

**MOEJ/GEC REDD+ Demonstration Study 2014**  
**Summary of the Final Report**

**“REDD+ in Prey Long Area and Seima Area”**

**( Implementing Entity:  
 Conservation International Japan and Asia Air Survey )**

**1. Overview of the Proposed JCM Project**

<b>Study partners</b>	<p>Conservation International Foundation (CI Foundation)</p> <ul style="list-style-type: none"> <li>• Conservation International Cambodia           <ul style="list-style-type: none"> <li>○ Coordination with Forestry Administration and assistance with financial planning and design details for study on Prey Long area.</li> </ul> </li> <li>• Conservation International headquarters           <ul style="list-style-type: none"> <li>○ Prediction of the deforestation area within the project boundaries using spatial models for the setting of reference emissions, as well as assistance in the formulation of the monitoring plan.</li> </ul> </li> </ul> <p>Wildlife Conservation Society (WCS)</p> <ul style="list-style-type: none"> <li>• Source of information for study of Seima region.</li> </ul> <p>Forestry Administration of Cambodia</p> <ul style="list-style-type: none"> <li>• Cooperation in financial planning and study design details for both regions, and advice aimed at participation in the JCM in subsequent years in response to information in the study.</li> </ul>	
<b>Project site</b>	Cambodia, Prey Long Area and Seima Area	
<b>Category of project</b>	REDD+	
<b>Description of project</b>	<p>Small-scale illegal logging and agricultural activities by local communities and large-scale conversion of forest into industrial agricultural land through economic concessions have been major threats of deforestation in the Prey Long area (estimated to be around 400,000 hectares) and the Seima area (estimated to be around 150,000 hectares). The present study is focused on the Prey Long area, which was selected as a candidate project area to be part of the Joint Crediting Mechanism (JCM). The project aims to prevent deforestation in the Prey Long area by strengthening forest management through law enforcement by the Forestry Administration of Cambodia and participation of the local community, thereby reducing greenhouse gas emissions. Because the Prey Long area supports Cambodia's agriculture and fisheries as an important water source, forest conservation in this region is essential for sustainable development in Cambodia.</p>	
<b>Expected project implementer</b>	Japan	Conservation International Japan

	Host country	Forestry Administration, Cambodia	
<b>Initial investment</b>	<b>JPY50,000,000</b>	<b>Date of groundbreaking</b>	2012
<b>Annual maintenance cost</b>	<b>JPY100,000,000</b>	<b>Construction period</b>	2015
<b>Willingness to investment</b>	In cooperation with relevant organizations and bodies, efforts will be made to raise funds from governments and international organizations as well as private sector.	<b>Date of project commencement</b>	2015
<b>Financial plan of project</b>	For the required funds, the plan is to utilize grant aid from the Japanese government and other governments as well as private funds in addition to the funding of the JCM mechanism.		
<b>GHG emission reductions</b>	1,136.158 (tCO <sub>2</sub> /year)		

## 2. Study Contents

### (1) Project development and implementation

#### 1) Project planning

##### Proposed project site

The proposed project site is the Prey Long area, which crosses Kampong Thom Province, Kratie Province, Stung Treng Province and Preah Vihear Province west of the Mekong River in Cambodia. A process to make the area a protection forest is currently underway. The project boundary is estimated at about 400,000 hectares.

The study began initially with the Prey Long area and Seima area as the proposed sites for implementation of a JCM REDD+ project for the next fiscal year and beyond. However, after careful consideration of the JCM system from the perspective of project implementation, the following points were identified as issues in terms of considering a candidate region.

- The total amount of the JCM subsidy is less than 100 million yen, and once this is distributed to multiple countries, the funding for a single country would reach 50 million yen only in the most optimistic scenario.
- Since both the Seima and Prey Long regions require funding on the scale of 100 million yen each, it is necessary to narrow down the target area to only one of the areas.
- Because the assistance payment from JCM is delivered after the year-end results report, another funding source is required to pay the full amount and to bear the financial risk in the period up to the delivery of the JCM funds. At present, the only realistic financial plan is for the CI Foundation to temporarily lend CI Japan the funds for its activities in the fiscal year. Because the JCM mechanism does not cover the full amount, CI Japan is required to bear part of the cost.

For these reasons, it became clear that the target area must be the area where CI, who is assuming risk and responsibility, is working in partnership with the Forestry Administration of Cambodia. The assumed local partners for a project started under the JCM would be CI Cambodia in the case of the Prey Long area and the Wildlife Conservation Society (WCS) in the case of the Seima area. It was therefore agreed that the Seima area would be excluded from the candidate sites for implementation of the REDD+ project.

##### Project implementation structure

The implementation structure was created based on examples of forest conservation projects that CI Cambodia has carried out over many years in other regions.

- [CI Japan] Responsible for managing the progress of the entire project, managing

execution of the budget, quantifying emissions reductions, and reporting to the Ministry of the Environment.

- Supervision, primary responsibility, accounting
- [Forestry Administration] Responsible for policing illegal activities in the target area and assisting with research.
  - Phnom Penh: 6 personnel
    - Supervisor, deputy supervisor, investigator, accountant, clerk, office coordinator
  - Local station headquarters: 29 personnel
    - Commander-in-chief, mobile team commander, commander, station manager, assistant, 3 research assistants
    - Government rangers: mobile team (12), station team (6)
    - Local rangers (3)
  - Local substations: 15 personnel (assuming two locations)
    - Station manager, deputy manager, assistant
    - Government rangers: station team (9)
    - Local rangers (3)
- [CI Cambodia] Support and supervise the activities of the Forestry Administration to ensure efficiency of forest conservation activities and appropriate use of funds.
  - Supervisor (CI Cambodia representative): Take responsibility for cooperating with the Cambodian government and reporting to CI Japan.
  - Manager: Maintain constant contact with personnel at the Forestry Administration in Phnom Penh, keep tabs on and manage the current status and budget execution, and promote efficiency. Accompany law enforcement on a regular basis to confirm that their activities are properly carried out. Send reports to CI Japan.
  - Law enforcement (1-2 personnel): Manage the establishment and operation of the stations. Accompany law enforcement on a regular basis to confirm that their activities are properly carried out. Assist with judicial proceedings.
  - Coordinators (multiple): Provide assistance to manager and law enforcement personnel. Also assist research on carbon and biodiversity.
- [Specialized agencies] Responsible for the analysis of satellite images.
- [CI USA] Carry out monitoring in general and provide technical support for PDD development.

[CI Foundation] Temporarily lend funds for activities within the fiscal year.

The organizations involved in the project implementation, CI Japan, CI Cambodia, Forestry Administration, and CI USA, each has a wealth of experience in the work that it will be responsible for (see the full report for specific accomplishments).

Project cost estimate

For the implementation of the Prey Long area forest conservation project under the JCM, the overall project cost required to carry out the ideal activities is estimated at 158 million yen in fiscal 2015, 141 million yen in fiscal 2016, and 135 million yen in fiscal 2017 (assuming 120 yen/US dollar).

This is well beyond the budget that can be borne by the JCM budget alone, which means a combination of multiple funding sources is required. Note that reducing the target area to fit the budget is not an option, since measures that target only part of the Prey Long area, which is on level ground, will only drive the deforestation into other areas.

The details of the activities and costs included in the project costs are shown below.

## Activity 1: Law Enforcement by the Forestry Administration

- Travel costs: Phnom Penh<=>local (supervision, reporting, personnel changes etc.)
- Fuel etc. : Vehicle, motorcycles, fuel for generators, tolls, ferry charges
- Miscellaneous expenses: Vehicle repair, printing, public relations, miscellaneous expenses, other
- Meetings: Quarterly meetings
- Cost of ranger activities

## Activity 2: Installation of facilities for forest conservation

- Construction: Station headquarters (\$100k), sub-stations (\$50k) x 2
- Vehicles: Pickup trucks (2), timber transport truck (1), motorcycles (24)
- Measuring instruments: GPS x 8, GPS camera x 1
- Other precision equipment: PCs (9), radios (20), satellite phone (including registration fee), copy machine
- Others: Personal field kits, water carriers, machetes, medical kits, ice box, vehicle batteries, replacement tires, cooking equipment, well, generator, water pumps, barricades, floodlights, etc.

## Activity 3: Community support

- Conservation activities: Community incentives, local rangers

## Activity 4: Training and research

- Monitoring from the sky
- Training related to patrol activities

**Activity 5: JCM registration and quantitative determination of emissions reductions**

- Document preparation assistance
- Satellite image analysis

**Activity 6: Support for local activities of CI Cambodia**

- Personnel costs
- Travel costs (Phnom Penh<=>Prey Long)
- Miscellaneous expenses

**Activity 7: JCM project management by CI Japan**

- Personnel costs
- Travel costs

**Funding plan**

Based on the contents of the Cambodia-Japan bilateral agreement on the JCM of April 2014, the outlines of JCM-subsidized projects from fiscal year 2013, and interviews with stakeholders, and merit of the case that the REDD project were to be funded by JCM and implemented in Cambodia, the key challenges of the project were identified, and countermeasures for each challenge were considered. As a result, it became clear that combining with other funding sources and support projects is essential. The issue of combining the JCM funds with support from Cambodian government funds and developing country aid agencies is currently under study, and it is necessary to continue careful coordination aimed at submitting an application for a JCM-subsidized project in the next fiscal year.

**2) Contribution of Japan**

Cambodia's forests are the fountainhead supporting key industries such as fishing and agriculture, and as a source of non-timber products such as resin, also support life in local communities where poverty is endemic. This forest conservation project, whose implementation would be enabled by the JCM scheme, would contribute significantly to the country's sustainable development by protecting these industries. In addition, the Cambodian government has positioned REDD as a strategic priority in its national forest program (2010-2029), and is aiming to strengthen governance and enforcement of forest law. Illegal activities such as corruption and embezzlement contribute to preventing sound management in Cambodia's forest sector. The REDD+ project, as part of the JCM, would demand financial reporting to the Japanese government in its capacity as an investor, thereby contributing to greater transparency of the flow of money and goods. On the other

hand, if the project fails, it could become a source of inappropriate funds, which is why appropriate monitoring by CI Cambodia, who has been active locally for many years, is essential.

Furthermore, by starting a REDD project funded by the government of Japan and building confidence, it might be possible to attract future investment to the REDD in Cambodia if Japanese companies were to start reducing emissions using credits from the JCM scheme.

### **3) MRV structure**

In order to make the measurements required to determine the amount of emission reductions, a forested area is required, and analysis of satellite images is called for. Properly speaking, monitoring should be carried out by the Forestry Administration of Cambodia, who has jurisdiction over the Prey Long area. However, the study so far has revealed that there is at present a conspicuous lack of human resources in the section in charge of remote sensing. Currently, technical assistance related to forest monitoring from FAO and JICA has been introduced, and in the long term it is expected that monitoring will be carried out mainly by the host government. Meanwhile, over the next few years, it is reasonable to assign the satellite image analysis for monitoring required for the JCM to an external organization with well-established technology.

On the other hand, when a forest survey for the estimation of forest carbon stocks was carried out during the feasibility study in fiscal year 2012, training was provided to the relevant departments of the Forestry Administration, and standard operating procedures for the survey were developed, along with an instruction manual for handling measurement equipment. Since fiscal year 2012, Forestry Administration staff who participated in the training and survey have been responsible for survey training in other regions, leveraging the results of the support provided through the feasibility study.

### **4) Environmental integrity and Sustainable development in host country**

#### Contribution to the sustainable development of Cambodia

The Prey Long area is an important watershed that regulates water and sediment flow to the Mekong River and the Tonle Sap Lake, and an estimated 700,000 Cambodians are directly dependent on the watershed for irrigation water (Thelaide & Schmidt 2010). In addition, the rivers that flow through the Prey Long area are spawning grounds for fish in the Mekong River system. The project is therefore intended to contribute not only to the lives of the indigenous communities living in the area, but also to the livelihoods of the downstream farmers and fishermen, and to the food security of the people who depend on them.

### Ensuring environmental integrity

If the forest conservation project is successful, there will be no adverse effect on the environment. On the other hand, because the Prey Long area is on level ground where illegal loggers have easy access from outside, enforcement that is targeted at only part of the area might drive the illegal logging to the other areas. To prevent this problem of structural transfer of deforestation, it was determined that it is essential to implement the project activities in their entirety by finding a combination of multiple funding sources. This means that the acquisition of funds after the project starts is an issue that needs to be addressed before the project starts.

### Impact on biological diversity

In contrast to mountain forests, which are protected, the lowland forests in many countries, including Cambodia, are not subject to protection and continue to disappear. The Prey Long area is valuable as the last vestige of the lowland evergreen forests that were once widespread not only in Cambodia but throughout Indochina.

The Prey Long area, which covers a vast area of contiguous mixed forest habitats cut across by numerous small rivers, is also valuable as a wildlife habitat. Wildlife whose presence has been confirmed include the Asian elephant (*Elephas maximus*), clouded leopard (*Neofelis nebulosa*), marbled cat (*Pardofelis marmorata*), Malayan sun bear (*Helarctos malayanus*), banteng wild ox (*Bos javanicus*), gaur wild ox (*Bos gaurus*), sambar deer (*Rusa unicolor*), wild dog (*Cuon alpinus*), sunda pangolin (*Manis javanica*), pileated gibbon (*Hylobates pileatus*), pig-tailed macaque (*Macaca memestrina*), and smooth-coated otter (*Lutrogale perspicillata*). The area is also rich in species of turtles and tortoises, including the elongated tortoise (*Indotestudo elongata*), Asian box turtle (*Cuora amboinensis*), Asian leaf turtle (*Cyclemys oldhamii*), Giant Asian pond turtle (*Heosemys grandis*), yellowed-headed temple turtle (*Heosemys annandalii*), Malayan snail eating turtle (*Malayemys subtrijuga*), black marsh turtle (*Siebenrockiella crassicollis*), and Asiatic softshell turtle (*Amyda cartilaginea*). A very rare endangered species Siamese crocodile (*Crocodylus siamensis*) has also been confirmed. Despite the high importance of the Prey Long area in terms of biodiversity, the wildlife populations are reported to be well below the number that originally inhabited the area. If the Prey Long area were to be effectively protected, and if wildlife species with populations that can be recovered at this time could recover to the same levels of wildlife populations of other protected areas of Cambodia, the importance of the protection of the Prey Long area at the national and global level would likely increase dramatically.

### Impact on local community

There are indigenous groups living in and around the Prey Long area. The forest supports

their lives directly, in addition to occupying an important position in their culture and spiritual life. Local residents collect resin, medicine, and material for housing from the forest, and resin in particular is a major source of cash income. Because the lives of the Prey Long area communities depend directly on the forest, forest conservation will bring about a positive impact on the livelihoods of local residents. At the same time, careful planning is required in the implementation of the project to guarantee that access to forest resources necessary to the survival of the inhabitants is never restricted. The project has incorporated the participation of the community in some of its activities, and plans to implement an incentive program that reflects the current status and aspirations of the community, including employment through participation in the forest patrol activity.

For the local residents of the Prey Long area, land tenure is insecure, leaving them highly vulnerable to outside concessions and confiscation of land. Residents who lose their land often exploit the forest for food. The land tenure issue is therefore an important challenge for forest conservation in the Prey Long area, and ways of addressing this challenge require adequate consideration.

### Safeguards

To avoid the negative effects of the project, and to evaluate its positive effects, it is recommended that the project adopt the Climate, Community and Biodiversity Standards (CCBS) or the REDD Social and Environmental Standard. The Cambodian government is seeking CCBS acquisition for a REDD+project that uses voluntary credits developed domestically, and this will also be effective in enhancing the integrity of other initiatives.

## **5) Toward project realization (planned schedule and possible obstacles to be overcome)**

Early March	<b>March – May Preparation and submission of application</b>	<b>June/July- JCM project implementation</b>
<b>Project planning</b>		
Report results of investigation to host country	<ul style="list-style-type: none"> <li>• Refine draft proposal for combination of multiple funding sources in accordance with 2015 fiscal budget of the JCM</li> <li>• Coordinate with potential partner institutions including private companies and aid organizations</li> <li>• Final coordination with host country</li> </ul>	Implementation of plan

	[Challenge: Need policy relating to method of apportioning emission reductions] [Challenge: To make the project plan most effective, need to design the plan while monitoring the latest situation of potential funding sources]	
<b>Field activities</b>		
	Gather information on local conditions from the Cambodian government and CI Cambodia	Start forest conservation activities under JCM grant
<b>Methodology</b>		
Finalize methodology	As soon as methodology guidelines are published, check their consistency with the methodology that was developed [Challenge: Relationship of requirements between the methodology that was developed and the methodology guidelines to be published]	In the case of items that do not conform to the guidelines, modify the methodology upon consideration of the need to do so →Enrollment in the JCM Joint Committee (JC)
<b>PDD</b>		
Complete setting of reference emissions		Documentation of PDD →Enrollment in the JCM JC
<b>Safeguards</b>		
	Check contents of safeguard guidelines as soon as they are published	Deployment to the community

## (2) JCM methodology development

### 1) Eligibility criteria

To ensure appropriate quantification of emission reductions using the developed methodology, the following eligibility requirements have been established.

- 1) The activities in the reference scenario shall not include planned deforestation by the government.
- 2) The target area shall be land that has been forest land for at least ten years. The

definition of "forest" shall be based on the national forest inventory and similar sources, and on the definition that is expected to be adopted in the REDD initiative at the national level in the host country. The definition according to the information as of January 2015 is "tree height of 5 m or more, crown ratio of 20% or more, including natural forest as well as plantations and other planted trees".

- 3) The target area shall not include areas where peatlands make up 0.3% or more of the total area. Peatlands are defined as organic soil with a thickness of 50 cm or more, containing 65% or more organic material by weight.

The reasons for setting these eligibility requirements are as follows.

- 1) If the project were to include planned deforestation as a cause of deforestation, the calculation of the reference emissions would be based on the plan, and calculation in the manner prescribed by this proposed methodology would not be used. This proposed methodology is therefore not applicable to cases where planned deforestation is an activity in the reference scenario. On the other hand, ELCs, which are one of the main causes of deforestation in Cambodia, are approved by the Cambodian government on the basis of applications submitted by the private sector. Without the ELC areas being identified in advance, it is not possible to predict where ELCs will be issued in the future. This requirement therefore does not apply to excluded deforestation planned by the government. If project activities include cancellation of the ELCs that have already been issued in the project target area, it becomes planned deforestation. The ELCs that have been issued will not be included in the reference scenario for the Prey Long area.
- 2) In Cambodia, the Forestry Administration has been asked to review the definition of forest. In the national forest management plan, the minimum tree crown ratio for determining a forest is 10%, but they have decided to adopt a definition that prioritizes consistency with REDD initiatives at the national level. [If the minimum number of years the area was a forest is stipulated in the methodology guidelines before the final report, the stipulation will be incorporated.]
- 3) The process of greenhouse gas emissions from peat swamp forests requires appropriate calculation methods that are different from forests. Because it is not clear whether there are peat swamp forests in Cambodia, including in the Prey Long area<sup>1</sup>, it was decided that they would not be included in this methodology. On the other hand, in order to deal with the possibility that they are found to exist in the project target area on a very small scale, it was decided that the ignorable upper limit of the area ratio should be determined. In general, carbon accumulation in peat swamp forests is claimed to be 5 times to 10 times that of forests (see, for example,

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<sup>1</sup> Sustainable Management of Peatland Forests in Southeast Asia

Page et al. 2011<sup>2</sup>), and assuming 3% or less of total emissions are small enough to be ignored, an upper limit of 0.3% of the total area was set for the target area.

## 2) Calculation of GHG emissions (including reference and project emissions)

The following data and information are required for the calculation of reference emissions.

Table 1 Data and information required to calculate reference emissions

Information or data	Type or unit
Polygon of project area	GIS
Polygon of reference area	GIS
Maps of land use and land cover changes	Maps
For each forest type, carbon stocks of the carbon pool of interest	tonCO <sub>2</sub> /ha
For each land use type that has become non-forested, carbon stocks of the carbon pool of interest	tonCO <sub>2</sub> /ha
Polygon data of concessions, protected areas, and other areas	GIS
[Optional] Data on factors that influence the deforestation rate (for example, population, crop prices)	Statistics (GIS)
Spatial information on factors that influence the spatial arrangement of deforestation (for example, population, distance from road, soil fertility)	GIS

The reference emission amounts are estimated using the following simple summarized methods.

- 1) Estimating the future rate of deforestation within the reference area (average, trend, and model)
- 2) Calculating the deforestation area each year within the reference area
- 3) Estimating where deforestation calculated in item 2) will occur in the reference area
  - 3.1) Analysing past deforestation risks from past deforestation and spatial patterns of its drivers
  - 3.2) Calculating spatial deforestation risks within the reference area from the spatial distribution of drivers and the results of item 3.1)
  - 3.3) Distributing deforestation calculated in 2), starting from places with high risk. Repeating this for each time step.
  - 3.4) Projecting future deforestation area within the project boundary
- 4) Calculating emission coefficients
  - 4.1) Estimating changes in carbon stocks by forest type
  - 4.2) Estimating changes in carbon stocks following changes to non-forest land

<sup>2</sup> Page, Susan E.; Rieley, John O.; Banks, Christopher J.. 2011 Global and regional importance of the tropical peatland carbon pool. *Global Change Biology*, 17 (2). 798-818.

## 5) Calculating reference emission amount

**3) Data and parameters fixed *ex ante***

This year it was confirmed that the results that were set in the survey of fiscal year 2012 were reasonable, in particular the allometric equations for estimating the carbon stocks in the above-ground and below-ground biomass pools, the wood density for estimating the carbon stocks in the dead-wood pool, and the forest carbon stocks of the Prey Long area.

Carbon stocks in the above-ground and below-ground biomass pools are typically calculated by allometric equations fitted to the diameter at breast height of the tree to be measured in the plot survey. There are also allometric equations for obtaining the tree height, but it takes time to make a precise height measurement in a dense forest, so this was excluded from consideration. After collecting existing allometric equations from the literature and fitting them to biomass data (12 points) collected close to the target area in Mondulhiri province in western Cambodia by the Forestry Administration and WCS, an international NGO, a set of conservative and good-fitting allometric equations were identified. After a comparison of Chave (2005) and Kiyono (2010), the equations in Kiyono (2010), which had a 2% error rate, were selected.

Carbon stocks in the dead-wood pool are estimated based on the thickness and length of the dead wood to be measured in the plot study (the items measured differ depending on the circumstances). In the estimation of the dead wood pool, the wood density is a difficult parameter to obtain. In a survey of existing information, almost the only data found were the default values of the AR-CDM tool ("Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities"). In the aforementioned Mondulhiri Province, an investigation of the wood density of dead wood was also conducted and compared with the AR-CDM tool values. The values in the AR-CDM tool were smaller, which confirms that they are conservative, so it was decided to use them as the default values of the methodology developed here.

The above-ground and below-ground biomass stores in the project boundaries and the leakage belt were set based on a plot survey in the field. The survey was conducted on 100 randomly chosen clusters composed of three plots in a nested structure with a maximum radius of 20 m. The table below shows the results obtained by the calculations using the allometric equations that were set and the density of the dead wood (Table 2).

Table 2: Estimated carbon stocks and statistics

	Evergreen forest				Deciduous forest			
	Above-	Below-	Above-and	Dead	Above-	Below-	Above-and	Deadwo

	ground	ground	below-ground	wood	ground	ground	below-ground	od
Average carbon stocks, tonCO <sub>2</sub> /ha	358.6	58.1	416.7	63.2	208.1	34.8	242.9	21.6
Standard deviation	161.4	24.9	186.2	52.3	103.9	16.5	120.3	22.8
± 90% CI, ton CO <sub>2</sub> /ha	35.7	5.5	41.2	11.6	27.7	4.4	32.0	6.1
Error %	10.0%	9.5%	9.9%	18.3%	13.3%	12.6%	13.2%	28.1%
Number of clusters	57	57	57	57	40	40	40	40

#### 4) Elaboration of the JCM methodology based on applying the draft to measure GHG emission reductions

In order to confirm that the proposed methodology is applicable, reference emissions were calculated, and emission reductions due to project implementation were estimated.

##### Calculation of reference emissions

##### 1) Prediction of future deforestation rate in the reference area (average, trend, model)

An analysis of historical land use and land cover change was conducted using Landsat, and a forest map of the entire reference area as it existed in 2002 was prepared. The table below shows the accuracy with which areas were classified into the categories of evergreen forest, deciduous forest, non-forest, and water.

Table 3: Accuracy assessment

TBD	Evergreen forest	Deciduous forest	Non-forest	Water	Total	Producers accuracy
Evergreen forest	486	18	95		<b>599</b>	0.811
Deciduous forest	27	214	176	3	<b>420</b>	0.510
Non-forest	44	41	619	2	<b>706</b>	0.877

Water	1	5	3	57	<b>66</b>	0.864
Total	<b>558</b>	<b>278</b>	<b>893</b>	<b>62</b>	<b>1791</b>	
Users accuracy	0.871	0.770	0.693	0.919		

Due to the low accuracy of classifying deciduous forest, overall accuracy was stuck at 77%, below the 80% threshold.

In Cambodia, deciduous forests drop their leaves in the dry season. The dry season is the season in which cloudless satellite images can be obtained, but it is a difficult time for classifying deciduous forests that are dropping leaves. In addition, the deciduous forests in this area have sparse vegetation, which means there is not a great difference in terms of vegetation density between deciduous forest and non-forest areas, and furthermore there is great variability within the areas that are classified as deciduous forests themselves. The deciduous forest area makes up approximately 20% of the project area, and its carbon stocks are about half of the evergreen forests. Because estimates of both surface area and carbon stores have large measurement errors, and their carbon contribution is small, it was decided to exclude deciduous forests from consideration. Agreement with the Forestry Administration will need to be reached in the future. This approach is provided in the methodology as one of the options in cases where classification accuracy is low. As a result, an overall classification accuracy of 89% was achieved, and an accuracy of 91% for the forest cover benchmark map.

Next, using the global forest cover change map of Hansen et al (2012)<sup>3</sup> (hereinafter, the Hansen map), the annual forest loss area for the past year was estimated by the time function approach. The Hansen map was created to show global forest cover change from 2000-2012 at 30 m spatial resolution using vast amounts of data. It shows multiple classifications based on crown canopy rate.

The forest portion of the Hansen map was identified by aligning the 2002 forest map with the Hansen map for the same period. The Hansen map shows forest change in units of one year. The annual forest loss area was examined by extracting the deforestation that occurred up to 2012 in the parts that were identified as forest. An analysis was performed using the time function approach, and the following deforestation function was obtained.

Annual deforestation area in reference region =  $2311.1 \times \text{year} - 2806.8$  (R2 = 0.83)

<sup>3</sup> M. C. Hansen, P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, J. R. G. Townshend, 2013. High-Resolution Global Maps of 21st-Century Forest Cover Change, 2012, Science: 342: 850-853

## 2) Calculation of each year's forest loss area in the reference area

The above formula was used to calculate forest loss area in the reference area from 2013 to 2022, and a result of 353,263 hectares in 10 years was obtained.

## 3) Prediction of the forest loss area within the project boundaries

The Land Cover Modeler (LCM) within IDRISI was used to estimate the locations of occurrence of deforestation. The LCM modeling was conducted in two phases. In the first phase deforestation between 2002 and 2006 was used to calibrate the model, and then project deforestation to 2012. The projected 2012 deforestation was compared with the actual deforestation within the reference region. Many combinations of driver variables were tested and ultimately 6 variables were included in the model. The final model had a Figure of Merit (FOM) of 25%.

After the model had been validated with that set of variables, the same variables were applied to the 2006 – 2012 epoch and deforestation was projected to the year 2022, using the rate calculated above. The projected deforestation from the latter model was used to create the reference scenario.

The area of forest loss within the project boundaries in the 10 years from 2013 to 2022 was estimated at 33,174 hectares.

Table 4: Future deforestation in the reference region and project boundary

	<b>Forest loss area (ha)</b>	
	<b>Reference region</b>	<b>Project boundary</b>
<b>2013</b>	24,926	467
<b>2014</b>	27,238	1,362
<b>2015</b>	29,549	1,914
<b>2016</b>	31,860	1,963
<b>2017</b>	34,171	2,590
<b>2018</b>	36,482	3,565
<b>2019</b>	38,793	3,555
<b>2020</b>	41,104	4,613
<b>2021</b>	43,415	5,907
<b>2022</b>	45,726	7,238
<b>Total</b>	<b>353,263</b>	<b>33,174</b>

## 4) Calculation of emission factors

Estimating changes in carbon stocks in forest (evergreen forest)

In the methodology, different periods of time are required, depending on the carbon pool, before the pool completely disappears after conversion to non-forest. The period was determined to be 10 years for the below-ground biomass and dead wood targeted by this study, compared to a single year for above-ground biomass. The change in carbon stocks was calculated based on the plot survey results.

#### Estimating changes in carbon stocks in plantations and farmland

The average carbon stocks over 20 years were calculated, based on the literature on the growth of rubber (Wauters et al. 2008) in the case of plantations, and data collected in Mondulkiri Province by the WCS in the case of agricultural land.

#### 5) Calculation of reference emissions

Using the methodology, it was possible to estimate the reference emissions, shown in the following table.

**Table 5: Total reference carbon stock change in the project area**

	<b>Total reference carbon stock change in the project area</b>
<b>2013</b>	160,007
<b>2014</b>	466,304
<b>2015</b>	655,501
<b>2016</b>	672,238
<b>2017</b>	887,173
<b>2018</b>	1,220,810
<b>2019</b>	1,217,697
<b>2020</b>	1,579,724
<b>2021</b>	2,023,218
<b>2022</b>	2,478,918
<b>Total</b>	11,361,588

#### Calculation of ex ante estimated net anthropogenic GHG emission reductions

Satellite images were used to examine deforestation in the period from 2012 to 2014, and ex ante estimated net anthropogenic GHG emission reductions were estimated. Because deforestation in the leakage belt was smaller than deforestation under the reference scenario, leakage was calculated as zero.

Table 6: Ex-post deforestation and carbon stock changes

	Forest loss area in project area (ha)	Emissions amounts (tonCo2/year)			
		Reference emissions	Project emissions	Leakage	Emissions reductions
<b>2013</b>	830	160,007	284,298	0	-124,291
<b>2014</b>	830	466,304	284,298	0	182,005

It was therefore possible to confirm that the proposed methodology is applicable.

### **(3) Activities for acquiring international understanding of REDD+ under the JCM**

REDD+ is a mechanism agreed to under the United Nations Framework Convention on Climate Change to reduce emissions of greenhouse gases from forests in developing countries. After international negotiations from 2005 under the United Nations Framework Convention on Climate Change, the "Warsaw framework for REDD+" was agreed to at COP19, which was held in Warsaw in 2012, and a set of basic rules was determined for promoting REDD+ as a global community.

Today, there is no opposition in the international community with respect to counting emissions reductions from REDD+ activities as part of the commitment to developing countries under the United Nations Framework Convention on Climate Change. On the other hand, some countries disagree about applying market mechanisms to credits for emissions reduction from REDD+. There is therefore very little discussion about the possibility of using emissions reductions from REDD+ to achieve the emission reduction targets of developed countries up to 2020, and in the next framework beyond 2020.

In recognition of this state of affairs, and with the aim of gaining recognition in the international community for the REDD+ in the JCM after the next fiscal year, the following two activities were carried out as part of the present study:

- Dissemination of REDD+ activities to the general public through the CI Japan website
- Outreach to the international community through panel participation in the COP20 side event

#### Outreach to the general public through the CI Japan website

As part of REDD+ outreach activities to the general public in Japan, the CI Japan website was given a significant update, incorporating the latest information about REDD+.

#### Outreach to the international community through a COP20 side event

On December 4, during the United Nations Framework Convention on Climate Change COP20 which was held in Lima, Peru in December 2014, the Forestry and Forest Products Research Institute and JICA co-hosted an on-site side event entitled "A collaboration platform for REDD+ express "Public-Private Platform": Japanese private companies are going on board". There, CI Japan participated as a panelist and presented the perspective of NGOs and the role that NGOs can play with respect to the challenges when the public and private sectors work together on REDD+ and how to overcome them. In addition, CI Japan expressed to the international community its desire to continue to utilize the experience and knowledge gained during participation in REDD+ activities as an international NGO in order to implement the JCM bilateral credit mechanism.