AFOLU Project Table Version 1.0

Project Type

(Afforestation and Vegetation Restoration)

Bamboo Afforestation Project in Xishuangbanna,Yunnan Province

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Yunnan Mengxiang Bamboo Industry co,.LTD.

Contents

Section1：PROJECT OVERVIEW

1.1 Project title

Project title：Bamboo Afforestation project in Xishuangbanna, Yunnan province

Version： 2.0

Date: 2013. 8.1

1.2 Project type and project activity

The proposed PS small-scale A/R project activity is going to plant 3582.34 hm^2*Dendrocalamusgiganteus* in Jinghongcity, Menghai county and Mengla county of Xishuangbanna prefecture. The natural region of the project area is the the low and humid mountain valley areas in north tropics-South Asia subtropical zone, which enjoys special location and unique natural conditions, and is helpful for the growth of *Dendrocalamusgiganteus.* The project is expected to produce **634472.40** tCO_2e VERs within a crediting period of 30 years, at an annual average of 21149 tCO_2e V ERs.

Both the operating entity (Mengxiang bamboo industry co,LTD.) and local farmers hold a view that the proposed A/R CDM project activity, through the above-mentioned activities, will contribute to poverty alleviation and environment improvement (biodiversity conservation and soil erosion control),thus contribute to sustainable development, specifically:

(1) Soil and water conservation ability will be improved along LangcangjiangRiver and its tributaries;

(2)Enhance biodiversity conservation by increasing Forest ecosystem landscape connectivity;

(3) Will contribute to the alleviation of climate change through planting high-quality forest vegetation;

(4) Generate income for the local farmers and promote the local community development.

Baseline survey results show that the some parts of projects field exist slightly natural update, but the conservative estimation of its maturing period coverage shows that even though these natural updates all grow up to be a tree, they still cannot reach 20% of the forest coverage requirements. Meantime, these lands are not only far away from the provenance, but also have lush ground vegetation, plenty of dry branches and fallen leaves, fern and gramineous weeds. So if no project is introduced from elsewhere to these lands, natural updates to be forest could not happen in these areas. Therefore, the plot of land in the project belongs to degrading land. Without project activities, the land will remain degrading state or continue its degradation.

This project activities plan to plant the *Dendrocalamusgiganteus* with high biomass, in degraded land, which can increase the long-term average carbon storage in the project plot. Due to the activities, the vegetation, within the project boundary, will reach the forest defined criteria. This activity belongs to the *Panda Standard Forestation and Vegetation Restoration in Agriculture and Forestry and Other Lands.*

1.3 Time boundary

In 2009, the project loan agreement of biological carbon sequestration forestation and biodigester construction was signed between the project owner and AFD. The project was approved by Yunnan provincial committee of development and reform in December, 2009, and could be demonstrated by the following documents, *Notice of The Second Batch Foreign Loan Alternative Projects Plan Issued by National Development and Reform Commission in 2009, Approval for FSR of AFD Loan Funded Biological Carbon Sequestration Forestation and Biodigester Construction by Yunnan Provincial Development and Reform*

Commission. Then, between January and April, 2010, the project baseline investigation and soil preparation were initiated to plant *dendrocalamus giganteus.* According to the company's actual operation record, the first batch of *dendrocalamus giganteuswas* planted on February, 25th, 2010. The second was planted between February and April, 2011.

- Project start date: the proposed project starts from 2/25/2010, according to the PS AFOLU specification and requirements detailed in methodology of bamboo afforestation on the degraded land.
- Crediting period :30 years
- Crediting period start date : 2/25/2010
- The project monitoring and verification date for the first time: start from 2013, the time interval between monitoring and verification is 10 years long.

1.4 Project boundary

This project is located in Xishuangbanna prefecture, south of Yunnan province, north latitude 21°10'~ 22°40'and east longitude 99°55'~ 101°50' respectively, it involves Jinghong City, Menghai county and Mengla County(Fig.1-1).

Panda standard afforestation and vegetation restoration stipulates that: the start date of the project is not earlier than January 1st, 2005. In other words, the proposed project plots have not covered by any forest since January 1, 2005. With those requirements,the staff can use the non-forest land interpretative result of remote sensing satellite imagery in diffident periods, to make the initial choice of the project plots. When evaluating the eligibility of the project plots, the staff can use the forestry-based digital information of the project area in different periods, such as forestmaps, land use and coverage maps and so on, and then combine them with the land chosen by the non-forest land interpretative result of remote

sensing satellite imagery in diffident periods, which has been mentioned above, and make the overlay analysis to check the eligibility of the project plots.

The following is the identifying steps of the project plots:

First, compare the interpretative results of remote sensing satellite imagery on the non-forest land in diffident periods, and then select the initial plots chosen accord with the project standards;

Second, use the forestry-based digital information in different periods, such as stand maps, covering maps of used land and so on, to evaluate the eligibility of the project plots;

Third, do field survey while record the coordinates of the inflection points on the boundary of the plots by the staff with hand-held GPS. Due to the limitation of land topography, vegetative cover and other factors, the staff cannot gain all of the inflection points on the boundary of the plots, therefore, the slope hook paint of the topographic map is needed at the same time, and the staff can gain the boundary of the plots according to the characteristics of the terrain;

Fourth, input the topographic maps, which have been loaded the boundary of the plots, to the GIS software to make the digital edition, and confirm the boundary gained by examining in the flied;

Fifth, use GIS software to extract the inflection points of the border of the plots on the topographical map of slope and the GPS inflection points gained from the field investigation and the initial project plots in the field, and ultimately determine the boundary of project plots and generate a distribution graph of the plots. If the inflection point falls in the boundary of the plots, then the staff choose the GPS point as the inflection point of the boundary of project plots, otherwise, the staff uses the boundary of the initial plots. 24 were conforming to the Panda standard requirements, involving 16 villages of 8 townships of 3 counties in

Jinghongcity,Menghaicounty and Mengla county. The total gross area of the project plot is 3582.34 ha. Details are as follows,

Table 1-1 the project plots information

county	township	village	Plot Name	Plot No	Area (hm^2)	Afforestation year
Jinghong	Gasa	Manmeke	Nannuoshan	JH-0207	36.33	2010
		Nanpa	Manhena	JH-0220	32.16	2011
	Menglong	Nanpen	Mansuola	JH-0212	44.77	2011
			Mansuolashangxiazhai	JH-0211	36.03	2010
			Longqiudaheishan	JH-0216	393.51	2010
		Heguan	Jijiapuxishan	JH-0122	82.16	2010
			Hongguanghoushan 1	JH-0118	345.03	2010
		Bangpiao	Hongguanghoushan 2	JH-0119	108.28	2011
Sub-total					**1078.27**	
Menghai	Gelanghe	Pazhen	Erdongshan	MH-0313	104.31	2011
			Jiebudiangejiaodongnanmian	MH-0310	72.88	2011
			Jiebudiangejiaonanmian	MH-0309	73.81	2011
		Pasha	Leidashan	MH-0315	305.36	2010
	Bulangshan	Manguo	Manwai	MH-0306	74.18	2010
		Banzhang	Oubigejiao	MH-0314	154.46	2011
		Mengang	Weidong	MH-0421	108.77	2010
	Mengsong	Daan	Daan	MH-0305	127.71	2010
		Banggang	Dajianshan	MH-0404	335.49	2011
			Sangengdi	MH-0303	105.38	2011
	Menghun	Hekai	Hekai	MH-0108	214.42	2010
			Banpen	MH-0117	42.74	2010
	Xiding	Nanleng	Baye	MH-0302	55.31	2010
		Jiuguo	Jiuguo	MH-0301	336.81	2010
Sub-total					**2111.6332**	
Mengla	Yiwu	Luode	Taguishan	ML-0424	206.62	2011
			Donggualin	ML-0323	185.82	2011
Sub-total					**392.439**	
Total					**3582.34**	

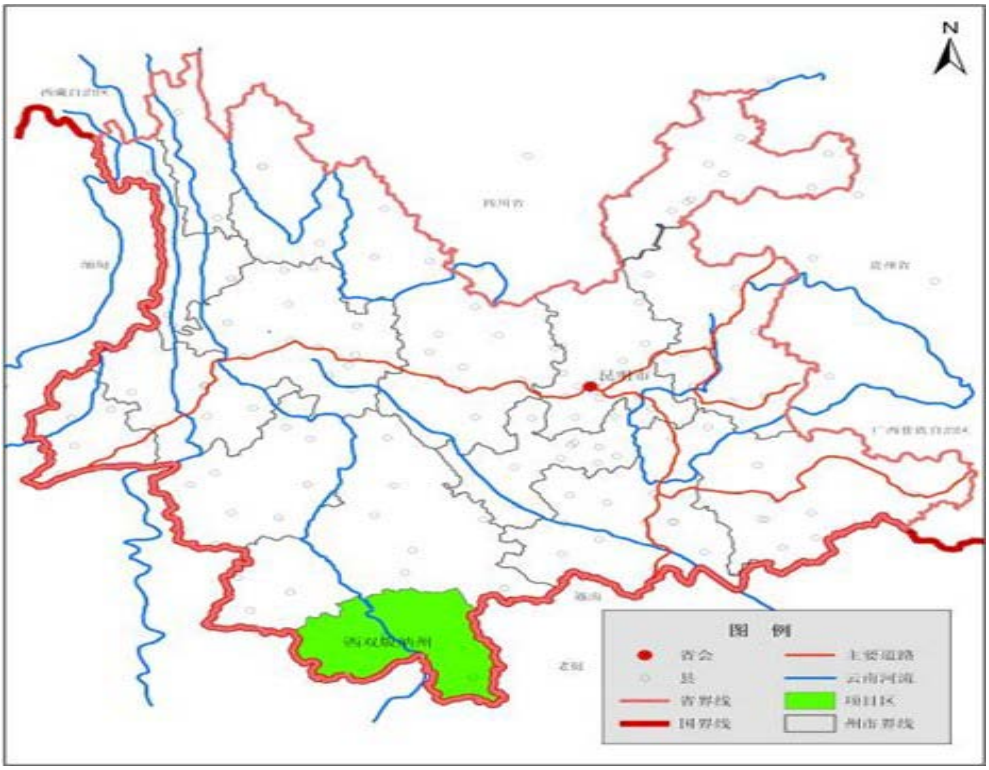


Fig 1-1 Project lands schematic map

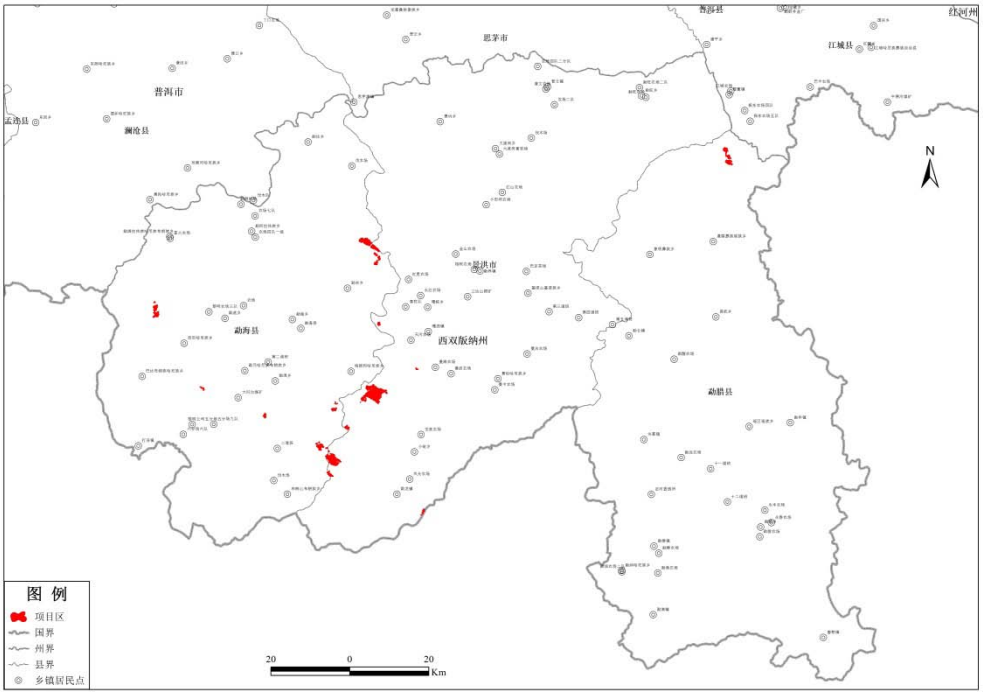


Fig 1-2 Project plots distribution

1.5 Project description

1.5.1 The environmental conditions of project areas are described as below:

(1) Meteorological condition

XishuangbannaDai Autonomous Prefecture is located at east longitude 99º56′~101º50′, north latitude 21º08′~22º36′, running across 1 degree 54 longitude point and occupying 1 degree 22 latitude point. The climate resource on the project area is superior, the average values of the meteorological elements representing light, heat and water conditions, can be showed as below:

Table 1-2 Mainmeteorological elements in the areas

Location	Yearly Average temperature(℃)	Monthly Average Temperature(℃)	≥18℃ Accumulative temperature(℃)	Extremely minimum temperature (℃)	(mm) Annual rainfall(mm)	Yearly average relative humidity(%)	Annual sunshine (h)
Menghai county	18.1	11.5	4283.1	-5.4	1308.0	82.0	2041.9
Jinghong City	21.9	15.7	6365.4	2.7	1157.3	82.0	2194.7
Mengla County	21.1	15.3	5870.4	0.5	1561.8	86.0	1871.3

There exists plenty kinds of meteorological disasters, especially droughts, floods, lightning, hail, wind and so on. They not only have wide distribution but also have high frequency.

(2) Soil characteristics:

The types of Xishuangbanna soil mainly include latosolic red soil, red soil, Clay bricks, yellow soil, yellow brown soil and purple soil. Latosolic red soil distribution area is at an altitude of 800 meters to 1500 meters of low mountain belt or low mountain (shallow cutting) basin hilly region. The region's total area is 17.5211 million mu, accounting for 59.3% of the total land area of Xishuangbanna, which is the largest soil type in area in the prefecture; Red soil distribution area is at an altitude of 1500 meters to 2000 meters of mountainous county, a total of 2.46 million mu, accounting for 8.3% of the total land area of the prefecture.

(3) Vegetation：

The forest area (including shrub) of Xishuangbanna prefecture is about 1,497 million hm^2,and the forest coverage rate is 78.3％. A complex and varied natural environment comes into being due to the special geographical environment and unique climate conditions. Xishuangbanna's water and hot are compatible with each other, and enjoys a wide range of biological species and boasts a broad verity of flora and fauna, which is the natural treasure-house of tropical flora and fauna and original germplasm resources. The vegetation is diversified including eight types forests such as tropical rain forest, tropical monsoon forest, subtropical evergreen broad-leaved forest, warm coniferous forest, the bamboo grove, secondary growth plants, beach thickets and grass. There are altogether 12 subvegetation types and 8 plant formations.

The national rare or endangered species and their level of protection

Species	Sort	Level of protection
Parashorea chinensis	rare	1
Vaticaxishuangbannaensis	rare	2
Pometia tomentasa	vulnerable	3
Terminalia myriocarpa	vulnerable	3
Tetrameles nudiflora	rare	2

(4) Hydrology

The proposed project is located within the Lancangjiang drainage, Langcangjiang River is the mainstream of Mekong river, flowing form small olive dam into Xishuangbanna, with a flowing path of 187.5km, its tributaries and tributaries at three levels.

Tributaries： Along the Menghai drainage lies Liusha river, Nanguo river, Nanxian river; along the Jinghong drainage lies Buyuan river (Xiaoheijiang and

Luosuojiang),Dakai river(Puwen river or south Puding river), Liusha river, Nana river; along Mengla drainage lies Luosuo river and Nanla river.

1.5.2 Technology applied in Panda standard afforestation and reafforestation project

The proposed Panda standard afforestation and reafforestation project is undertaken by the following agencies, they are Yunnan designing institute of forestry survey and planning, TNC China project office, Yunnan CDM service center and Xishuangbanna Tropical botanic garden, Chinese academy of sciences. These agencies are responsible for preparing the proposed Panda standard afforestation and reafforestation project, executing quality control and so on. The proposed project takes various new technologies and afforestation models.

(1) The proposed project strictly conforms to the following technology standards,

- State Technical Regulations for Afforestation/Reforestation:(GB/T 15776-2006)
- Design regulations for Afforestation(LY/T 1607-2003)
- State Technical Regulations for Watershed Management(GB/T 16453.1-16453.6-1996)
- State standard for Forest Tending(GB/T 15781-2009)
- Yunnan Provincial Standard for Major Afforestation Tree Species and Seedlings(DB53/062-2006)
- Technical Standard for Seedling Breeding(LY1000-991)
- Yunnan Provincial Standard for Major Afforestation Tree Species and Seedlings(DB53/062-2006)

- State Regulations for Non-commercial forest construction(GB/T 18337.1-2001, GB/T 18337.2-2001, GB/T18337.3-2001)

(2) Tree species selection and afforestation progress arrangement

The proposed project adopts the locally breeding bamboo specie- *dendrocalamus giganteus.*

Table 1-3 Annual afforestation area

year	afforestation area (hm^2)
2010	2158.36
2011	1423.98
Total	3582.34

(3) Provenance and seedling tending

All seedlings taken by the proposed project are locally bred, taking the method of pole-burying and repeatedly division propagation. All bamboo poles needed for seedling tending are locally adopted with similar site condition. And the seedling quality is closely following Yunnan Provincial Standard for Major Afforestation Tree Species and Seedlings (DB53/062-2006). All seedlings used are up to the required seedling standards grade I and grade Ⅱ. Details are shown in Table1-4,

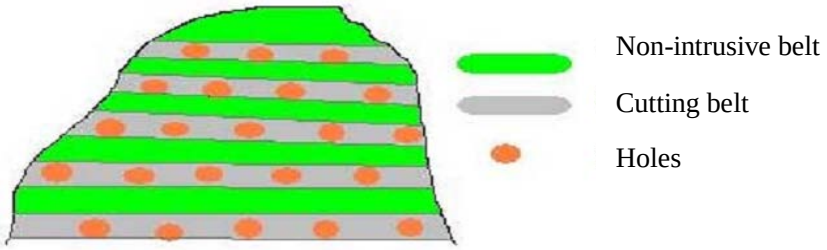
Table 1-4 seedling grade standards

Tree species	Seedling type	Seedling Age (month)	Seedling grade				Major Controlled conditions	Note
			Grade I		Grade Ⅱ			
			Ground diameter (cm)	Height of seedling (cm)	Ground diameter (cm)	Height of seedling (cm)		
dendrocalamus giganteus	Container seedling	12	0.5	80	0.3~0.5	50~80	flouring Root and sturdy seedling	DB53/062-2006

							(2 poles)	

(4) Soil preparation

In order to avoid water and soil erosion, minimize GHG emission, and preserve the existing carbon sink pool, site burning and overall tillage will be forbidden in the proposed project. Existing non-tree vegetation will be slashed manually along landform contour with a width between 120 cm and 150 cm.Small holes will be dug with 40 cm length,40 cm width and 40 cm depth. The holes will be arranged in a triangle form on slope. Details are shown in Picture 1-3.



Pic 1-3 Sketch map for the planting holes:

(5) Afforestation

At the initial stage of afforestation, the forest tending will last for 2 years, once a year for the sake of a high survival rate and better growth condition, including seedling-supporting, after-replacement, intertillage, weeding, and topdressing. The survival rate will be examined 6 months after the afforestation, and big seedlings will be applied to do after-replacement if the survival rate is lower than 85%.

And the afforestation activity will be conducted manually in rainy days as much as possible. The density of plantation of each bamboo varity will conform with State Technical Regulation for Non-commercial Forest Construction(GB/T 18337.1-2001) , the density of *Dendrocalamus giganteus* is 250 clumps/hm^2, and

the seedling row spacing is 5m×8m, and trenches will be built along the slope of planting caves for the sake of water and soil reservation.

Project lands Dajianshan, Erdongshan, Oubigejiao, Donggualin and Mansuola are interplanted with *Eucalyptus* respectively, with an area of 207.51ha in Dajianshan, 104.31ha in Erdongshan, 72.37ha in Oubigejiao, 20ha in Donghualin and 44.77ha in Mansuola. Interplantation takes the form that a row of *Dendrocalamus giganteus* interplant two rows of *Eucalyptus*, with the row space of eucalyptus is 3m×2.6m, and row space of *Dendrocalamus giganteus* remains unchanged.

(6) Bamboo management

Rational formation of the bamboo forest. The bamboo seedling density of the proposed project is about 16~18clumps/mu, its the seedling row spacing is 5m×8m. After it grows into mature forest, 220-330 strong and mature bamboos plant will be kept each mu.

Raise bamboo plants while removing bamboo shoots. Bamboo shooting sprouting time is divided into three periods, initial stage (from June to July), peak stage (from August to September), and last stage (from October to November). During initial stage and last stage, bamboo shoots sprouts rapidly and strongly, and the newly sprouting bamboo is taller than the stock plants. While bamboo shoots sprouting at the last stage are relatively smaller and shorter, so bamboo shoots sprouting after September should be removed, just keeping them sprouting between June and September.

Proper cutting. The process of reaping the bamboo serves as the process of bamboo forest tending. In order to facilitate the sound growth of bamboo and a

high yield, the following points should be noticed, the bamboo of the proposed project is planted by means of cuttage, the seedling used is only one finger thick, and will be sprouting bamboo shoots every year until it grows into mature bamboo, but the sprouted bamboo shoot at the first three years is too thin to be used as timber. Thus, at the fourth year after being planted, the bamboo shoot will grow larger and can be taken as timber use, however, which is high in moisture content, so we can't cut them until they continue growing for the following four years to reach the timber moisture content standard and fabric condition, i.e., at the seventh year after being planted, we can harvest the bamboo. Cutting can be conducted all year round, better to do it in spring and winter. All *Eucalyptus* planted can be cut at the age of 5, and the carbon sink stored by it will not be counted as the project carbon sink volume.

1.6 Ex-ante Estimation of Net Emission Reductions/Removals

Crediting year	Estimation of baseline emission reduction (tones of CO_2e)	Estimation of net emission reductions/removals under project Scenario (tones of CO_2e)	Estimation of leakage (tones of CO_2e)	Estimation of net emission reduction (tones of CO_2e)
2010	-771.39	31139.97	0	30368.58
2011	-939.56	96897.42	0	95957.86
2012	-1109.86	96897.42	0	95787.56
2013	-1141.74	96897.42	0	95755.68
2014	-1294.11	96897.42	0	95603.31
2015	-1440.34	96897.42	0	95457.08
2016	-1579.28	96897.42	0	95318.14
2017	-1710.26	38516.72	0	36806.45
2018	-1580.14	0	0	-1580.14
2019	-1689.61	0	0	-1689.61
2020	-1641.74	0	0	-1641.74
2021	-949.54	0	0	-949.54
2022	-721.23	0	0	-721.23
2023	0	0	0	0
2024	0	0	0	0
2025	0	0	0	0
2026	0	0	0	0
2027	0	0	0	0
2028	0	0	0	0
2029	0	0	0	0

Crediting year	Estimation of baseline emission reduction (tones of CO_2e)	Estimation of net emission reductions/removals under project Scenario (tones of CO_2e)	Estimation of leakage (tones of CO_2e)	Estimation of net emission reduction (tones of CO_2e)
2030	0	0	0	0
2031	0	0	0	0
22032	0	0	0	0
2033	0	0	0	0
2034	0	0	0	0
2035	0	0	0	0
2036	0	0	0	0
2037	0	0	0	0
2038	0	0	0	0
2039	0	0	0	0
Total (tones of CO_2e)	**-16568.81**	**651041.20**	**0.00**	**634472.40**

1.7 Project participants

entity	contact	Brief introduction	Role and responsibility	Function
Entity A	Yunnan Mengxiang Bamboo Industryco.,LTD	Co-funded with a registered capital of 225million by five shareholder like Yunnan investment holding co.,LTD and Xishuangbanna development investment co.,LTD	Project owners	Project participants

1.8 Emission reduction ownership

The project is funded and constructed by Yunnan Mengxiang Bamboo Industry co.,LTD. The project lands are state-owned and collectively-owned. The local government treats the state-owned land as a part of investment reckoning in the stock of Yunnan Mengxiang Bamboo Industry co.,LTD, while the collectively-owned land is rented by with a constant tenure of 50 years. All bamboo products planted on the land and generated carbon sink belong to the Yunnan Mengxiang Bamboo Industry co., LTD. Meanwhile, the GHG generated in this project is not traded under any other standards before.

Section 2: METHODOLOGY APPLIED

2.1 Methodology

The project employs the approved methodology PS-AFOLU afforestation and reforestation on the degraded land (FM-001).

2.2 Methodology eligibility

2.2.1Eligible conditions

(1) The proposed afforestation activity is conducted on degraded land. According to the *Notice on water and soil erosion key prevention regions issued by Yunnan provincial governmentin 2007,* three counties of Xishuangbanna prefecture are among the 30 key prevention areas, and the proposed afforestation activity is conducted on the most degraded lands of these three counties.

Field survey indicates that, the project lands are degrading land with low productivity, mainly covered by ferns, gramineae weeds, scattered trees, shrubs and so on.Pic 2-1, Pic 2-2,Pic 2-3,Pic 2-4 are Reference pictures.

The community survey also shows that the project lands are degrading lands, which used to be lush and thick forest in the history. Due to the improper policies and human intervention, these lands had gone through deforestation several times. Because of the severe land degradation and obvious obstacles, local farmers choose not to afforest on it. Without the project activity, the afforestation land will still remain degraded and the situation will continue to deteriorate, and without human intervention, the project land will not naturally restore to its original state.

(2) Field survey indicates that the project land is latosolic red soil, instead of organic soil.

(3) Field survey indicates that the project lands are hilly areas at an altitude of 1200 meters, not belonging to swamps.

(4) The bamboo planted on the project land is at least 2-meter high, and the bamboo stalk eyebrow diameter is not lower than 2 cm.

(5) Basin irrigation is excluded in the project.

(6) Due to the exclusion of grazing in the project, the fodder quantity under the project activity is less than that of the baseline scenario.

(7) The increase in GHG emissions due to the displacement of pre-project grazing and crop cultivation are insignificant.

(8) The project activity will not result in emigration of the surrounding areas

(9) Under the project scenario, the ground litter will not be collected.

(10) According to the project afforestation technical requirements, without overall ploughing, site preparation follows the land contour, project activities on soil disturbance is small.

2.2.2 Land eligibilty demonstration

In accord with PS requirements, land compliance can be demonstrated by The Eligibility of Lands for Afforestation and Reforestation of CDM Project Activities (Version 01).

The forest definition by Chinese government is

——minimum area： 0.067 hm^2；

——minimum crown covering degree: 20%；

——minimum height：2 meters.

The following ways can demonstrate the project land is non-forest land at the initial stage.

(1)Field survey indicates, as mentioned in 2.2.1,the proposed project are based on degrading lands, which still keep degrading or in a stable low-carbon state, mainly covered by ferns, gramineae weeds, scattered trees, shrubs and so on. Pic 2-1,Pic 2-2,Pic 2-3,Pic 2-4 are Reference pictures. Tree crown covering degree is lower than that of Chinese forest definition, and without the proposed project, the project lands will not reach the standards of Chinese forest definition.

(2)The provenance is hardly transmit to the project land due to the long distance from the neighbouring forest, meanwhile, the renewal of the natural vegetation is impossible because of the land being covered by ferns with competitive edge. These lands have been in a state of non-forest since the 1980s, which implies the natural renewal is impossible, thus, can't reach the Chinese forest standards.

(3) At least since 1989, the project land non-forest state is not caused by human interventions like cutting and indirect natural reasons like fire disaster, pest and disease damage.

(4) Based on the GIS vector data land boundary picture before afforestation, TM remote sensing images of 1988 and 2008, overlay analysis are conducted and it turns out that there is no forest covering in the project lands.

(5) Interview with the local farmers shows history of land use/cover and an activity influencing the land use/cover, which displays that the proposed project lands has been in non-forest state since 1989.

To sum up, the project lands conform to what PS stipulate.

Table 2-1 the current land use/cover and deforestation time

county	township	village	Plots name	Current vegetation	deforestation time
Singsong	Gaza	Manmade	Nannuoshan	Grass, ferns, gramineae weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the agricultural cultivation of the educated youth; in 1980s, the forest land contracted to the households and firewood cutting.
		Nanpa	Manhena	Grass, ferns, gramineae weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the agricultural cultivation of the educated youth; in 1980s, the forest land contracted to the households and firewood cutting.
	Menglong	Nanpen	Mansuola	Grass, ferns, gramineae weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the agricultural cultivation of the educated youth; in 1980s, the forest land contracted to the households and firewood cutting.
			Mansuolaxiazhai	Grass, ferns, gramineae weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the agricultural cultivation of the educated youth; in 1980s, the forest land contracted to the households and firewood cutting.
			Longqiudaheishan	Grass, ferns, gramineae weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the agricultural cultivation of the educated youth; in 1980s, the forest land contracted to the households and firewood cutting.
		Heguan	Jijiapuxishan	Grass, ferns, gramineae weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the agricultural cultivation of the educated youth; in 1980s, the forest land contracted to the households and firewood cutting.
		Bangpia	Honggu anghous	Grass, ferns,	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the

county	township	village	Plots name	Current vegetation	deforestation time
		o	han-!	graminea eweeds, scattered trees	agricultural cultivation of the educated youth; in 1980s, the forest land contracted to the households and firewood cutting.
			Honggu anghous han-2	Grass, ferns, graminea eweeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
Menghai	Gelan ghe	Paz hen	Erdongs han	Herbaceo us and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
			Jiebudia ngejiao dongna nmian	herbaceou s and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
			Jiebudia ngejiao nanmia n	herbaceou s and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
		Pash a	Leidash an	herbaceou s and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
	Bulan gshan	Man guo	Manwai	herbaceou s and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
		Ban zhan g	Oubigej iao	herbaceou s and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
		Men gan g	Weidon g	herbaceou s and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
	Meng song	Daa n	Daan	herbaceou s and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.

county	township	village	Plots name	Current vegetation	deforestation time
		Banggang	Dajianshan	herbaceous and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
			Sangengdi	herbaceous and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
	Menghun	Hekai	Hekai	herbaceous and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,theagricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
			Banpen	Grass, ferns, graminea e weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
	Xiding	Nanleng	Baye	Grass, ferns, graminea e weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
		Jiuguo	Jiuguo	Grass, ferns, graminea e weeds, scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
Mengla	Yiwu	Luode	Taguishan	herbaceous and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.
			Donggualin	herbaceous and scattered trees	In the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s,the agricultural cultivation of the educated youth;in 1980s, the forest land contracted to the households and firewood cutting.

Pic. 2-1 the ex-ante land use picture

Weidong(BSL-IV)

Pic. 2-2 the ex-ante land use picture

Banpen（BSL-I）

Pic 2-3 the ex-ante land use picture

Taguishan(BSL-IV)

Pic 2-4 the ex-ante land use picture

Jiuguo（BSL-III）

2.3 Determine the sources of GHG emission and carbon pools

Based on the methodology applied and PS-AFOLU specification, the GHG emission source and carbon pools of the proposed project are listed below.

Table 2-2 the sources of GHG emission and carbon pools of this project

GHG	Source	Yes or no	Remarks
CO_2	Woody biomass combustion (including bamboo)	No	CO_2 emission is taken into consideration in the carbon storage variation
	Fossil fuel combustion	No	Its potential emission is negligible duo to the methodology
CH_4	Woody biomass combustion	Yes	Notable CH_4 emission caused by Woody biomass combustion (including bamboo) during the soil

GHG	Source	Yes or no	Remarks
	(including bamboo)		preparation and forest managing period
	Fossil fuel combustion	No	Its potential emission is negligible duo to the methodology
	Flooding	No	Flooding is not allowed
	Livestocks and their excrement	No	Grazing is not allowed in project scenario
N_2O	Woody biomass combustion (including bamboo)	Yes	notable NO_2 emission caused by Woody biomass combustion (including bamboo) during the soil preparation and forest managing period
	Fossil fuel combustion	No	Its potential emission is negligible duo to the methodology
	fertilization	No	Its potential emission is negligible duo to the methodology
	Livestocks and their excrement	No	Grazing is not allowed in project scenario

Table 2-3 Carbon pool options within PS project activity boundary

Carbon pool	Yes or no	Remarks
Woods(Bamboo forest) Biomass above ground	Yes	The main carbon pool of the project activities
Woods(Bamboo forest) Biomass underground	Yes	The carbon pool will increase due to the PS project activities
Non-wood biomass above ground	No	Not considered duo to the methodology
Non-wood biomass underground	No	Not considered duo to the methodology
Deadwood	No	Not considered duo to the methodology
Litter	No	Not considered duo to the methodology
Soil organic carbon	No	Not considered duo to the methodology
Harvest woody products(including bamboo products)	No	The harvest products are mainly used to be as pulpwood for papermaking. With short stock time, not considered.

Section 3: ADDITIONALITY

Pursuant to the additionality demonstration requirements of PS-AFOLU, there are two methods to be used to demonstrate a project's additionality. The first is triple test method; the second is *comprehensive tools for identifying CDM A/R project baseline scenario and additionality evaluation*. And this project takes the latter to demonstrate its additionality, details are as follows.

3.1 Comply with laws and regulations

The project owner is going to plant *Dendrocalamus giganteus* on the degraded land in Jinghongcity, Menghai county and Mengla county of Xishuangbanna prefecture, which is belonging to the afforestation activity on barren hills and lands. The *Dendrocalamus giganteus* to be planted is the local provenance, which complies with the national forestry policy, and accords with *The 12th plan of Yunnan National economic development* and *Forestry Yunnan construction effort* put forward by Yunnan provincial government. Besides, it also conforms to the requirement of *setting up an ecological prefecture* proposed by Xishuangbanna prefecture government, but there is no governmental documents stipulating by force that the degraded land of this project has to be used for afforestation.

3.2 Common Practice

The project land takes just a small fraction of Xishuangbanna prefecture, for there are other afforestation projects based there, mainly referring to the economic forest such as rubber tree afforestation and reforestation activities, which is financially attractive, but hard to conduct on degrading areas with bad transportation and higher than 1200m above sea level. Despite that rubber tree afforestation project is experimented by individuals and enterprises on these poor lands, it turns out a failure because of the low yield or no products. The fact that the increasingly raising price including staff salary, seeds, fertilizer and

transportation cost prevents investors from conducting afforestation and reforestation activities on these degraded lands.

Conducting afforestation and reforestation activities on these degraded land is becoming somehow financially attractive due to its carbon sink revenue, which enables the project owner to loan from French Development Agency(AFD) to do afforestation and reforestation activities, in order to obtain ecological benefits as much as possible.

3.3 Implementing barriers

The project additionality and non-baseline scenario will be expounded in the following steps.

Step one, determine the start date of the project. The start date of the proposed project is February 25,2010, which can be proved by the following evidences, *Notice of The Second Batch Foreign Loan Alternative Projects Plan Issued by National Development and Reform Commission in 2009, Approval for FSR of AFD Loan Funded Biological Carbon Sequestration Forestation and Biodigester Construction by Yunnan Provincial Development and Reform Commission, The Soil Preparation Records for Baseline Survey and Afforestation Date.* Without AFD loan and carbon sink revenue, the proposed project is impossible to develop.

Step two, Identify the alternative land use scenarios of the proposed project.

(1) Identify credible alternative land use scenarios

- Analyze the land use history and the current land use and cover and its influencing factors

From the information collected, the project lands are forestland before 1960, but due to the human intervention since 1960s, forest is cut down. Details are like this, in the early 1960s, the “slash-and-burn” farming method of ethnic minority; in the early 1970s, the agricultural cultivation of the educated youth7; in 1980s, the forest land contracted to the households and frequent firewood cutting. Thus, these lands degraded into non-forest barren lands since 1989.

- Field investigation

Interview with the local forestry bureau and community shows that woods keeps reducing in recent decades ,especially since 1989, due to various human intervention like cutting for grain planting, cutting for sale, cutting for firewood and so on. Thus, these lands degraded into non-forest and waste lands. Severe deterioration results in serious water and soil erosion. Without human interference, these lands will keep degrading and deteriorating water and soil erosion, then, the land carbon storage will reduce or keep at a relatively low level.

- National (local/industrial) land use policy and regulation

Since 1980s, Chinese government enacts a series of forestry laws and regulations such as National Implementing Regulations of Forest Law, Grain for Green Regulation, National Act on Wild Animal Protection, Act on Conservation Zone, Regulations for Forest Fire Prevention, Regulations for Forest Pest Control and Prevention and so on. In the 1990s, Chinese government unveiled a policy that whoever conducting tree-planting benefits to encourage tree-planting on waste lands. Villages owning waste lands can contract with individuals or enterprises with a tenure of 50-year and entitle them the right of afforestation. During the contract period, the land ownership cannot be changed, after the terms expire, the land use contract can be extended if an application is offered. In view of a high

cost and low yield of afforestation and reforestation on the waste lands, there are no any afforestation and reforestation activities on the project lands in recent decades.

For the sake of restoring the forest, Chinese government then launches several projects like Grain for Green Project(2001), encouraging farmers to yield the slope land for afforestation by subsidizing them, Key Area Fast-growing and High-yield Plantation Project(2000), Natural Forest Protection Project(1998) , Nature Reserves and Wildlife Protection Project (2000)and so on. These projects, although, do not focus on degraded lands, instead, they focus on developing forestry. Key Area Fast-growing and High-yield Plantation Project aims at planting rubber tree and tea with high economic return. Therefore, without the proposed project, these lands will keep degrading; besides, the proposed project will not affect other afforestation projects supported by the government.

- Relevance with other afforestation projects in this area

Learned from the local forestry department that the previous afforestation project in the three counties of Xishuangbanna targets at planting economic forest like rubber tree on rich lands lower than 1200 meters sea level, with good transportation. And Grain for Green Project areas subsidized by the government are close to the villages. Therefore, there exist a huge difference between the proposed project and Grain for Green Project, the former will not affect the latter.

To sum up, the most possible land use alternative scenarios are as follows,

First, the proposed project is not conducted as a PS project;

Second, the lands keep its original state or keep degrading.

(2) The credible land alternative scenario compliance with laws and regulations

See 3.1

Step three, barrier analysis

Sub-step 1, implementing barrier that at least one land use alternative scenario can be impeded.

- Afforestation and reforestation project has low investment benefit

Forestry enterprise serves as the project owner in the proposed project, which is a financially independent legal entity, and limited to marketing woods (adhere to the national indicator control) and other bamboo products, besides, as the rising of staff salary, forest land restoration fee, afforestation and reforestation project will be done at a high expense, resulting in a low economic return.

- Hard to loan from banks

Conducting afforestation and reforestation project in remote hilly area involves big risk and low economic returns, so it’s hard to get loan from commercial banks. While done as a PS project, it can not only get bamboo product return, but also carbon sink revenue, which increases the project profits. So the proposed project cannot be conducted unless it obtains loan from AFD, which will facilitate a loan agreement to the DOE.

- Hard for the farmer to directly invest in it

Agricultural cultivation is the local farmers’ main livelihood. But local farmers get low income due to the agriculture deeply affected by flood, drought and plant

disease and pest damage. Community survey indicates that the annual household income of the project area is 2219 RMB Yuan (with an annual per capital income740 RMB Yuan). A large number of households live below the poverty level. In addition, there lacks a long-term credit mechanism for farmers to loan and develop forestry. Conducting afforestation and reforestation project involves a high upfront cost and a late economic return, which is impossible for the local farmers to invest in it.

Sub-step 2, remove those land use alternative scenarios with great implementing barriers

To sum up, the first land use alternative scenario –the proposed project is not conducted as PS project, facing unconquerable barrier, thus, excluded from project scenario.

Sub-step 3, Identify the baseline scenario

Baseline scenario: keep the land use degrading status quo.

3.4 Performance standards

The proposed project takes *Comprehensive Tools for Identifying CDM A/R Project Baseline Scenario and Additionality Evaluation* to demonstrate its additionality. In line with PS-AFOLU specifications, the performance standard can be skipped.

Section 4: NETEMISSION REDUCTION/NET ANTHROPOGENIC GHG REMOVALS BY SINKS

4.1 Baseline scenarios

4.1.1 Identify the project boundary

See 1.4.

4.1.2 Land use analysis

The project lands were all forest before 1980s, and then large-scale deforestation took place due to the improper reform policy. Currently, they are barren lands with low productivity, mainly covered by herbs, shrubs, and scarce trees. In accordance with the local land use plan, all land within the project boundary are forestry land, so all kinds of grazing within the boundary is illegal. The baseline survey shows that the current land scarce tree cover is only 1.5%, less than 20%, fall short of the Chinese forest definition standards. In addition, affected by long distance from the provenance, firewood cutting and water and soil erosion, natural update possibly cannot allow the project land to reach 20% forest cover.

Meanwhile, interview with the local farmers shows that arbor tree and non-arbor tree cover of these lands keep reducing over last decades mainly because of the severe firewood cutting and water and soil erosion.

National, local, and industrial land use policy and regulation. Chinese government enacted and revised as well a series of forestry laws and regulations since the 1980s, *National Implementing Regulations of Forest Law, Grain for Green Regulation, National Act on Wild Animal Protection, Act on Conservation Zone, Regulations for Forest Fire Prevention, Regulations for Forest Pest Control and Prevention* and so on.

In the 1990s, Chinese government unveiled a policy that *whoever conducts tree-planting benefits* to encourage tree-planting on barren lands. Villages owning barren lands can contract with individuals or enterprises with a tenure of 30 or 50-years and entitle them the right of afforestation. During the contract period, the land ownership cannot be changed, after the terms expire, the land use contract can be extended if an application is offered. In view of a high cost and low yield of afforestation and reforestation on the barren lands, the project lands is almost non-forest lands in recent decades.

For the sake of restoring the forest, Chinese government then launches several projects like Grain for Green Project, encouraging farmers to yield the slope land for afforestation by subsidizing them, Key Area Fast-growing and High-yield Plantation Project, Natural Forest Protection Project , Nature Reserves and Wildlife Protection Project and so on. These projects, although, do not focus on those degraded lands; instead, they focus on developing forestry. Key Area Fast-growing and High-yield Plantation Project aims at planting rubber tree and tea with high economic return. In addition, whether these project can reach their expected goals or not depends solely on the investment, for they are not enforced by laws, and a big cash flow gap is facing these projects. Over the decades, there has been short of money to support those afforestation and reforestation projects. Once the money is available, it will be used to plant trees on rich land with good transportation. The proposed project is so remote that strong market competitiveness lacks and hard to be incorporated into national afforestation plan. Besides, it’s hard for the local farmers to loan from commercial banks to do afforestation and reforestation projects. Therefore, without the proposed project, these lands will keep degrading; besides, the proposed project will not affect other afforestation projects supported by the government.

The degraded land use by the proposed project is the very forestry land in accordance with the national policy. And other land use like agricultural cultivation and grazing is clearly forbidden. Field survey, local farmer interview and social analysis are combined to show that the possible land use is to keep its current state——barren lands or illegal firewood cutting state or afforestation with carbon sink revenue. .

4.1.3Identification of baseline scenario

In line with the methodology applied in the proposed project, baseline scenario should be demonstrated by *Comprehensive Tools for Identifying CDM A/R Project Baseline Scenario and Additionality Evaluation*. See 3.3. The possible baseline scenario is keeping current land use. Under such baseline scenario, the land cover will keep reducing without natural update. The provenance is hardly transmit to the project land due to the long distance from the neighbouring forest, meanwhile, the renewal of the natural vegetation is impossible because of the land being covered by ferns with competitive edge. These lands have been non-forest since the 1980s, which implies the natural renewal is impossible, thus, can't reach the Chinese forest defined criteria.

Without PS project, the project land will keep degrading as always or at a low carbon state, which is the government-licensed forestry land and precluded from other use. Conducting afforestation and reforestation faces great investment difficult, involving a huge sum of upfront cost and a slim profit afterwards. These lands will keep its current use state since it's hard for the local farmers and enterprises to loan from commercial banks.

In baseline scenario, non-forest biomass carbon pool will keep stable or reducing, therefore, baseline scenario carbon pool variation equals, without PS project, carbon pool storage variation in the project boundary.

4.1.4Categorization of baseline carbon strata

Based on the methodology of PS-AFOLU (version 1.0),see baseline scenario in *SECTION 3 Categorized the baseline carbon strata* in 3.2.

Before the baseline investigation taken place, the project organizer has developed basic research in Xishuangbanna to vectorize information such as project boundary, current land use, geographic conditions and vegetation coverage rates. The research provides basic information and the qualification of the existing lands and preliminarily identifies24project lands, which are scattering in Jinghong, Menghai and Mengla, involving 16 villages of 8 townships of 3 counties, 3582.34 ha in total..

Field investigation and interview show that the differences in climate, soil, plants cover and topographies among 3 counties are subtle. Actually, vegetation and grazing conditions are major factors influencing baseline scenario categorization. The project lands are therefore divided into 4 baseline strata, as listed below,

- BLS-I：grazing carbon stratum of grass, shrub and scattered trees

Vegetation cover:grass+shrub+scattered trees

Land use: grazing land

- BLS-II：non-grazing carbon stratum of grass, shrub and scattered trees

Vegetation cover：grass+shrub+scattered trees

Land use: barren lands

- BLS-III：grazing carbon stratum of grass and scattered trees

Vegetation cover: grass +scattered trees

Land use: grazing land

- BLS-IV：non-grazing carbon stratum of grass and scattered trees

Vegetation cover: grass +scattered trees

Land use: barren lands

Carbon strata details are listed in table 4-1,table 4-2 and table 4-3.

Table 4-1 The General strata Division in Counties

County	Carbon strata	Land serial number	Quantity of land	Area (hm^2)
Jinghong	BSL-I	BSL-JH-0118, BSL-JH-0119, BSL-JH-0122	3	535.47
	BSL-II	BSL-JH-0207, BSL-JH-0220, BSL-JH-0212, BSL-JH-0211, BSL-JH-0216	5	542.80
	BSL-III	N/A		
	BSL-IV	N/A		
Menghai	BSL-I	BSL-MH-0108,BSL-MH-0117	2	257.16
	BSL-II	N/A		
	BSL-III	BSL-MH-0301,BSL-MH-0302,BSL-MH-0303,BSL-MH-0305,BSL-MH-0306,BSL-MH-0309,BSL-MH-0310,BSL-MH-0313,BSL-MH-0314,BSL-MH-0315	10	1410.21
	BSL-IV	BSL-MH-0404,BSL-MH-0421	2	444.26

County	Carbon strata	Land serial number	Quantity of land	Area (hm^2)
Mengla	BSL-I	N/A		
	BSL-II	N/A		
	BSL-III	BSL-ML-0323	1	185.82
	BSL-IV	BSL-ML-0424	1	206.62
Total			24	3582.34

Table 4-2 strata Categorization and Individual Area

Strata number	Strata name	Quantity of land	Area (hm^2)	Rates (%)
BLS-I	grazing carbon stratum of grass, shrub and scattered trees	5	792.63	22.13%
BLS-II	non-grazing carbon stratum of grass, shrub and scattered trees	5	542.80	15.15%
BLS-III	grazing carbon stratum of grass and scattered trees	11	1596.03	44.55%
BLS-IV	non-grazing carbon stratum of grass and scattered trees	3	650.88	18.17%
Total	4 strata	24 lands	3582.34	100.00 %

Table 4-3 ex-ante scattered tree distribution

Strata number	Population	Mean age (year)	Mean DBH(cm)	Mean height (meter)	Number of trees per hectare	Mean canopy density (%)	Predicted mean canopy density (%)
BLS-I	Soft broadleaf forest	6.5	13.17	4.43	39	2.11%	8.4%
	Hard broadleaf forest	7.6	8.19		27		
BLS-II	Soft broadleaf forest	9.1	19.04	6.84	18	0.84%	2.1%
	Hard broadleaf forest	8.6	14.71		13		
BLS-III	Soft broadleaf forest	8.2	20.00	6.40	28	1.14%	3.9%
	Hard broadleaf forest	6.4	7.32		13		

Strata number	Population	Mean age (year)	Mean DBH(cm)	Mean height (meter)	Number of trees per hectare	Mean canopy density (%)	Predicted mean canopy density (%)
BLS-IV	Soft broadleaf forest	11.6	28.98	11.65	25	1.89%	7.2%
	Hard broadleaf forest	16.2	26.96		16		

4.2 Baseline scenario net GHG emission reduction /removal

Baseline scenario carbon pool variation equals, without PS project, carbonpool storage variation within project boundary. Therefore, the baseline net removals will be determined by the following forum:

$$\Delta C_{BSL} = \sum_{t=1}^{t^*} \Delta C_{TREE\_BSL,t} \quad (4.1)$$

Where,

ΔC_{BSL}	Baseline net removals; t CO2e
$\Delta C_{TREE\_BSL,t}$	Change in carbon stock in baseline tree biomass within project boundary in year t,tCO2e；
t	$1, 2, 3, \ldots t^*$ 1, 2, 3, … t* years after the start of the PS project activity

According to the eligibility of PS-AFOLU methodology (version 1.0) applied to the proposed project, baseline net reduction should meet the following needs,

——in baseline scenario, variation of carbon stock above-ground and underground non-tree biomass in the baseline scenario is not considered;

——in baseline scenario, dead wood and litter carbon storage variation are not considered.

——in baseline scenario, the soil organic carbon storagevariation is not considered.

——According to the baseline investigate report, in baseline scenario, since shrub coverage of all carbon strata is less than 5% in all strata, the shrub biomass may be assumed to be zero.

——natural update investigation indicates that slight nature regeneration happens in partial project land, mature period coverage conservative assumption shows that even all natural update grows into trees, it could not reach 20% forest coverage requirement . Meanwhile, these lands with nature regeneration are far from provenance, covered with lush vegetation and heavy litter, and having grazing to some degree, without the proposed project, regeneration is impossible. So variation of carbon stock may be assumed to be zero.

——variation of scattered tree carbon stocks in baseline scenario. According to the baseline investigation, scattered trees exist on all strata, but the covering ratio is small, with a minimum of 0.84%, and a maximum of 2.11%. And scattered tree age gap is big, ranging from 1 year to 35-years. Lots of these trees have not reached the mature period, therefore, during carbon baseline investigation, their future biomass should be estimated.

Therefore, baseline scenario net emission reduction equals, without the proposed project, scattered tree carbon storage variation within the project boundary. In line with the baseline survey, the number, age, species of the scattered tree should be categorized and counted by the following steps,

Scattered tree biomass calculation. Based on the growing curve of hard broadleaf forest and soft broadleaf forest, the average volume V will be calculated, then, based on V, Biomass expansion factor and root ratio, biomass above and underground will be obtained, through carbon content and conversion factor, scattered tree carbon storage variation can be worked out.

Growing curve equation[1]:

Hard broadleaf forest: $V == 0.9741(1-e^{-0.0314 \cdot A})^{4.2366}$

Soft broadleaf forest: $V = 1.12599/((1+9.000025/A)^{6.8837})$ (4.2)

Where, A is Age of the trees

Table 4-4 hard broadleaf forest and soft broadleaf forest parameters

Forest standing	BEF[2]	Density of wood(t D M.m-3)	Root ratio	Carbon fraction(CF)	Conversion factors
soft broadleaf forest	1.59	0.443	0.289	0.5	44/12
hard broadleaf forest	1.67	0.598	0.261	0.5	44/12

Based on the hard broadleaf forest and soft broadleaf forest parameters and their growing curves, scattered tree carbon storage variation of each carbon strata is figured out and listed as below,

[1] P_{141}, Registered CDM projects No. 3561, Reforestation on Degraded Lands in Northwest Guangxi, http://cdm.unfccc.int/filestorage/N/C/Y/NCY49V0GZ6SRHJXOALM8WQIUBDEFPT/PDD.pdf?t=SXZ8bXJlcXppfDDe1eao1fYoJDH3D5nX_984

[2] $P_{60\sim61}$, Registered CDM projects No. 3561, Reforestation on Degraded Lands in Northwest Guangxi, http://cdm.unfccc.int/filestorage/N/C/Y/NCY49V0GZ6SRHJXOALM8WQIUBDEFPT/PDD.pdf?t=SXZ8bXJlcXppfDDe1eao1fYoJDH3D5nX_984

Table 4-5 scattered tree carbon storage variation unit: t CO2e

Strata number	Forest standing	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
BSL-I	soft broadleaf forest	107.0	145.8	186.1	226.2	264.8	301.0	334.4	364.5	391.3	414.8	435.1	452.4	467.0	4090.4
	hard broadleaf forest	39.4	53.0	68.6	86.0	105.0	125.5	147.3	170.0	193.5	217.6	242.1	266.7	0.0	1714.8
BSL-II	soft broadleaf forest	67.4	79.8	91.5	102.3	112.2	121.0	128.8	135.5	141.3	146.2	0.0	0.0	0.0	1126.0
	hard broadleaf forest	17.5	22.7	28.5	34.7	41.5	48.7	56.2	63.9	71.9	80.0	88.1	0.0	0.0	553.7
BSL-III	soft broadleaf forest	253.1	311.4	367.9	421.3	470.7	515.5	555.5	590.8	621.4	647.6	669.8	0.0	0.0	5424.9
	hard broadleaf forest	25.2	36.0	48.8	63.6	80.1	98.3	118.0	138.8	160.7	183.4	206.7	230.4	254.2	1644.2
BSL-IV	soft broadleaf forest	160.8	178.1	193.7	207.6	219.8	230.3	239.2	246.7	0.0	0.0	0.0	0.0	0.0	1676.1
	hard broadleaf forest	101.0	112.8	124.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	338.6
total		**771.4**	**939.6**	**1109.9**	**1141.7**	**1294.1**	**1440.3**	**1579.3**	**1710.3**	**1580.1**	**1689.6**	**1641.7**	**949.5**	**721.2**	**16568.8**

Remarks：In line with baseline survey, the average age of scattered tree is 6.5-year. According to methodology we choose a default value of 20 years to reach a steady state.

So, baseline net emission reduction is counted like this,

$$\Delta C_{BSL} = 16568.8 \text{t } CO_2e \qquad (4.3)$$

4.3 Project scenario net GHG emission reduction/ removals

Project scenario net emission reduction equals carbon storage variation within the project boundary minus increase in GHG emissions as a result of the PS afforestation project. In line with the methodology, non-tree biomass carbon storage variation above and underground may be conservatively assumed to be zero for all strata in the project scenario. Project net removals will be calculated by following forum.

$$\Delta C_{WP} = \Delta C_P - GHG_E \qquad (4.4)$$

Where,

ΔC_{WP}	Project net removals; t CO_2e
ΔC_P	Sum of the carbon storage variation of the selected carbon pool within the project boundary; t CO_2e
GHG_E	Increase in GHG emissions within the project boundary as a result of the PS afforestation project; t CO_2e

The carbon storage variation of the selected carbon pools within the project boundary are estimated using the following equation[3],

$$\Delta C_P = \sum_{t=1}^{t^*} \Delta C_t \quad (4.5)$$

Where,

ΔC_P	Sum of the carbon storage variation of the selected carbon pools within the project boundary; t CO_2e
ΔC_t	carbon storage variation of selected carbon pools, in year t; t CO_2e
t	1, 2, 3, … t*years after the start of the PS project activity; yr
44/12	molecular weights ratio of CO_2 and C; dimensionless

Carbon storage variation of selected carbon pools, in year t:

[3] IPCC GPG-LULUCF 2003, Equation 3.2.3.

$$\Delta C_t = \Delta C_{BAMBOO\_PROJ,t} + \Delta C_{TREE\_PROJ,t} + \Delta C_{DW\_PROJ,t} + \Delta C_{LI\_PROJ,t} + \Delta C_{SOC\_AL,t} + \Delta C_{HWP\_PROJ,t} - C_{TREE\_BSL} - C_{SHRUB\_BSL} \quad (4.6)$$

Where,

ΔCt	Carbon storage variation of selected carbon pools, in year t; t CO_2e
$\Delta C_{BAMBOO\_PROJ,t}$	Carbon stock variation of bamboo tree biomass in project scenario , in year t; t CO_2e
$\Delta C_{TREE\_PROJ,t}$	Carbon stock variation of non-bamboo tree biomass in project scenario, in year t,; t CO_2e
$\Delta C_{DW\_PROJ,t}$	Carbon stock variation of dead woods biomass in project scenario, in year t, t CO_2e.
$\Delta C_{LI\_PROJ,t}$	Carbon stock variation of litters biomass in project scenario, in year t, t CO_2e.
$\Delta C_{SOC\_AL,t}$	Carbon stock variation of SOC biomass in project scenario, in year t, t CO_2e.
$\Delta C_{HWP\_PROJ,t}$	Carbon stock variation of harvest wood product (bamboo) in project, in year t; t CO_2e.
C_{TREE_BSL}	Carbon stock of baseline woods biomass at the start of the project (t CO_2e).
C_{SHRUB_BSL}	Carbon stock of shrub biomass at the start of the project (including small bamboo bundle) (t CO_2e).
t	1, 2, 3, … t*years after the start of the PS project activity

(1) Estimation of bamboo biomass carbon storage variation **(**$\Delta C_{BAMBOO\_PROJ,t}$**).**

Due to annual harvesting or natural mortality supplemented by annual growth of new bamboo culm, bamboo biomass above-ground usually reach equilibrium within seven years after planted. Therefore, as for ex-ante estimation, methodology III is selected to work out bamboo biomass carbon storage variation by following forum,

$$\Delta C_{BAMBOO\_PROJ,t} = \sum_i \sum_j \begin{cases} A_{Bamboo,i,j,t} \bullet \dfrac{C_{BAMBOO_{equilibrium},i,j}}{T_{equilibrium,j}} & for \quad t_a \le T_{equilibrium,j} \\ 0 & for \quad t_a > T_{equilibrium,j} \end{cases} \quad (4.7)$$

Where,

$\Delta C_{BAMBOO\_PROJ,t}$	bamboo biomass carbon storage variation within the project boundary in year t; t CO_2e
$A_{Bamboo,i,j,t}$	Area of bamboo j planted in stratum i , hm^2
$C_{BAMBOO_{equilibrium},j}$	Carbon stock of bamboo j at equilibrium; t $CO_2.hm^{-2}$
t_a	Age of stand(yr) ; t_a =t-a,a: year for afforestation

$T_{equilibrium,j}$	Time needed before bamboo j reaches equilibrium; yr
t	1, 2, 3, … t*years after since the start of the PS project activity

Based on the land eligibility screening, 3582.34hm^2 and meets the PS requirement and all eligible lands are included in the project scope, so the area of the bamboo planted is 3582.34hm^2. Based on the relevant published document *Biomass and its regression models of artificial Dendrocalamus giganteus within different stand ages in Xishuangbanna*[4], bamboo can be divided into 4 age-classes: bamboo age ≤1year-Age-class I, bamboo age between 1~2 years -Age-class Ⅱ, bamboo age between 2~3 years -Age-classⅢ, bamboo age more than 3 years-Age-classⅣ. The Biomass Prediction Model of *Dendrocalamus giganteus* at different stand age isTable 4-6:

Table 4-6 The Biomass Prediction Model

age-class	organ	Biomass regression equation		regression coefficient(R^2)	*F-test*	$F_{0.01}$*-test*
Ⅰ	culm	$Ws = 0.102D^{2.099}$	n = 16	0.967**	434.912	8.68
	branch	$Wb = -0.012D^2 + 0.306D - 0.58$	2.8 ≤ D ≤16.3	0.848**	38.918	6.51
	leaf	$Wl = -0.016D^2 + 0.380D - 0.808$		0.829**	33.84	6.51
	root	$Wr = 0.045D^{1.863}$		0.902**	138.818	8.68
	total	$Wt = 0.226D^{1.925}$		0.966**	419.898	8.68
Ⅱ	culm	$Ws = 0.334D^2 - 2.475D + 5.734$	n = 19	0.980**	391.821	6.23
	branch	$Wb = 1.292\ln(D) - 0.630$	1.97 ≤ D ≤18.4	0.812**	69.29	8.4
	leaf	$Wl = 0.100D + 0.038$		0.823**	78.938	8.4
	root	$Wr = 0.060D^2 - 0.398D + 1.542$		0.985**	512.901	6.23

4

Biomass and its regression models of artificial Dendrocalamus giganteuswithin different stan d ages in Xishuangbanna, Vol. 31 No.12，54-60，
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age-class	organ	Biomass regression equation		regression coefficient(R^2)	*F-test*	$F_{0.01}$-*test*
	total	$Wt = 0.398D^2 - 2.709D + 8.046$		0.986**	517.702	6.23
III	culm	$Ws = 0.072D^{2.331}$	n = 16	0.975**	535.524	6.51
	branch	$Wb = 1.497\ln(D) - 0.877$	1.91≤ D ≤17.3	0.934**	198.213	6.51
	leaf	$Wl = 0.118D - 0.214$		0.972**	491.001	6.51
	root	$Wr = 0.061D^2 - 0.388D + 1.373$		0.980**	318.366	6.7
	total	$Wt = 0.275D^{1.955}$		0.988**	1195.999	6.51
Ⅳ	culm	$Ws = 0.131D^{2.141}$	n = 12	0.986**	723.974	10.04
	branch	$Wb = -0.010D^2 + 0.365D - 0.400$	1.97 ≤ D ≤16.7	0.926**	56.283	8.02
	leaf	$Wl = 0.091D - 0.085$		0.857**	59.748	10.04
	root	$Wr = 0.071D^2 - 0.575D + 1.675$		0.960**	108.897	8.02
	total	$Wt = 0.385D^{1.820}$		0.987**	787.853	10.04

remarks:W：kg； D: cm； ** *P*< 0.01

The average DBH of *dendrocalamusgiganteus* is 10cm when it reaches period of stabilized production. According to the Afforestation Standard of the company and FSR of the project, planting density of *Dendrocalamusgiganteus*is 306 plant/mu, Age-classⅣ will be harvested per year after 7 years from plantation. It can be assumed that there is 76.5 plant for each age-class. According to the calculation, biomass for one hectare is 103.28t (dry weight). Using IPCC default value-0.5 in calculation, we can get 51.64t carbon sink for each hectare. The sum of Dendrocalamusgiganteus carbon sinks each hectare in 7 years is as table 4-7：

Table 4-7 Amounts of carbon sinks per unit area of bamboo

Year	Amount of Dendrocalamusgiganteus carbon sinks per hectare (t/hm^2)
1	7.4
2	14.8
3	22.1
4	29.5
5	36.9
6	44.3
7	51.6

(2) Estimation of carbon sink variation of non-bamboo tree biomass in project scenario ($\Delta C_{TREE\_PROJ,t}$).

Counted by the latest version of Tree *and Shrub Carbon Storage Variation Estimating Tools for CDM Afforestation and Reforestation Project*, *Dendrocalamus giganteus* is the only planted tree species in the proposed project, so $\Delta C_{TREE\_PROJ,t}$ is zero.

(3) Estimation of carbon sink variation of dead woods biomass in project scenario.($\Delta C_{DW\_PROJ,t}$) .

Not considered.

(4) Estimation of carbon sink variation of litters biomass in project scenario.($\Delta C_{LI\_PROJ,t}$) .

Not considered.

(5) Estimation of carbon sink variation of SOC biomass in project scenario. ($\Delta C_{SOC\_AL,t}$) .

Not considered.

(6) Estimation of carbon sink variation of harvested bamboo products.($\Delta C_{HWP\_PROJ,t}$) .

Not considered.

(7) Estimation of carbon storage of baseline tree biomass at the start of the project. (C_{TREE_BSL}) .

Counted by the latest version of Tree *and Shrub Carbon Storage Variation Estimating Tools for CDM Afforestation and Reforestation Project*[5], scattered tree distribution at the start of the project is shown in table 4-3.

Based on scattered tree distribution, classification and allometric growing equation, scattered tree biomass can be worked out as follows[6],

Soft broadleaf forest： $W = 0.09517(D^2 H)^{0.847291}$

Hard broadleaf forest： $W = 0.6131(D - 0.9678)^2$ (4.8)

Based on table 4-3 data, all strata carbon storage at the start of the project can be worked out, table 4-8,

Table 4-8 Carbon storage of all carbon strata at the start of the project

Strata No.	Forest stand	biomass (kg D.M/culm)	(CF)	Carbon storage (t CO_2e)
BLS-I	Soft broadleaf forest	26.5	0.5	1503.6
	Hard broadleaf forest	32.0	0.5	1254.0
BLS-II	Soft broadleaf forest	71.6	0.5	1281.9
	Hard broadleaf forest	115.7	0.5	1497.0
BLS-III	Soft broadleaf forest	73.5	0.5	6024.7
	Hard broadleaf forest	24.7	0.5	940.4
BLS-IV	Soft broadleaf forest	228.9	0.5	6829.9
	Hard broadleaf forest	414.3	0.5	7909.2
				27240.7

[5]While using this tool, the height of baseline trees should be less than 2m, diameter 2cm, area less than 1mu and bamboo population canopy rate less than 20%.

[6] Guide to Carbon Sink Calculation and Test issued by National Forestry Ministry.2011,2.

The baseline tree biomass carbon storage at the start of the project is about 27240.7 t CO_2e。

(8) Estimation of the shrub biomass carbon storage at the start of the project (C_{SHRUB_BSL}) .

Not considered.

4.4 Leakage

No leakage occurred in the project, so,

$$LK = 0$$

Where,

LK GHG emission caused by leakage.(t CO_2e)

4.5 Uncertainty

With reference to the applied methodology, compared with the biomass carbon storage variation, variation of SOC carbon stock, harvested wood products, litter and dead woods biomass is relatively small, the uncertainty could not be estimated. Based on methodology 5.1, the total uncertainty of the project equals the project biomass uncertainty, so 10% carbon sink is taken as uncertainty of this project.

4.6 PS carbon credit calculation

In line with the methodology applied, PS carbon credit can be worked out,

$$C_t = (\Delta C_{WP} - \Delta C_{BSL} - \Delta C_{LK}) \cdot \begin{cases} 1 & if \quad UNC \le 0.1 \\ 1-(UNC-0.1) & if \quad UNC > 0.1 \end{cases}$$

Where,

$C_{,t}$	GHG emission reduction/removals of the project in year t, (t CO_2e)
ΔC_{WP}	in project scenario, difference between carbon storage variation and increase in GHG emission in year t,(t CO_2e)
ΔC_{BSL}	in baseline scenario, the total carbon storage variation in year t, (t CO_2e)
ΔC_{LK}	carbon storage variation and increase in GHG emission caused by leakage in year t, (t CO_2e)

UNC Project emission reduction uncertainty, (%)

To sum up, during 30-year crediting period, total PS carbon credit of this project is 634,472.40t CO_2e.

4.7 Net emission reduction/ removals

Crediting year	Predicted net emission reduction in baseline scenario (tones of CO_2e)	Predicted net emission reduction in project scenario (tones of CO_2e)	Predicted leakage (tones of CO_2e)	Predicted net emission reduction/removals (tonesofCO_2e)
2010	-771.39	31139.97	0	30368.58
2011	-939.56	96897.42	0	95957.86
2012	-1109.86	96897.42	0	95787.56
2013	-1141.74	96897.42	0	95755.68
2014	-1294.11	96897.42	0	95603.31
2015	-1440.34	96897.42	0	95457.08
2016	-1579.28	96897.42	0	95318.14
2017	-1710.26	38516.72	0	36806.45
2018	-1580.14	0	0	-1580.14
2019	-1689.61	0	0	-1689.61
2020	-1641.74	0	0	-1641.74
2021	-949.54	0	0	-949.54
2022	-721.23	0	0	-721.23
2023	0	0	0	0
2024	0	0	0	0
2025	0	0	0	0
2026	0	0	0	0
2027	0	0	0	0
2028	0	0	0	0
2029	0	0	0	0
2030	0	0	0	0
2031	0	0	0	0
22032	0	0	0	0
2033	0	0	0	0
2034	0	0	0	0
2035	0	0	0	0
2036	0	0	0	0
2037	0	0	0	0
2038	0	0	0	0
2039	0	0	0	0
Total (tones of CO_2e)	**-16568.81**	**651041.20**	**0.00**	**634472.40**

Section 5: PERMANENCE AND RISK MITIGATION

5.1 Risk assessment

Due to the rick assessment tools of PS have yet to be announced, according to PS-AFOLU rules and the methodology of the bamboo plantation on degraded land which is adopted by this project, the risk assessment uses following tools for evaluation:

$$RISK=RISK_{fire}+PT/30\times5\%$$
$$RISK_{fire}=PT\times F_{fire}$$

where：

RISK	project risk, %
$RISK_{fire}$	forest fire risk,%
PT	project time,year
F_{fire}	forest fire risk factor,%

The default of forest fire risk factor of Yunnan province is 0.079% by national publication; project time is 30 years, plugging the number into the formula, the result is:

$$RISK=RISK_{fire}+PT/30\times5\%$$
$$=30*0.079\%+30/30*5\%=7.37\%。$$

5.2 Risk mitigation

According to the adopted Panda Standard ——the methodology of the bamboo plantation on degraded land requirement, the proposed project will follow the method in section 7.3 Option for Mitigation of Risk in PS-AFOLU.Project Proponents may set aside, at each verification and issuance of new PS Credits, this percentage of offsets from the Project itself for deposit t o the Panda Buffer Pool. In this case PS Credits issued to the Proponent's accou nt will be:

$$PSC_t=(C_{t2}-C_{t1})\times(1-BUF)$$

where：

PSC_t	NumberofPSCreditsattime
C_{t2}	CumulativetotalnetGHGemissionsreductionsuptotimet2,includingallrequireddeductionsfor Leakageanduncertainty
C_{t1}	CumulativetotalnetGHGemissionsreductionsuptotimet1,includingallrequireddeductionsfor Leakageanduncertainty
BUF	PercentageofProjectcreditscontributedtothePandaBufferPool

According to section 5.1 Risk Assessment result, 7.37% of offset from the project itself for deposit to the Panda Buffer Pool. In this case, the number of PS Credits in the 30 years is:

$$PSC_t=(C_{t2}-C_{t1}) \times(1-BUF)$$
$$=634472.40\times(1-7.37\%) =587711.8t\ CO_2e$$

Section 6: MONITORING

6.1 Monitoring frequency

The monitoring content of the proposed project include project boundary, afforestation activities and carbon stock. Project reports and certification frequency is 10 years once.

6.2. Monitoring of the project implementation:

6.2.1 Monitoring of Project Boundary

---Use GPS or other verifiable measures to determine the geographic boundary of project plots(the latitude and longitude of the polygon plots' inflection point) Described in the monitoring report the coordinate system and the precision of the instruments and equipment be used.

--- Checking the actual project boundary is consistent with the PF description. If the actual boundary locates out the PF description, the outer part is not accounted as project boundary.

---Put all the measured GPS coordinates into GIS, to calculate the areas of project plots and each carbon strata.

---In the crediting period, project boundary should be monitored regularly. If there is any change of project boundary occurred such as deforestation, it should measure the geographic coordinates and area of the deforestation land and explained in the next verification. The plot which deforestation land located should be excluded from the project boundary, and it will not be monitored anymore. And also, if some plots because of some reason failed in forestation, the plot was utilized by other ways; the plot should be excluded from the project boundary and no longer be monitored and verified. But the project plot which once is excluded from the project boundary, it can't be taken into the project boundary again. If the excluded plot is used to be verified before, its verified

carbon stocks in previous time should stay the same and take into the calculation of carbon stock changes.

6.2.2 Monitoring of afforestation activity

The bamboo afforestation activity includes cleaning up, land preparation, afforestation, tending management, felling, protection management, forest fire prevention, extermination of disease and insect, and so on. The Plot Afforestation Monitoring Card (as Table 6-1 below) can be used to record all happened activities in each plot. One card is set up for one plot to make sure all project related activities are coincident to conditions of referred methodology tool. The project participant should follow the bamboo afforestation technical requirements of China and should be accord with the technical standards of forest resource investigation. The project participant must set up Standard Operation Procedure (SOP) and Quality Assessment and Quality Control (QA/QC) in monitoring activities, which should be included in field data collection, data record, management and archive.

Table 6-1the Plot Afforestation Monitoring Card

Monitoring Item	**Record content**		**Remark**
Geographic location	Plot No.		
	County		
	Township		
	Village		
	Forest No.		
	Working Plot No.		
Land owner			
Bamboo type	Type 1		
	Type 2		
	Hybrid way and proportion		
Area (hectare)	Designed area for each plot		

Monitoring Item	**Record content**				**Remark**
	Actual working area				
Boundary monitoring		Monitoring date	Comparison with previous monitoring result		Attached project boundary coordinates
	First				
	Second				
	Third				
	Fourth				
	Fifth				
	Sixth				
Land preparation	Date				
	Method				
	Spec				
Soil preparation	Date				Keeping implementation contract
	Method				
	Spec				
Planting	Date				Keeping implementation contract
	plant/hectare				
Fertilizing	Date	Type	Amount of fertilizer		Keep related photos and purchase invoice and other related other evidence.
Survival rate and preservation rate investigation	Date	Survival rate/preservation rate			Provide investigation method
Complementary planting	Date	Type	plant/hectare		Keeping implementation contract
Tending management	Date	Content	Method and Spec		

Monitoring Item	Record content			Remark	
Disease and insect	Time				Measuring the GPS coordinates of infected boundary.
	Name of disease and insect				
	Infected area(hectare				
	Infected level				
	Prevention method				
	Prevention result				
Fire	Time				Measuring the GPS coordinates of infected boundary.
	Infected area(hectare)				
	Type of fire				
	Infected degree				
Felling	Date	Method	Felling volume	Purpose	
Other operation managing activities and issues	Date	Description			

6.2.3 Operating procedure and quality control/quality assessment (QA/QC) procedure

For ensure the net emission reduction/removals is accurate, reliable, verifiable and transparent, the quality assessment and quality control (QA/QC) procedures will be implemented, which include:

(1) Reliable filed investigation

For ensure the reliable field investigation:

----Each step of field investigation should include all detailed standard operation procedure (SOP) that is required in the field measure and verification files, and this should be established and insisted till the end of the project.

----The spot trainings for date collecting and data analysing will be held on the actual working field for staffs.

----The training course should ensure all the working staffs can fully realize all the procedures and aware the importance to collect high accuracy data.

----One file which shows those steps are implemented should be submitted as part of monitoring report.

----Any new staff will be sufficiently trained.

(2) Field data collection of validation

In order to verify the sample plots has been set up and measurement correctly:

------15% of plots will be chosen at random, and remeasured by another team.

------ The location of plots are the main points of remeasuring.

------ Remeasured data should be comparing with original data. The error of two measures should be less 5% otherwise it will be measuring again. All errors will be corrected and recorded. Using percentage to express errors, and provide measurement error estimation.

(3) Approve the input data and analysis

Take sufficient analysing for original data which were input into spread sheet, and to build up a reliable carbon storage database. During the process of data analysis, if the monitored data show obvious abnormal, it should communicate

with data measuring staff to solve the problem. If there are any problems referring monitored data which cannot be solved, the plot should not be taken into the reliable analytic rage for the carbon storage.

(4) Data maintenance and filing

Keep paper documents and electronic documents on file, and data copyare provided to participants. All electronic data and reports are copied on long-term storage CD. Files including

------ All the original field measurement data, laboratory data, data analysis and the copy of trial table.

------ All the electronic tables for calculating the change of carbon stock.

------All kinds of pictures product in GIS;

------Copy of measurement and monitoring report.

6.3 Sample design and stratification

Stratified method of ex-ante project baseline is described in 4.1.3, *Dendrocalamus giganteus* is the only one bamboo type used in proposed project afforestation activities, for making the inner homogeneous and reducing the inner variability of project carbon strata, to improve the measuring accuracy and lowing down the uncertainty, the project scenario will be stratified into 2010 and 2011 two layers according to the time of afforestation.

6.3.1 Sample volume

Bamboo biomass monitoring should be controlling, according to the applied methodology, which should get to 90% of reliability level, the average is ± 10%. Using “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities” to calculate. Assuming that the cost of sample plots construction is constant, to use “Calculation of the number of

sample plots for measurements within A/R CDM project activities" to determine the volume of permanent sample plots and space allocation scheme.

6.3.2Plot size

The bamboo forest stands density is 250clumps per hectare, so the plot is set to 400 square meters (20m×20m).

6.3.3 Plot location

To avoid the subjectively selecting plot location (such as the middle of plot, reference point of plot, plot middle position transition) and to ensure the high possibility of selected plots distributed averagely in each layer, the fixed plots location should be determined by system, but the start point is random. The detailed location method is as below:

Step 1: On the computer, using geographic information system software, to divide project area into many grindings (spec as 100m×100m). To calculate the crossing points of grindings N which locate in each layer (it's the possible middles of plot). The crossing points in each layer should be numbered from 1.

Step 2: In Excel spread sheet, using formula" ROUND(RAND()*[max_N],0)"to create a random number. Taking the crossing point whose serial number is the same as created random number to be the middle of fist plot.

Step 3: Start from the middle of first plot, to transit the position by the order of "west-east-south-north", to select next plot by a fixed distance. The fixed distance is determined by the numbers of crossing points in layers and the plots numbers. For example the fixed plots number is 10, and the crossing points in layer are 100, so the plots should be selected by the interval of 10 crossing points. If the shortest distance from plot margin to project boundary is less than 10 meters, or a part of the plot locates in the position out of project or carbon strata of the project, the plot should be transited toward the middle point.

In actual measuring, GPS is used to determine the geographic position of plots (by GPS coordinates), and then to record and save the data of plot position and carbon stratas.

To build up the permanent marks on the middle point and four angle points of the plot (the PVC pipe of 5cm diameter and 30 cm length, embedded 20cm into the ground, 10 cm above the ground), this is easier to precisely find out the fixed plot boundary in next monitoring activity. After this, it's need to measure the BDH and the ages of each plant bamboo in the fixed plot.

After the field measures, if the precision is less than 10%, it should based on the standard derivation of measured biomass storage volume to re-calculate the plots number as method described above, and also the new plots should be selected and allocated as method above.

6.4 The monitoring of baseline scenario emissions / carbon removals

According to the requirement of methodology, baseline scenario emissions were determined before the project start. There is no need to monitor the baseline scenario carbon removals in crediting period.

6.5 The monitoring of project scenario emissions / carbon removals

6.5.1 Calculate the changes of carbon stock in project boundary

In order to calculate the changes of carbon stock in project boundary, the data required to be monitored as follows:

Data / Parameter:	w_i
Data unit:	dimensionless
The Number of Equations:	(6.5) and (6.6)
Description:	ratio of project carbon strata i to total area
Source of data to be used:	Field measurements
Monitoring Procedure	Use national forest resources survey related technical details, specifications and standard operation procedure (SOP)
Monitoring frequency	After the first verification, monitoring will be done once in ten years
QA/QC Procedure：	Use QA/QC procedures in national forest resources survey related technical details, specifications, standards

Data / Parameter:	$A_{p,i}$
Data unit:	hm^2
The Number of Equations:	"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" equation (4) and (18); "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities" equation (7) ,(12)and (13);
Description:	area of plot p in stratum i
Source of data to be used:	Field measurements
Monitoring Procedure	Use national forest resources survey related technical details, specifications and standard operation procedure (SOP)
Monitoring frequency	After the first validation, monitoring will be done once in ten years
QA/QC Procedure：	Use QA/QC procedures in national forest resources survey related technical details, specifications, standards

Data / Parameter:	DBH
Data unit:	cm or other unit of length
The Number of Equations:	"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" equation (2) and (15); "Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities" equation (1) ,(2)and (4);
Description:	Usually use Breast height diameter or Eyebrow-diameter, if not, any diameter (Eyebrow-diameter) or other unit of monitoring, eg. ground diameter , basal area etc.
Source of data to be used:	Field measurements
Monitoring Procedure	Use national forest resources survey related technical details, specifications and standard operation procedure (SOP)
Monitoring frequency	After the first verification, monitoring will be done once in ten years
QA/QC Procedure	Use QA/QC procedures in national forest resources survey related technical details, specifications, standards

Data / Parameter:	*BA*
Data unit:	year
The Number of Equations:	(6.1)
Description:	Age of bamboo
Source of data to be used:	Field measurements
Monitoring Procedure	Record
Monitoring frequency	After the first verification, monitoring will be done once in ten years
QA/QC Procedure	Use QA/QC procedures in national forest resources survey related technical details, specifications, standards

Data / Parameter:	*A*
Data unit:	hm^2
The Number of Equations:	(6.8)
Description:	Whole area of the project
Source of data to be used:	Field measurements
Monitoring Procedure	Use national forest resources survey related technical details, specifications and standard operation procedure (SOP)
Monitoring frequency	After the first verification, monitoring will be done once in ten years
QA/QC Procedure	Use QA/QC procedures in national forest resources survey related technical details, specifications, standards

Data / Parameter:	T
Data unit:	year
The Number of Equations:	"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities" equation (12) and (25);
Description:	Time span between two continuous monitoring.
Source of data to be used:	recorded time
Monitoring Procedure	not applicable
Explanation	Two continuous monitoring is the different time in t2 and t1 (eg. April t1 and September t2), so time span is not an integer year.

6.5.2 The measurement and estimation of carbon storage change

For the consideration of conservative estimation, it's not to measure and calculate the scattered tree when the project started. According to the chosen methodology, it doesn't need to measure and calculate the non-tree plant (such as herb, grass and shrub).

During the monitoring activity of bamboo afforestation project, the most important thing is to measure the carbon volume stored in bamboo stock, and the carbon stock change estimation and allometric equation methods are applied in this project, the procedure is as below:

Step 1: To measure the number, the ages and the BDH of bamboo plant in each fixed plot.

Step 2: According to the allometric equation in table 4-6 to calculate the biomass volume for each bamboo plant

Step 3: To calculate the biomass $B_{TREE,p,i,t}$ in plot p of stratum i in the year t,

$$B_{TREE,p,i,t} = \sum_{j} B_{TREE,j,p,i,t} \quad (6.1)$$

Step 4: To calculate the biomass per hectare $b_{TREE,p,i,t}$ in plot p of project stratum i in the year t,

$$b_{TREE,p,i,t} = \frac{B_{TREE,p,i,t}}{A_{p,i}} \quad (6.2)$$

Where $A_{p,i}$ is the Area of plot p in stratum i(hm^2)

Step 5: To calculate the biomass per hectare and the variance of biomass per hectare in stratum i at a given point of time in year t

$$b_{TREE,i,t} = \frac{\sum_{p=1}^{n_i} b_{TREE,p,i,t}}{n_i} \quad (6.3)$$

$$s_i^2 = \frac{n_i \cdot \sum_{p=1}^{n_i} b_{TREE,p,i,t}^2 - \left(\sum_{p=1}^{n_i} b_{TREE,p,i,t} \right)^2}{n_i \cdot (n_i - 1)} \quad (6.4)$$

Where：

$b_{TREE,i,t}$	the biomass per hectare in project stratum i at a given point of time in year t, ($td.m.hm^{-2}$)
n_i	Number of sample plots in stratum i
s_i^2	Variance of biomass per hectare in stratum i at a given point of time in year t, $(td.m.hm^{-2})^2$

Step 6: To calculate mean biomass per hectare and variance of biomass per hectare of the project in the year t

$$b_{TREE,t} = \sum_{i=1}^{M} w_i \cdot b_{TREE,i,t} \quad (6.5)$$

$$s_{b_{TREE}}^2 = \sum_{i=1}^{M} w_i^2 \cdot \frac{s_i^2}{n_i} \quad (6.6)$$

Where：

$b_{TREE,t}$	Mean tree biomass per hectare within the project boundary at a given point of time in year t,($td.m.hm^{-2}$)
w_i	Ratio of the area of stratum i to the sum of areas of biomass estimation strata (dimensionless)
M	Number of tree biomass estimation stratum within the project boundary

Step 7: To calculate the uncertainty of the mean biomass per hectare of the project in the year t

$$u_{b_{TREE,t}} = \frac{t_{VAL} \cdot s_{b_{TREE,t}}}{b_{tree,t}} \quad (6.7)$$

Where：

$u_{b_{TREE,t}}$	Uncertainty of tree biomass per hectare within the project boundary at a given point of time in year t, %
t_{VAL}	Two-sided Student's *t*-value for: (i) Degrees of freedom equal to *n – M*, where *n* is total number of sample plots within the project boundary, and *M* is the total number of tree biomass estimation strata; and (ii) a confidence level of 90%. For example two-sided Student's *t*-value for a probability value of10% (which implies a 90% confidence level) and 45 degrees of freedom can be obtained in Excel spreadsheet as "=TINV(0.10,45)"1 which returns a value of 1.6794

Step 8: To calculate carbon stocks in bamboo trees within the project in the year t:

$$C_{TREE,t} = A \cdot b_{TREE,t} \cdot CF_{BAMBOO} \cdot \frac{44}{12} \quad (6.8)$$

Where：

A	Sum of areas of the bamboo biomass estimation stratum within the project boundary(hm^2)
$C_{TREE,t}$	(t CO_2e) Carbon stock in bamboo trees within the project boundary in the year t
CF_{BAMBOO}	Carbon fraction of bamboo tree, a default value is0.4.

Step 9: To calculate the change in carbon stock in bamboo trees within the project boundary in the year t; assuming that the change of bamboo biomass between two monitoring activities is a linear growth, so:

$$dC_{TREE,(t_1,t_2)} = \frac{C_{TREE,t_2} - C_{TREE,t_1}}{T} \quad (6.9)$$

$$\Delta C_{BAMBOO\_PROJ,T} = dC_{TREE,(t_1,t_2)} \cdot 1yr \ (t_1 \le t \le t_2) \quad (6.10)$$

Where:

$dC_{TREE,(t_1,t_2)}$	Rate of change in carbon stock in bamboo trees within the project boundary during the period between a given point of time in year t_1 and a point of time in year t_2(tCO_2ea^{-1}) ;
$\Delta C_{BAMBOO\_PROJ,t}$	The change in carbon stock in bamboo trees within the project boundary at a given point of time in year t(tCO_2e)
C_{TREE,t_2}	the carbon stocks in bamboo trees within project boundary at a given point of t_2(t CO_2e)
C_{TREE,t_1}	the carbon stocks in bamboo trees within project boundary at a given point of t_1(t CO_2e)
T	the time interval between tow monitorings($T=t_2-t_1$)

6.6.Leak Monitoring

Non.

Section 7: ADDITIONAL BENEFITS

7.1Social impacts

Farming and cash crops is income source of rural households in local communities. The main income source of local communities is dependent on resources and environment highly. Economic income and geographical conditions are complementary to each other. Economic income is generally low. This project employs the model of independent operation to develop raw material bamboo forest with high quality by creating *Dendrocalamusgiganteus* forest on degraded land.

The major social benefits of the project include:

7.1.1Increase income source:

Project construction and operation need about 130,000 man-day labours. The cost for each man-day labour is 50~80 Yuan (RMB), so the local farmers can get 6,500,000~10,400,000 Yuan (RMB) per year. At the same time, Local farmers receive 40% of the bamboo product revenue as compensation for land leases .

7.1.2 Employment

Each afforestation land can employ two people after project implement. 24 afforestation lands will provide 48 long-term jobs. The workforces of the proposed small scale bamboo carbon sink afforestation project come from local place and surrounding communities.

7.1.3 Strengthen social cohesion

Farmers or communities cannot operate the whole process of the project successfully (investment-production-sale), The proposed small scale bamboo carbon sink afforestation project will set up the close relationship among individuals, communities, company and local government.

7.1.4 Technical training and demonstration

Community survey shows that community farmers are lack of skill to get high quality seed, cultivate seed with high survival rates, and prevent fire and forest pest. This is also a major barrier for local communities. In the proposed small scale bamboo carbon sink afforestation project, the local forestry systems and forest farms will organize training in order to helping them to understand some problems which involved in project evaluation, eg. seedling chooses, nursery management, soil preparation, afforestation module and integrated control for diseases and pest insects.

7.1.5 Cultural resource

There is no cultural heritage and cultural protected areas in project area. So the proposed small scale bamboo carbon sink afforestation project couldn’t cause serious problems for cultural heritage. In addition, the project does not involve any local social gathering or other activities, which have no effect on local gathering and religious activities.

7.1.6 Women and minority groups

The project involves 3 counties, 8 towns and 16 administrative villages of Jinghong, Menghai and Mangla. There are 25514 women (about 48.6% of the total number) and 47034 minorities (about 89.7% of the total number) in project area. Women and minority groups participate in the project actively and get salary by working. And then, they can get some technical training during the project. However, pay more attention on national customs of minority groups is very important. We should respect their national and cultural characteristics and don’t affect their production and life.

7.1.7 Community

Although the project limited the graze activities and also increased the cost of livestock breeding, villagers need to go further place for graze which takes time

and energy, but for the villagers in the same village who are not involved in the bamboo afforestation plots they can get salary by joining in the afforestation, managing activities. There is no adverse effect in these areas.

7.2Environmental impacts

By creating 3582.34 hectare are *Dendrocalamus giganteus* on the humid areas of north tropical and south Asian tropical low-mountain valley, the proposed small scale bamboo carbon sink afforestation project can improve forest coverage and bring some additional environmental benefit.

7.2.1 Conservation of biological diversity and ecosystem

It is good to protect biodiversity by choosing native trees to create a forest, include:

(1) Enhance biodiversity conservation by improving connectivity of forest ecosystem landscape around forest ecosystem;

(2) Enhance forest connectivity by afforestation. It is important to protect threatened species by increase forest area;

(3) The proposed small scale bamboo carbon sink afforestation project brings some income to local communities, which can reduce poaching, firewood collection, illegal logging and non-timber forest products collection in the conservation district, in order to reduce threats of biodiversity.

7.2.2 Erosion control

Bamboo forest will produce large amounts of litter annually with a strong water absorption power. The quantity of water absorption can get to 2 to 4 time of own dry weight. According to some relevant study, with common situation the average retention rate of ground litter layer of bamboo forest is 270%~290%, which get to the maximum retention rate among forest litter retention rate. Moreover, bamboo has a well-developed root system. According to the survey, a

clump of bamboo can fix 6 cubic meters soil. As the project is planted forest which have more human intervention, water and soil conservation rate is lower than above data, but it is good for improve ecological environment of steep slope and local area which exist land degradation and water and soil erosion, and get more water and soil conservation benefits.

7.2.3 Risk analysis and countermeasures

The influence on biodiversity from planted forest management:

(1)Fire and pest risk: company will unify their management and provide some technical training to households and communities, in order to enhance management and monitoring, create firebreaks, and reduce fire and pest risk.

(2)Soil preparation: strip soil preparation along the contour line will be used to soil preparation. It means to turn the soil of partial afforestation land alone the contour line, and maintain a certain width of original vegetation and land. Strip soil preparation should maintain original vegetation and prevent water and soil erosion, improve site conditions and prevent soil corrosion. So, the negative impact of soil preparation is relatively small.

(3)Fertilization: on the rational fertilization conditions, try to return bamboo leaves and other weeds to woodland possibly. So, the potential risk of using fertilizer will reduce to the minimum range.

(4)Pesticide: The inappropriate use of pesticides will endanger natural environment, pollute soil, water and air, and bring a threat to wild animals. The proposed project will popularize biological natural enemies' prevention measures and reduce pesticide using.

To sum up, all risks are not very significant.

7.3Stakeholder comments

7.3.1 A brief introduction on how to collect stakeholder comments of the project

Investigate all villages and Collect stakeholder comments by Participatory Rural Appraisal (PAR). The concrete steps are as follows:

Step 1: On March.16th 2010, Yunnan Academy of Scientific and Technical Information and Yunnan MengXiang Bamboo Industry Co.,Ltdheld training sessions of community survey on Yunnan Xishuangbanna Bamboo Afforestation Project. On the training meeting, they concretely explained and demonstrated the methods, contents and other problems, which needed to be noted during survey period, of community surveys. About 24 participants Yunnan MengXiang Bamboo Industry Co.,Ltd joined in the training and learned the project significance, procedure, method, and using method of assessment form. Experts form TNC also gave them a report on the project.

Step 2: Organize assessment team, collect relevant socio-economic data, design assessment plan and prepare some tools for participatory village rapid assessment.

Step 3: Each group will organize participatory village rapid assessment. 16 people from Academy of Social Sciences of Yunnan Province, Green Environmental Development Fund of Yunnan Province, Forestry Bureau of Xishuangbanna, Forestry Bureau of Jinghong City, Forestry Bureau of MenghaiCounty , Forestry Bureau of Mengla County and Yunnan MengXiang Bamboo Industry Co.,Ltd joined in the survey which divided into 3 survey groups. Assessment methods including:

Semi-structured interview:

A. Key Members Interview: village master and other people who have more knowledge on local socio - economic situation, land and forest resource, land use and ownership, firewood consumption, grazing behaviour, essential activities, environmental situation and people. Based on the visit, record the local community resource map, agricultural season and historical activities.

B. There are 3 counties, 8 towns and 16 villages involved in the project in Xishuangbanna.

C. Questionnaires is distributed widely among different stakeholders, include household, town and village government, forestry station, forestry bureau and natural reserve. By questionnaires collection and analysis, we can get some information about local socio - economic situation, land use and ownership, income and sources, land management situation, awareness, technical knowledge preferences tree species, technical and financial squeeze, and requirement of households.

Discussion forum for household representatives was held in each village. On the forum, we introduce the conception, profits, risk, procedure and characteristic of small scale afforestation PS project and understand the requirements and hope of household through historical and current existing problems of local communities.

Step 4: Draw a report;

Step 5: Invite experts join in a seminar to discuss the report.

Step 6: According to the suggestion of experts, carry out supplement survey and modify the reports.

The suggestion of local household, villages and company is:

(1) Major stakeholders

Households / Communities

During the interview, some villagers cannot understand the profits of forest carbon sink. It is difficult for them to understand that they can get some profits by selling CO_2 which absorbed by bamboo afforestation. But they can understand that the project can improve ecological environment, protect local environment and water resources. The project can bring some good social and ecological benefits.

Villagers expressed a strong desire to join in the project after the project introduction. They think that they can get some benefits from the project:

- Jobs: they can work in the project which is not far away from their home. It is good for them to look after farmland and livestock.
- They can get more profits by transfer leasehold of barren hills and wasteland.
- Planting trees on barren hills and wasteland can improve local environment, protect farmland, and reduce drought, flood, landslide and other natural disasters.
- Get more and more planting and forest management experience by participating the training.

Company staffs.

The owner of proposed small scale bamboo carbon sink afforestation project is Yunnan MengXiang Bamboo Industry Co.,Ltd. All bamboo products and carbon sinks amount belongs to Yunnan MengXiang Bamboo Industry Co.,Ltd. Company staff are willing to join in the project and they are also willing to support their company to do this unattractive investment.

- They can get some profits from VERs sale without any market risk. Of course,

they also can get bamboo products.

- Commercial loans can relieve the financial barriers of the project inputs. They cannot get commercial loans without the proposed small scale bamboo carbon sink afforestation project.
- They cannot invest afforestation project without the proposed small scale bamboo carbon sink afforestation project, because the profit is lower.

(2) Other stakeholders

Local forestry department: Forestry Bureau of Jinghong City, Menghai County and Mengla County and Forestry Station find that the project can increase forest resource, improve local environment and farmers' income, and show the procedure of small scale afforestation CDM project. They are willing to provide technical training and consultation to local householder and control and instruct project implementation.

Local government: The government of Jinghong City, Menghai County and Mengla County think that the project can improve local economy, relief poverty pressure, especially in minority area. Implementation of the project is conducive to slow global warming, good for biodiversity conservation and erosion control.

7.3.2How to collect suggestions for application report:

The comments of Participatory Rural Appraisal (PAR) have been fully adopted, include:

Consider the tree types preference of local farmers and communities;

Plant local *Dendrocalamus giganteus* in the project;

Put the fertilizer in planting hole, and never sowing;

Chemical pesticides are forbidden and Biological mechanisms implementation will control plant diseases and insect pests

Never burning on the vegetation, soil preparation and total cultivation.

Annex 1. Connection information of project participant

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Annex 2: Public funds

No.

Annex 3: Monitoring plan

Detailed in SECTION 6.