

Participatory Carbon Monitoring: Manual for Field Reference

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Table of Contents

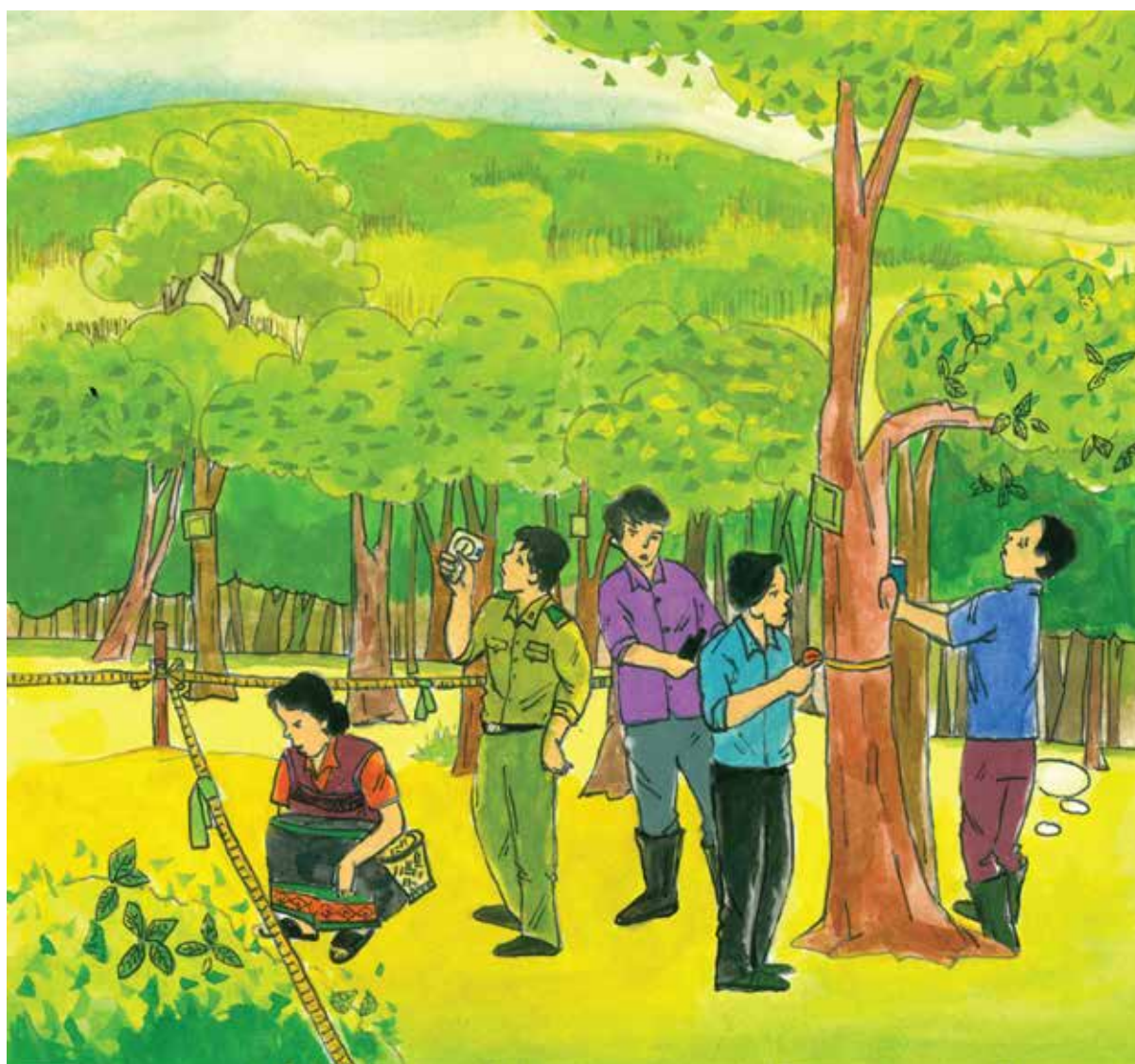
	Page
1 Participatory carbon monitoring field task (PCM).....	4
2 Monitoring changes in area and forest status	5
3 Determining position of sample plot.....	6
4 Establishing permanent sample plot.....	7
5 Measure forest biomass carbon in sample plot	13
Appendix: Field Forms.....	16
Form 1: Measuring change in forest area, forest status and forest owner	16
Form 2: Data sheet form for forest inventory.....	17
Form 3. Data Sheet for measuring DBH<6 cm and H<1.3 m in 1 m radius sub-plot.....	18
Form 4. Data sheet for bamboo inventory.....	19
List of Figures and Tables	
Figure 1. Layout of circular nested plot with four concentric sub-plots.....	7
Figure 2. Making knots of different colours corresponding to radius of concentric sub-plot	9
Figure 3. Compass and clinometer and obtaining slope using clinometer.....	9
Figure 4. North-east section of plot	12
Figure 5. South-east section of plot.....	12
Figure 6. South-west section of plot	12
Figure 7. North-west section of plot.....	12
Figure 8. Measure diameter class according to radius of sample plot.....	13
Figure 9. Measuring DBH tree.....	19
Table 1. Slope correction factors	11

Participatory carbon monitoring field task

This PCM manual, **Manual for Field Reference**, is one of three individual manuals designed to facilitate stakeholders' participation in carbon monitoring and is designed to be used in the field for quick reference. The **Manual for Local Technical Staff** is for use by local forestry staff for designing and implementing PCM activities in the field and for analysing PCM data. A third in the series, the **Manual for Local People**, is for use by local households and communities for collecting and monitoring field data.

This **Manual for Field Reference** is not a substitute for the other two manuals, but is to be used as a quick reference guide while performing the following PCM field tasks:

1. Monitoring changes in area and forest status
2. Determining position of sample plot
3. Establishing permanent sample plot
4. Measuring forest biomass and carbon in sample plot



Expected outcomes:

- Complete information on change in area and status of forest
- Track data delimited in the GPS.

Materials required:

- Map showing the boundaries of forest owners
- GPS to check the boundaries of forest owners and forest change
- Suunto clinometer and compass
- Data recording sheet (Form 1)
- Digital camera (optional).

Procedure:

When the forest status changes, such as from deforestation and selected exploitation, data on area and change is collected using the following approach:

- Determine the forest blocks that were lost or changed in status.
- Use Track function of the GPS to delineate the area.
- Record information about change in area, forest status in Form 1.

Expected Outcome:

- Each sample plot in the field is identified.

Materials required:

- Map of location of random sample plots
- Suunto clinometer and compass
- GPS with coordinates of random sample plots
- Table recording the list of sample plot codes and coordinates
- Iron boards to use as identification tags
- Hammer and nails to affix tree tags
- Permanent paint to mark identification tags
- Digital camera (optional).

Procedure:

- Use Goto function of the GPS to go to correct coordinate of each sample plot have been positioned on map and installed in the GPS.
- Fix landmark in the centre of the sample plot and affix iron board.

Expected Outcome:

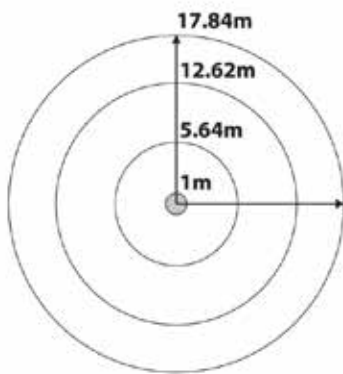
- Concentric circular plots of various size are established for different forest types or tree size.

Materials required:

- Suunto clinometer and compass
- Four ropes with a range of colours knots at specified intervals equivalent to the radius of the sub-plots
- Form for additional distances at different radius for plots located on slope
- Digital camera (optional).

Procedure:

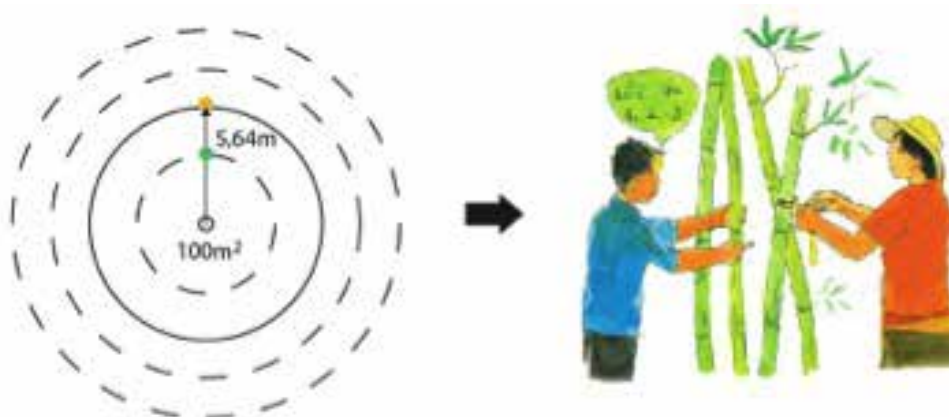
- For **evergreen, semi-deciduous, dipterocarp, and pine forest**, establish four concentric circular plots:



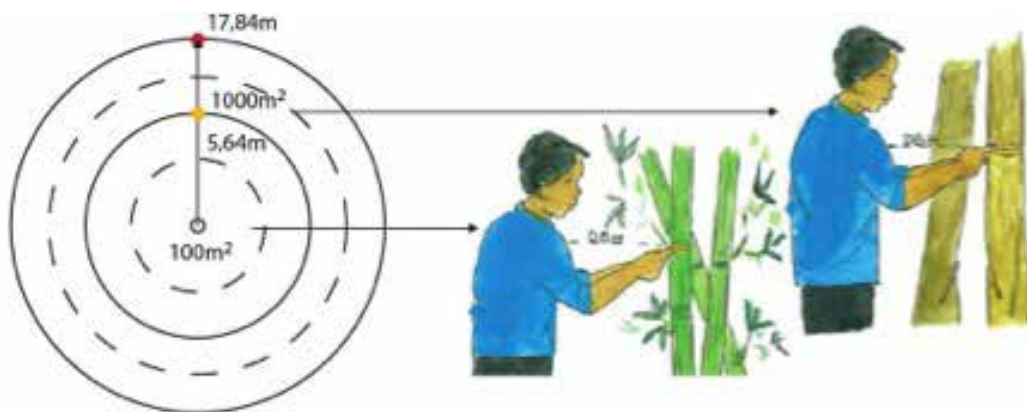
- Sub-plot 1: radius 1 m, area 3.64 m², measure regeneration with DBH < 6 cm and H > 1.3 m
- Sub-plot 2: radius 5.64 m, area 100 m², measure tree with 6 cm ≤ DBH ≤ 22 cm or bamboo
- Sub-plot 3: radius 12.62 m, area 500 m², measure tree with 22 cm ≤ DBH ≤ 42 cm
- Sub-plot 4: Radius 17.84 m, area 1000 m² to measure tree with DBH ≥ 42 cm

Figure 1. Layout of circular nested plot with four concentric sub-plots

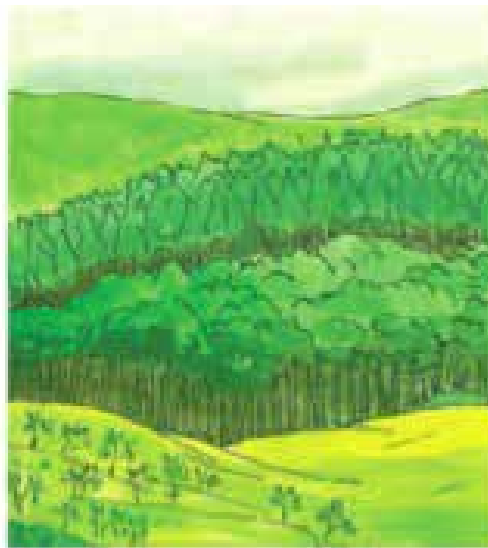
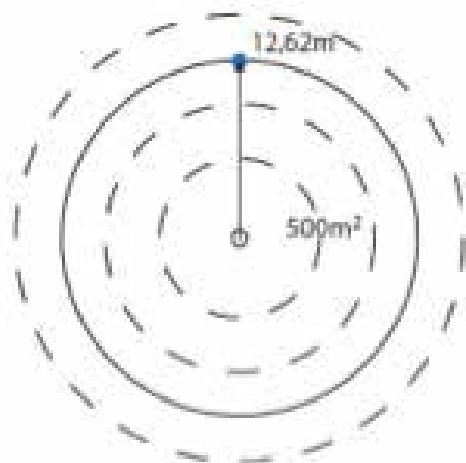
- For **bamboo forest**, the size of the sample plot is 100 m² (sub-plot 2).



- For **mixed woody – bamboo forest**, measure trees as in the case of evergreen forest in four concentric sub-plots, but measure bamboo only in sub-plot 2.



- For **plantation forest**, establish three concentric plots i.e. sub-plot 3 as described for evergreen forest.



- Prepare a rope with several knots using different colours. Make a green knot at 1 m, a yellow knot 5.6 m, a blue knot at 12.62 m and a red knot at 17.8 m (Figure 5). Four ropes are needed.
- Measure slope of the ground at each plot using the clinometer in eight directions (i.e. every time rope is laid on the ground along the plot radius) (Figure 6). Use slope correction table (See Table 1) and adjust position of knots accordingly.

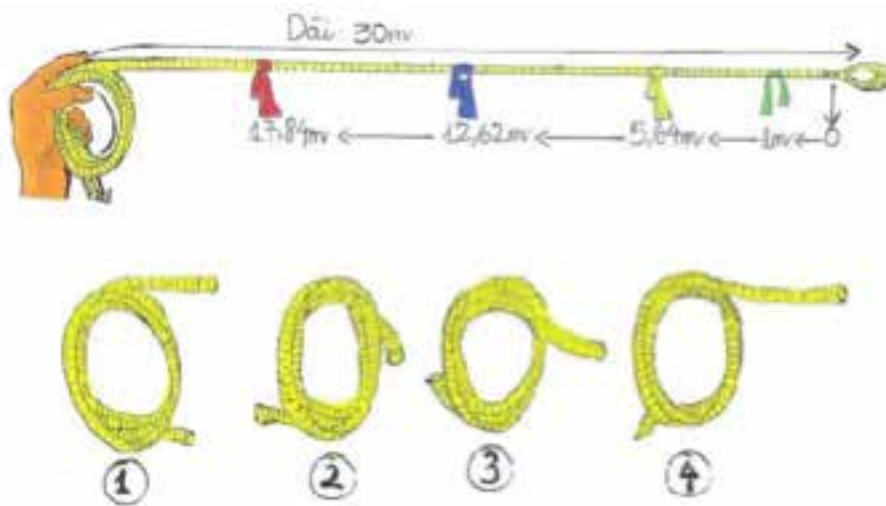


Figure 2. Making knots of different colours corresponding to radius of concentric sub-plot



Figure 3. Compass and clinometer and obtaining slope using clinometer

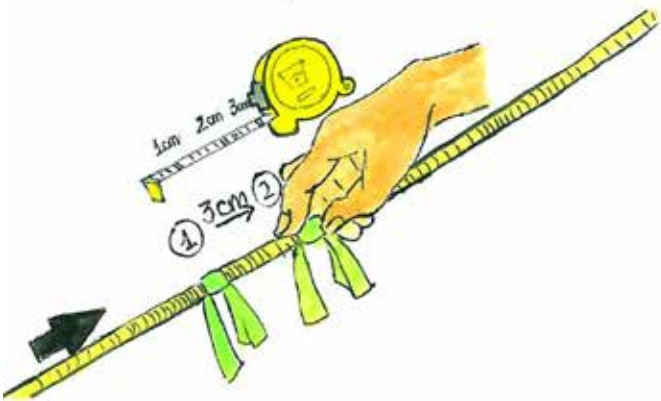


Table 1. Slope correction factors

Slope (degree)	Radius (m)			
	1.00 (Green)	5.64 (Yellow)	12.62 (Blue)	17.84 (Red)
0	0.00	0.00	0.00	0.00
2	0.00	0.00	0.01	0.01
4	0.00	0.01	0.03	0.04
6	0.01	0.03	0.07	0.10
8	0.01	0.06	0.12	0.18
10	0.02	0.09	0.19	0.28
12	0.02	0.13	0.28	0.40
14	0.03	0.17	0.39	0.55
16	0.04	0.23	0.51	0.72
18	0.05	0.29	0.65	0.92
20	0.06	0.36	0.81	1.14
22	0.08	0.44	0.99	1.40
24	0.09	0.53	1.19	1.69
26	0.11	0.64	1.42	2.01
28	0.13	0.75	1.67	2.37
30	0.15	0.87	1.95	2.76
32	0.18	1.01	2.26	3.20
34	0.21	1.16	2.60	3.68
36	0.24	1.33	2.98	4.21
38	0.27	1.52	3.40	4.80
40	0.31	1.72	3.85	5.45
42	0.35	1.95	4.36	6.17
44	0.39	2.20	4.92	6.96
46	0.44	2.48	5.55	7.84
48	0.49	2.79	6.24	8.82
50	0.56	3.13	7.01	9.91

- First, stretch one rope from centre towards the north. Stretch another rope to the east. Stretch a third rope at 45° N between the first and second ropes. As a result, two segments are established from north to east. Measure from left to right (i.e. clock-wise) and from the centre towards the sub-plot perimeter.

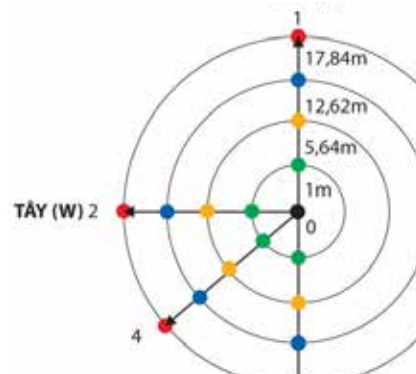


Figure 4. North-east section of plot

- Second, leave the north and east ropes fixed. Move the rope that was in between north and east to the south. Stretch a fourth rope between south and east creating two segments between south and the east. Start measuring from left to right and from the centre towards the plot perimeter

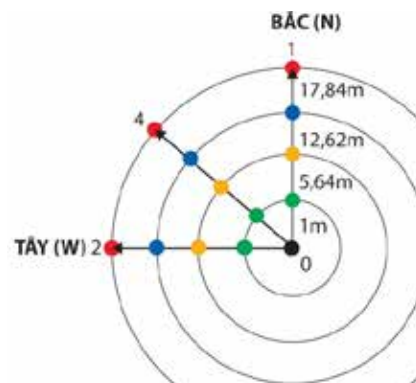


Figure 5. South-east section of plot

- Third, leave the north and south ropes are fixed and move the rope in the east to the west. Also move the rope that was between east and south to between south and west. Measure from left to right and from centre towards the plot perimeter.

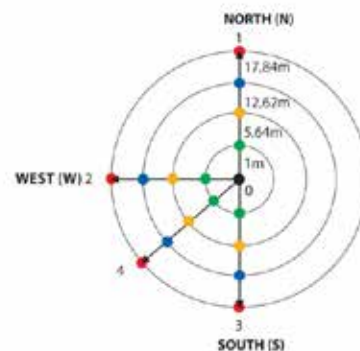


Figure 6. South-west section of plot

- Finally, leave the rope in the north and west and place another rope between west and north. Start measurement from left to right and from the centre towards the perimeter.
- Place a red wooden pillar at the north, east, south and west edges of the plot.

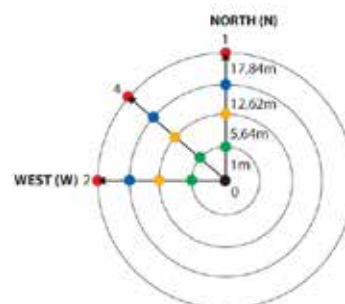


Figure 7. North-west section of plot

Expected outcome:

- Validated data about tree, bamboo and forest resources.

Materials required:

- Diameter measurement tape (i.e. D tape)
- Chalk, marker or paint for marking
- Iron board or tree tag for marking trees
- Hammer and nails to affix tree tag
- Paint to mark sign of tree
- Spreadsheet for recording inventory factors
- Digital camera for taking pictures.

Procedure:

- Within 1 m radius sub-plot (green), measure all trees with DBH ≥ 6 cm and count regeneration trees with DBH < 6 cm and H ≥ 1.3 m.; within 1m - 5.54 m radius sub-plot (yellow), measure all trees with DBH ≥ 6 cm; within 5.64 m - 12.62 m radius sub-plot (blue), measure trees with DBH ≥ 22 cm; and within 12.62 m - 17.84 m radius sub-plot (red), measure trees DBH ≥ 42 cm (Figure 8)

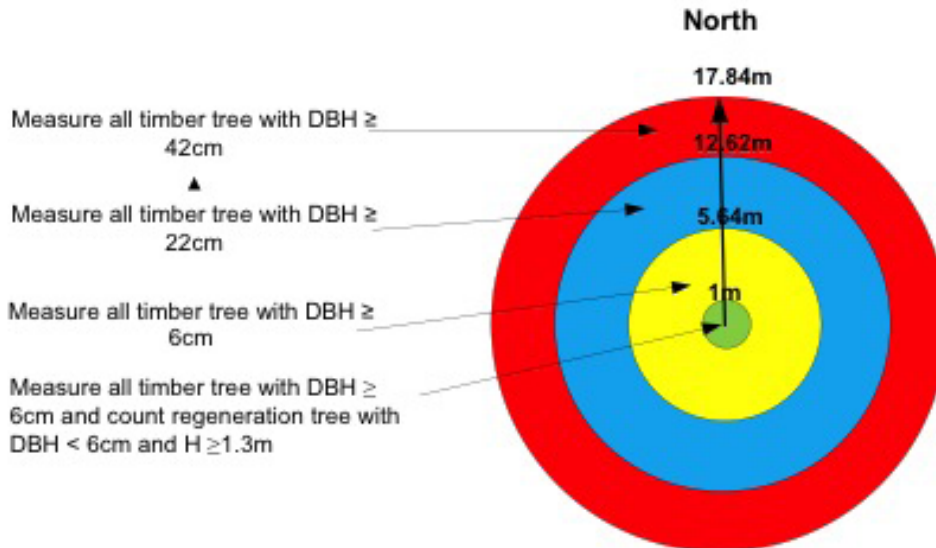


Figure 8. Measure diameter class according to radius of sample plot

- For woody tree, identify species and measure DBH if trees DBH is greater than 6 cm. For trees with DBH < 6 cm and height ≥ 1.3 m, count the number within the sub-plot 1
- Use tree tags to mark the trees
- For bamboo record age and average DBH
- Take picture of trees and of crews measuring trees.

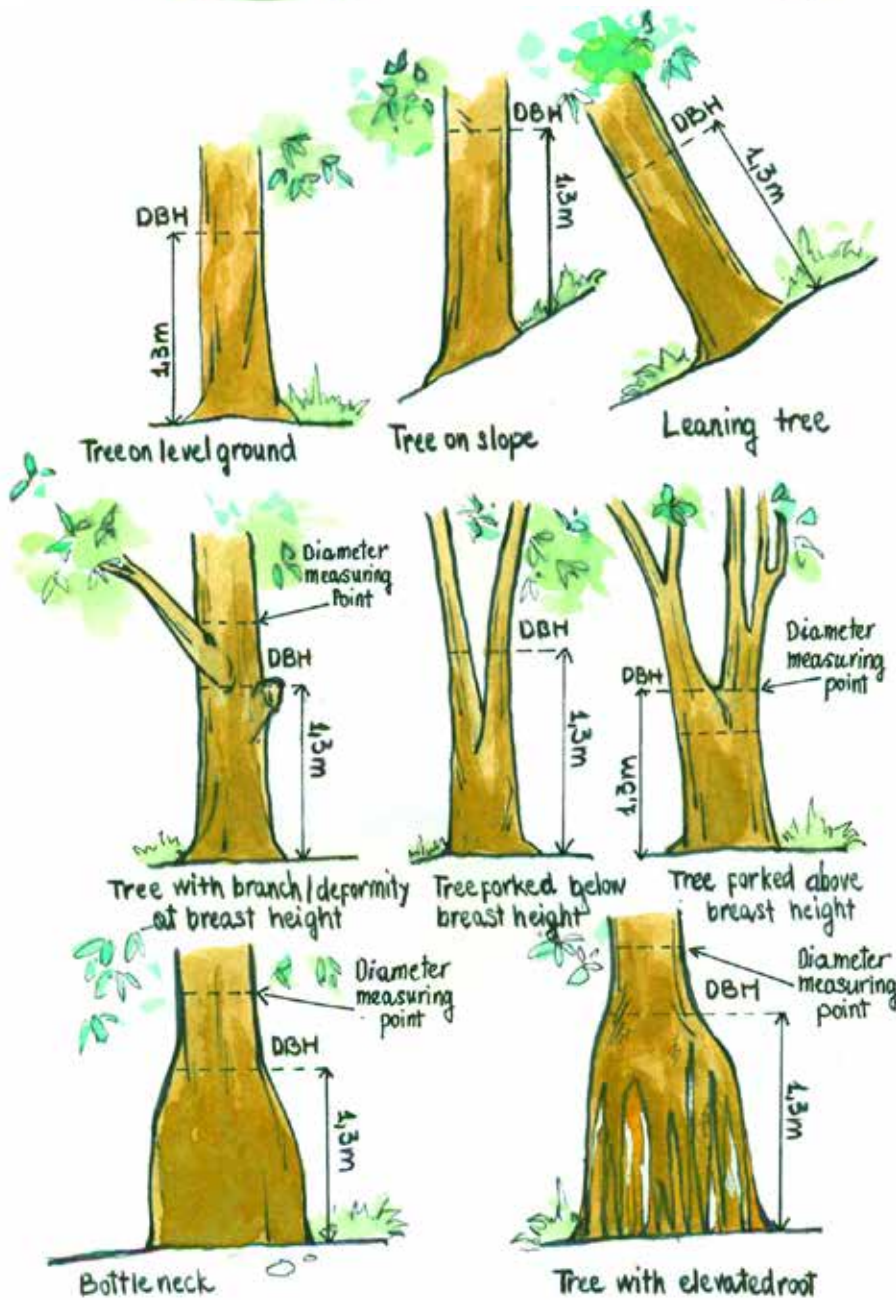


Figure 9. Measuring DBH tree

**Method of bamboo age based on their aerial stem
(Lam Xuan Sanh và Chau Quang Hien, 1984)**

- **First year of age:** a bamboo tree that finished its growth period in the previous rainy season is characterised by:
 - Sheath still existing on stem, usually near root
 - Stem colour light green and covered by a layer of “white powder”, but lichen has not developed
 - many small branches along the main stem but very few young branches on the upper stem.
- **Second year of age: Characterised by:**
 - Sheath is not present
 - Stem colour is green and is covered by a layer of “white powder”, but less than that at the first year.
 - No, or minimal, lichen present near root
 - Many branches and may have young sub-branches.
- **Third years of age: Characterised by:**
 - Main stem colour is dark green, lichens cover 30-40% of stem surface creating white spots in the stem, green colour of stem is still visible
 - Branches are mainly on top of tree, old main branches are dark green with spotted lichen, sub-branches may show.
- **Fourth years of age: Characterised by**
 - Stem is white due to strong presence of lichen (accounts for 70-80% of stem surface)
 - Branches are limited to the upper stem, o main branches are dark green with spotted lichen.
- **Five years and more: Characterised by**
 - Stem colour changes to yellow, dense lichen develops along the stem
 - Decay and fall are apparent.

Appendix: Field Forms

Form 1: Measuring change in forest area, forest status and forest owner

Forest type and forest status on map:

Coordinate of plot centre (in VN2000): X: Y:

Forest type (observed): Forest status (Observed):

Forest owner: Contractor:

Location (village, commune, district, province):

Forest compartment:

Sub-compartment:

Block:

Measurement recorded by: Date: Time:

Picture: Yes/No (Circle Yes if pictures were taken. Circle No if pictures were not taken.)

No	VN2000 coordinates of four corners of forest block, forest owner				Description of change, (i) Loss of forest cover, (ii) Change in forest type	Underlying causes or reasons for change
	X/Y	X/Y	X/Y	X/Y		
1	2	3	4	5	6	7

Note: Information on change in area and status are stored as tracks in the GPS and are named to follow the identification number of delineated area.

- Column 1: Identification number of delineated area. Numbers in serial order such as 1, 2, 3 can be used. Use separate form for each forest boundary. This identification number must be used to name the track in the GPS.
- Column 2, 3, 4 and 5: Record X, Y coordinates of the four corners using the GPS. On the GPS coordinates page the value for the x-coordinate is located at the top and the y-coordinate is at the bottom.
- Column 6: Description of change, either i) Forest loss, or ii) Reduced quality of forest, e.g. selected logging/exploitation.
- Column 7: Underlying causes or reason for change, e.g. logging forest for cropping, exploited as planned in 2013 etc.

Form 3. Data Sheet for measuring DBH<6 cm and H≥1.3 m in 1 m radius sub-plot

Plot no.:

No.	Species		Num-ber of tree	Com-ment	No.	Species		Num-ber of trees	Com-ment
	Local name	Com-mon name				Local name	Com-mon name		
1					26				
2					27				
3					28				
4					29				
5					30				
6					31				
7					32				
8					33				
9					34				
10					35				
11					36				
12					37				
13					38				
14					39				
15					40				
16					41				
17					42				
18					43				
19					44				
20					45				
21					46				
22					47				
23					48				
24					49				
25					50				

Form 4. Data sheet for bamboo inventory

Plot No.: Forest status on map:

VN2000 Coordinates: X Y

Location (village, commune, district, province):

Forest type: Forest stratum/status:

Forest owner: Contractor:

Forest compartment: Altitude (m):

Forest sub-compartment: Canopy cover (%):

Forest block: Slope (degree):

Recorded by: Date:

Bamboo species: Height average (m):

Picture: Yes/No (Circle Yes if pictures were taken. Circle No if pictures were not taken.)

For special bamboo: Every shoot is measured

Species: Average height (m)

Number of tree: Average DBH (cm):

No.	DBH (cm)	Age	Com-ment	No.	DBH (cm)	Age	Com-ment
1				26			
2				27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
10				35			
11				36			
12				37			
13				38			
14				39			
15				40			
16				41			
17				42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24				49			
25				50			

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