j	1, 2, 3 …J tree species.

In accordance with the VCS AFOLU Requirements, the amount of carbon stored in wood products that would decay within 3 years after harvest (ie, the Wood Waste (WW) and the Short Lived Fraction (SLF)), are assumed to be emitted at the time of harvest.

Wood products that are retired between 3 and 100 years after harvest (ie, the Additional Oxidised Fraction, OF), must be accounted according to a 20 year linear decay function. This decay function is applied when the net greenhouse gas emissions/removals are calculated on an annual basis in equations 11 and 12.

All other wood product pools are considered to permanently store carbon.

Therefore, the carbon stock of extracted timber that is immediately emitted to the atmosphere at the time of harvest is calculated as

$$C_{WP0,i|BSL} = \sum_k C_{EX,i,k|BSL} * (WW_k + SLF_k) \tag{7}$$

Where:

$C_{WP0,i|BSL}$	carbon stock of extracted timber from stratum i that is assumed to be emitted immediately at the time of harvest, in $tC \cdot ha^{-1}$;
$C_{EX,i|BSL}$	mean carbon stock of extracted timber per unit area in stratum i, for wood product type k, $tC \cdot ha^{-1}$;
WW_k	fraction of biomass carbon from wood waste that is assumed to be emitted to the atmosphere immediately at the time of harvest for wood product k, dimensionless;
SLF_k	fraction of biomass carbon from the short lived wood product pool that is assumed to that be emitted to the atmosphere immediately at the time of harvest for wood product k, dimensionless;
i	1, 2, 3 …M strata; and
k	Wood products (sawnwood, wood base products, etc).

The amount of extracted carbon stock that is assumed to enter the wood products pool that is not immediately emitted at harvest is calculated as per equation 8 below:

$$C_{WPi|BSL} = \sum_k C_{EX,i,k|BSL} - C_{WP0,i|BSL} \tag{8}$$

Where:

$C_{WP,i|BSL}$	carbon stock of extracted timber from stratum i that is assumed to enter the wood products pool that is not immediately emitted at the time of harvest ,in $tC \cdot ha^{-1}$;

$C_{EX,i|BSL}$ mean carbon stock of extracted timber per unit area in stratum i, for wood product type k, $tC \cdot ha^{-1}$;

$C_{WP0,i|BSL}$ carbon stock of extracted timber from stratum i that is assumed to be emitted immediately at the time of harvest, in $tC \cdot ha^{-1}$;

i 1, 2, 3 …M strata; and

k Wood products (sawnwood, wood base products, etc).

Therefore, the carbon stock of wood products assumed to be retired between 3-100 years following harvest is calculated as:

$$C_{WP100,i|BSL} = C_{WP,i|BSL} * OF_k \tag{9}$$

Where :

$C_{WP100,I,p|BSL}$ Amount of carbon stored in wood products that are assumed to be retired between 3-100 years after harvest from stratum i in land parcel p, $tC \cdot ha^{-1}$;

$C_{WP,i|BSL}$ carbon stock of extracted timber from stratum i that is assumed to enter the wood products pool that is not immediately emitted at the time of harvest ,in $tC \cdot ha^{-1}$;

OFk fraction of biomass carbon for wood product type k that is assumed to be emitted to the atmosphere between 3 and 100 years of timber harvest, dimensionless; and

i 1, 2, 3 …M strata

3.1.4 Change in carbon stocks due to forest regrowth after harvest

The carbon sequestration in the baseline resulting from forest regrowth after timber harvest up to year t is equal to the forest regrowth rate of each stratum.

Therefore, carbon sequestration resulting from forest regrowth after timber harvest is calculated as:

$$C_{RG,i,p|BSL} = \sum_i RGR i \tag{10}$$

Where:

$C_{RG,i,p|BSL}$ carbon sequestration resulting from forest regrowth after timber harvest in stratum i in land parcel p, tC ha^{-1} yr^{-1};

RGR_i regrowth rate of forest post timber harvest for stratum i, tCha^{-1} yr^{-1};

i 1, 2, 3 …M strata

3.1.5 Calculation of baseline scenario greenhouse gas emissions from change in carbon stocks

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 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:

$$\Delta C_{NET|BSL(1)} = \sum_{i,p} A_{1,i,p} * \sum_{i=1}^{M} (C_{DWSLASH,i,p\backslash BSL}/10) + C_{WP0,i,p\backslash BSL} + (C_{WP100,i,p\backslash BSL}/20) \quad (11)$$

Where:

$\Delta C_{NET|BSL(1)}$ net change in carbon stock across all parcels in the baseline scenario in the first year since harvest in the baseline scenario, in tC;

$\Delta C_{DWSLASH,i,p\backslash BSL}$ change in carbon stock of dead wood as logging slash resulting from timber harvest per unit area in stratum i in land parcel p, in tC ha^{-1};

$\Delta C_{WP0,i,p\backslash BSL}$ change in carbon stock resulting from wood product conversion and retirement from stratum i in land parcel p, that is assumed to be emitted in the first year of harvest in the baseline tC ha^{-1};

$\Delta C_{WP100,i,p\backslash BSL}$ Amount of carbon stored in wood products that is assumed to be retired between 3-100 years after harvest from stratum i in land parcel p, tC ha^{-1};

$A_{1,i,p}$ the area of stratum i in land parcel p that was harvested 1 year ago, ha;

i 1, 2, 3 …M strata; and

p 1, 2, 3 ...P land parcels harvested within the project crediting period.

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:

$$\Delta C_{NET|BSL(2-10)} = \sum_{i,p} A_{2-10,i,p} * \sum_{i=1}^{M} (C_{DWSLASH,i,p\backslash BSL}/10) + (C_{WP100,i,p\backslash BSL}/20) \quad (12)$$

Where:

$\Delta C_{NET\|BSL(2-10)}$	net change in carbon stock across all parcels in the baseline scenario in years 2-10 since harvest in the baseline scenario, in tC;
$\Delta C_{DWSLASH,i,p\backslash BSL}$	change in carbon stock of dead wood as logging slash resulting from timber harvest per unit area in stratum i in land parcel p, in tC ha^{-1};
$\Delta C_{WP100,i,p\backslash BSL}$	Amount of carbon stored in wood products that is assumed to be retired between 3-100 years after harvest from stratum i in land parcel p, tC ha^{-1};
$A_{2-10,i,p}$	the area of stratum i in land parcel p that was harvested 2 and 10 years ago, ha;
i	1, 2, 3 …M strata; and
p	1, 2, 3 ...P land parcels harvested within the project crediting period.

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

$$\Delta C_{NET|BSL(11-20)} = \sum_{i,p} A_{11-20,i,p} * \sum_{i=1}^{M} (C_{WP100,i,p\backslash BSL}/20) \quad (13)$$

Where:

$\Delta C_{NET\|BSL(11-20)}$	net change in carbon stock across all parcels in the baseline scenario in years 11-20 since the start of the project activity, in tC;
$\Delta C_{WP100,i,p\backslash BSL}$	Amount of carbon stored in wood products that is assumed to be retired between 3-100 years after harvest from stratum i in land parcel p, tC ha^{-1};
$A_{11-20,i,p}$	the area of stratum i in land parcel p that was harvested 11 and 20 years

	ago, ha;
i	1, 2, 3 …M strata; and
p	1, 2, 3 ...P land parcels harvested within the project crediting period.

The net change (sequestration) in carbon stock due to forest regrowth across all parcels in all years since harvest in the baseline scenario is calculated according to equation 14 below. Note that there will be no more emissions quantified from decay of logging slash or wood products.

$$\Delta C_{NET|BSL(1+)} = \sum_i A_{t*} * \sum_{i=1}^{M}(-\Delta C_{RG,i,p\backslash BSL}) \quad (14)$$

Where:

$\Delta C_{NET\|BSL(1+)}$	net change in carbon stock due to forest regrowth in all parcels that have been harvested in the baseline scenario, in tC;
$\Delta C_{RG,i,p\backslash BSL}$	carbon sequestration resulting from forest regrowth after timber harvest in stratum i in land parcel p, tC ha^{-1}
A_{t*}	Cumulative area harvested until time t*, ha;
i	1, 2, 3 …M strata; and
p	1, 2, 3 ...P land parcels harvested within the project crediting period.

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:

$$\Delta C_{NET|BSL,t*} = \sum_{p=1}^{P} \Delta C_{NET|BSL(1)} + \Delta C_{NET|BSL(2-10)} + \Delta C_{NET|BSL(11-20)} + \Delta C_{NET|BSL(1+)} \quad (15)$$

Where:

$\Delta C_{NET\|BSL,t*}$	net change in carbon stock across all parcels in the baseline scenario in the year t* since the start of the project activity, in tC;
$\Delta C_{NET\|BSL(1)}$	net change in carbon stock in the baseline scenario for all parcels p that are within 1 year of harvest in the baseline scenario, in tC;
$\Delta C_{NET\|BSL(2-10)}$	net change in carbon stock in the baseline scenario for all parcels p, that were harvested between 2-10 years ago in the baseline scenario, in tC;

$\Delta C_{NET|BSL(11-20)}$ net change in carbon stock in the baseline scenario in parcel p, that were harvested between 11-20 years ago in the baseline scenario, in tC;

$\Delta C_{NET|BSL(1+)}$ net change in carbon stock due to forest regrowth in the baseline scenario for all parcels p that have been harvested in the baseline scenario, in tC;

t* time elapsed since the start of the project, in years; and

p 1, 2, 3 ...P land parcels harvested within the project crediting period.

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

$$GHG_{NET|BSL,t*} = \Delta C_{NET|BSL,t*} * \frac{44}{12} \quad (16)$$

Where:

$GHG_{NET|BSL,t*}$ net greenhouse gas emissions in the baseline scenario in the year t* since the start of the project activity, tCO_2e;

$\Delta C_{NET|BSL}$ net change in carbon stock across all parcels in the baseline scenario in the year t* since the start of the project activity, tC; and

44/12 ratio of molecular weights of carbon dioxide and carbon, $tCO_2\text{-e}\ tC^{-1}$.

3.2 Project Emissions

3.2.1 Ongoing forest growth in the project scenario

This section calculates $\Delta C_{AB,t|PRJ}$ annual carbon stock change in aboveground biomass of trees in the project scenario, in tCO_2e.

3.2.1.1 Allometry

Select the appropriate allometric equation for forest type/group of species j (e.g. tropical humid forest or tropical dry forest) or for each species or family j (group of species) found in the inventory (hereafter referred to as species group) that converts tree dimensions from field timber inventories on sample plots to aboveground biomass of trees.

3.2.1.2 Measurements

Only the individual trees, species and strata which were to be harvested in the baseline scenario are to be measured. Any minimum values employed in inventories are held constant for the duration of the project.

3.2.1.3 Determining Sample Plot Carbon Stocks

The carbon stock in aboveground biomass for each individual tree of species group j in the sample plot located in stratum i will be estimated using the selected allometric equation applied to the tree dimensions resulting from section 3.2.1.2.

Therefore, the sum of the carbon stock in each sample plot will be calculated as:

$$C_{AB,j,i,t,sp|PRJ} = \sum_{l=1}^{L_{j,i,sp,t}} f_j(X,Y\ldots) * CF_j$$

(17)

Where:

$C_{AB,j,i,t,sp|PRJ}$	carbon stock in aboveground biomass of trees of species j in plot sp in stratum i at time t in the project scenario, tC
CF_j	carbon fraction of biomass for tree group j, tC t d.m.$^{-1}$;
$f_j(X,Y\ldots)$	aboveground biomass of trees based on allometric equation for species group j based on measured tree variable(s), t. d.m. tree-1;
i	1, 2, 3, …M strata;
j	1, 2, 3 … J tree species;
l	1, 2, 3, … $L_{j,i,t,sp}$ sequence number of individual trees of species group j in stratum i at time t in sample plot sp;
t	0, 1, 2, 3, …t* years elapsed since start of the project activity; and
sp	1, 2, 3 …SP sample plots.

3.2.1.4 Determining Stratum Carbon Stocks

The total carbon stock in the aboveground biomass of all trees present in sample plot sp in stratum i at time t, must be calculated as:

$$C_{AB,i,t,sp|PRJ} = \sum_{j=1}^{J} C_{AB,j,i,t,sp|PRJ}$$

(18)

Where:

$C_{AB,i,t,sp|PRJ}$	aboveground biomass carbon stock of all trees of stratum i at time t in sample plot sp in the project scenario, tC;
$C_{AB,j,i,t,sp|PRJ}$	carbon stock in aboveground biomass of trees of species j in stratum i at time t in plot sp in the project scenario, tC;
i	1, 2, 3, …M strata;
j	1, 2, 3 … J tree species; and
t	0, 1, 2, 3 …t* years elapsed since the start of the project activity.

3.2.1.5 Determining Mean Carbon Stocks

Therefore, the mean carbon stock in aboveground biomass for each stratum per unit area is calculated as:

$$C_{AB,i,t|PRJ} = \frac{1}{SP} * \sum_{SP=1}^{SP} \left(\frac{C_{AB,i,t,sp|PRJ}}{A_{sp}}\right)$$

(19)

Where:

$C_{AB,i,t|PRJ}$	mean aboveground biomass carbon stock of trees in stratum i at time t, tC ha^{-1};
$C_{AB,i,t,sp|PRJ}$	aboveground biomass carbon stock of trees in stratum i at time t in sample plot sp, tC;
$A_{,sp}$	area of sample plot sp, ha;
sp	1, 2, 3 … SP sample plots;
i	1, 2, 3 … M strata; and
t	0, 1, 2, 3 … t* years elapsed since the start of the project activity.

3.2.1.6 Determining Carbon Stock Changes

The annual carbon stock change in aboveground biomass of trees in year t is the difference in mean carbon stock in aboveground biomass between sampling events and, when expressed in tCO_2e, is calculated as:

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

(20)

Where:

$\Delta C_{AB,t\|PRJ}$	annual carbon stock change in aboveground biomass of trees in year t, $tCO_2e\ yr^{-1}$;
$C_{AB,i,t\|PRJ}$	mean aboveground biomass carbon stock of trees in stratum i at time t, $tC\ ha^{-1}$;
$A_{,i}$	area covered by stratum i, ha;
sp	1, 2, 3 … SP sample plots;
T	number of years between monitoring time t1 and t2 ($T=t_2 - t_1$); years;
i	1, 2, 3 … M strata; and
t	0, 1, 2, 3 … t* years elapsed since the start of the project activity; and
44/12	ratio of molecular weights of carbon dioxide divided carbon, $tCO_2e\ tC^{-1}$.

The carbon stock change in aboveground biomass of trees ($\Delta C_{AB,t|PRJ}$) is the output of this section and is necessary to calculate net greenhouse gas emissions in the project scenario.

3.2.2 Forest disturbance in the project scenario

This section calculates $\Delta C_{DIST\_FR,t|PRJ}$, carbon stock change due to fire disturbance in the project scenario; tCO_2-e, $\Delta C_{DIST,t|PRJ}$, carbon stock change due to non-fire natural disturbance in the project scenario; tCO_2-e

3.2.2.1 Natural disturbance

3.2.2.1a Natural Disturbance - Fire

Where fires occur ex post in the project area, the area burned shall be delineated. Therefore, based on the IPCC 2006 Inventory Guidelines, estimation of greenhouse gas emissions from biomass burning shall be calculated as:

$$\Delta C_{DIST_{FR},t|PRJ} = \sum_{i=1}^{M} A_{burn,i,t} * B_{i,t|PRJ} * COMF_i * G_{g,i} * 10^{-3}.GWP_{CH4} \quad (21)$$

Where:

$\Delta C_{DIST\_FR,t\|PRJ}$	net greenhouse gas emissions resulting from fire disturbance in year *t*, tCO_2e ;
$A_{burn,i,t}$	area burnt for stratum *i* at time *t*, ha;
$B_{i,t\|PRJ}$	average aboveground biomass stock present in the project scenario but absent in the baseline scenario before burning stratum *i*, time *t*; t d. m. ha^{-1};
$COMF_i$	combustion factor for stratum *i*, dimensionless;
$G_{g,i}$	emission factor for stratum *i* for methane, g kg^{-1} dry matter burnt;
GWP_{CH4}	global warming potential for CH_4 (IPCC default: 21), tCO_2e tCH_4^{-1};
i	1, 2, 3 …*M* strata; and
t	1, 2, 3, … *t** years elapsed since the start of the IFM project activity.

The average aboveground biomass stock present in the project scenario but absent in the baseline scenario before burning for a particular stratum shall be calculated as:

$$B_{i,t|PRJ} = \sum_{j=1}^{J} \{V_{EX,i,j|BSL} * BCEF_R\} \quad (22)$$

Where:

$B_{i,t\|PRJ}$	average aboveground biomass stock present in the project scenario but absent in the baseline before burning for stratum *i*, time *t*, t d. m. ha^{-1};
$V_{EX,j,i\|BSL}$	mean volume of extracted timber per unit area for species *j* in stratum *i*, m3·ha^{-1};
$BCEF_R$	biomass conversion and expansion factor applicable to wood removals in the project area, t.d.m m^{-3};
i	1, 2, 3 …*M* strata;
j	1, 2, 3 …*J* tree species; and
t	1, 2, 3, … *t** years elapsed since the start of the IFM project activity.

3.2.2.1b Natural Disturbance – Non-Fire

There are no fire disturbance occurred in the project area, therefore, $\Delta C_{DIST\_FR,t|PRJ}=0$

Where non-fire natural disturbances occur ex post in the project area, the area disturbed must be delineated.

$$\Delta C_{DIST,t|PRJ} = \sum_{i=1}^{M}\left(A_{dist,i,t} * \sum_{j=1}^{J}\{C_{AB,j,i|BSL}\}\right) * \frac{44}{12} \quad (23)$$

Where:

$\Delta C_{DIST,t\|PRJ}$	net greenhouse gas emissions resulting from non-fire natural disturbance in year *t*, tCO_2e ;
$A_{dist,i,t}$	area disturbed for stratum *i* at time *t*, ha;
$C_{AB,i\|BSL}$	carbon stock in aboveground biomass per unit area in stratum *i*, $tC \cdot ha^{-1}$;
44/12	ratio of molecular weights of carbon dioxide and carbon, $tCO_2e\ tC^{-1}$;
i	1, 2, 3 …*M* strata;
j	1, 2, 3 …*J* tree species; and
t	1, 2, 3, … *t** years elapsed since the start of the IFM project activity.

There are non-fire natural disturbances occur ex post in the project area, therefore, $\Delta C_{DIST,t|PRJ}$=0

3.2.2.2 Illegal logging

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:

$$\Delta C_{DIST-IL,t|PRJ} = \sum_{i=1}^{M}\left(A_{DIST-IL,j} * \frac{C_{DIST-IL,i,t|PRJ}}{AP_i}\right) \quad (24)$$

Where:

$\Delta C_{DIST\_IL,t\|PRJ}$	net carbon stock changes as a result of illegal logging at time *t*, tCO_2e;
$A_{DIST\_IL,}i$	area potentially impacted by illegal logging in stratum *I*, ha;
$C_{DIST\_IL,i,t\|PRJ}$	biomass carbon of trees cut and removed through illegal logging in stratum i at time t, tCO_2e;
APi	total area of illegal logging sample plots in stratum *i*, ha;
i	1, 2, 3 …*M* strata in the in the project case; and
t	1, 2, 3, … *t* years elapsed since the projected start of the project activity.

There are no degradation occurred indicated in PRA and limited sampling, therefore, $\Delta_{CDIST\_IL,t|PRJ}$ =0

3.2.3 Net greenhouse gas emissions in the project scenario

This section calculates $\Delta C_{NET,t|PRJ}$, the net greenhouse gas emissions in the project scenario in year t, in tCO_2e.

The net greenhouse gas emissions in the project scenario are the sum of net greenhouse gas emissions resulting from fire and non-fire forest disturbance, plus any carbon stock changes that occur as a result of illegal logging, minus the annual carbon stock change in the aboveground biomass of trees due to forest growth.

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

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

(25)

Where:

$\Delta C_{NET,t\|PRJ}$	net greenhouse gas emissions in the project scenario in year t, tCO_2-e
$\Delta C_{DIST\_FR,t\|PRJ}$	net greenhouse gas emissions resulting from fire disturbance in year t, tCO_2e
$\Delta C_{DIST,t\|PRJ}$	net greenhouse gas emissions resulting from non-fire natural disturbance in year t, tCO_2e
$\Delta C_{DIST\_IL,t\|PRJ}$	Net carbon stock changes as a result of illegal logging at time t, tCO_2e
$\Delta C_{AB,t\|PRJ}$	annual carbon stock change in aboveground biomass of trees in year t, tCO_2e yr^{-1}; and
t	1, 2, 3, t* years elapsed since start of the project activity.

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

$$GHG_{NET|PRJ} = \sum_{t=1}^{t^*} \Delta C_{NET,t|PRJ}$$

(26)

Where:

$GHG_{NET\|PRJ}$	net greenhouse gas emissions in the project scenario since the start of the project activity, tCO_2e
$\Delta C_{NET,t\|PRJ}$	net greenhouse gas emissions in the project scenario in year t, tCO_2e; and
t	1, 2, 3, t* years elapsed since start of the project activity.

3.3 Leakage

3.3.1 Activity shifting leakage

There may be no leakage due to activity shifting because:

- Comparing to the records of inventory data in 2012, the historical records of inventory data in 2006 shows trends in harvest volumes paired with records from the with-project time period showing no deviation from historical trends;
- Prior to the start of the project on 01/01/2013, forest management plans prepared in 2006 to 2012 shows harvest plans on all owned/managed lands paired with records from the with-project time period showing no deviation from management plans.

3.3.2 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:

$$GHG_{LK|LtPF} = LF_{me} * GHG_{NET|BSL,t*} \tag{27}$$

Where:

$GHG_{LK\|LtPF}$	is total market leakage as a result of IFM LtPF activities, tCO_2e;
T LF_{ME} h	is the dimensionless leakage factor for market-effects calculations;
e $GHG_{NET\|BSL,t*}$	net greenhouse gas emissions in the baseline scenario in the year t* since the start of the project activity, tCO_2e.

l

The leakage factor (see Box 2) is determined by considering where in the country logging will be increased as a result of the decreased timber supply caused by the project.

Box 2. Leakage factor calculation

The leakage factor is determined by 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. The relevant data is not available during validation. Therefore,

$LF_{ME} = 0$

The actual value will be monitored when verification.

3.4 Net GHG Emission Reductions and Removals

3.4.1 Net Project Greenhouse Gas Emission Reductions

According to VM0010 version 1.3, the Net Project Greenhouse Gas Emission Reductions are calculated as:

$$GHG_{CREDITS|LtPF,t*} = GHG_{NET|BSL,t*} - GHG_{NET|PRJ,t*} - GHG_{LK|LtPF,t*} \quad (28)$$

Where:

$GHG_{CREDITS|LtPF,t*}$ project greenhouse gas credits associated with the implementation of improved forest management (IFM) activities in the year t* since the start of the project activity, in the project scenario, tCO_2e

$GHG_{NET|BSL,t*}$ net greenhouse gas emissions in the baseline scenario in the year t* since the start of the project activity, tCO_2e

$GHG_{NET|PRJ,t*}$ net greenhouse gas emissions in the project scenario in the year t* since the start of the project activity, tCO_2e; and

$GHG_{LK|LtPF,t*}$ total greenhouse gas emissions due to leakage arising outside the project boundary as a result of the implementation of improved forest management (IFM) activities in the year t* since the start of the project activity, in the project scenario, tCO_2e

3.4.2 Project Verified Carbon Units

The number of Verified Carbon Units (VCUs) for each year t in the project crediting period is the greenhouse gas emission reductions and removals adjusted for uncertainty and risk.

3.4.2.1 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 LtPF project is calculated as:

$$U_{TOTAL\,|LtPF} = \sqrt{U_{|PRJ}^2 + U_{|BSL}^2} \quad (29)$$

Where:

$U_{total\|LtPF}$	total uncertainty for LtPF Project, dimensionless;
$U_{\|PRJ}$	total uncertainty for the improved forest management activities in the project scenario, dimensionless; and
$U_{\|BSL}$	total uncertainty for the baseline scenario, dimensionless.

Project proponents must justify the selection of uncertainty propagation in the VCS-PD.

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:

$$Credits_{total|LtPF} = GHG_{credits|LtPF} \cdot (1 - U_{total\,|LtPF}) \quad (30)$$

Where:

$Credits_{total\,\|\,LtPF}$	total greenhouse gas credits adjusted for uncertainty for each year t in the project crediting period;
$GHG_{credits\|LtPF}$	project greenhouse gas credits associated with the implementation of improved forest management (IFM) activities in the project scenario,

$tCO_2e \cdot year^{-1}$; and

$U_{total|LtPF}$ total uncertainty for LtPF Project, dimensionless.

3.4.2.2 Calculation of verified carbon units

The amount of greenhouse gas credits estimated at section 3.4.2.1 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 VCU's that can be issued at time $t=t_2$ (the date of verification) for monitoring period $T=t_2-t_1$, is calculated as:

$$VCU_{net|LtPF} = \left(Credits_{total,t2|LtPF} - Credits_{total,t1|LtPF}\right) - Bu_{|IFM-VCS} \tag{31}$$

Where:

$VCU_{net|LtPF}$ number of verified carbon units; dimensionless;

$Credits_{total.t1|LtPF}$ net anthroprogenic greenhouse gas removals by sinks, as estimated for $t^*=t_1$ in tCO_2e;

$Credits_{total.t2|LtPF}$ net anthroprogenic greenhouse gas removals by sinks, as estimated for $t^*=t_2$ in tCO_2e; and

Based on the analysis in NON-PERMANENCE RISK REPORT, the overall risk rating is 23, then 23% of the total emission reductions should be deducted .

Therefore, for the calculation of $GHG_{NET|BSL}$, according to section 3.1, the process is shown below:

Table 6: Basic Parameter

Basic Parameter		Value	Data Unit	Data Source
D_j	Birch	0.443	t d.m. m^{-3}	"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change"
	Larch	0.490	t d.m. m^{-3}	
BEF	Birch	1.586	dimensionless	
	Larch	1.416	dimensionless	
$BCEF_R$	Birch	0.703	t d.m. m^{-3}	calculated by BEF and D

	Larch	0.694	t d.m. m^{-3}	
CF_j	Birch/Larch	0.5	tC t $d.m.^{-1}$	VM0010 version 1.3
WW	Birch/Larch	24%	kg kg^{-1}	
SLF	Birch/Larch	0	kg kg^{-1}	
OF	Birch/Larch	0.62	kg kg^{-1}	
Regrowth rate in baseline scenario	Birch	1.56	$m^3.ha^{-1}.yr^{-1}$	pre-existing local forest data
	Larch	1.83	$m^3.ha^{-1}.yr^{-1}$	
Ongoing growth rate in project scenario	Birch	2.80	$m^3.ha^{-1}.yr^{-1}$	
	Larch	2.35	$m^3.ha^{-1}.yr^{-1}$	

Table 7: The baseline emission during the crediting period

Year	$\Delta C_{NET\|BSL}$	$GHG_{NET\|BSL}$
2013	3,503.50	12,846
2014	2,729.88	10,009
2015	1,811.09	6,640
2016	5,230.33	19,177
2017	3,022.16	11,081
2018	12,647.09	46,372
2019	19,318.36	70,833
2020	19,055.88	69,871
2021	31,774.38	116,506
2022	17,339.18	63,577
2023	22,373.57	82,036
2024	25,125.22	92,125
2025	19,749.26	72,413
2026	22,446.58	82,304
2027	19,300.41	70,768
2028	22,507.98	82,529
2029	19,575.34	71,776
2030	20,271.36	74,328
2031	17,535.72	64,297
2032	16,807.98	61,629
2033	16,297.34	59,756
2034	12,164.30	44,602
2035	13,684.66	50,177
2036	12,433.63	45,589
2037	11,149.52	40,881

2038	9,181.70	33,666
2039	6,875.20	25,209
2040	3,952.31	14,491
2041	3,035.84	11,131
2042	-330.75	-1,212
Total	410,569	1,505,407
Average	13,685	50,180

For the calculation of $GHG_{NET|PRJ}$, according to section 3.2, the process is shown below:

Forest disturbance in the project scenario:

This section calculates $\Delta C_{DIST\_FR,t|PRJ}$, carbon stock change due to fire disturbance in the project scenario; $\Delta C_{DIST,t|PRJ}$, carbon stock change due to non-fire natural disturbance in the project scenario; and $\Delta C_{DIST\_IL,i,t|PRJ}$, the net carbon stock changes as a result of illegal logging in stratum i at time t.

According to the analysis in section 3.2, $\Delta C_{DIST\_FR,t|PRJ}$, $\Delta C_{DIST,t|PRJ}$ and $\Delta C_{DIST\_IL,i,t|PRJ}$ are all = 0.

Table 8: The project emission during the crediting period

Year	$\Delta C_{AB,t|PRJ}$	$\Delta C_{DIST\_FR,t|PRJ}$	$\Delta C_{DIST,t|PRJ}$	$\Delta C_{DIST\_IL,t|PRJ}$	$\Delta C_{NET,t|PRJ}$
2013	67,812	0	0	0	-67,812
2014	67,812	0	0	0	-67,812
2015	67,812	0	0	0	-67,812
2016	67,812	0	0	0	-67,812
2017	67,812	0	0	0	-67,812
2018	67,812	0	0	0	-67,812
2019	67,812	0	0	0	-67,812
2020	67,812	0	0	0	-67,812
2021	67,812	0	0	0	-67,812
2022	67,812	0	0	0	-67,812
2023	67,812	0	0	0	-67,812
2024	67,812	0	0	0	-67,812
2025	67,812	0	0	0	-67,812
2026	67,812	0	0	0	-67,812
2027	67,812	0	0	0	-67,812
2028	67,812	0	0	0	-67,812
2029	67,812	0	0	0	-67,812

2030	67,812	0	0	0	-67,812
2031	67,812	0	0	0	-67,812
2032	67,812	0	0	0	-67,812
2033	67,812	0	0	0	-67,812
2034	67,812	0	0	0	-67,812
2035	67,812	0	0	0	-67,812
2036	67,812	0	0	0	-67,812
2037	67,812	0	0	0	-67,812
2038	67,812	0	0	0	-67,812
2039	67,812	0	0	0	-67,812
2040	67,812	0	0	0	-67,812
2041	67,812	0	0	0	-67,812
2042	67,812	0	0	0	-67,812
Total	2,034,360	0	0	0	-2,034,360
Average	67,812	0	0	0	-67,812

For the calculation of $GHG_{LK|LtPF}$, according to section 3.3, the process is shown below:

$GHG_{LK|LtPF}$ =0

Therefore,

$$GHG_{CREDITS|LtPF} = GHG_{NET|BSL} - GHG_{NET|PRJ} - GHG_{LK|LtPF}$$

=1,505,407 -(-2,034,360) –0

=3,539,767 tCO_2e

The $GHG_{CREDITS|LtPF}$ is calculated for the project greenhouse gas credits associated with the implementation of improved forest management (IFM) activities in the project scenario for the whole 30 years' crediting period. For the average annual project greenhouse gas credits, it will be 3,539,767/30 =117,992 tCO_2e.

Then the ex-ante calculation (estimate) of baseline emissions/removals, project emissions or removals, leakage emissions and net emission reductions and removals are shown below:

Uncertainty for the baseline scenario:

According to *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*[1], 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:

$$U_{total} = \frac{\sqrt{(U_1 \times E_1)^2 + (U_2 \times E_2)^2 + \cdots + (U_n \times E_n)^2}}{E_1 + E_2 + \cdots + E_n} \quad (32)$$

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);

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:

$$U_{total} = \sqrt{U_1^2 + U_2^2 + \cdots + U_n^2} \quad (33)$$

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);

[1] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, Chapter 6, Quantifying Uncertainties in Practice.

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

The uncertainty is 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 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		6.91%	
Uncertainty of BEF-Birch	6.89%	Uncertainty of D-Birch	0.45%
BEF		D	
Sample size	39	Sample size	189
Sample mean (BEF)	1.59	Sample mean (D)	0.44
Standard error	0.05	Standard error	0.00
Standard deviation	0.34	Standard deviation	0.01
Average error	0.05	Average error	0.00
Confidence level	0.95	Confidence level	0.95
Degree of freedom	38	Degree of freedom	188
Two-sided Student's t-value	2.02	Two-sided Student's t-value	1.97
Allowable error	0.11	Allowable error	0.00
Lower confidence limit	1.48	Lower confidence limit	0.44
Upper confidence limit	1.70	Upper confidence limit	0.44
Confidence interval	0.11	Confidence interval	0.00

   For Larch:

Uncertainty of BCEF-Larch		5.84%	
Uncertainty of BEF-Larch	3.20%	Uncertainty of D-Larch	4.89%
BEF		D	
Sample size	321	Sample size	13
Sample mean (BEF)	1.42	Sample mean (D)	0.49
Standard error	0.02	Standard error	0.01
Standard deviation	0.41	Standard deviation	0.04
Average error	0.02	Average error	0.01
Confidence level	0.95	Confidence level	0.95
Degree of freedom	320	Degree of freedom	12
Two-sided Student's t-value	1.97	Two-sided Student's t-value	2.18
Allowable error	0.05	Allowable error	0.02
Lower confidence limit	1.37	Lower confidence limit	0.47
Upper confidence limit	1.46	Upper confidence limit	0.51
Confidence interval	0.05	Confidence interval	0.02

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 using formula (32):

Uncertainty of carbon stock-Birch	7.31%	Uncertainty of carbon stock-Larch	7.20%
Uncertainty of volume-Birch	2.39%	Uncertainty of volume-Larch	2.02%
carbon stock-Birch	618100.46	carbon stock-Larch	548648.87
Area(ha)	10454.00	Area(ha)	10072.00
Sample size	830	Sample size	1139
Sample mean (m^3/ha)	168.31	Sample mean (m^3/ha)	157.02
Standard deviation	59.13	Standard deviation	54.47
Average error	2.05	Average error	1.61
Confidence level	0.95	Confidence level	0.95
Degree of freedom	829	Degree of freedom	1138
Two-sided Student's t-value	1.96	Two-sided Student's t-value	1.96
Allowable error	4.03	Allowable error	3.17
Lower confidence limit	164.28	Lower confidence limit	153.85
Upper confidence limit	172.33	Upper confidence limit	160.18
Confidence interval	4.03	Confidence interval	3.17

4) Uncertainty of regrowth

The uncertainty of regrowth is only associated with the parameter RGR_i, which is quoted from IPCC Guidelines for National Greenhouse Gas Inventories (2006), Table 4.9, and the uncertainty for non-industrialized countries of 30% is regulated on page 4.19 at the same time. As China is a non-industrialized country, the uncertainty of RGR_i and regrowth is 30%.

Based on the calculation of the 4 parameters and coefficients above, the calculation of $U_{Birch|BSL}$ and $U_{Larch|BSL}$ are shown below:

Stratum		**$A_{i,p}$ (Ha)**	**$V_{EX,j,i\|BSL}$ (m^3 ha^{-1})**	**D**	**$BCEF_R$**	**CFj**	**$C_{HB,j,i\|BSL}$ (tC ha^{-1})**	**$C_{EX,j,i\|BSL}$ (tC ha^{-1})**	$\Delta C_{DW,i,p\|BSL}$	**$C_{WP,i\|BSL}$**	$\Delta C_{WP,i,p\|BSL}$	$\Delta C_{RG,i,p\|BSL}$	$\Delta C_{NET,\ i,P\|BSL}$
		A	**B**	**G**	**C**	**D**	**E=B*C*D**	**F=B*G*D**	**H=A*(E-F)**	**I=F*(1-WWK)*(1-SLFK)*(1-OFk)**	**J=(F-I)*A**	**K**	**L=H+J-K**
Birch	U	10454	2.39%	0.45%	6.91%		7.31%	2.43%	4.58%	2.43%	1.97%	30%	**2.35%**
	E		168.31	0.443	0.70	0.50	59.13	37.28	228377.60	10.77	277170.90	9148	496400.84
Larch	U	10072	2.02%	0.45%	6.91%		7.20%	2.07%	4.48%	2.07%	1.67%	30%	**2.28%**
	E		157.02	0.443	0.70	0.5	55.16	34.78	205275.21	10.04	249132.64	11020	443387.89
U|BSL													1.64%

Therefore, as there are 2 strata in the project activity, the uncertainty across combined strata for is calculated with the revised equation below:

$$U_{|BSL} = \frac{\sqrt{(U_{\mathrm{Birch|BSL}} \times E_{\mathrm{Birch}|BSL})^2 + (U_{\mathrm{Larch|BSL}} \times E_{\mathrm{Larch}|BSL})^2}}{E_{\mathrm{Birch}|BSL} + E_{\mathrm{Larch}|BSL}} \qquad (34)$$

Where:

$U_{\|BSL}$	Total uncertainty in baseline scenario; %
$U_{Birch\|BSL}$	Uncertainty in baseline scenario in stratum Birch; %;
$U_{Larch\|BSL}$	Uncertainty in baseline scenario in stratum Larch; %;
$E_{Birch\|BSL}$	Sum of net change in carbon stock in the baseline scenario in stratum Birch in the baseline case; t CO_2e
$E_{Larch\|BSL}$	Sum of net change in carbon stock in the baseline scenario in stratum Larch in the baseline case; t CO_2e

After calculation, $U_{|BSL}$ is 1.64% for the baseline scenario.

For the project scenario:

According to *Carbon Inventory Methods*, the uncertainty in the project scenario is expressed for parameter $C_{AB,i,t2|PRJ}$ (tC/ha). The uncertainty across combined strata for $C_{AB,i,t2|PRJ}$ is calculated with the revised equation below:

$$U_{|PRJ} = \frac{\sqrt{(U_{\mathrm{Birch|PRJ}} \times E_{\mathrm{Birch}|PRJ})^2 + (U_{\mathrm{Larch|PRJ}} \times E_{\mathrm{Larch}|PRJ})^2}}{E_{\mathrm{Birch}|PRJ} + E_{\mathrm{Larch}|PRJ}} \qquad (35)$$

Where:

$U_{\|PRJ}$	Total uncertainty in project scenario; %
$U_{Birch\|PRJ}$	Uncertainty in project scenario in stratum Birch; %;
$U_{Larch\|PRJ}$	Uncertainty in project scenario in stratum Larch; %;
$E_{Birch\|PRJ}$	Sum of net change in carbon stock in stratum Birch in the project case; t CO_2e
$E_{Larch\|PRJ}$	Sum of net change in carbon stock in stratum Larch in the project case; t CO_2e

VCUs adjusted for uncertainty and risk will be considered in the period of verification. Therefore, it will be considered $U_{|PRJ}$=0 in VCS-PD.

Total uncertainty

Total uncertainty for LtPF project is calculated according to the follow equation:

$$U_{Total|LtPF} = \sqrt{U_{|PRJ}^2 + U_{|BSL}^2} = \sqrt{0^2 + 1.64\%^2} = 1.64\% = 0.0164$$

According to the methodology, if $U_{total,LtPF} \leq 0.15$ then no deduction will result for uncertainty, as U_{total}<0.15, then no deduction will result from uncertainty.

Therefore, the emission reduction detail is listed:

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)	Estimated net GHG emission reductions or removals with buffer deduction (tCO_2e)
Year 2013	12,846	-67,812	0	80,658	62,106
Year 2014	10,009	-67,812	0	77,821	59,922
Year 2015	6,640	-67,812	0	74,452	57,328
Year 2016	19,177	-67,812	0	86,989	66,981
Year 2017	11,081	-67,812	0	78,893	60,747
Year 2018	46,372	-67,812	0	114,184	87,921
Year 2019	70,833	-67,812	0	138,645	106,756
Year 2020	69,871	-67,812	0	137,683	106,015
Year 2021	116,506	-67,812	0	184,318	141,924
Year 2022	63,577	-67,812	0	131,389	101,169
Year 2023	82,036	-67,812	0	149,848	115,382
Year 2024	92,125	-67,812	0	159,937	123,151
Year 2025	72,413	-67,812	0	140,225	107,973
Year 2026	82,304	-67,812	0	150,116	115,589
Year 2027	70,768	-67,812	0	138,580	106,706
Year 2028	82,529	-67,812	0	150,341	115,762
Year 2029	71,776	-67,812	0	139,588	107,482

Year 2030	74,328	-67,812	0	142,140	109,447
Year 2031	64,297	-67,812	0	132,109	101,723
Year 2032	61,629	-67,812	0	129,441	99,669
Year 2033	59,756	-67,812	0	127,568	98,227
Year 2034	44,602	-67,812	0	112,414	86,558
Year 2035	50,177	-67,812	0	117,989	90,851
Year 2036	45,589	-67,812	0	113,401	87,318
Year 2037	40,881	-67,812	0	108,693	83,693
Year 2038	33,666	-67,812	0	101,478	78,138
Year 2039	25,209	-67,812	0	93,021	71,626
Year 2040	14,491	-67,812	0	82,303	63,373
Year 2041	11,131	-67,812	0	78,943	60,786
Year 2042	-1,212	-67,812	0	66,600	51,282
Total	1,505,407	-2,034,360	0	3,539,767	2,725,605
Average	50,180	-67,812	0	117,992	90,853

4. MONITORING

4.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$\mathbf{V_{l,j,i,sp}}$
Data unit:	m^3
Description:	Merchantable volume for tree *l* of species *j* in sample plot *sp* in stratum *i*
Source of data:	
Value applied:	See the detailed excel spreadsheet
Justification of choice of data or description of measurement methods and procedures applied:	
Any comment:	-

Data Unit / Parameter:	$\mathbf{CF_j}$
Data unit:	$tC{\cdot}td.m.^{-1}$

Description:	Carbon fraction of dry matter for species j
Source of data:	According to VM0010 version 1.3, the default value 0.5 tC·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
Any comment:	-

Data Unit / 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:	"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change"
Value applied:	<table><tr><th>Tree species</th><th>D_j</th></tr><tr><td>Birch</td><td>0.443</td></tr><tr><td>Larch</td><td>0.490</td></tr></table>
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	-

Data Unit / Parameter:	**$f_j(X, Y…)$**
Data unit:	t d.m. tree^{-1}
Description:	Allometric equation(s) for species j linking measured tree variable(s) to aboveground biomass of living trees
Source of data:	Equations are derived using a wide range of measured ages based on datasets that comprise at least 30 trees. Equations are

	based on statistically significant regressions and the r^2 is ≥ 0.8. The source of equations are chosen from academic paper and equations developed for regional forest types.
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	-

Data Unit / Parameter:	**$BCEF_R$**
Data unit:	t d.m. m^{-3}
Description:	Biomass conversion and expansion factor applicable to wood removals in the project area
Source of data:	"Land Use Change and Forestry GHG Inventory(2013)" of "Second National Information Notification on China Climate Change"
Value applied:	see table below
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	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 lcad (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).

Tree species	**$BCEF_R$**
Birch	0.703
Larch	0.694

Data Unit / Parameter:	**OF, SLF,WW**
Data unit:	Kg kg^{-1}
Description:	OF = Fraction of wood products that will be emitted to the

	atmosphere between 3 and 100 years after production; SLF = Fraction of wood products that will be emitted to the atmosphere within 3 years of production; and WW = Fraction of extracted biomass effectively emitted to the atmosphere during production
Source of data:	According to VM0010 version 1.3, the default values are chosen.
Value applied:	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 24% for developing countries. Short-lived fraction (SLF) Winjum et al 1998 give decay rates for proportions of wood products with short-term (<3 yr) uses. As the wood products are more than 3 yr, this parameter will not be used. 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). As the wood products are woodbase panels for more than 3 years and the project is located in boreal area, this fraction over 95 years giving the additional proportion that is oxidized between the 3rd and 100th years after initial harvest is 0.62.
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	-

Data Unit / Parameter:	**RGR_i**
Data unit:	$tC.ha^{-1}.yr^{-1}$
Description:	Forest regrowth rate post timber harvest for stratum *i*
Source of data:	According to VM0010 version 1.3, the default values are chosen.

Value applied:	
Justification of choice of data or description of measurement methods and procedures applied:	N/A
Any comment:	Default values shall be updated whenever new guidelines are produced by the IPCC

Data Unit / Parameter:	$V_{EX,j,i\|BSL}$
Data unit:	$m^3.ha^{-1}$
Description:	Mean volume of extracted timber per unit area for species *j* in stratum *i*
Source of data:	The timber harvest plan sets the allowable mean extracted volume is equal to the merchantable volume of timber in the forest inventory ($V_{j,i\|BSL}$), based on legal limits.
Value applied:	please refer to ER sheet
Justification of choice of data or description of measurement methods and procedures applied:	The measurement method is from academic paper and equations developed for regional forest types. Please refer to ER sheet
Any comment:	-

Data Unit / Parameter:	$A_{i,p}$
Data unit:	Ha
Description:	Area covered by stratum *i* over land parcel *p*
Source of data:	Legal parcel records
Value applied:	See the detailed Project Land Form
Justification of choice of data or description of measurement methods and procedures applied:	-

Any comment:	Be assumed ex-ante that land parcel boundaries and strata areas must not change through time

Data Unit / 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:	Legal parcel records
Value applied:	See the detailed Project Land Form
Justification of choice of data or description of measurement methods and procedures applied:	-
Any comment:	-

Data Unit / 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:	Legal parcel records
Value applied:	See the detailed Project Land Form
Justification of choice of data or description of measurement methods and procedures applied:	-
Any comment:	-

Data Unit / 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:	Legal parcel records
Value applied:	See the detailed Project Land Form
Justification of choice of data or description of measurement methods and procedures applied:	-
Any comment:	-

Data Unit / Parameter:	A_{t*}
Data unit:	Ha
Description:	Cumulative area harvested until time t*
Source of data:	Legal parcel records
Value applied:	See the detailed Project Land Form
Justification of choice of data or description of measurement methods and procedures applied:	-
Any comment:	-

Data Unit / Parameter:	$A_{s,p}$
Data unit:	Ha
Description:	Area of sample plot *sp*
Source of data:	Recording and archiving of size of sample plots
Justification of choice of data or description of measurement methods and procedures applied:	Standard procedures for plot delineation in forest timber inventory surveys shall be used
Any comment:	Ex-ante the size of the plots shall be defined and recorded in the monitoring plan.

Data Unit / 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:	-
Any comment:	95% confidence level is prescribed in methodology VM0010 version 1.3.

Data Unit / Parameter:	**E**
Data unit:	T d.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 S_i
Source of data:	A default value equal to 10% of the mean biomass stock within the project boundary
Value applied:	0.9960
Justification of choice of data or description of measurement methods and	-

procedures applied:	
Any comment:	-

Data Unit / 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, Chapter 2, of the IPCC 2006 Inventory Guidelines in table 2.5
Value applied:	Emission factor for stratum i for gas g
Justification of choice of data or description of measurement methods and procedures applied:	-
Any comment:	Default values shall be updated whenever new guidelines are produced by the IPCC

4.2 Data and Parameters Monitored

Data Unit / Parameter:	*Illegal Logging PRA Results*
Data unit:	
Description:	
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 shall 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 shall be triggered. 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.

Frequency of monitoring/recording:	Every two years
Value applied:	*0*
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	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 Unit / Parameter:	*Result of 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 to be repeated each time the PRA indicates a potential for illegal logging.
Value applied:	*0*
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	Ex ante an 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 Unit / Parameter:	A_i

Data unit:	Ha
Description:	Area covered by stratum *i*
Source of data:	legal parcel records
Description of measurement methods and procedures to be applied:	-
Frequency of monitoring/recording:	-
Value applied:	See the detailed Project Land Form
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	In the baseline scenario strata areas shall not change through time. In the project scenario it shall be assumed *ex-ante* that stand boundaries and strata areas shall 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 Unit / Parameter:	*DBH*
Data unit:	Cm
Description:	Diameter at breast height of a tree in cm
Source of data:	Field measurements in sample plots
Description of measurement methods and procedures to be applied:	Typically measured 1.3m aboveground. Measure all trees above some minimum *DBH* in the sample plots. The minimum *DBH* varies depending on tree species and climate; for instance, the minimum *DBH* may be as small as 2.5 cm or as high as 20 cm, but for humid tropical forests 10 cm is commonly used. Minimum DBH employed in inventories is held constant for the duration of the project.
Frequency of monitoring/recording:	Not more than 5 years
Value applied:	-

Monitoring equipment:	-
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 form the *IPCC GPG LULUCF 2003*, is recommended.
Calculation method:	-
Any comment:	QA/QC procedures apply not only to DBH but to all tree or non-tree vegetation dimension variables measured, as may be identified by allometric equations employed but not specifically identified here.

Data Unit / Parameter:	*N*
Data unit:	dimensionless
Description:	Total number of possible sample plots within the project boundary (the sampling space or the population); dimensionless
Source of data:	Calculation
Description of measurement methods and procedures to be applied:	*N* is equal to project area divided by the size of the sample plot
Frequency of monitoring/recording:	-
Value applied:	119
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	W_i
Data unit:	dimensionless
Description:	Relative weight of the area of stratum i; dimensionless

Source of data:	Calculation
Description of measurement methods and procedures to be applied:	The relative weight of the area of a stratum i is equal to the area of the stratum i divided by the project area
Frequency of monitoring/recording:	-
Value applied:	See the plot calculator
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	S_i
Data unit:	t d.m.ha^{-1}
Description:	Estimated standard deviation of biomass stock in stratum i. Standard deviation of biomass stock per unit area (in t d.m. ha-1) may also be used for this purpose
Source of data:	Calculation
Description of measurement methods and procedures to be applied:	Approximate value of the standard deviation of biomass stock in each stratum is either known from existing data related to the project area or existing data related to a similar area, or is estimated from a preliminary sample
Frequency of monitoring/recording:	-
Value applied:	See the plot calculator
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	-

Data Unit / Parameter:	$A_{burn,i,t}$

Data unit:	Ha
Description:	Area burnt in stratum *i* at time *t*
Source of data:	GPS 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 applied:	-
Monitoring equipment:	-
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 form the IPCC GPG LULUCF 2003, is recommended.
Calculation method:	-
Any comment:	Ex ante estimations of areas burned shall be based on historic incidence of fire in the Project region

Data Unit / Parameter:	$A_{dist,i,t}$
Data unit:	Ha
Description:	Area disturbed in stratum *i* at time *t*
Source of data:	GPS coordinates and/or Remote Sensing data
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Areas disturbed shall be monitored at least every five years
Value applied:	-
Monitoring equipment:	-
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 form the IPCC GPG LULUCF 2003, is

	recommended.
Calculation method:	-
Any comment:	Ex ante estimations of areas burned must be based on historic incidence of fire in the Project region

Data Unit / 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:	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 applied:	-
Monitoring equipment:	-
QA/QC procedures to be applied:	-
Calculation method:	-
Any comment:	Ex ante a limited survey can be used to determine a likely depth of degradation penetration

Data Unit / Parameter:	$C_{DIST\_IL,i,t\|PRJ}$
Data unit:	tCO_2-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
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 form the IPCC GPG LULUCF 2003, is recommended.
Calculation method:	-
Any comment:	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 Unit / 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 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.
Measurement Frequency	Not more than five years
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 form the IPCC GPG LULUCF 2003, is recommended.
Any comment:	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 Unit / 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:	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.
Measurement Frequency	Not more than five years
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 form the IPCC GPG LULUCF 2003, is recommended.
Any comment:	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.

4.3 Monitoring Plan

4.3.1 Scope of monitoring and the monitoring plan

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.

4.3.2 General requirements for monitoring

All data collected as part of monitoring will be archived electronically and be kept at least for 2 years after the end of the project crediting period. All measurements will be conducted according to relevant standards.

Data archiving shall take both electronic and paper forms, and copies of all data shall be provided to each project participant.

All electronic data and reports shall also be copied on durable media such as CDs and copies of the CDs are to be stored in multiple locations.

The archives shall include:

Copies of all original field measurement data, laboratory data, data analysis spreadsheets;

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.

4.3.3 Monitoring of project implementation

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 and archived. This will be achieved by field survey (e.g. using GPS) or by using geo-referenced spatial data (e.g. maps, GIS datasets, aerial photography, or geo-referenced remote sensing images);

Commonly accepted 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 will be applied. SOPs already applied in national forest monitoring or available from published handbooks or from the IPCC GPG LULUCF 2003 will be used.

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

4.3.4 Stratification

An ex ante stratification of the project area in the project scenario is developed by project proponents through sampling in the project area according to the species.

Sampling to adjust the number and boundaries of the strata defined ex ante where an update is required because of

a) unexpected disturbances occurring during the project crediting period affecting differently various parts of an originally homogeneous stratum and/or

b) forest management activities that are implemented in a way that affects the existing stratification in the project scenario.

Established strata may also be merged if the reasons for their establishment have disappeared.

4.3.5 Monitoring of actual carbon stock changes

Carbon stocks will be 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 and age, 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 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 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.

For the baseline scenario, 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

In the baseline scenario:

n_{BSL} for n and $n_{BSL,i}$ for n_i.

In the project scenario:

N_{PROJ} for n and $n_{PROJ,i}$ for n_i

The sample plot will be 0.04 ha and at least 1 sample plot will be selected in 1 subcompartment. As the area of every subcompartment is larger than 0.8 ha, the area sampled is less than 5% of the subcompartment area, and then less than 5% of the project area, which means a small sampling fraction. Therefore, the following simplified equation can be used for estimating the number of sample plots:

$$n = \left(\frac{t_{VAL}}{E}\right)^2 * \left(\sum_i \omega_i * S_i\right)^2 \quad (36)$$

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^{-1}), i.e. in the units used for S_i

w_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})

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:

$$n_i = n * \frac{\omega_i * S_i}{\sum_i \omega_i * S_i} \quad (37)$$

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
w_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})
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 in shown in table 10 below:

Table 10: The estimation of number of sample plots required

STRATA No.	Stratum Name	Area (ha)	Plot size (ha)	Plot Quantity	Rounded Plot Quantity
Total Sample Size (n_{BSL})				117.45	
Strata 1 ($n_{BSL,1}$)	Birch	10,454	0.04	42.31	43
Strata 2 ($n_{BSL,2}$)	Birch	10,072	0.04	75.14	76
TOTAL NUMBER OF PLOTS					**119**

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

Carbon stock changes over time shall be estimated by taking measurements in plots at each monitoring event. Monitoring events shall take place at intervals of 5, or preferably 3 years. Including monitoring all the parameters needed. Monitoring reports can use such extrapolated parameter values for the determination of net emissions by sources and removals resulting from the project.

The design of the sampling regime will be determined by the number of strata and timber harvest the baseline case.

4.3.6 Conservative approach and uncertainty

Project proponent will also apply all relevant equations for the ex-ante calculation of net anthropogenic GHG removals by sinks with care and provide transparent estimations for the parameters that are monitored during the project crediting period. These estimates shall be based on measured or existing published data where possible and project proponents should retain a conservative approach; that is, if different values for a parameter are equally plausible, a value that does not lead to over-estimation of net anthropogenic GHG removals by sinks must be selected

An uncertainty analysis is required for all estimates from monitoring related to change in area, change in carbon stocks and emissions for both the baseline and project case.

5. SAFEGUARDS

5.1 No Net Harm

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

5.2 Environmental Impact

An Environmental Impact Assessment (EIA) is not required for logged to protected forest projects according to Construction project classification management of environmental impact assessment list[2]. The key mitigation action of the project activity is avoiding the illegal harvest of the forest, which can protect and improve the surviving environment, keep the ecological balance, save the species resources and enhance homeland security.

5.3 Local Stakeholder Consultation

Comments by stakeholders have been invited using PRA approaches which were held in Oct 2012.

>> The comments received from the PRA survey were fully taken into account as follows:

 All the stakeholders supported the conversion activity from logged to protected forest.

 Participation of local farmers/communities and companies/farms is on a voluntarily basis.

 All tree species used are native to local, and a mixed species arrangements will be used;

 Use of chemical pesticides will be limited. Rather, disease and pest will be controlled by mixed tree species arrangement and other biological measures;

 Slash and burn site preparation and overall ploughing for soil preparation will not be used.

5.4 Public Comments

The survey shows that all of the stakeholders and the residents of the areas supported the conversion activity from logged to protected forest.

[2] http://www.gov.cn/gongbao/content/2009/content_1265996.htm

In conclusion, the survey indicates that the Project has few negative impacts on local environment.