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Trial for CDM A/R Projects

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Abstract
Sumitomo Forestry is preparing for the potential CDM afforestation/ reforestation (A/R) projects in the East Java Province, Indonesia, together with PT Kutai Timber Indonesia. The boundary is about 2,500ha, which is made up of about 10 sites in the Province. Selecting main species for reforestation such as Falcata (*Paraterianthes falcataria*), Mahogany (*Swietnia macrophyla*), and Agathis (*Agathis borneensis*), the project will proceed forest management, paying special attention to sustainable forest management including soil conservation and biodiversity. The project period is 20 years. It is the unique case that combines the activity to secure industrial timber resources and to foster future timber property for local community. The project has the variety in its structure from industrial plantation to agro-forestry, however, the core concept is co-existence with local community and environmental concern. The proposed baseline methodology of this project applies an approach of past trend data and extrapolate to the future use, introducing a number of assumptions.
Monitoring methodology and plan is introduced so that all the GHGs should be monitored in and out of the project boundary, targeting 5 carbon pools. Technology to be applied to the project are breeding of selective seedlings, forest management such as thinning, pruning and harvesting management etc. Cooperation with local community will give the project useful meaning. Environmental concerns are key issue to create successful CDM A/R projects. The project studied environmental impact assessment at one of the areas. It is estimated that the project will be able to attain 266,725 CO2-ton net anthoropogenic greenhouse removals by sink for the project period 20 years.

1. Introduction

Sumitomo Forestry Co., Ltd. is preparing for the implementation of CDM A/R projects in the East Java Province in Indonesia and has started plantation in some areas. Although this is a trial case as the procedures are still under process, the company would like to realize the case in the earliest timing. There are still a lot of things to be considered. The company made the Project Design Document under the scheme of UNFCCC CDM. The document mentions sustainable development, mechanism of the CO_2 removals, baseline methodology, monitoring methodology and plan, agro-forestry through community forest, and environmental concerns, etc.This report will provide key information on the project.

The survey was carried out by Sumitomo Forestry in the scheme of CDM/ JI Feasibility Study, which was projected by the Ministry of the Environment of Japan in 2003- 3004. Final report is available to see on the web-site of Global Environmental Center Foundation (URL: http://www.unep.or.jp/gec/)

2. Main Contents

Sumitomo Forestry has been studying the project with its title as “A/R CDM project in East Java Province”. This project have plural objectives;

a) To increase carbon stock by planting trees in community land through falcata-based agroforestry system and in state land through industrial timber plantation.

b) To reduce pressure on natural forest to meet demand for future raw material of timber for plywood industry.
c) To increase soil productivity and reduce soil degradation at steep slopes surrounding the project area.
d) To improve income of local communities.

2.1. Contribution to the sustainable development of a host country

Indonesia has about 191Mha of land area, among which forest cover occupies about 60%, 160Mha in 1990, however, deforestation has been rapidly advancing until now. In particular, critical land is a land that has been declining up to the level where the function is disappeared or reduced from what should be. Critical land in Indonesia according to the official data was about 6.8 Mha in 1990 with annual incremental at about 1.7 Mha during 1990 - 2000. Hense, compared to the need for rehabilitating critical lands 23.7 Mha in the year 2000, this is not really sufficient. It highlights the importance of developing CDM projects in Indonesia.

Photo 1 Land condition at steep areas with Grati Lake

2.2. General description of the project activity

The project is implemented in three locations. The first location is at Pasuruan District where the land belongs to local communities. Here will be developed large area with agriculture land but due to regional climate and topography, the lands are very dry and crop productivity is very low. So the the project will proceed agro-forestry with local community. As the land used by the project is land which has been used for agriculture activities for more than 50 years, type of CDM activities in this land would be 'afforestation'.

The second location is at Krucil, Probolingo District, a state land where the land use right is held by a local organization. In the wet region the length of rainy season was 6-7 months while in the dry areas, it is between 3-4 months. Effect of topography on the rainfall is quite strong. Location of the project at Krucil is in high altitude areas, more than 700 m a.s.l. The organization used the land for coffee plantation with Lamtoro trees (*Leucena leucocephala*) for shading. However, this land has been abandoned before 1990 and lamtoro leaves have been harvested intensively by local community for animal feeds. Without the project, A/R activities at this site may not increase.

Photo 2 Land condition before planting at Pasuruan

Photo 3 Condition of Krucil Coffee Plantation with some Lamtoro trees

The third location is at Jember District, where PT KTI implement the project with PT Perkebunan Nusantara XII (“PTPN”) who is a public cooperation producing agricultural products such as cocoa, coffee, coconuts and rubber in the state agriculture land. The area is plantation

Table 1 Project area

Site	Area	Address
Pasuruan	500ha	Pasuruan district
Krucil	500ha	Probolinggo district
jember	1,000ha	Jember district and other area in PTPN
others	500ha	Approx. 10 sites
	2,500ha	

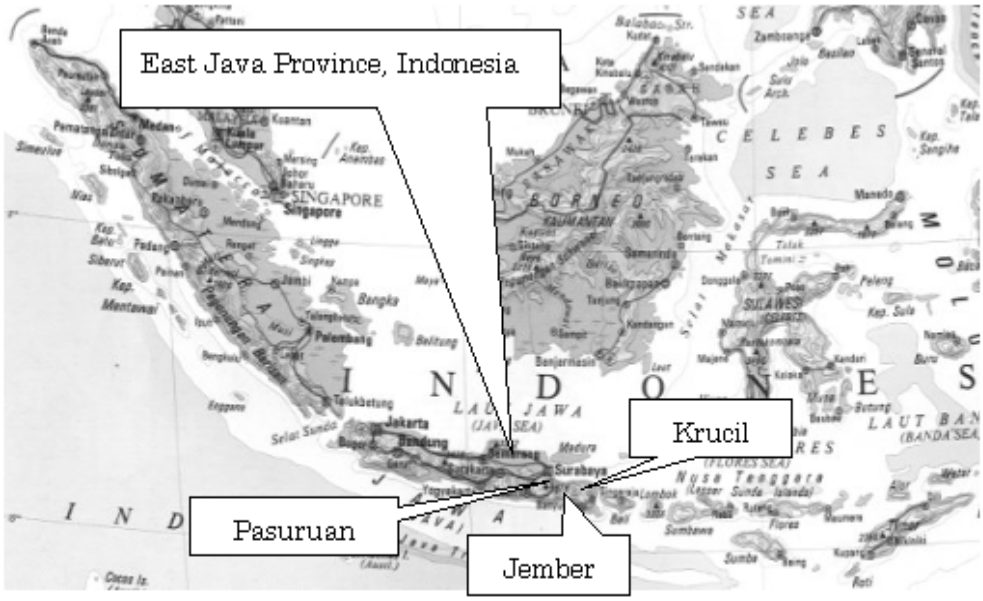

Fig. 1 Location map of the project

of falcate trees at brown area where agricultural crops have not grown since before 1990. These areas are composed of slope area, wet land and poor soil productive areas. This activity is categorized as reforestation activity.

The project is developed by Sumitomo Forestry and PT. Kutai Timber Indonesia (" PT KTI"), who is plywood manufactures in Indonesia established in 1975. Overall project type is afforestation and reforestation activities among LULUCF activities.

2.3. Technology to be employed by the Project Activity

The tree species used in the project at the area are falacata (*Paraserianthes falcataria*) combine with some agricultural crops such as annual food crops, horticultural crops, fruit trees, coffee, lamtoro, manioc, and medicinal plant of the family zingiberaceae. The seedling of sengon species is obtained from high quality seeds with potential increment of 43.18 m3/ha/year for good soil, 28,81 m3/ha/year for medium soil and 19.55 m3/ha/year for poor soil; mahogany(*Swietnia macrophyla*), with potential increment of 8.49 m3/ha/year and Agathis (*Agathis borneensis*) with potential increment of 10.55 m3/ha/year. Combination of trees and crops selected by the project will depend on the preference of the project participants. New silvicultural methodology that will be transferred to the farmer (planter) is selective breeding for high growth rate tree species and tissue culture technique; new technique for forest management such as thinning, pruning, zoning, technique to combine plantation of fast growing species with medium-term growing species.

2.4. Establishment of the baseline methodology

The title of baseline methodology is "Methodology for A/R activity in Indonesia". A methodology of LULUCF projects should choose one of the three approaches; (i) existing or historical data on land use and carbon stocks changes in the carbon pools within the project boundary, (ii) changes in carbon stocks in the carbon pools within the project boundary from a land use that represents an economically attractive course of action, taking into account barriers to

investment, (iii) changes in carbon stocks in the pools within the project boundary from the most likely land use at the time when the project starts.

Based on the above three general approaches, this project proposed an approach for defining baseline using past trend data and extrapolate to the future using a number of assumptions. The assumptions are developed based on official available documents and answered provided by local stakeholders (local NGOs, local governments, community group leaders etc) to set of questions.

2.5. The possibility that the project would be initiated within the public and private sector in the absence of the CDM

There is little possibility of A/R activities, because the national budget called Reforestation Fund (DR) is very limited. The available funding may only be able to rehabilitate about one tenth of the total critical area (Boer et al., 2001a). Without support from other sources such as CDM, the reforestation rate might not increase.

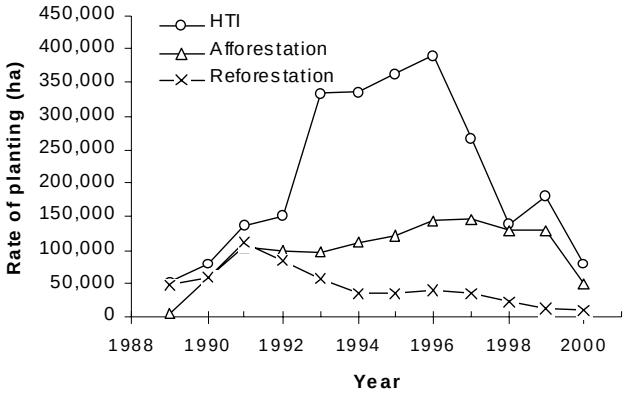

Fig. 2 Rate of planting under the rehabilitation program (MoE, 2003)

Development of Industrial tree plantation (HTI) is very low recently as the government does not provide any more subsidies for forest companies to implement such activities. In the past, forest companies could get forest rehabilitation fund from government either in the form of financial sharing with government or loan with low interest (Minister of Forestry RI Decree No. 375/ Kpts-II/ 1996 date: July 19th 1996). In addition, the internal rate of return of the HTI is low (APHI, 2002), while investor from overseas are also not interested to invest in the country due to unfavorable climate for investment, such high transaction cost. Without the existence of carbon incentive and clear regulation, the development of Industrial tree plantation (HTI) would be low. (Figure 2)

2.6. The possibility that the project would be initiated by the Project Developer under the absence of the CDM

[1] Ministry of Forestry is in the process of preparing Ministrial Decree to assist investors to conduct such CDM project

According to KTI, it was stated that up to 1995, 100% of wood demand of the KTI came from natural forest. It was planned that about 30% of its wood demand will come from tree plantation by the end of 2003 and about 70% by the end of 2008. This is in order to reduce pressure on natural forest. However, if income from the plantation is only from wood, the company is not interested in establishing the plantation since it gives low IRR (APHI, 2002), thus the wood demand may be mainly from natural forest and the target may not be achieved. Additional benefit generated from selling carbon is expected to increase the IRR. This expectation motivates the KTI to establish the plantation with local community participation. Local participants acquire both incentives, benefit share from timber and carbon, which scheme is originated from the CDM presence. Thus, under the absence of CDM (in term of carbon benefit and CDM regulations[1]), the project is unlikely to be implemented.

2.7. The possibility that the project would be initiated by local communities under the absence of the CDM

In Pasaruan, studies showed that agro-forestry system is economically favorable, however, it would not be in place in the project location due to a number of reasons. Some of the important reasons are:

a) Lack of financial support. Most farmers in Java are subsistence farmers and many of them are trapped by Money Lenders. Therefore, without financial support from outside sources, such activities will not exist.
b) High drought risk. The project site has long dry season (with Dry season of more than or equal to 8 months), and therefore survival rate of trees is very low. This condition discourages local communities to implement such activities.

Table 4 Biomass standing stock at Krucil and Pasuruan Project sites prior to CDM project implementation

Location	Source/ Size of plot (ha)	Species	Age (year)	Number of trees (trees/ha)	Average diameter (cm)	Average Height (m)	Volume (m3/ha)	Dry weight (t/ha)
Krucil	0.0522	Coffee	18.7	3201	1.9	2.04	3.161	5.251
		Lamtoro	19.7	1457	8.6	4.30	34.815	39.413
	0.0568	Coffee	18.8	2166	1.9	1.83	1.994	3.308
		Lamtoro	19.8	1356	8.6	4.41	33.144	37.545
Grati/ Puspo	Tomich *et al*. (1998)	Cassava						3.6±2.1
	Wasrin et al. (2000)	Food crops						3.5±2.6
	Boer *et al*. (2001b)	Bareland						2.5±0.3

Note: Sampling of carbon stock in various land uses at the project locations will be measured by KTI for the final draft of PDD.

c) Market barrier. Without the project, PT KTI would have purchased their timber from another local market. Eventually people in this area would not have participated in the market of the timber.

In Krucil, *Probolinggo.* without new initiative, coffee plantation may be abandoned for long period in the future. KTI has interest to invest in the land considering additional benefit that can be gained from CDM.

In Jember also, without CDM scheme, PT PN would not promote tree plantation because it is not their own business line and eventually lack of technology and finance.

2.8. What is baseline of the project ?

The estimated standing carbon stock at the project location prior to project implementation is presented in Table 4. Following the baseline projection, the c-stock in the project site in the future will remain the same as the c-stock condition prior to project implementation.

2.9. Methodology for Stakeholder Process

The process of gathering local stakeholder comments has been conducted through survey to provide evaluation on the project. Several questions which have been forwarded to people community in the prospective location of Krucil project in year 2002 and in Pasuruan in year 2003, were as follows:

a) Do you believe that the socio-economic situation of the local will improve due to the implementation of the project?
b) Is the implementation of the project able to improve the environmental situation in the region?

Table 5 Biomass baseline for each project site

Boundary	Area(ha)	Baseline	Object	Amount (CO_2-ton/ha)
Pasuruan	500	Agriculture land with some trees	existing tees	0.92
Jember	1,000	Fallow and bare land （next to cacao and coffee plantaion）	alan-alan grasses cacao plantation coffee plantation	0.35
Krucil	500	coffee plantation (30%)、grassland and bare land (70%)	coffee and lamtoro trees	-0.41
Sub total	2,000			
Others				
Ngantang	13	degraded natural secondary forest(30%)、 and agriculture land(70%)	degraded natural forest and alan-alang grasses	0.35
UNIBRAW	10	fallow land and bare land	alan-alan grasses	0.35
UNESA	9	fallow land and bare land	alan-alan grasses	0.35
Probolinggo	210	Agriculture land with some trees	existing tees	0.92
Golf Singosari	6	Land with some trees, golf course	alan-alan grasses	0.35
Puspo	34	Agriculture land with some trees	existing tees	0.92
Malang	178	agriculture land	existing tees	0.92
Bondowoso	40	agriculture land	nothing	0
Sub total	500			
Average	2,500			0.40

This table was developed by PT KTI estimation based on ground survey in 2003.

Table 6 Details on stages, means (tools) and purposes in participatory process

Stage (phase)	Means (tools)	Purpose
I. Preparation and mobilization of stakeholders	Description of rural sociology	Evaluating and learning the rural socio-economic condition in the project boundary
	Stakeholders analysis	Identifying stakeholders and analyzing the existing regulations
	Risks anticipation	Supplying information on possibility of risks and disturbances.
	Gender analysis	To ensure balanced participation between males and females in decision making, responsibilities and implementation.
II. Developing stakeholder commitments	Preparing draft of commitments	Preparing drafts of consensus to be discussed
	Facilitation	Increase the stakeholders contribution and ensure their effective and active participation.
	Consultation	Increasing stakeholder dialogues. Developing consensus and commitment.
	Stakeholder concensus	Preparing consensus on negotiation between partners in formal form.
	Stakeholder working group	Creating mechanism for coordination between sectors and institutions (multi institutions)
III. Strategy for formulation and implementation.	Action Plan	Elaborating the general strategy, relationship with actors, schedule target and commitments.
	Program formulation	Supplying methodological framework for program formulation.
	Establishment of Demonstration Plot	Conducting demonstration for understanding project objective.
	Conflict resolution	Facilitating in negotiation to obtain consensus and/or win – win solution.
IV. Follow up and consolidation	Monitoring the means (tools)	Measuring whether the tool is still suitable or not, and obtain feedback to make improvement and adaptation.
	Program evaluation	Evaluating the success rate of the program and providing inputs for program design improvement and its implementation.
	Institutionalization	Ensuring that such approach has been understood, accepted, and implemented routinely.

c) How does the development of the project affect you (positively or negatively) or on your environment?
d) Will the project implementation produce impacts (positively or negatively) on socio-cultural condition of the community?
e) Do you recommend a certain institution to develop this project?
f) Give additional comments in accordance with what you think.

Table 7 shows monitoring plan for emissions from the project

ID	activity	source	monitoring
E1	emissions from transportation and works except plantation	fossil fuel consumed by project activities such as transportation and heavy equipment	planning at the projection and monitoring at the verification
E2	emissions from other project activities concerning plantation	fossil fuel consumption form plantation works such as nursery, planting, fostering and cutting	planning at the projection and monitoring after the commencement of the project
E3	emissions from fertilizer	emissions from chemical fertilizer and compost	planning at the projection and monitoring after the commencement of the project. Not necessary, if the impact proved to be neglible.

Table 8 Leakage (CO2-ton)

ID	Activity	source	monitoring
L1	Use of fossil fuel for transporting wood product or materials for the project	Increase in transportation intensity to and from project site due to CDM activities	prior to project implementation, then every 5 years
L2	Use of fossil fuel by wood factory	The increase in wood supply from the project will increase fossil fuel consumption	as above
L3	Leaves harvesting for animal feed	At Krucil local communities may shift to locations outside project boundary for collecting leaves for their animal feeds	as above
L4	Use of fossil fuel for public transportation	If from analysis indicated that the project may not have significant impact on regional economic, this data will not be monitored[2]	Not necessary, if the impact proved to be neglible.
L5	Deforestation	As above	Not necessary, if the impact proved to be neglible.

Those questions were conveyed just to people who were candidate of project participants. Therefore, those questions should also be conveyed or forwarded to people who are not participants of the project. Beside that, for achieving sufficient transparency and legality, the process to obtain this stakeholder comments should be extended which will finally obtain a decision from all stakeholders through participatory process. Stages in each participatory process to obtain stakeholder comments are given in Table 6.

2.10. Monitoring methodology and plan

The monitoring methodology and plan use for this A/R CDM project will be based on the "Monitoring Verification Protocol for an afforestation/reforestation in East Java Province, Indonesia".

[2] The analysis will be done using multiplier analysis (Moor, 1996)

Data being monitored are those related to the process of calculation baseline net GHG removals by sinks, actual net GHG removals by sinks and leakage are presented in Tables 7and 8.

Table 9 Growth Rate of Falcata by Soil Conditions

Soil Good	Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	Diameter(cm)	4	14	21	26	29	31.5	33
	Height(m)	5.5	14.5	19	23	25	26	26.5
	Density(pieces/ha)	1100	900	750	400	400	400	400
	Volume(m^3/ha)	2.9	76.7	188.5	186.6	252.3	309.6	346.3
	Thinning volume (m^3/ha)				108.7			
Soil Medium	Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	Diameter(cm)	3	9	15.5	20	23	25	27
	Height(m)	4.5	12	16	18.5	20.5	22	22.5
	Density(pieces/ha)	1100	950	800	600	600	600	600
	Volume(m^3/ha)	1.3	27.7	92.3	133.2	195.2	247.5	295.2
Soil Poor	Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	Diameter(cm)	1.5	6	12	16	19	21	22.5
	Height(m)	3	9	13	15.5	17	18	18.5
	Density(pieces/ha)	1100	950	800	800	800	800	800
	Volume(m^3/ha)	0.2	9.2	44.9	95.2	147.3	190.5	224.8

Table 10 Growth Rate of Mahogany (*)

Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Diameter(cm)	0.0	0.0	0.9	2.8	4.6	6.3	8.0	9.6	11.2	12.8	14.3	15.8	17.2	18.6	20.0
Height((m)	0.3	0.6	1.5	2.1	2.7	5.3	7.5	9.5	11.3	12.9	14.4	15.7	16.9	18.0	19.0
Pieces/ha	2500	2200	2000	1750	1500	1400	1300	1200	1100	1000	940	880	820	760	700
Volume(m3)	0.0	0.0	0.1	0.9	2.6	8.8	18.7	31.8	47.1	63.5	83.1	103.4	123.4	142.2	159.1
Age	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Diameter(cm)	21.3	22.6	23.8	25.1	26.2	27.4	28.5	29.6	30.7	31.7	32.7	33.7	34.6	35.6	36.5
Height((m)	19.9	20.7	21.5	22.1	22.8	23.3	23.9	24.4	24.8	25.2	25.6	26.0	26.3	26.6	26.9
Pieces/ha	660	620	580	540	500	490	480	470	460	450	325	325	325	325	325
Volume(m3)	178.6	196.4	212.1	225.1	235.1	257.5	279.5	301.1	322.1	342.3	267.2	287.4	307.8	328.3	348.9

Source: The growth data of Mahogany and Agathis is cited from “Nettairinn-no- seishou-data No.1 0.121” by N. Shiraishi and others JIFPRO.

Table 11 Growth Rate of Agathis(*)

Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Diameter(cm)	0.0	0.0	0.0	3.2	4.5	5.9	7.4	9.1	10.8	12.7	14.7	16.7	18.7	20.7	22.8
Height(m)	0.3	0.6	0.9	1.2	1.6	2.1	3.7	5.3	6.9	8.4	9.9	11.3	12.7	14.0	15.3
Pieces/ha	2300	2100	1900	1700	1500	1390	1280	1170	1060	950	886	822	758	694	630
Volume(m3)	0.0	0.0	0.0	0.6	1.4	3.0	7.8	15.3	25.7	38.6	56.3	77.3	100.8	125.6	150.3
Age	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Diameter(cm)	24.8	26.8	28.7	30.5	32.3	34.0	35.6	37.1	38.6	39.9	41.2	42.4	43.5	44.6	45.5
Height((m)	16.6	17.8	19.0	20.2	21.3	22.4	23.4	24.5	25.5	26.4	27.4	28.3	29.2	30.0	30.9
Pieces/ha	596	562	528	494	460	448	436	424	412	400	388	376	364	352	340
Volume(m3)	182.3	215.1	247.6	278.4	306.5	347.6	388.7	429.1	468.4	505.8	541.0	573.5	603.1	629.4	652.3

Source: Same as above.

2.11. Calculation of net anthropogenic GHGs removals by sinks

Table 12

PDD	Table		Year 2001 (1)	2002 (2)	2003 (3)	3004 (4)	2005 (5)	2006 (6)	2007 (7)	2008 (8)	2009 (9)	2010 (10)	1-10 Subtotal
E.1	4	Actual greenhouse gas removal by sink (CO2-ton)	427	10,119	35,433	57,851	84,991	47,639	3,066	6,065	3,167	3,097	251,854
E.1	5	Actual project emission (CO2-ton) 41.17 ton/year	41	41	41	41	41	41	41	41	41	41	412
E.4		Baseline net removals (CO2-ton) 0.4 ton/ha	204	315.2	120	360.8	0	132	158	162	151.2	152	1,755
E.2	6	Leakage (CO2-ton) 242 ton/year	242	242	242	242	242	242	242	242	242	242	2,420
E.5		Net anthropogenic greenhouse gas removals by sink(	-61	9,520	35,030	57,207	84,708	47,224	2,624	5,620	2,732	2,662	247,267

PDD	Table		2011 (11)	2012 (12)	2013 (13)	2014 (14)	2015 (15)	2016 (16)	2017 (17)	2018 (18)	2019 (19)	2020 (20)	11-20 Subtota
E.1	4	Actual greenhouse gas removal by sink (CO2-ton)	2,392	2,363	2,539	2,885	1,264	3,401	1,702	2,796	1,741	2,537	23,620
E.1	5	Actual project emission (CO2-ton) 41.17 ton/year	41	41	41	41	41	41	41	41	41	41	412
E.4		Baseline net removals (CO2-ton) 0.4 ton/ha	136.8	124	132	140	143.2	132	132	136.8	134	124	1,335
E.2	6	Leakage (CO2-ton) 242 ton/year	242	242	242	242	242	242	242	242	242	242	2,420
E.5		Net anthropogenic greenhouse gas removals by sink(	1,972	1,956	2,123	2,462	837	2,986	1,287	2,376	1,324	2,130	19,454

The approach proposed for carbon accounting is land-based accounting system. The formula to estimate the carbon is adopted from the IPCC Special Report on LULUCF (Noble *et al.*, 2000):

Table 13 Items of Environmental Impact Assessment

item	object
Air quality	Dust, oxygen
Water quality	Surface water, under ground water, drainage
Land quality	Soil quality, land conservation, erosion, productivity
biodiversity	Flora, fauna, other wildlife, other biology
Quality of life	Socio-economic impacts, cultural, communication, landscape and scenery, housing, road, leisure, job
Land use and land use change	Conflict about lands,
Etc	others

$$Q = \sum_{i=1}^{M}\sum_{j=1}^{N}[S_{i,j}(TE) - S_{i,j}(TB)] - \sum_{k=1}^{R} A_k$$

Where,

Q is total carbon sequestered or released,

i=1, 2, 3,…, M index for landscape unit within the project boundary;

j=1,2, 3,…, N index for carbon pools (e.g. above-ground biomass, below-ground biomass, etc)

k=1, 2, 3, …, R index for adjustment;

$S_{i,j}$ = stock of carbon on landscape unit-*i*, in carbon pool-*j*

TB= Beginning year of the accounting period,

TE= Ending year of the accounting period,

A= Adjustment term to account for leakage, baseline, uncertainty etc. Based on COP-9 decision, the A factors are limited to leakage and baseline only.

Table 14 Survey items

No	*Component*	Parameter / Description
1	Physics/ Chemistry Water quality	Temperature, pH, BOD, COD, DO, Heavy Metal
2	Biology	Flora and Fauna, including water biota or Macrobiotics
3	Social, Economic and Culture	Job, Ownership Of House Status, Condition of Society
4	Society Health	Condition Of Society Health, Available Efforts and change

Table 15 Water Quality

Parameter	Quantity	B – 3	B – Outside	H - 8	I – Outside	AA2	Standard
Physic							
Temperature	^{0}C	26.5	26.5	26.5	26.5	26.5	Normal water temperature
TDS	mg/L	82	110	80	96	80	1500
Chemistry							
pH		7.34	6.75	7.2	7.76	7.59	6-8.5
Barium	mg/L	0.19	0.19	0.19	0.2	0.2	1
Iron	mg/L	0	0.2	0.15	0.09	0.12	5
Manganese	mg/L	0.12	0	0	0	0	0.5
Copper	mg/L	0.12	0.12	0.12	0.1	0.1	1
Zinc	mg/L	0	1	1	1	1	5
Hexavalen Chrom	mg/L	0	0	0	0	0	0.05
Cadmium	mg/L	0	0	0	0	0	0.01
Mercury	mg/L	-	-	-	-	-	0.001
Lead	mg/L	0	0	0	0	0	0.1
Arsen	mg/L	0	0	0	0	0	0.05

Source of: Result of analysis

Data used for the estimation of MAI of Sengon, Mahogany, and Agathis

In conclusion, overall removal is calculated as following table. Overall antoropogenic removals by the sink is totally 266,721 CO2-ton per project period as shown the table 12.

2.12. Harmonious development with environmental respect

Environment is a key issue to create successful CDM A/R projects. We studied environment impact assessment in 2003-2004 at 500ha project area by professional assessors for trial case as to following items;

The results of the trial EIA in Krucil

We carried out the environmental impact assessment in Krucil for the trial case on the contract with specialist, Environmantal Engineering Department, Institut Teknologi Nopember, Surabaya, East Java Province. The assessment was implemented in Dec. 2003 - Jan. 2004. In conclusion, there were not any fundamental and negative impacts. Followings are results from our survery.

Table 16 Flora

No	Local name	Scientific name	Description
	TREE		
1	Lamtoro	*Robustepordes*	Livestock
2	Kina	*Cinchona pubefcebs*	Tree
3	Kopi	*Coffea Arabica A. and Coffea Robusta*	Tree
4	Pinus	*Pinus merkusii*	Tree
5	Nangka	*Artocarpus integra*	Tree
6	Apokat	*Porcea americana*	Tree
	CLUMP		
1	*Ervatamia*	*Ervatamia divaricata*	Cover vegetation
2	*Tembelekan*	*Lantana camara*	Cover vegetation
3	*Malatus*	*Malatus sp*	Cover vegetation
4	*Makaranga*	*Makaranga sp*	Cover vegetation
5	Caliandra	*Caliandra sp*	Cover vegetation
6	*Benta*	*Leersia hexandra*	Cover vegetation
7	*Alang-alang*	*Imperata cylindrical*	Cover vegetation
8	*Sandapus*	*Sandapus sp*	Cover vegetation
9	*Rumput gajah*	*Papaerus sp*	Cover vegetation

Source: Result of analysis and secondary data

Table 17 Fauna

No	Local name	Scientific name
	MAMMAL	
1	Kera	*Macaca sp.*
2	Kijang	*Muntaicus muntjak*
3	Babi Hutan	*Sub babayrusa*
4	Tikus	*Rattus rattus*
	AVES	
5	Peking	*Lenchura leucogastroides*
6	Bubut	*Clamator sp*
7	Sikatan emas	*Ficedula zantrhropygia*
8	Kacamata gunung	*Zosterops montatus*
9	Kacamata jawa	*Zosterops flavus*
10	Ayam hutan	*Gallus sp.*
11	Kutilang	*Pycnonotus aurugaster*
	AMPHIBIAN	
12	Katak	*Rana sp.*
	REPTILE	
13	Biawak	*Varanus salvator*
14	Ular air	*Ophidia sp.*
15	Kadal	*Mobouya multifasciata*
16	Tokek	*Gecko gecko*

Source: Result of analysis and secondary data

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