Country Report of Cambodia:
Efforts to Estimate Country-Specific Mean Annual Biomass Increment and Its Uncertainty

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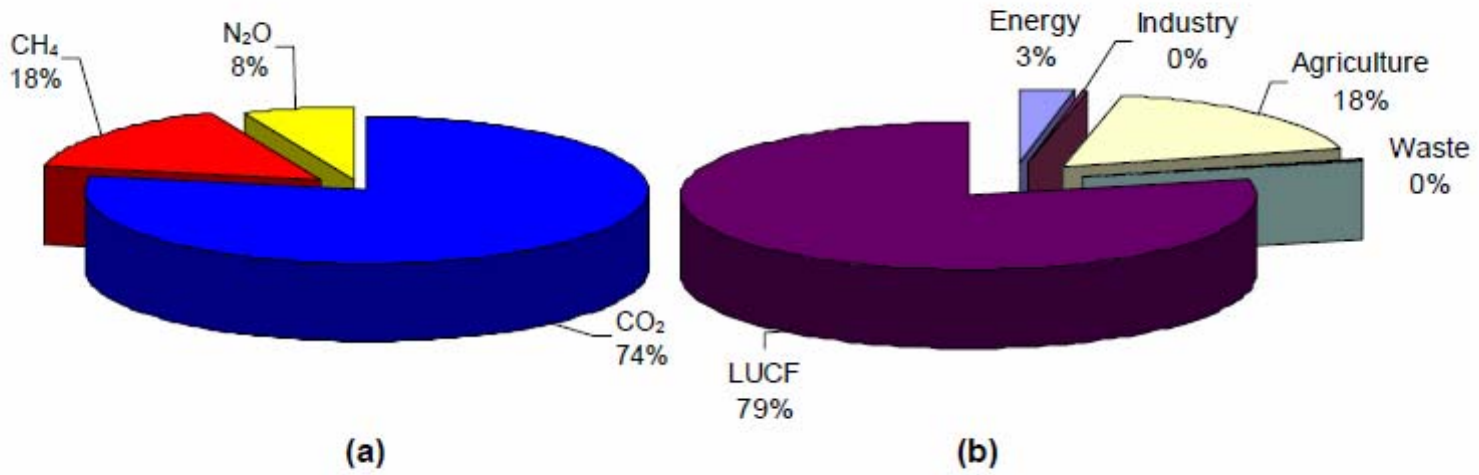
Outline

- Overview
- Review of 1994 LUCF Inventories in NC1
- Methodology and Results of the Pilot Study
- Summary

Overview

- 3-year pilot study (completed in Mar. 2006) implemented jointly by MoEC and NIES with the financial assistance from the Asia-Pacific Network for Global Change Research CAPaBLE Programme
- Lack of country-specific MAI for the top key categories of the LUCF sector
- Conducted plot-based field measurement to estimate MAI of 3 major forest types
- Estimated the uncertainty of MAI for evaluation of the measurement
- Lessons learned

1994 Inventories in NC1



Percentage share of 3 main GHGs

Total CO_2 eq. emissions by sector

- Total national uptake is bigger than total emissions by around 5,000 Gg of CO_2-eq.

Source: MoEC (2002) Cambodia's Initial National Communication.

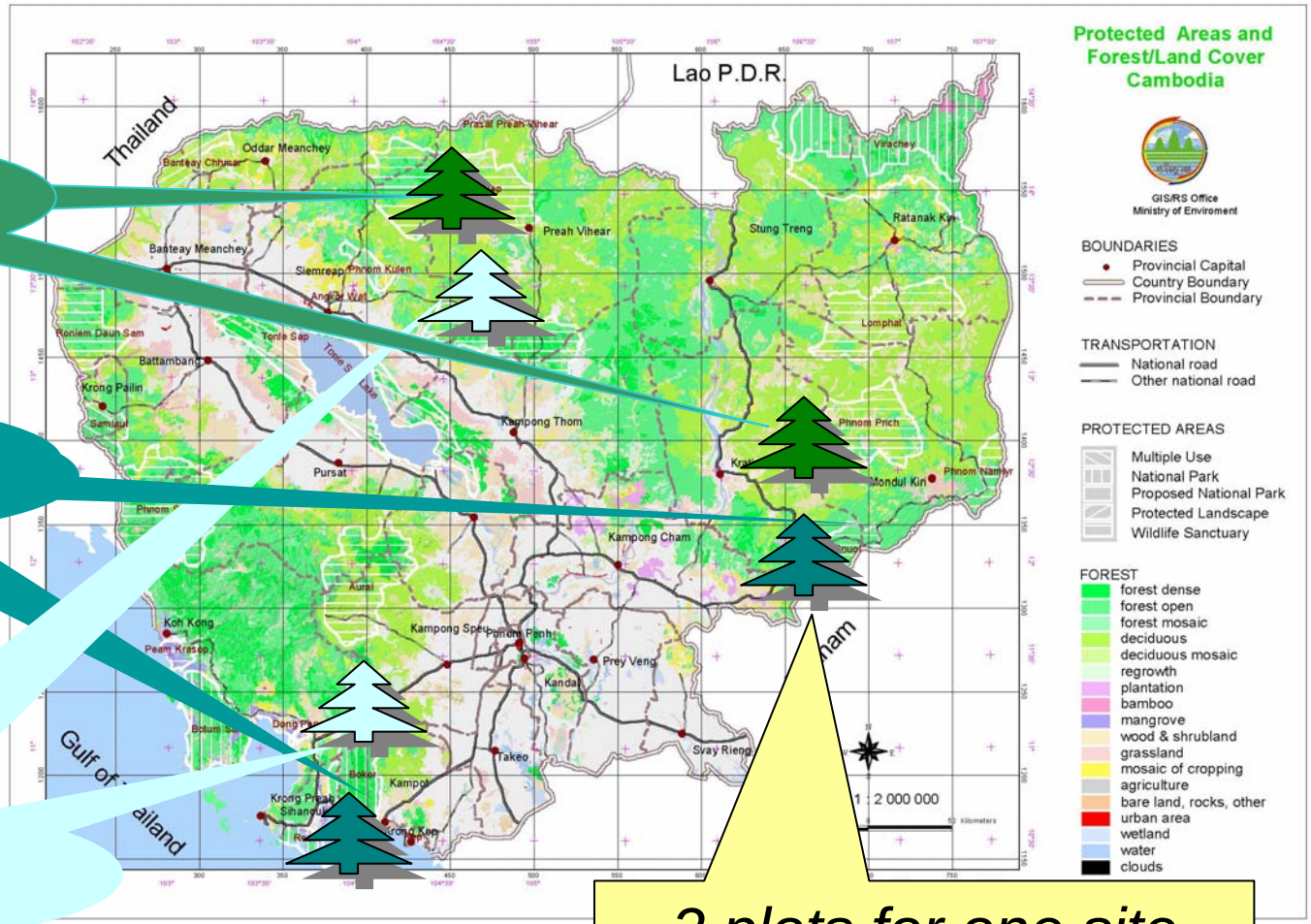
1994 Inventories in NC1

Results of Key Category Analysis

IPCC Source Category		Direct GHGs	1994 Estimate (Gg CO2eq.)	% Contribution to Level
5A Changes in Forest / Woody Biomass	Forest - Deciduous	CO_2	-28,597.80	20.26%
5A Changes in Forest / Woody Biomass	Forest - Evergreen	CO_2	-22,148.50	15.69%
5B Forest & Grassland Conversion	Biomass-Decay- Forest - Secondary/Regrowth	CO_2	14,124.00	10.01%
5A Changes in Forest / Woody Biomass	Forest - Mixed&Coniferous	CO_2	-11,757.90	8.33%
5B Forest & Grassland Conversion	On-Site-Burning- Forest - Secondary/Regrowth	CO_2	10,169.28	7.20%
5A Changes in Forest / Woody Biomass	Roundwood Harvested	CO_2	8,271.94	5.86%
5B Forest & Grassland Conversion	Biomass-Decay- Forest - Deciduous	CO_2	4,154.33	2.94%
5A Changes in Forest / Woody Biomass	Shrubland	CO_2	-3,974.67	2.82%
5B Forest & Grassland Conversion	On-Site-Burning- Forest - Deciduous	CO_2	2,991.12	2.12%
4A Enteric Fermentation	Non-dairy Cattle	CH_4	2,587.20	1.83%

Methodology

Step 1: Established sample plots in 3 major forest types designated by national forest definition



Methodology

Step 2: Conducted field measurement once a year for two years

Period	● Feb.-Apr. 2005 (1st time) ● Jan.-Feb. 2006 (2nd time) } **1 year gap**
Number of sites & plots	2 separate sites for each forest type with 2 plots in one site
Size of plots (m)	● 20*100 (bigger plots) ● 5*40 (sub-plot within a bigger plot)
Items	Diameter (DBH), height, species of each tree
Reference	*Hairiah, K. et al. (2001) "Methods for sampling carbon stocks…" ICRAF.*

Notes: Living trees with more than 30cm in diameter were measured in bigger plots and those below were in sub-plots.

Methodology and Results

Step 3: Estimated aboveground biomass by applying a biomass regression equation

Biomass regression equation used:

$$Y = 42.69 - 12.800(D) + 1.242(D^2)$$

Where: D = DBH in cm

Reference: Brown, S. (1997) "*Estimating Biomass and Biomass Change of…"* FAO.

Step 4: Subtracted year 1 values from year 2 values to obtain annual increments

	EvF			DF			SF		
	t d.m./ha/yr								
	T=1	T=2	Difference	T=1	T=2	Difference	T=1	T=2	Difference
Living tree	388.39	397.15	8.76	269.50	275.23	5.73	154.66	160.33	5.68
Value in NC1		295	3.00		120	3.60		190	2.83

Methodology and Results

Step 5: Estimated uncertainty of the values following IPCC's method

Equation used:

$$\% \text{ uncertainty} = 2\sigma / \mu * 100$$

Where: σ = standard deviation

μ = the mean value

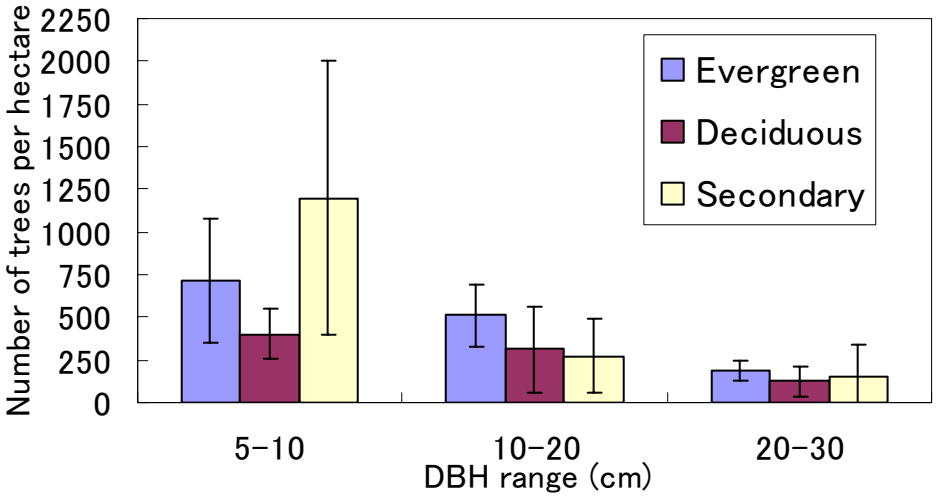
Reference: IPCC. (2003) *"GPG for LULUCF" IGES.*

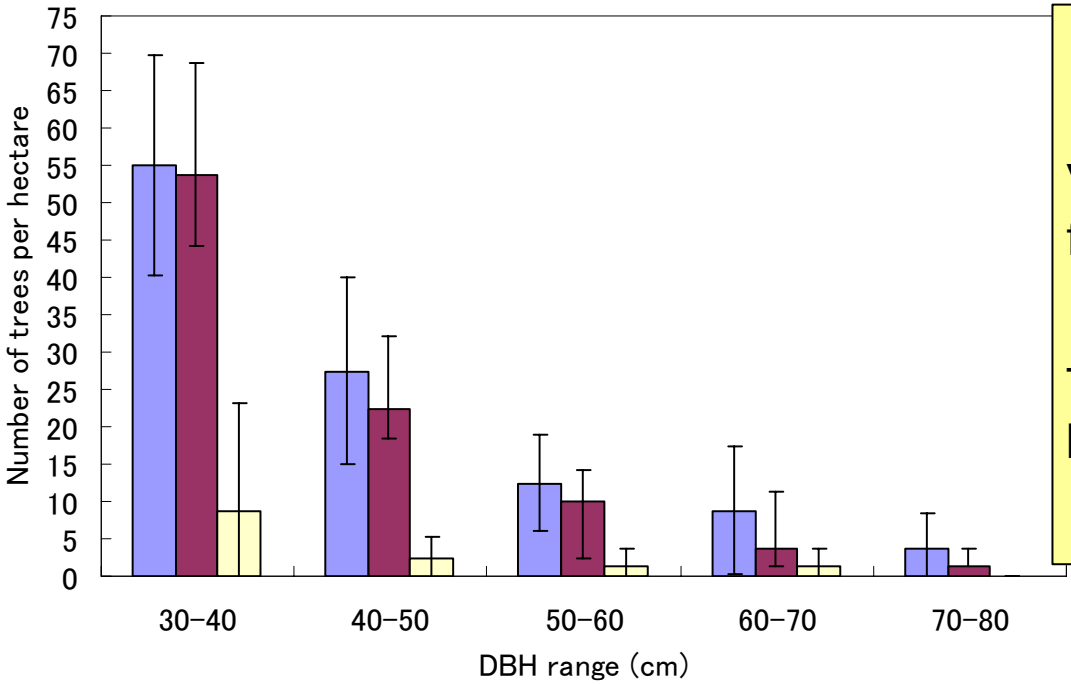
	Aboveground biomass in time 1 (t d.m./ha)	Uncertainty (%)
Evergreen	388.39	115
Deciduous	269.50	171
Secondary	154.66	267

High!

Results

Average Number of Trees within Different DBH Ranges (cm)





Lesson learned

Variation of biomass stock in the same forest type is high across plots

The living condition of the forests is likely key rather than “forest definition”

Summary

- Efforts to develop country-specific MAI are encouraged as the categories are key
- AGB of forest is influenced mainly by the living condition and not necessarily by the national forest definition
- Nation-wide information of forests' living condition is desired

- Is such a Map available or can be developed?
- How about the consistency with the activity data (i.e. forest area) used?

Thank You!