

FMB Technical Bulletin No.3

MEASUREMENT STANDARDS AND PROCEDURES IN THE CONDUCT OF INVENTORY FOR STANDING TREES (TIMBER)

I. The Technical Bulletin:

In view of the observation that most timber inventory data gathered and submitted to the DENR Central Office do not conform with the procedures and measurement standards prescribed under DENR Memorandum Order No.08, Series of 1991, in particular measurements of Diameter at Breast Height /Diameter Above Buttress (DBH/DAB) of a tree and its corresponding merchantable height. This technical bulletin provides guidelines and procedures on how data/information will be gathered in the field. Inventory data (e.g. DBH, Merchantable Height (MH) are needed for the computation of the volume of trees to be harvested /cut in a given particular area.

II. Users of the Technical Bulletin:

The intended users of the technical bulletin are personnel of DENR who are involved in the conduct of tree inventory in forest land, plantation forest, and all other areas that have tree vegetation.

III. Basic Equipment and Tools

The basic equipment and tools used in timber inventory include among others, diameter tape, bearing compass, meter tape, Global Positioning System (GPS) receiver, haga altimeter/laser dendrometer described as follows:

a. **Diameter tape:** it is a measuring tape that measures (direct reading) the diameter of a given tree (DBH), in centimeters.

b. **Bearing Compass:** it is an instrument that gives the direction (north, south, west, east direction) of the next tree to be measured.

c. **Meter tape:** it is an instrument that measures the distance of the next tree to be measured.

d. **GPS receiver:** it is an instrument that locates the exact location/position by giving its coordinates acquired through satellites feeds.

e. **Laser Dendrometer** (e.g. TruPulse)/Haga altimeter: it is an instrument that measures the height of a given tree, in meters

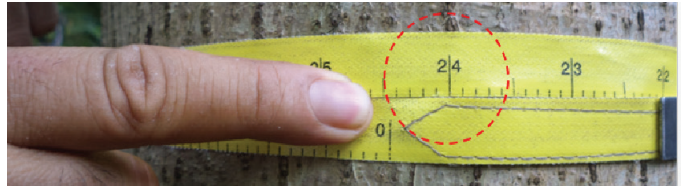


IV Measurement Standard Procedures

A. Diameter Measurement

The diameter is expressed as Diameter at Breast Height (DBH) or Diameter Above Buttress (DAB) measured and recorded to the nearest centimeter. The DBH is the average stem diameter outside bark at a point 1.3 meters above the ground as measured from the uphill side of the stem while DAB is measured at 0.30 meter above the highest flange/buttress. DBH/DAB shall be determined by the used of Diameter Tape, Tree Caliper or any measuring instrument suitable for the purpose.

To avoid over estimation of the volume and compensate measurement error, DBH is adjusted in a decreasing sense (e.g. 24.5cm is recorded as 24cm DBH).



1. **Normal Tree** – Measure the DBH at 1.3 meters above the ground (Figure 1a), if the ground is sloping, reckon the 1.3 meters from the upper portion of the slope (Figure 1b).

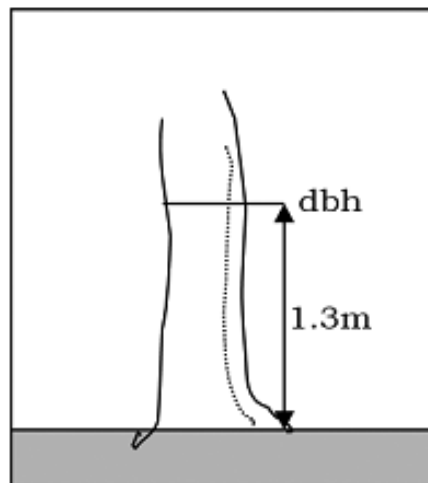


Figure 1a

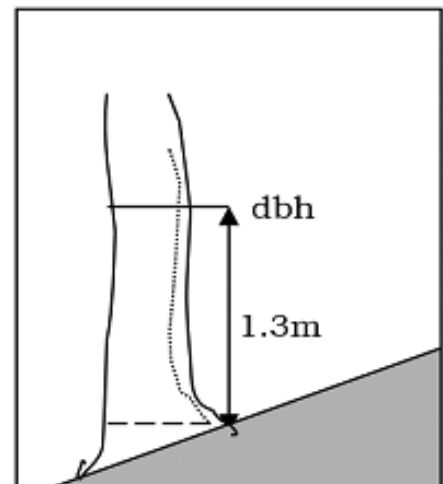


Figure 1b

2. **Swell/Butted Tree** – If the trees are naturally swell/butted/high basal flanges, the DAB shall be measured 30 centimeters above the highest buttress or flange (Figure 2).

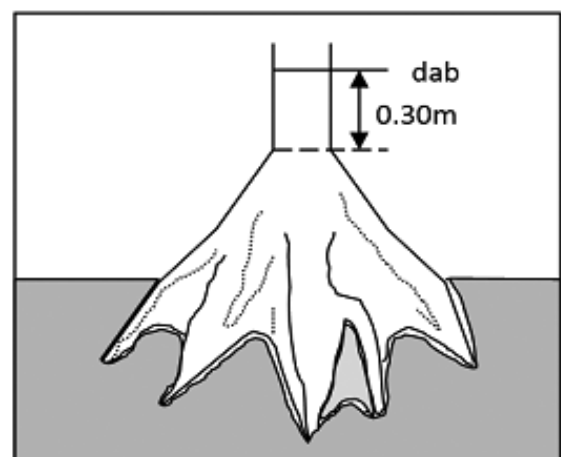


Figure 2

3. **Leaning Trees** – If the trees are naturally leaning, measure the DBH at 1.3 meters above the ground reckon from the lower leaned portion of the tree parallel to the tree axis (Figure3).

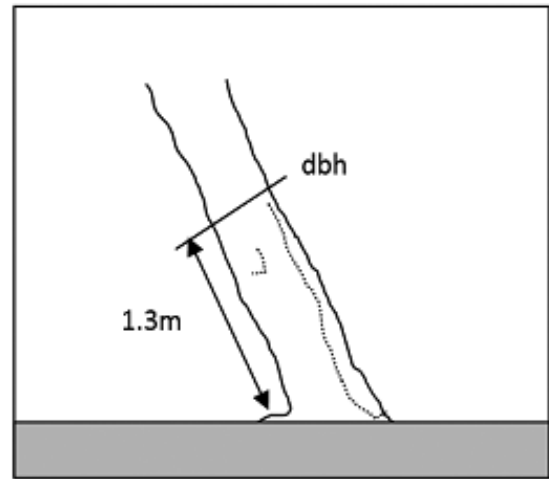


Figure 3

4. **Forked Trees** – If forking is above 1.3 meters (Figure 4a), consider it as one tree and measure the diameter at 1.3 meters above the ground. However, if forking is less than 1.3 meters from the ground (Figure 4b), consider the stems as separate trees and measure the diameter at each stem 1.3 meters above the ground.

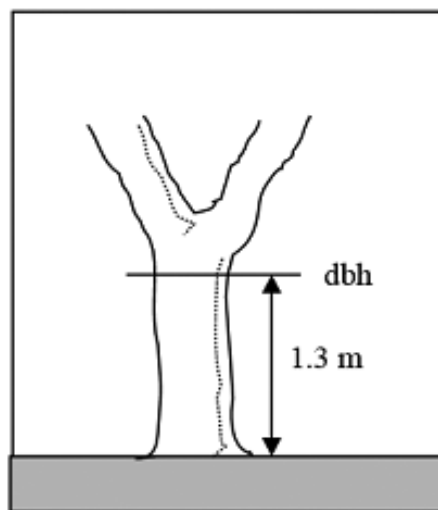


Figure 4a

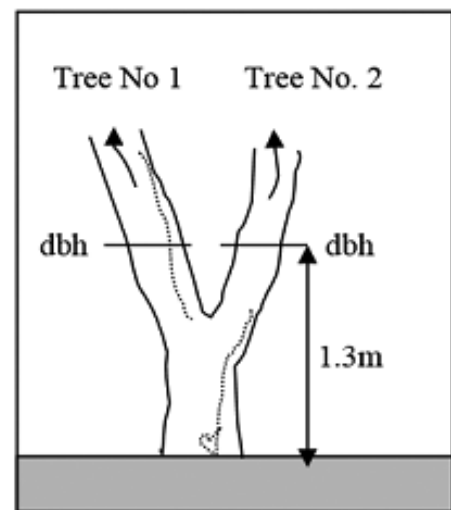


Figure 4b

5. When **bulges, swelling, depressions, branches or other abnormalities** occur at breast height (Figure 5a and 5b), diameter is measured just above the abnormalities at a point where it ceases to affect normal stem form.

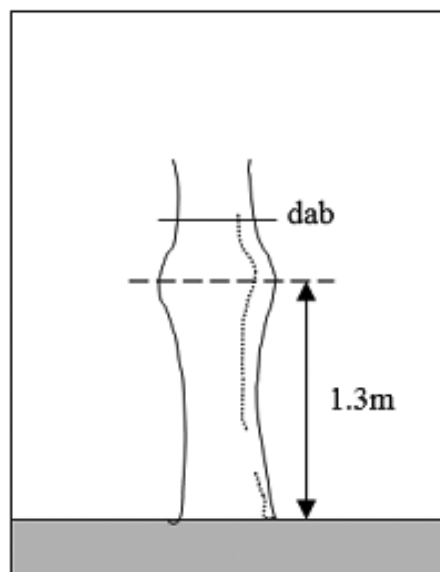


Figure 5a

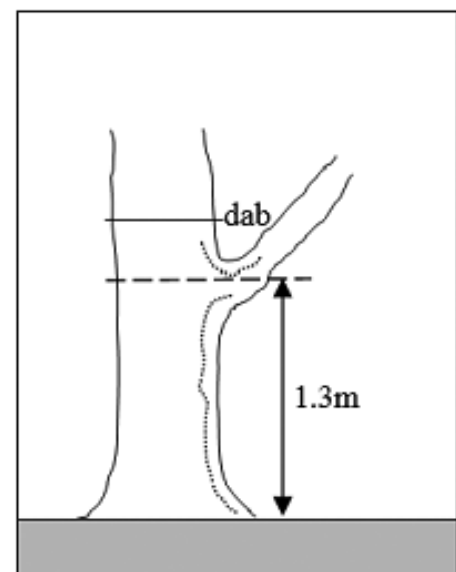


Figure 5b

6. **Trees with Stilt Roots (Mangroves & some Palaquim Species)** – Diameter is usually measured at 1.3 meters reckoned from the highest stilt root (Figure 6).

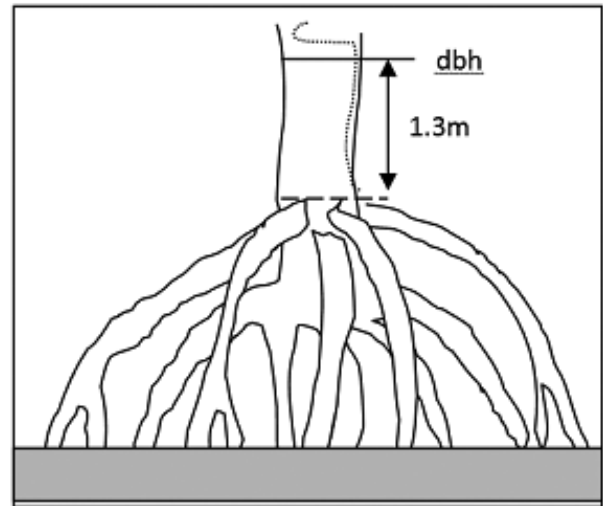
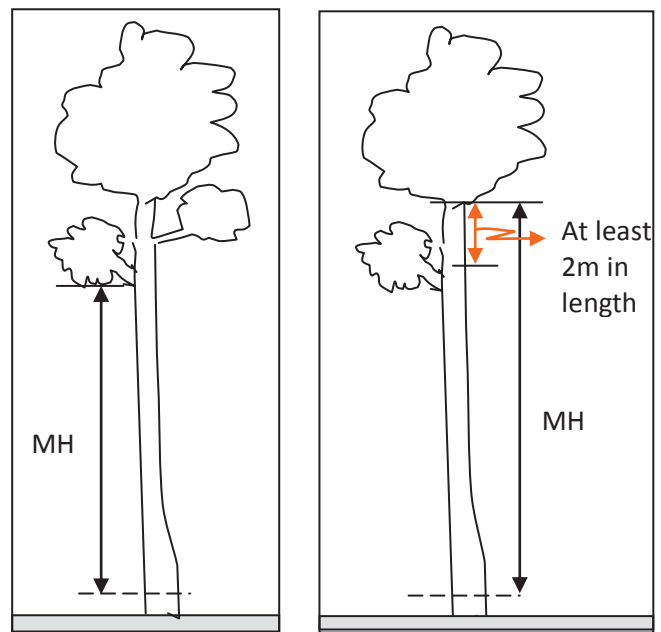


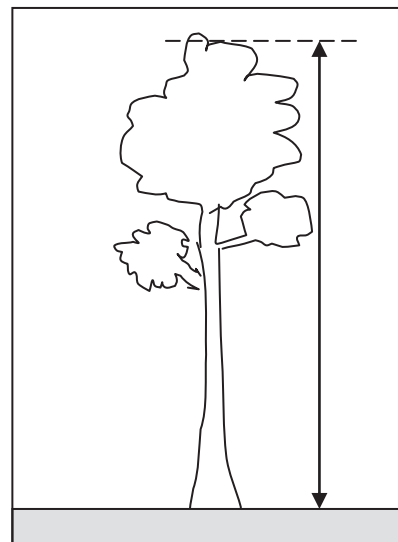
Figure 6

B. TREE HEIGHT MEASUREMENT

1. **Merchantable Height** of a tree is the linear distance along the axis of the bole from the stump height, approximately 50 centimeters (0.5 meter) above the ground or end of buttress to the first major branch, however, it could be extended beyond the first major branch if there is a clear length of at least 2.0 meters up to the succeeding branch or at top end diameter of 30 centimeters. The MH shall be measured/recorded to the nearest meter.



2. **Total Height** is the linear distance along the axis of the bole from the ground to the top of the crown. This is commonly used when measuring the height of the saplings which is 5 to 14 centimeters in diameter during forest inventory through sampling technique. While MH is commonly used in measuring the diameter of trees ranging from 15 centimeters and above i.e. poles and piles, and saw timber.



C. TREE IDENTIFICATION

Trees shall be identified by their official common names or scientific names only. Local names are not suited to definitely identify forest tree species because they vary from place to place and from dialect to dialect. Whenever a species name cannot be ascertained, all efforts shall be geared towards the identification of at least the botanical genus and/or family. Only species whose botanical family cannot be determined may be recorded as “Miscellaneous”. Below is the standard Tally Sheet.

TALLY SHEET (Sample Format)									
Name of Proponent :						Area Inventoried (ha) :			
Location of the Project:						Date of Inventory :			
Tree No.	Species	DBH/DAB (cm)	MH (m)	TH (m)	Volume (m3)	*Tree Location (GPS reading)		Tree Category Planted/Natural	Stem Quality
						Northing	Easting		
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
nth									
*Location (geographical coordinates) of the affected trees for government projects (e.g. DPWH, NGCP, Energy, etc.), Mining, P/SPLTP, etc. is required to be recorded and serve as basis in charting the affected trees/saplings.									
Inventoried by									
Team Leader			Member			Member			Member
STEM QUALITY:									
Code 1 - Straight, cylindrical tree without visible defects or damage .									
Code 2 - Tree with little defects or damage									
Code 3 - Tree with several defects or damage									

D. POST INVENTORY ACTIVITIES

1. Volume Computation

The volume of every tree recorded shall be computed based on the “Regional Volume Equations for Standing Trees”. In order to expedite computations of volumes (and basal area, in the case of IFMA) of individual trees measured, it is required that the raw data recorded (species name, diameter, merchantable height, and total height) shall be imputed/encoded in the computer using Microsoft Excel program, and shall form part of the Inventory Report.

REGIONAL VOLUME EQUATION

REGION	SPECIES GROUP	
	DIPTEROCARP	NON-DIPTEROCARP
Northern Luzon (Region 1,2, and 3)	$V = 0.00005203(D^2 * H)$	$V = 0.00005109(D^2 * H)$
Southern Luzon (Region 4 & 5 except Palawan)	$V = 0.00005171(D^2 * H)$	$V = 0.00005204(D^2 * H)$
Western Visayas (Region 6, 7 & Palawan)	$V = 0.00004649(D^2 * H)$	$V = 0.00004874(D^2 * H)$
Eastern Visayas (Region 8 & Bohol)	$V = 0.00005231(D^2 * H)$	$V = 0.00005109(D^2 * H)$
Eastern Mindanao (Region 11 & 13) (Portion of Agusan, East of Agusan River, Davao & Surigao)	$V = 0.00005087(D^2 * H)$	$V = 0.00004961(D^2 * H)$
Central Mindanao (Region 10, 12 & ARMM) (Bukidnon, Cotabato, Lanao, Misamis & Portion of Agusan, West of Agusan River)	$V = 0.00005019(D^2 * H)$	$V = 0.00005039(D^2 * H)$
Western Mindanao (Region 9) (Basilan, Sulu & Zamboanga)	$V = 0.00004668(D^2 * H)$	$V = 0.00004840(D^2 * H)$

Where : V= Tree volume in cubic meter
 D = Diameter at Breast Height in centimeter
 H = Merchantable Height in meter

Sample Tree Volume Computation			
Given:		Vol (m³)	= 0.00005109 (D²H)
Location:	Isabela, Region 2		= 0.00005109 (41)²* 10
Species:	Amugis (Non-Dipterocarp)		= 0.00005109 (1681)* 10
DBH (cm):	41		= 0.00005109 (16810)
MH (m):	10		= 0.859 m³
Given:		Vol (m³)	= 0.00005171 (D²H)
Location:	Catanduanes, Region 5		= 0.00005171 (37)²* 9
Species:	Apitong (Dipterocarp)		= 0.00005171 (1369)* 9
DBH (cm):	37		= 0.00005171 (12321)
MH (m):	9		= 0.637 m³
Given:		Vol (m³)	= 0.00004649 (D²H)
Location:	Cebu, Region 7		= 0.00004649 (25)²* 7
Species:	Bagtikan (Dipterocarp)		= 0.00004649 (625)* 7
DBH (cm):	25		= 0.00004649 (4375)
MH (m):	7		= 0.203 m³
Given:		Vol (m³)	= 0.00004961 (D²H)
Location:	Surigao del Sur, Region 13		= 0.00004961 (78)²* 17
Species:	Toog (Non-Dipterocarp)		= 0.00004961 (6084)* 17
DBH (cm):	78		= 0.00004961 (103428)
MH (m):	17		= 5.131 m³

2. Preparation of Stand and Stock Table

Each inventory report shall be accompanied by a Stand and Stock Table (SST). The SST shows the summary list of species recorded within the sample plots which shall be arranged into species groups and diameter classes. It likewise shows the total number of trees for each species recorded and its corresponding volume for each diameter class and species group. In the case of areas covered by IFMA, the basal area for DBH classes 20 – 60cm is likewise included.

2.1 Species Groups

The species groupings to be adopted shall be in accordance with the species groupings as prescribed by DENR Administrative Order No. 2000-63 as follows:

- | | |
|------------------------------|------------------------------------|
| a) Philippine Mahogany group | i) Softwood Species except Igem |
| b) Manggachapui Group | j) Igem species |
| c) Palosapis Group | k) Nato group |
| d) Manggasinoro Group | l) Furniture/Construction Hardwood |
| e) Guijo Group | m) Premium species |
| f) Narig Group | n) Lesser Used Species |
| g) Yakal Group | o) Pulpwood/matchwood |
| h) Apitong Group | |

2.2 Diameter Classes

The standard diameter classes are structured in multiples of ten (10) such as 10, 20, 30, 40, etc. Each of this diameter class includes specific range of diameter sizes as hereunder illustrated:

DBH/DABCLASSES(cm)	DIAMETER RANGES(cm)
*10	5-14
20	15-24
30	25-34
40	35-44
50	45-54
60	55-64
70	65-74
80	75-84
90	85-94
100	95-104
110	105-114
120	115-124

*Saplings (diameter ranging from 5-14 cm) that are to be affected by the projects (e.g. DPWH, NGCP, Energy, Mining, etc.) are required to be inventoried, and shall be included in the SST under Diameter Class 10 centimeters. The healthy saplings are recommended for earth-balling.

STAND AND STOCK TABLE (Sample Format)

LICENSEE/PERMITTEE :	SAMPLING INTENSITY: 10%
LOCATION :	AREA INVENTORIED (ha): 2.0 ha
AREA FORESTED (ha) : 20 ha	

SPECIES GROUP	DIAMETER CLASSES IN CENTIMETERS														TOTAL			
	10		20		30		40		50		60		70				N th	
	T	V	T	V	T	V	T	V	T	V	T	V	T	V	T	V	T	V
A. Phil. Mahogany Group																		
1. Red Lauan	10	0.17	1	0.15	1	0.47					1	2.4					13	3.19
<i>Sub-total</i>	10	0.17	1	0.15	1	0.47	0	0	0	0	1	2.4	0	0	0	0	13	3.19
<i>Per Hectare</i>	5	0.09	0.5	0.08	0.5	0.24	0	0	0	0	0.5	1.2	0	0	0	0	6.5	1.595
B. Premium Species																		
1. Ipil	8	0.13			2	0.98	1	1.1	1	1.69							12	3.9
<i>Sub-total</i>	8	0.13	0	0	2	0.98	1	1.1	1	1.69	0	0	0	0	0	0	12	3.9
<i>Per Hectare</i>	4	0.07	0	0	1	0.49	0.5	0.6	0.5	0.85	0	0	0	0	0	0	6	1.95
C. Furniture/Construction Group																		
1. Amugis	15	0.25	3	0.41	2	0.73							1	2.22			21	3.61
<i>Sub-total</i>	15	0.25	3	0.41	2	0.73	0	0	0	0	0	0	1	2.22	0	0	21	3.61
<i>Per Hectare</i>	7.5	0.13	1.5	0.21	1	0.37	0	0	0	0	0	0	0.5	1.11	0	0	10.5	1.805
D. Lesser-Used Species																		
1. African tulip	12	0.2	6	0.98	2	1.24					1	4.97					21	7.39
2. Kupang	17	0.28	1	0.14	6	2.48			1	1.28							25	4.18
<i>Sub-total</i>	29	0.48	7	1.12	8	3.72	0	0	1	1.28	1	4.97	0	0	0	0	46	11.57
<i>Per Hectare</i>	14.5	0.24	3.5	0.56	4	1.86	0	0	0.5	0.64	0.5	2.49	0	0	0	0	23	5.785
GRAND TOTAL	62	1.03	11	1.68	13	5.9	1	1.1	2	2.97	2	7.37	1	2.22	0	0	92	22.27
AVE. PER HECTARE	31	0.52	5.5	0.84	6.5	2.95	0.5	0.6	1	1.49	1	3.69	0.5	1.11	0	0	46	11.135

3. SUBMISSION OF REPORTS

The report to be submitted shall be subscribed and sworn to by the forest officers who conducted the forest inventory, and shall include the following:

1. **Narrative report**— it shall consist of the sampling method used, description of the area evaluated, duration of inventory work, recommendations, etc.
2. **Stand and Stock Table (SST)** — it shall indicate the species and species groups, size classes, number and volume of each tree species.
3. **Sketch Maps** — shall show the locations of the base lines, strip lines, tying points established; the forest cover of the whole concession area, among others.
4. For projects that require the cutting of all inventoried trees, a sketch map showing the relative locations of the trees charted must be prepared and submitted. The map should contain the geographical coordinates (latitude/longitude) of the area.
5. Original tally sheets and the electronic copy (USB or CD) containing the records of trees inventoried; and
6. Photographs showing sample of trees measured, the interior portion and the panoramic view of the inventoried area.

