

# **The 3rd Workshop on GHG Inventories in Asia Region**

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## **Development of the LULUCF's GHG Inventories of Cambodia**

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1

## **Outline of Presentation**

1. Introduction
2. Direct Measurement of Biomass of the Major Forest Type
3. Conversion of measured biomass values into values in carbon pools under the GPG-LULUCF
4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion

2

## 1. Introduction

- Cambodia ratified the UNFCCC on 18 December 1995;
- Acceded to the Kyoto Protocol on 4 July 2002;
- **Ministry of Environment (MoE)** is the National Focal Point for the UNFCCC and the Kyoto Protocol;
- **Cambodian National GHG Inventory** was prepared for the first time in 1994 as the base year by the Climate Change Enabling Activity Project (CCEAP) *phase1 and phase2*: Improvement of Activity Data and Emission Factors for Forestry Sector. The methodologies based on the Revised 1996 IPCC Guidelines;
- **Cambodia** is a project partners, which conduct a field surveys for the improvement of GHG inventories of the LULUCF sector, funded by Asia Pacific Network (APN) and executed by the National Institute for Environmental Studies (NIES) of Japan;

3

## 1. Introduction (cont.)

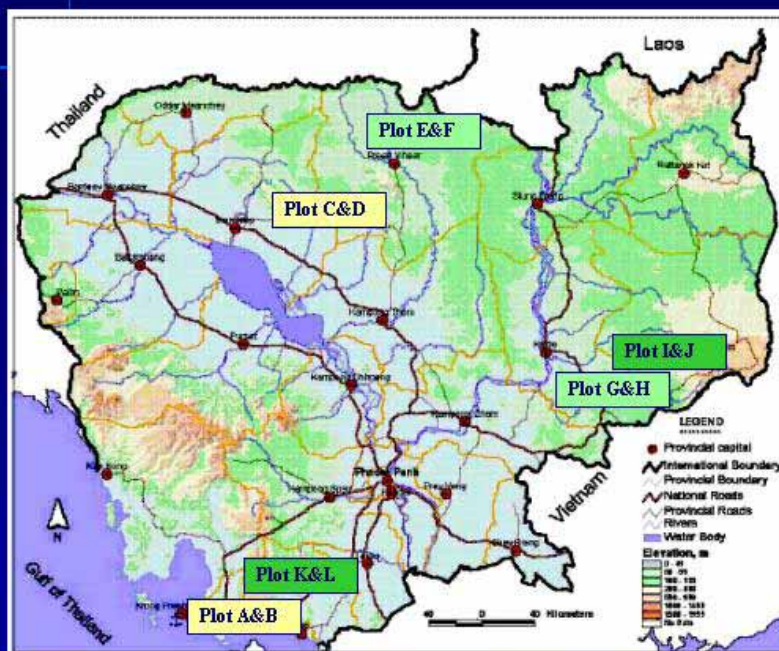
- For 2004-2006, the CAPaBLE project in Cambodia focused on activities:
  - Determination of the overall work plans
  - Planning and preparation for the training in Dec. 2004
  - Organizing a three-days field training (Koh Kong province)
  - Planning and preparation for the measurement in CAPaBLE plots
  - Implementation of the first time measurement (Mar. 2005)
  - APN CAPaBLE-NIES: Meeting with MoE-Cambodia (October 4-7, 2005): Prepare the Excel table format for the application of collected and analyzed data to an inventory by using the IPCC's GPG-LULUCF; Compare the estimation methodologies used between the previous and new inventories; Evaluate the overall methodology used; Discuss the items to be included in the final activity report
  - The second time measurement (Jan-Feb. 2006)
  - Data analysis, evaluation of the measurement, and report.

## 2. Direct Measurement of Biomass of the Major Forest Type

- The field survey focused on the main forest types which play an important role as the key source/sink categories:
  - Evergreen forest;
  - Deciduous forest; and
  - Secondary forest;
- Two different locations of field measurements were conducted for each forest type;
- The objectives of field surveys are to: (i) identify type, species and number of trees in three selected forest types; (ii) estimate the aboveground biomass of trees in these selected forest types; and (iii) estimate the annual biomass increment of the selected forest types.

5

## 2. Direct Measurement of Biomass of the Major Forest Type (cont.)



### Note:

- Secondary: A,B,C,D
- Deciduous: E,F,G,H
- Evergreen: I,G,K,L

### Map of Cambodia

6

## 2. Direct Measurement of Biomass of the Major Forest Type (cont.)

### Locations and schedule of survey

Plot	Forest type	Location	Measurement Time 1	Measurement Time 2
A	Secondary forest	Sihanoukville (Ream NP)	28 Feb-3 March 05	January 06
B				
C		Siem Reap (Kulen Prumtep NP)	6 -9 March 05	February 06
D				
E	Deciduous	Preah Vihear (Wildlife sanctuary)	19-23 March 05	February 06
F				
G		Kratie -Snoul (Wildlife sanctuary)	27-31 March 05	January 06
H				
I	Evergreen	Kratie -Snoul (Wildlife sanctuary)	2-5 April 05	January 06
J				
K		Kampot (Bokor NP)	6-9 April 05	January 06
L				

7

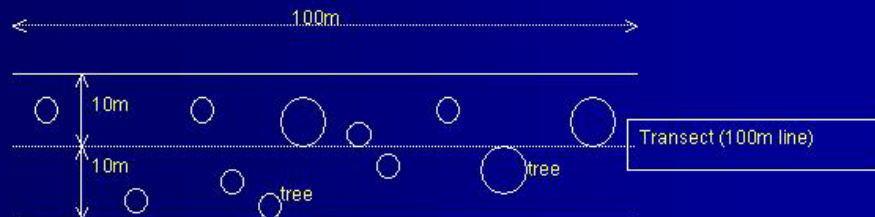
## 2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- **The methodology for field survey** followed by *Hairiah K. et al. (2001): Methods for sampling carbon stocks above and below ground* and the final report of the Cambodia Climate Change Enabling Activity Project's Phase 2 (2003).
- **The measurement consists of two parts:**
  - (i) non-destructive sampling for the trees, including diameter and height of living trees and necromass;
  - (ii) destructive sampling for the understory, necromass, and living tree biomass.

8

## 2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- **Sampling protocol for living tree biomass and tree necromass (Diameter >30 cm):** Sample area:  $20\text{m} \times 100\text{m} = 2000\text{m}^2$ ;



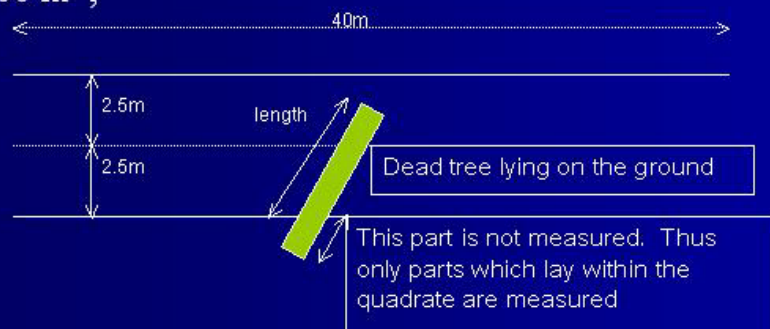
- **Sampling protocol for living tree biomass and tree necromass (Diameter from 5-30 cm):** Sample area:  $5\text{m} \times 40\text{m} = 200\text{m}^2$  within in the sample size Diameter >30cm



9

## 2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- For each tree specie is recorded and the diameter at 1.3m above the soil surface is measured using a diameter tape (diameter at breast height: DBH) for the First and Second time;
- Height of trees, selected within a plot, is also measured and recorded for the First and Second time;
- **Sampling protocol for tree necromass:** Sample area:  $5\text{m} \times 40\text{m} = 200\text{m}^2$ ;



10

## 2. Direct Measurement of Biomass of the Major Forest Type (cont.)

- Sampling protocol for destructive sampling in 1.25 m<sup>2</sup>:  
Sample area: 5m x 40 m = 200 m<sup>2</sup> ;



- **Living tree biomass:** set up randomly a sampling frame of 0.5m x 0.5m in each quadrat with trees less than 5 cm DBH, i.e. seedling or saplings, are harvested within the 1m x 1m quadrat;
- **Coarse litter:** crop residues, all unburned leaves and branches;
- **Fine litter:** dark litter, including all woody roots which partly decomposed;
- **Sun dry:** living tree biomass, coarse litter and fine litter are dried using sun-light.

11

## 3. Conversion of measured biomass values into values in carbon pools under the GPG-LULUCF

Translation of carbon pools from CAPaBLE to GPG-LULUCF

CAPaBLE	Symbol	Definition	Sampling method	IPCC Pool
Carbon pools				Carbon pools
Live trees	BT	with a stem diameter of 30 cm in standard sample plot (20*100 m)	Non-destructive	Above ground biomass
	LT	with a stem diameter of 5<...<30 cm in large area (5*40 m)		
Understorey	L+S	includes trees less <5cm in diameter	Destructive	Above ground biomass
Litter	CLit	Coarse/standing litter: tree necromass <5cm in diameter and/or <50 cm length	Destructive	Litter
	FLit	Fine litter: dark litter, including all woody roots which partly decomposed Surface roots		Litter
Dead felled trees	DFT	Dead trees on the ground with a diameter >5cm and >50cm length	Non-destructive	Dead wood
Stump (trunk) remains in forest	DST	Dead standing trees with a diameter >5cm and >50cm length	Non-destructive	Dead wood

### 3. Conversion of measured biomass values into values in carbon pools under the GPG-LULUCF (cont.)

Summary of key points of CAPaBLE survey in IPCC definition

IPCC pools	CAPaBLE Carbon pools	Forest types: Secondary, Deciduous, and Evergreen Forests (t dm/ha)			
		T=1	T=2	Difference	Average
<b>Living Biomass:</b> - Aboveground and - Belowground biomass	- Live trees - Understorey				
<b>Dead Organic Matter:</b> - Dead wood, - Litter	- Dead wood - Coarse litter - Fine litter				
<b>Soils: Soil organic matter</b>	N/A				

13

### 4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion

- Base on IPCC GPG-LULUCF, to estimate the land areas which go through the conversion of land uses in 2000, a number of assumptions were proposed to be taken;
- The difference areas of specific land use categories between the initial and final point in time experienced land conversion;
- For example, in Cambodia, it was estimated that the land area of Forest Land was decreased by around 55,000 hectares in 2000. In this case, we assumed the area of Forest Land went through land use conversion and the rest of Forest Land area remained as Forest Land;

14

#### 4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion (cont.)

- The difference areas of land use categories between the beginning and end of year 2000, the increased and decreased areas of land use categories through conversion in 2000 were obtained;
- The increased land area of a land use category means that the area was increased because some lands were converted from different land use categories into the land use category;
- The total of increased area is equivalent to that of the decreased area. Then estimated the areas of land use conversion of each land use category by making assumption considered the most realistic;

15

#### 4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion (cont.)

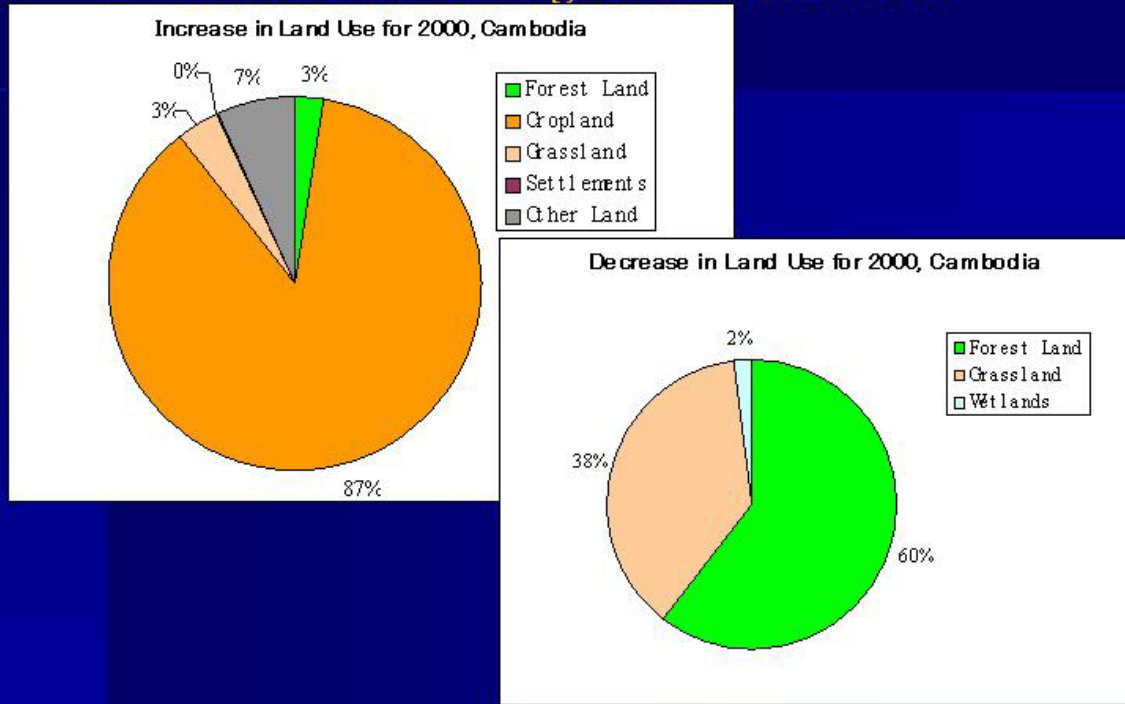
##### Assumptions made to estimate the areas of land use conversion

Assumption No.	Land conversion concerned (Area in Ha)		Description of assumption
	Before	After	
1	Grassland (2,529.5)	Forestland (2,529.5)	It is difficult to predict forest planting was conducted after destroying existing forests. Considering ecological reasons, it is also difficult to plant trees in wetlands. Hence, it is assumed that all plantations were established in grasslands.
2	Forestland (3,336.3)	Grassland (3,336.3)	It is the most realistic to assume grassland was established by converting forestland.
3	Grassland (247.5)	Settlements (247.5)	It is the most realistic to assume settlements was established by converting grassland.
4	Forestland (54,565.3)	Cropland (83,785.3)	The remaining area of forestland that went through conversion was reported here.
5	Grassland (29,220)		It is assumed that the rest of area of cropland converted from different land uses was area converted from grassland.
6	Grassland (4,196.5)	Other land (6505.5)	The remaining area of grassland that went through conversion was reported here.
7	Wetlands (2309.0)		It is assumed that the rest of area of other land converted from different land uses was area converted from wetlands. <sup>16</sup>



4. Development of activity data for 2000 including assumptions made to estimate land areas which went through land use conversion (cont.)

Land area went through conversion in 2000



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