Participatory Carbon Stock Assessment Guideline for Community Forest Management Areas in Vietnam

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PART I: Introduction

The approach "**R**educing **E**missions from **D**eforestation and Forest **D**egradation – REDD" has been elaborated to diminish the release of CO_2 in the athmosphere. Additonal, further negative impacts caused by deforestation and forest degradation, like depletion of biodiversity and reduction of the protective function of the forest, should be addressed as well. The basis for any REDD payment will be the remaining CO_2 in the forest area , due to improved (sustainable) forest management and the amount of CO_2 absorbed by the forest due to increase of biomass over its lifespan.

The main reasons for integrating communities in any REDD-scheme are the following:

- **Stable and long-term user rights** (Land Certificate, so called "Red Book" provides land use rights for 50 years). This is the precondition for long term planning and sustainable forest management,
- **Communities** are the **actual owners** of the forest and the CO_2 stored, consequently they can benefit directly from any certificate traded,
- **Forest inventories** and **monitoring** of forest changes can **be carried out by communities in a very cost-effective way**. Furthermore, communities living adjacent to state forests could be an important player to protect the forest. Gained REDD benefits will be channeled through the Vietnamese tax system and money will be used to improve the livelihood of the poor.
- **Active involvement** will enhance the awareness of local people (also them, who are no forest owners) towards the value of the forest and the need to protect them.

In order to claim for REDD credits, it is necessary to have knowledge on forest resources (Forest inventory data base), biomass relations and the amount of CO_2 absorbed by the forest; therefore, it is necessary to have a simple method to support communities to assess their forest resources and analyze the absorbed CO_2 stored in the forest over the time. The method should be as simple as possible, to enable the community to do it by themselves with the support of forestry staff. On the other hand a certain degree of reliability needs to be maintained in order to claim for REDD credits, which can be accepted by the market or governmental bodies.

Objectives:

- Provide methods and skills for local forestry staff to support community in their self-assessment of current forest resources.
- Provide forms to convert measured field data into CO_2 values according to each forest status block of the community. Different forest blocks have different management objectives which consequently results in different amount of CO_2 stored in the area.

Users:

Users should be governmental departments involved in forest management and those staffs who facilitate the process of community-based forest management, in particular:

- Provincial Forest protection and forest department staff, who has on the one hand to ensure that state forest enterprises manage their forest resources sustainably and might in the future claim for REDD credits and on the other hand staff, who has to support community based forest management.
- District staff (sub-department of agriculture and rural development, forest protection station, agro-forestry extension) and technical staff of state forestry enterprises.

The Guideline can be used as training document on procedure of community forest management and REDD implementation in universities and colleges on forestry; or to train technical staffs to promote the procedures at the localities.

Part II: Principles of Participatory Carbon Stock Assessment (PCSA)

2.1 Role and responsibilities of each stakeholder

2.1.1 Cooperation among stakeholders

The integration of local communites in the process of **Participatory Carbon Stock Assessment (PCSA)** right from the beginning will help them to self-organize their forest resource assessment and enhance the awareness of forest values in the context of climate change.

The participation of local people means that every person is allowed to attend in all activities, while it does not mean that they have to do everthing by themselves. Within the **Community Forest Management(CFM)** and REDD projects, local people will not be able to formulate and implement forest management plans as well as determine their carbon credits without the assistance of technical staff. On the other hand, the technical staff by themselves cannot manage to establish a plan - they need to not know the actual timber stocks existing in the area, the preferred management objectives for each forest management block and certain needs of the local population. Thus, both (communities and technical staffs) need to have a close cooperation and understanding of each other in order to come up with a practicable and adjusted forest management plan, which is the prerequisite for any sustainable forest management. Finally, these are the preconditions for any REDD claim in the future.

2.1.2 Role of technical staff

The role of technical staff is to facilitate and support the community during the PCSA process and monitoring of forest resource changes. They also provide the community with new policies and regulations, and instruction on necessary silviculture techniques and market information on CO_2 trade.

The responsible of technical staffs is to establish a communication method to create mutual trust, to enhance information sharing, to learn and share experiences and to cooperate with the community members and with outsiders. Thus, facilitators need to be equipped with regulations for training elder people, participatory approaches as well as facilitating skills.

2.1.3 Role of community members

Community should be considered as people, who have an active role in the CFM decision making process and REDD project implementation, in particular:

- The **community forest management board (CFMB)** is responsible to organize and carry out the PCSA in each forest management block. It is in charge for any further CO_2 monitoring in order to maintain the validity of the CO_2 claims.
- **Representatives of the households** and other community members participate in the assessment of forest resources, forest management planning as well as carbon valuation of their forest plots.

2.2 Principles of PCSA in community forest

2.2.1 Methods and simple tools

In the context of community forestry development and implementation of REDD in Vietnam, methods of assessment and analysis of forest resources, and of estimation of carbon storage have to be adopted to the local circumstances in order to ensure that local communities can understand and implement them properly.

Technical staffs have to develop beforehand the models for estimating volume, biomass and absorption of CO_2 using complex methods but they need to turn the models into tools simple and easy to understand like tables and charts. When collecting data, do not use those methods of surveying which are too complex for local people to understand. If forest users do not fully participate in the assessment and analysis of forest resources, they will not bear responsibility for the result and not be so willing to follow a management plan based on that data.

2.2.2 Relevance and suitability

The process of community forest management and of REDD should rely on management capacity of rural people. It should be as simple as possible, while fulfilling minimum requirements for administrative (governmental) needs. Besides simplicity, it should focus on the collection and analyzing of absolute necessary information and data.

2.2.3 Effectiveness and cost

Reducing cost and time and human resources of community and relevant stakeholders is an important principle in community forest management and in implementation of REDD. With such a requirement, the activity can last long and can be implemented regularly even by poor communities, who usually lack implementation resources (especially time availabity).

In addition, activities related to forest surveys often take more resources because forests are often located in remote areas having complicated terrain thus, forest carbon inventory, and outdoor work in the forest should be well prepared and a realistic time schedule should be agreed upon. Yearly monitoring of changes in carbon stock, due to forest management plan implementation, needs to be discussed as well. This is not explicit part of this guideline but this further workload must be discussed with the forest owners and agreed upon.

Part III: PCSA and monitoring of CO_2 dynamics

Objectives:

- Assess current carbon stocks according to each forest block
- Establish a system of long-term positioning sample plots to track biomass, and the CO_2 absorption
- Provide information on forest resources for community forest management planning
- Provide information on the amount of CO_2 absorbed over time to participate in REDD
- Monitor periodically changes in forest condition and status, and the situation of forest loss

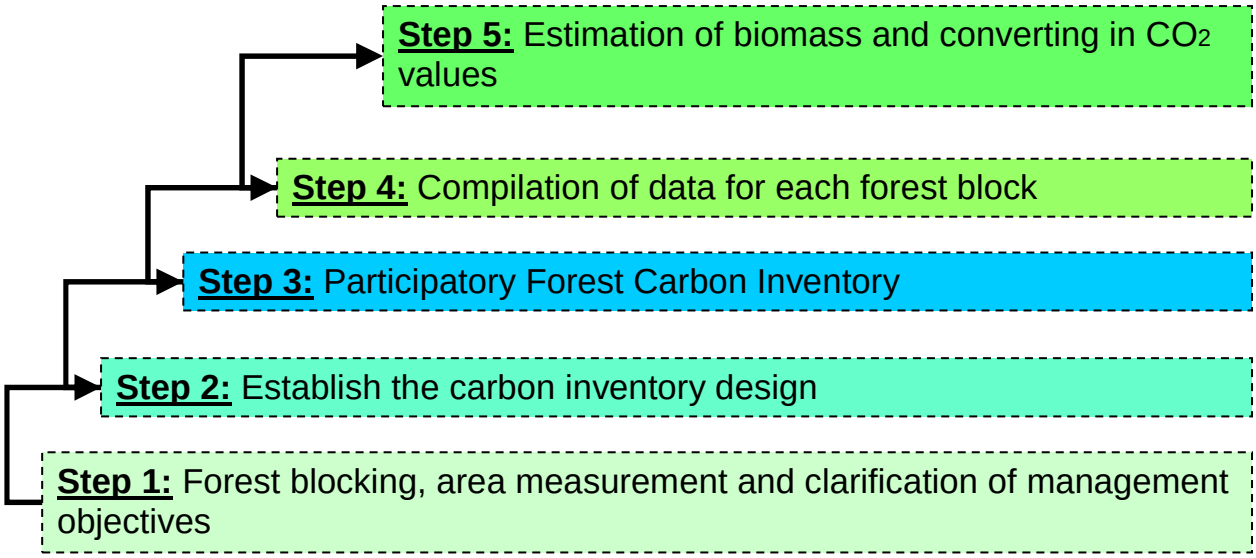


Figure 1: Procedure of Participatory Carbon stock Assessment

3.1 *Forest blocking, area measurement and clarification of management objectives*

Objectives:

- Assess the current situation of forest degradation and loss.
- Divide forest into blocks of homogeneous forest status that are actually easy to be recognized by local people in order to organize the survey to assess forest resources, to protect forest, to elaborate forest management plan and to sell forest carbon credits

Results:

- Village forests are divided into separate blocks based on forest status and on management goals of the community.
- Forest plots are named after local names, are identified with forest status (technically and locally), are calculated for plot area and agreed with forest management goals for each plot.

Preparation:

- Forest status and topographic map with rate of 1:10.000 analyzed from SPOT 5 satellite image with resolution of 10x10m depicting CFM area boundaries,
- Forest plot description sheets,
- GPS receivers to check the boundary of the forest blocks,
- Transparent paper (big enough to cover the map) with pins,
- Marker pen to write on transparent paper and oil colour pen to draw on map; alcohol and cotton-wool to erase wrongly-drawn lines,
- Compass to identify map direction,
- Transparent paper with grid net of 1 x 1 cm to calculate area.

Location and time:

- Location: At community house of the village or at the house of the head of the community forest management board
- Time: 2 hours

Implementation

- Establish a group of core farmers together with the community forest management board, about 7-10 members,
- Introduce maps depicting current situation/status of forest and simple specifications of topographic maps, locations and boundaries of community forests to the people.
- Ask people to orient maps northwards,
- Put the transparency over the map and use clips to temporarily hold it in place. Using a whiteboard marker show how to draw roads, rivers and streams and boundaries of forest blocks. Encourage local people to draw and show them that if they draw incorrectly, they still can erase easily and draw again.
- Criteria for division of forest blocks: In the same area, plots of forest have the same forest status, same management purposes, and locate in a small area of 0.5 – 100 ha. Should utilize natural boundaries such as rivers, streams, bridges, hills, etc. to be boundaries of the forest plots.
- Upon completion of drawing lines and boundaries of the forest blocks on the map; ask people to discuss and name each block on the map. Encourage the use of place names being familiar to people like rivers, streams, mountains, hills, or commonly known local names.
- Write the name of forest blocks to the map with the forest status (technical and local names),
- In case of doubt, it is necessary to verify the boundaries of forest blocks in the field with local people: Use a compass to navigate in the forest. Use GPS to identify the exact boundary points on the field.
- Measure the area of each forest block: Explain to people that they need to know the exact area to be able to check and monitor forest status and to calculate the number of forest trees on each forest block in order to calculate amount of CO_2 absorbtion.
- Instruct people how to estimate the area by drawing squares on the transparency paper. If the map is with the rate of 1:10.000, a 1 x 1 cm squares corresponding to 1ha (*compare figure 2: Forest status map of Bun Bo Nor Commune*). Write the area of each plot on the map. In addition, if conditions are available, the boundaries identified with GPS receivers will be transmitted into computer using map management softwares such as MapInfo or ArcGIS to digitalize the block-division map and to calculate area of each block.

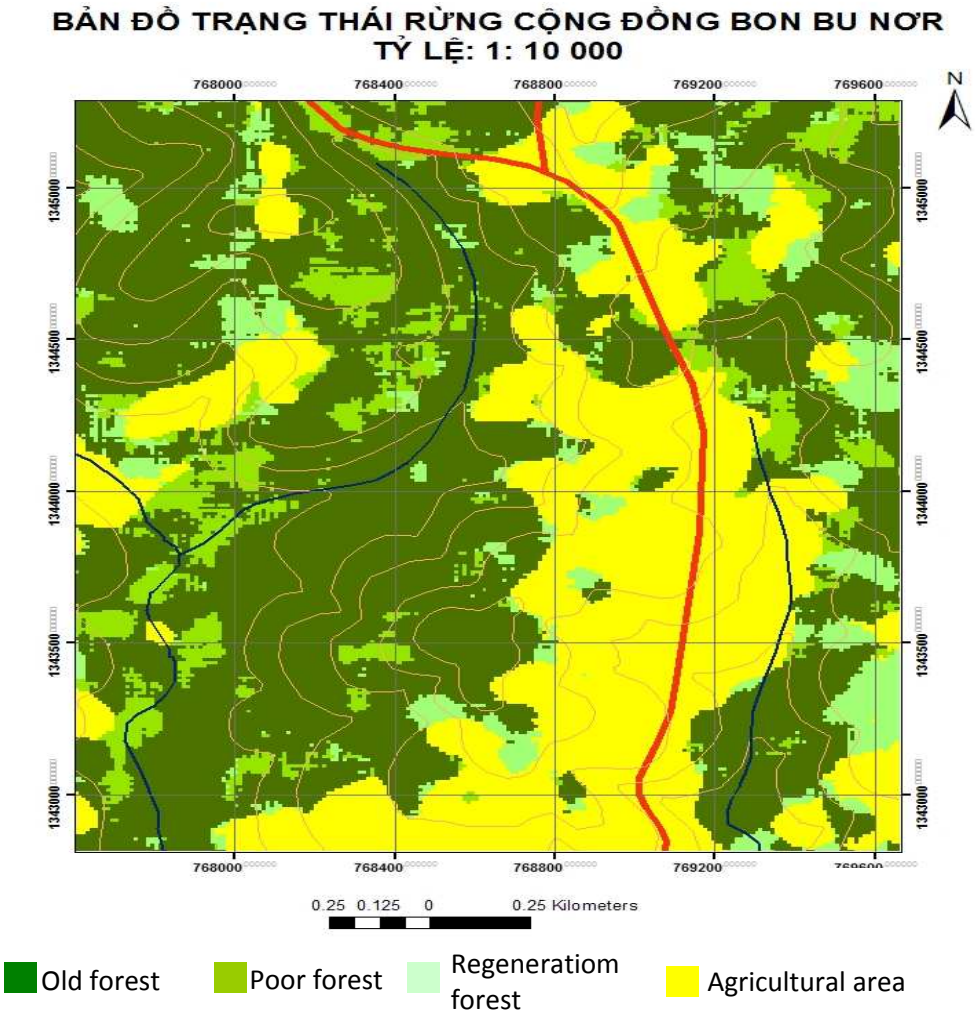


Figure 2: Forest status (analyzed from SPOT 5 satellite images in 2009, resolution 10x10m)

- Finally draw up all the curvature of the terrain, rivers, roads, forest plot with the permanent marker pen.
- On the basis of each plot having its name, status, area, location on the map; discuss with the group of core farmers to describe and define forest management objectives for their forest blocks for example, timber production, firewood, NTFPs, bamboo production, watershed protection, sacred forest.
- Define management difficulties and challenges, elaborate opportunities to improve the situation and finally write down solutions to overcome these challenges in order to manage the forest area properly.

→ Use Table 1

- After analysation of every forest block a summary table should be filled out together with the villagers at a community meeting.

→ Use Table 2

Table 1: Identification of management goals for each forest block

Forest Block Name / Forest Block Number		
Management goal		
Difficulties / Challenges		
Strengths / Opportunities		
Solutions to enable proper forest management		

Table 2: Summary of forest blocks of the community

No.	**Unit**	**Compartment**	**Name of block**		**Forest status**		**Area (ha)**	**Management goals of community**
			Technical	Local	Technical	Local		
Total	**No. of unit**	**No. of compartment**	**No. of block**				**Area**	

3.2 Establish the carbon inventory design

Objective:
Establish a sample plot design on the map and on the field for carbon measurements, evaluation and monitoring of forest resources.

Results

- Sample plots are identified on the map and locations are GPS coordinates recorded
- Identified sample plots are "permanent" and will be used for further monitoring

Preparation:

- Forest status map, topography and division of forest blocks with rate of 1:10.000,
- Transparent paper (big enough to cover for the whole map) with pins,
- Marker pens to write on transparent paper and oil colour pens to draw on map; alcohol and cotton-wool to erase wrongly-drawn lines,
- 50 cm ruler to draw grid net for positioning sample plot,
- Compass to identify map direction,
- GPS hand-held machine to identify location of sample plots.

Location and time:

- Location: At community house of the village or at the house of the head of the village community forest management board.
- Time: 0.5 hour

Implementation

- Establish a group of core farmers together with the community forest management board, about 7-10 members and one technical staff
- Calculate amount of sample plots to be measured:
    - The sample plot density (percentage of the total forest area to be measured) needs to be clarified in advance based on the forest structure and political regulations. **Sample density for CFM should be between 0,75 to 2,5%** but can be less for state forest enterprises.

- The following calculation should be applied:

$$\text{Sample area} = \frac{\textit{Forest block in square meter } \mathbf{x} \textit{ sample intensity}}{100}$$

$$\text{Number of sample plots} = \frac{\textit{Sample area}}{\textit{Plot size}}$$

$$\text{Grid net distance} = 2\sqrt{\frac{Forest\_block\_in\_square\_meters}{Number\_of\_sample\_plots}}$$

- Following these fomula, a **sample plot intensity of 1,25 %** would result in a **grid net of 2x2cm** (200x200m in the field). This calculation should be done by technical staff before the field implementation starts. Beside the adaptation of the sample plot intensity based on forest homogenity a “drawable” grid net should be applied
- Lay the transparent paper over the map and use pins to temporarily hold on a flat surface and draw a grid net of 2x2 cm (200x200m in the field) on transparent paper, with map rate of 1:10,000
- Identify the GPS UTM co-ordinates and record them for each sample plot *Note: only record location of those plots that are really inside the forest area to be investigated.*
- Location of sample plots is demarcated with permanent landmarks when the survey is implemented

3.3 *Participatory Forest Carbon Inventory*

Objective:
Collect information on forest resources in sample plots to estimate number of trees, volume, biomass and amount of CO_2 absorbtion

Results: Complete datasets of all relevant forest data.

Preparation:

- Establish group of core farmers (especially those who have indepth knowledge about the forest). Each group has five people, four farmers and one technician.
- Forest inventory set for each group must consist of:
    - 2 adjusted color tapes to measure DBH at 1.3m (centimer scale as well as colour scale division),
    - 3 twenty meter ropes with a knod in the middle,
    - 1 thirty meter measurement tape,
    - 1 improvised slope measurement tool (refer to Annex 1)
    - 1 compass,
    - 1 GPS receivers,
    - Chalk to mark the tree,
    - Survey sheets for each sample plot.
- Form inventory groups and agree on the minimum amount of sample plots to be investigated for one day.

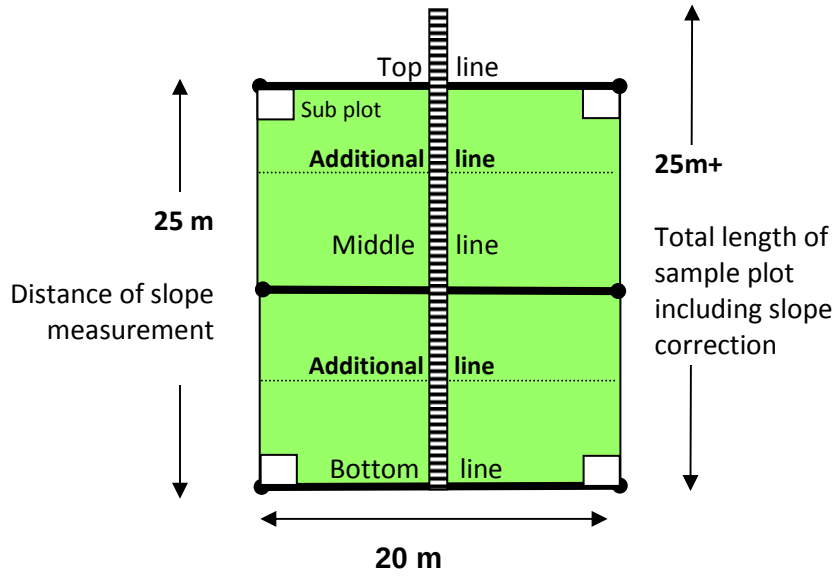
Location and time

- Location: Identified sample plots in the forest area
- Time: Depending on the amount of groups available and the terrain.

Implementation

- Use compass and GPS machine to identify location of the sample plots in the field based on the pre-identified coordinates of the sample plot system (recommend to use the routine-guiding function of GPS machine),
- Identify the slope and correct the sample plot accordingly

Figure 3: Sample plot design (20x25m+slope correction)



- Establish permanent landmarks at the location of the sample plots and record the UTM coordinates,
- Measurements to be conducted in the sample plots:
  - Measurement of all trees of H≥1m and a diameter larger than 5 cm

Table 3: Diameter measurement tape

Diameter class	Class width	Min. Girth [cm]	Colour
05–9,9	5cm	15,71	white
10-14,9	5cm	25,13	yellow
15-19,9	5cm	47,12	black
20-24,9	5cm	62,83	stripes
25-29,9	5cm	78,54	blue
30-34,9	5cm	94,25	dots
35-44,9	10cm	109,96	saw
45 – 54,9	10cm	141,37	red
> 55	open	172,78	

→ Use Table 4: Tally sheet

Table 4: Tally sheet

Province		District		Commune				
Village		Date		Reporter				
Forest plot		Plot number		Slope				
Coordinates UTM X		Coordinate UTM Y		Canopy layer*		1	2	3
Forest type		Forest status		Canopy coverage				
#	**Tree name**	**Girth**	**Color**	**Quality****			**Social class *** **	**Remarks**
1	**2**	**3**	**4**	**5**			**6**	**7**
				A	**B**	**C**		
				A	**B**	**C**		
				A	**B**	**C**		
				A	**B**	**C**		

* **Layer:** Divide the forest into 5 layers, the highest layer is marked with 1, the lowest 5.
** **Quality:** A,B,C (A: Good, B: Average, C: Poor)
***Social class:** **1 -5** (1 = dominant tree in the canopy layer, 2 = restrained tree in the canopy layer, 3 = good tree in the subjacent layer, 4 = restrained tree in the subjacent layer, 5 = dead tree)

- Set 4 sub-plots of 2x2m at 4 corners to identify species and number of trees of H<1m (*remark: all trees are recorded with names, while only trees with a height<1m are counted*)

→ Use Table 5: Survey sheet for subplots

Table 5: Survey sheet for subplots

Number of sub-plot 2x2m	Species	Amount of trees with height <1m

3.4 *Compile data for each forest block*

Objective:
On the basis of the forest inventory survey, compile data on forest resources in a simple way to have all basic information for forest resources. Basically, there are two steps: firstly the mean values of each forest blocks based on the measured values of each sample plot must be calculated and, secondly all this data need to be summarized in one flip chart representing the mean values of each forest block. During the inventory precise diameter values are measured but in order to allow the calculation in a participatory way without computers, the defined diameter classes must be used.

Results:

Compile the following basic criteria for each forest plot: plot name, area, status, management goals, dominant three species (name the three most often ones), number of trees per hectare and per forest block, number of trees by diameter class of the forest plot

Preparation:

- Set up groups of core farmers:
  2-3 people/group
- Summary sheet for the forest plots
- Calculators

Location and time:

- Location: At community house
- Time: 4 working groups (1 day)

Implementation:

-
- Calculate number of trees per diameter class and per forest block. Participants count the amount of trees according to the respective diameter class and record them on a A0 summary sheet. At the end of the table the mean values are calculated.

→ Use Table 6: Compiled forestry data of one forest block

Table 6: Compiled information on forest resources of one forest block

Sample Plot	Dominant species	Total number of tree per plot	Number of trees per diameter class (color)									
			H <1m	White H≥1m, D = 5-9.9 cm	Yellow 10 – 14.9 cm	Black 15 – 19.9 cm	Stripes 20 – 24.9 cm	Blue 25 – 29.9 cm	Dotts 30 – 34.9 cm	Saw 35 – 44,9 cm	Red 45 – 54,9 cm	≥55cm
Sum												
Average*												

* This values are calculated by dividing the **"Sum"** values through the amount of sample plots investigated

- Calculated averages values (sample plots) need to be converted into ha-values, the following calculation should be applied:
- Number of tree with height <1m per ha:
  - N_1/ha = n_{plot1} x 625, with n_{plot1}: average number of trees with H<1m in 4 2x2m sub-plots.
- Number of tree with height ≥1m and with diameter <5cm:
  - N_2 /ha = n_{plot2} x 20, with n_{plot2}: average number of trees with H≥1m and with diameter <10cm in 01 plot.
- Calculated ha-values need to be multiplied with the current size of the forest block and must be recoreded in the following table

→ Use Table 7: Compiled forest data

Table 7: Compiled information on forest resources of each forest block

Forest Block (Local and technical name)	Forest status		Dominant species	Number of trees per ha	Number of tree per block	Number of trees per forest block according to each diameter class									
	Local name	Class				H< 1m	White H≥1m & D = 5-9.9 cm	Yellow 10 – 14.9 cm	Black 15 – 19.9 cm	Stripes 20 – 24.9 cm	Blue 25 – 29.9 cm	Dotts 30 – 34.9 cm	Saw 35 – 44,9 cm	Red 45 – 54,9 cm	≥55cm
Total															

3.5 *Estimation of biomass and converting in CO2 values*

Objectives:
Calculation of the CO_2 amount stored in the community forestry area.

Results:
Total amounts of CO_2 stored according to forest blocks

Preparation

- Establish groups of core farmers (2-3 people/group).
- Print out of a summary table presenting the relations between diameter class and CO_2 amount stored
  (Remark: This table must be prepared by a technicans and is based on a local biomass – diameter regression, which has to be elaborated by a scientific body)
- Calculators

Location and time:

- Location: At community house
- Time: 1 day with 4 working groups

Implementation

- The amount of trees per diameter class (as recorded in Table 7) are multiplied with the values given in Table 8 (*local biomass regression*),

Table 8: Amount of CO2 in an average tree based on DBH class

DBH class (cm)	Colour	Average D1.3 (cm)	CO_2 (kg)
<5		2.5	1.4
5 – 9.9	White	7.5	21.3
10 – 14.9	Yellow	12.5	75.8
15 – 19.9	Black	17.5	174.8
20 – 24.9	Stripes	22.5	326.1
25 – 29.9	Blue	27.5	536.7
30 – 34.9	Dots	32.5	812.5
35 – 44.9	Saw	40	1360.2
45 - 54.9	Red	50	2366.4
>55		*70**	5454.3

This value is estimated since very few, but large trees occur in that diameter class. The regression formula who are the basis for the relation between average diameter and CO_2 content are the following:

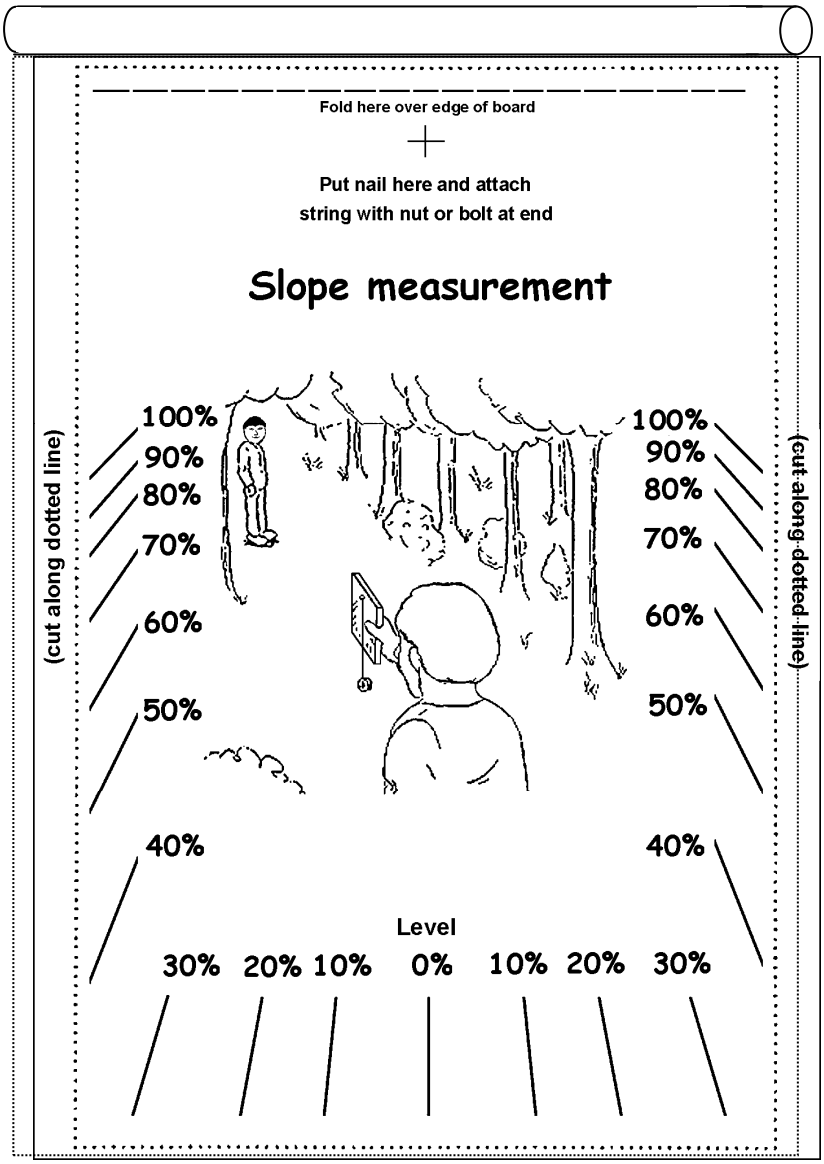
CO_2 = 0.1438*(Average breast high diameter)^$^{2.4817}$

→ Use Table 9: Summary table carbon contents

Table 9: Estimated CO_2 stored in the forest area according to forest blocks

Forest Block (Local and technical name)	CO_2 content per diameter class										Total CO2 value / forest block
	H< 1m	White H≥1m & D = 5-9.9 cm	Yellow 10 – 14.9 cm	Black 15 – 19.9 cm	Stripes 20 – 24.9 cm	Blue 25 – 29.9 cm	Dotts 30 – 34.9 cm	Saw 35 – 44.9 cm	Red 45 – 54,9 cm	≥55cm	

Appendix 1: Slope Measurement Tool



Instruction for preparing the slope measurement tool:

- Print out the slope measure tool and glue the page on a piece of carton or veneer board and cut it along the dotted line.
- The top has to be cut precisely along the bold dotted line.
- Print out the slope correction table and glue it on the other side of the measurement tool.
- Fix a plastic straw on the top line of the tool
- Drill a hole through the "+" at the top of the tool and attach a fine string with a nut or bolt at the end exceeding the size of the measurement tool.

Table 10: Slope correction table

Slope	Plot length		Slope	Plot length
%	25 m		%	25 m
15	25,25		70	30,50
20	25,50		80	32,00
25	25,75		90	33,75
30	26,00		100	35,25
35	26,50		110	37,25
40	27,00		120	39
45	27,50		130	41
50	28,00		140	43
60	29,25		150	45

Note: The table provides corrected distances for 25m horizontal distances, as function of the slope, e.g. the distance correction for a horizontal distance of 25 meters, with a slope of 40% is 27 m.