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Technical Manual for Participatory Carbon Monitoring - PCM

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UN-REDD Viet Nam PROGRAMME

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Contents of Presentation

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2. Organizing PCM
3. PCM in the field
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The basics of the technical manual for PCM in Vietnam

The manual was developed through steps of

a) developing a **draft outline**, followed by

b) piloting of **PCM orientation and field exercises** with a number of target groups in the Central Highlands of Viet Nam, and

c) **revising** and completing the manual.

The manual is intended as first version of a living-document, to be updated and revised as the National REDD+ Program for Viet Nam

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1. Introduction

1.1. Background

1.2. Principles of PCM

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1.7. A summary of PCM approach

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1.1. Background on REDD+ and National MRV system

The MRV system of Viet Nam will be based on four main pillars:

- **A Land Monitoring System (LMS)**
- **A national biomass inventory** based on multipurpose National Forest Inventory (NFI) and Participatory Carbon Monitoring (PCM)
- **A National GHG Inventory** to estimate and report anthropogenic emissions by sources and removals by sinks.
- **A National REDD+ Information System (NRIS)**

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1.2. Principles of PCM

Some of the key principles of PCM for REDD+, which have also been applied as the basis for developing this manual.

- **Participation**
- **Simple methods and tools**
- **Cost and time effectiveness**
- **Reliability of data:** PCM methods must conform to IPCC guidelines, also, PCM will be integrated with the other components of the MRV system

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1.3. Objectives of PCM

PCM is considered an important mechanism for REDD+:

- **Changes in carbon stocks** need to be measured on the ground.
- **Mobilizing communities** can be more cost-effective
- **Community's understanding** of carbon monitoring will work as an incentive to promote **further improvements in forest management.**
- Community's engagement in carbon monitoring will **increase the livelihood**

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1.4. PCM participants in the context of Viet Nam REDD+

- **Households** owning forests allocated through **red-book certificates**
- **Community** groups managing forests allocated through **red-book certificates**
- **Households** managing forests **through contracts** with other forest owners.

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1.5. Integration of PCM with the MRV system

Under the current discussions, data for monitoring biomass will collected at two levels:

- **Level 1: Through PCM** involving participants in the National REDD+ Program, **activity data and emission factors** can be collected in a statistically significant number of sample plots;
- **Level 2:** For the comprehensive **national data**, activity data will be collected primarily through a **satellite-based land monitoring system**, while **emission factors can be based on the data collected** for the National Forest Inventory (NFI).

Level 1 data will be limited to basic forest measurement on forest area and for estimating biomass per management unit and stratified by eco-zone

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1.6. Target audience of the manual

This manual provides a practical overview of PCM and direct audiences of this manual are **local foresters**.

For actual application of PCM additional manuals will be developed:

- **Field manual** for use by PCM teams (local communities);
- Operational manual **for facilitators**;
- Procedural manual **for managers** of PCM

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1.7. A summary of the PCM approach

Stage1
- Preparation
  Training PCM facilitators - forming PCM teams

Stage 2
- PCM orientation session
  Training in sampling and data recording

Stage 3
- PCM field campaign
  Measuring the forest block - setting up the sample plot - taking measurements

Stage 4
- Follow-up and synthesis session
  Data management and analysis

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1.7.1. Parameters for measurement

There are largely **two groups of parameters** for measurement:

- **Changes in forest area** (Activity Data)
  - Forest area per management unit, management objective and eco-zone (initial year).
  - **Area of land-use change** (subsequent years) per management unit, management objective and eco-zone.
- **Basic forest mensuration for estimating biomass**. Of the five carbon pools, the above-ground biomass (trees and bamboo) is essential. Dead wood and litter may also be collected, but on a lower sampling density. Below-ground biomass measurement is outside of the scope of PCM.

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1.7.2. Frequency of the PCM exercise

- In principle, the more data is generated through PCM, the more robust will be the national data set
- PCM should be carried as an on-going activity to be engaged by local forest offices and communities.
- It can easily be integrated in the scheduling of other tasks of local people (e.g. patrolling boundaries, layout or maintenance of fire breaks, enrichment planting or thinning, collection of NTFPs)
- In any event, changes in forest land use and area need to be reported at least annually

The frequency and/or rolling-nature of implementing the PCM exercise will need to be considered within the larger context of the MRV system

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2. Organizing PCM

2.1. Preparation

2.2. Classroom orientation session

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2.1. Preparation

- **General coordination and data management**
  - PCM will be implemented by local communities or individual forest owners
  - The coordination and data management should be organized at a higher level at District, Province
- **Organizing the activities:** To be organized at the level of administration closest to the community
- **Training local forest officers to become "PCM facilitators"**
- **Forming PCM teams**
- **Preparation of maps, tools, materials and equipment**

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2.2. Classroom orientation session

- The orientation should be organized **at the commune level**/forest management unit;
- and **facilitated by local forest officers** who have received PCM facilitator training;
- After the training, participants should be able to inform and demonstrate to the other members of the PCM team on:
  - Why PCM is necessary?
  - Steps of the PCM survey
  - How to use GPS and other survey tools
  - How to set up sample plots
  - How to take measurements
  - Reporting collected data
  - Use of the collected data

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3. PCM in the field

Step 1: Identifying and measuring the area of forest blocks

Step 2: Upload and update the forest area information onto maps

Step 3: Determine the optimal number of plots to be surveyed

Step 4: Set up sample plots in the forest

Step 5: Measurement of trees and bamboo

Step 6: Litter measurement (optional)

Step 7: Dead wood measurement (optional)

Step 8: Data management

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Step 1: Identifying and measuring the area of forest blocks

Objective	**To record the forest of each forest owner**
Result	Boundaries of forest management units per forest owner reflected on map
Responsibility	**PCM team members**, with assistance of FPD, PFMB or FC
Materials / equipment	**GPS** for checking boundary of forest boundary of the forest owners
Implementation	Initial year: Go to each of the forest blocks and, using the “tracking” function of the GPS, Later years: Use the same GPS “tracking” function to detect location and area of forest land use change

Monitoring boundaries of forest owners, forest block, setting management objectives and solution

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Step 2: Upload and update the forest area information onto maps

Objective	**Update maps on forest location and land use change**
Result	Location information of forest blocks and land use change is reflected on to updated forest stratum maps
Responsibility	**District DARD staff, or PFMB or FC if relevant**
Materials / equipment	• Forest stratum maps provided by technical inventory agencies • GPS data recording forest area (and land use change) tracks • GIS software such as Mapinfo, ArcGIS, DNRGarmin
Implementation	• Download GPS Track data (delineate variable areas in GIS) • Estimate the areas of individual forest blocks after digitizing and editing the data downloaded.

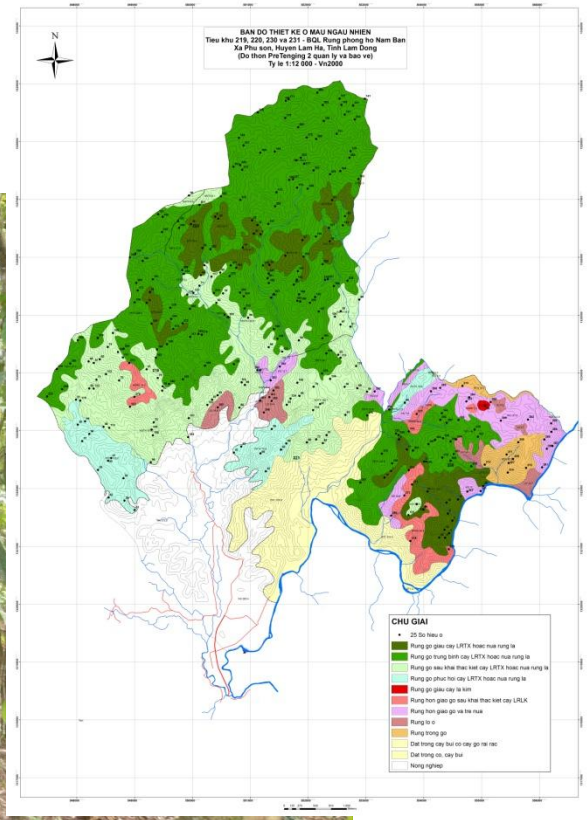
Step 3: Determine the optimal number of plots to be surveyed

Objective	**To determine the minimum sampling density per stratum**
Result	**Number of sample plots per each forest stratum** determined with confidence level 95% and estimation error below 10%.
Responsibility	**National REDD + Information System (NRIS) and SDOF**
Materials / equipment	• Forest status • ArcGIS software • Computer for data analysis
Implementation	**A preliminary inventory** needs to be completed to estimate the **variance of the carbon stock** in each forest stratum and to provide a basis for calculating the number of plots required for surveying. Sample plots are located **randomly on the stratum map**

Step 4: Set up sample plots in the forest

Objective	**To set up plots in which measurements will be taken**
Result	Random sample plots located, set up in the forests
Responsibility	**PCM team**
Materials / equipment	• GPS • Tape measure • Metal peg with attached rope
Implementation	• The sampling plots are located at random locations in the forest. • The location of the plot is recorded by GPS if the forest block is larger than 4 hectares. • The slope of the plot is recorded • **The dimension of the plot** is dependent on the type, condition of the forest and size of DBH

Identify randomly sample plots in the field



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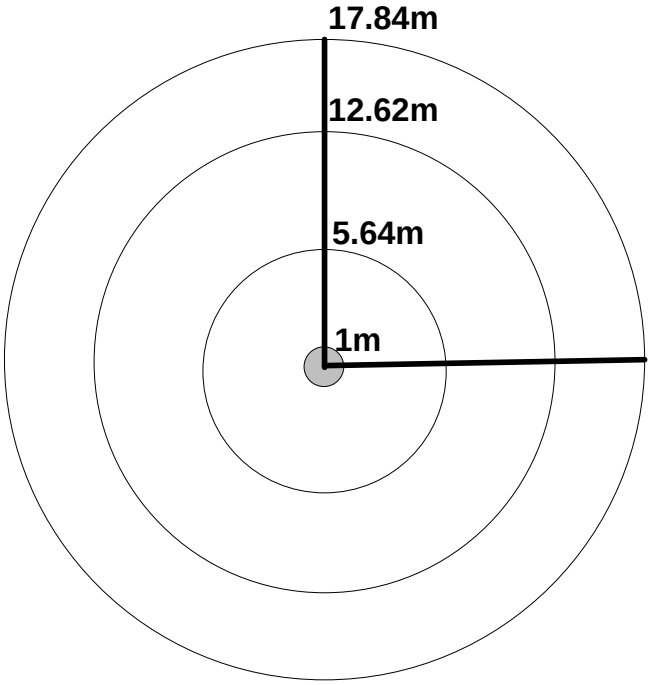
Design circular sample plot according to forest types and size of DBH

- ***Type of evergreen, semi-deciduous, dipterocarp, and pine forest***



17.84m radius plot to measure tree ≥ 50cm DBH

12.62m radius sub-plot to measure tree 30 cm ≤ DBH < 50cm

5.64m radius sub-plot to measure tree 6 cm ≤ DBH < 30cm

1m radius sub-plot to measure tree DBH < 6 cm

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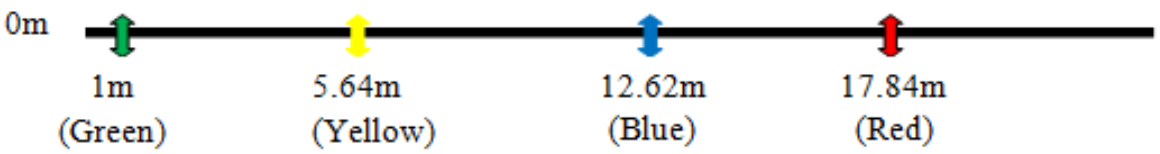
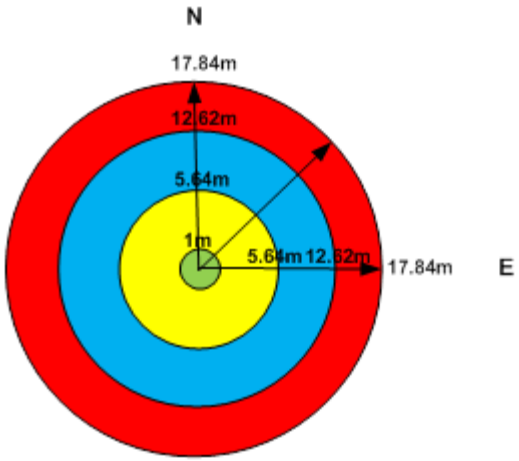
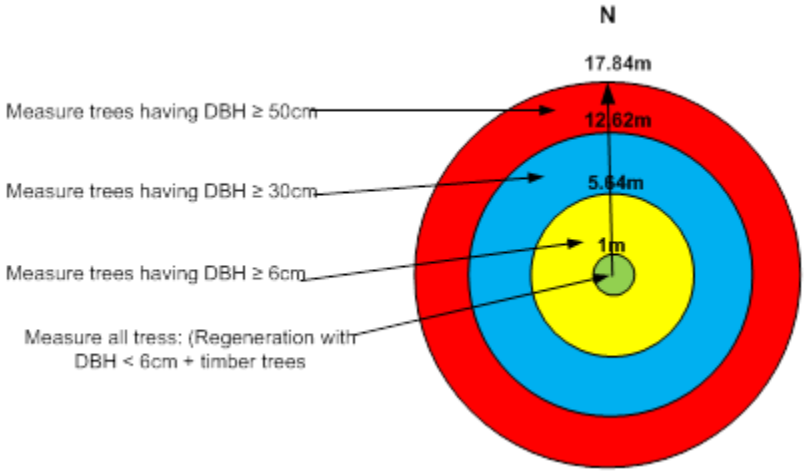
How to design circular sample plot and sub-plot



Rope prepared for circular sub-plot with colour bands according to difficult radius





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Sample plot set up

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Radius distances on slope calculated according to the slope angle could be taken in the field by Clinometer.

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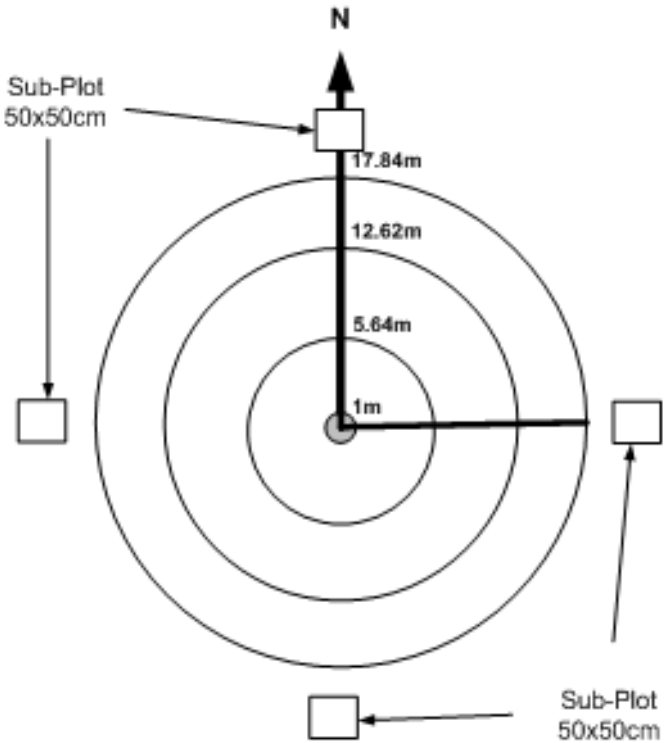
Location of 4 sub-plots 50x50 cm for measuring biomass of LHG



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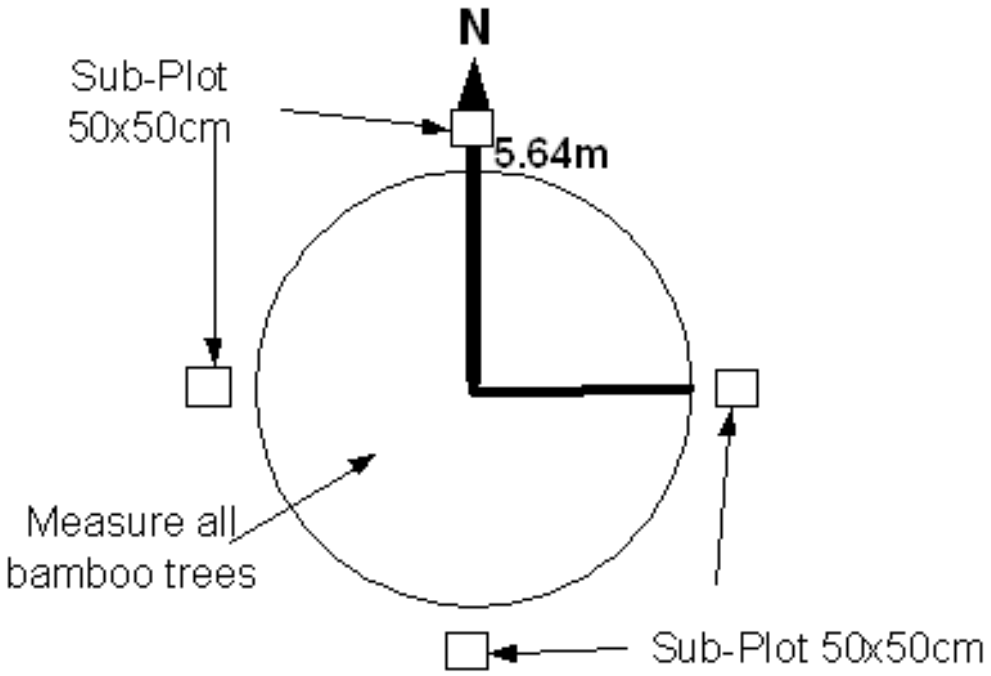
Bamboo forest



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Step 5: Measurement of trees and bamboo

Objective	**Measure the properties of trees and bamboo**
Result	Forest properties measured for plot-wise above-ground biomass calculation
Responsibility	**PCM team**
Materials / equipment	• **Diameter tape** • **Writing board with paper forms or field computer**
Implementation	**For natural forests with trees:** • Measure DBH of every tree with DBH >6cm using the diameter tape. • Tally every tree that has a DBH <6cm (i.e. count the total number of small trees in the plot; do not measure them). **For natural forests with bamboo:** • Bamboo is measured by age and average height, if possible. • If the bamboo is monopodial (single stem), DBH is measured as for trees. • If the bamboo is growing sympodial (in a culm), DBH of 10 individual stems in each culm

Inventory in sample plot

DBH mesurement and fix tree number sign

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Bamboo measurement: Species, DBH, Age

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Measurement in sample plots

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Step 6: Litter measurement (optional)

Objective	**To take measurements of the litter**
Result	Litter measured for plot-wise litter biomass calculation
Responsibility	**PCM teams**
Materials / equipment	• Measuring tape • Bag for collecting litter • Spring scale • Writing board with paper forms or field computer
Implementation	• Within the plot (step 5), mark a 50cmx50cm square sub-plot (4 sub-plot) • Collect all litter within the sub-plot and weigh

Weight biomass of Litter and specimens

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Shrub, herb, grass, NTFPs measurement

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Step 7: Dead wood measurement (optional)

Objective	**To take measurements of the dead wood**
Result	Dead wood measured for plot-wise dead wood biomass calculation
Responsibility	**PCM teams**
Materials / equipment	• Measuring tape • Bag for collecting dead wood (fallen branches) • Spring scale • Writing board with paper forms or field computer
Implementation	**For small branches:** • Within the plot (step 5), mark a 100cmx100cm square sub-plot. • Weigh only the part that was inside. • This procedure may be repeated up to four times in the larger plot. **For large branches** (>6cm diameter) or dead tree trunks (fallen or standing): • Measure their length (height) and diameter.

Step 8: Data management

Objective	**To securely store all data measured in the forest**
Result	All measured data is stored in the MRV system
Responsibility	**SDOF and district FPD, FC or PFMB staff**
Materials / equipment	• **Paper forms with field data or field computer** • **Internet connected computer**
Implementation	• **If a field computer** with appropriate software is used, data can be uploaded to the MRV database automatically. • **If paper forms** have been used, navigate to the National REDD+ Program website on a computer with internet connection and enter the data manually. This information can and should be shared with the communities or households having measured the data.

4. Some allometric equations developed in Vietnam

1. Ever-green broad-leaves forest:

- AGTB (kg) = $0.2137*DBH^{2.4514}$ $R^2 = 0.9545$
- AGTC (kg) = $0.0428*DBH^{2.4628}$ $R^2 = 0.9378$ (Carbon in tree)
- BB (kg) =$0.039*DBH^{2.288}$ $R^2=0.9577$
- BC (kg) =$0.051*DBH^2 - 0.6756*DBH+2.8901$ $R^2=0.9983$ (Carbon in the root of tree)

2. Dipterocarp forests

- AGTB (kg) = $0.1910*DBH^{2.5136}$ $R^2 = 0.9695$
- AGTC (kg) = $0.0332*DBH^{2.7147}$ $R^2 = 0.9573$ (Carbon in tree)

3. Bamboo forest:

AGBC (kg) = $0.2786A^2 - 0.9496A + 4.3803$ (Carbon in bamboo);

$R^2 = 0.9377$; A: Bamboo age.

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5. Conclusion

- **The discussion on the reliability of data collected by community** should be assessed based on results of actual PCM experiences, such as:
  - Those carried out in the Central Highlands and the **national program of community forest management** (CFM) in 10 provinces (implemented by MARD 2007-2009).
  - These results showed that **with appropriate training community** are well positioned to carry out the basic steps of forest inventory.
- In addition, in 2010 PCM methodology, **methods tested in 5 places** of UN-REDD and SVN REDD project; **the participatory evaluation** results showed that **community members are confident** of their ability to carry out PCM.

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6. Challenges of PCM

- Still existing debate on accuracy and reliability of data collected by community
- Number of ToT training courses
- Number of training courses for local people
- Ability of local staffs to support/coordinate the PCM (forest inventory, facilitation skills)
- Input database in the whole country such as stratification maps, random sample plots for each sub-eco region
- Set up and operate an national/sub-region updated - data management system and share with the local people.
- Different types of community participation (red book, contract) – different types of coordination, organization, management of PCM
- Mechanism of benefit sharing from Carbon credit to local people? to promote the PCM, engage communities in the process.

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