Volume Tables for *Acacia auriculiformis, Cassia siamea and Pinus caribaea* in Bangladesh

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Abstract

The paper presents volume tables for *Acacia auriculiformis* (akashmoni), *Cassia siamea* (minjiri) and *Pinus caribaea* (pine), three fast growing plantation species from Bangladesh. Diameter at breast height (D)-volume and D - height - volume relationships were determined to estimate the total volumes overbark and underbark.

সারসংক্ষেপ

আলোচ্য প্রবন্ধে বাংলাদেশের সৃষ্ট বাগানে উৎপাদিত দ্রুত বর্ধনশীল তিনটি প্রজাতি যথা : *Acacia auriculformis* (আকাশমনি), *Cassia siamea* (মিনজিরি) এবং *Pinus caribaea* (পাইন) এর ভলিউম টেবিল উপস্থাপিত করা হয়েছে । বুক উচ্চতায় গাছের ব্যাস এবং বুক উচ্চতায় গাছের ব্যাস ও মোট উচ্চতার সহিত ভলিউমের সম্পর্ক নির্ণয় করে প্রয়োজনীয় টেবিল তৈরী করা হয়েছে ।

Key words : *Acacia auriculiformis,* Bangladesh, *Cassia siamea, Pinus caribaea,* volume table

Introduction

Acacia auriculiformis (akashmoni), *Cassia siamea* (minjiri) and *Pinus caribaea* (pine) are promising fast growing tree species. These have been successfully introduced and included in the plantation programme in Bangladesh.

The older and matured plantations of these species are now ready for harvesting. So volume tables for these species are needed to estimate the quantity of harvest. This paper presents the volume tables for these three species.

Materials and methods
Measurement of trees

We observed that most of the trees fall within the diameter at breast height (dbh) range of 5 - 20 cm. We divided this range into 5 cm dbh classes, and collected data of at least 30 trees from each class. Larger trees were also included whenever available. We selected trees at random having average to better stem form in a plantation for data collection. We marked and measured the dbh first, and then felled the trees for the species akashmoni and minjiri, and total heights were

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measured. The trees were marked at one metre intervals from one metre above ground level to a top-end diameter of approximately 3.0 cm overbark, to measure overbark diameters. The barks were then removed from each point to measure underbark diameters.

Total heights, dbh, overbark diameter and bark thicknesses to estimate the underbark diameters at one meter intervals were measured for pine from standing trees. We collected data for akashmoni and minjiri from the plantations of Dinajpur, Tangail, Chittagong and Cox's Bazar; and for pine from the plantations of Chittagong, Cox's Bazar, Sylhet and Dinajpur. The dbh-height class distributions of the sample trees are given in Table 1.

Compilation of data

The volumes of all the sections except the top and bottom portions were computed by using the mean cross-sectional area of the two ends of each section (Das et al. 1992). The bottom section was assumed cylindrical and volume was estimated. The top most section was assumed a cone, and volume was computed as one third of the cylindrical volume of the portion. The top end diameter measurement for each tree was considered as the base diameter of the cone. The volume of the cone was ignored for estimation of underbark tree volume. The individual tree volume was then estimated by summing up the volumes of each section of a tree. The individual tree volume (V) was related to dbh (D) and total height (H) by regression analyses using various functions and transformations as required in the regression models.

Table 1. Dbh and height class distribution of the sample trees taken for estimation of volumes

Dbh class in cm	HEIGHT CLASS IN METRES								
	6	8	10	12	14	16	18	20	Total
	Number of trees in each dbh class								
AKASHMONI									
5 - 10	10	21	21	5					57
10 - 15		3	10	23	15				51
15 - 20			1	12	8	4			25
20 - 25				4	2				6
Total	10	24	32	44	25	4			139
MINJIRI									
5 - 10	9	26	6	5					46
10 - 15		4	12	13	10	2	1		42
15 - 20			4	11	6	7	2		30
20 - 25						1	1		2
Total	9	30	22	29	16	10	4		120
PINE									
5 - 10	8	16	10	2					36
10 - 15			9	5	9	2			25
15 - 20			2	4	5	13	3		27
20 - 25					4	9	10	1	24
25 +						5	4	1	10
Total	8	16	21	11	18	29	17	2	122

Computation of volume functions

Multiple regression analyses were done to select the best suited models. The following 10 models used by Latif *et al.* (1993) were tested to select the best models with different variables :

1. $V = b_0 + b_1 D$
2. $V = b_0 + b_1 D + b_2 D^2$
3. $V = b_0 + b_1 D^2$
4. $V = b_0 + b_1 D^2 H$
5. $V = b_0 + b_1 D^2 + b_2 H + b_3 D^2 H$
6. $V = b_0 + b_1 D^2 + b_2 DH + b_3 D^2 H$
7. $\log (V) = b_0 + b_1 \log (D)$
8. $\log (V) = b_0 + b_1 \log (D) + b_2 \log (H)$
9. $V/D^2 = b_0 + b_1 HD^2 + b_2 / H + b_3/D^2$
10. $V/D^2 = b_0 + b_1 / D^2 + b_2 /H + b_3/D$

Where, V = volume in cubic meters, D = dbh in centimetres and H = total height in meters and b_0 is the regression constant and b_1, b_2 and b_3 are regression coefficients. The logarithmic functions are to the base e.

The best fitted models were chosen based on the highest coefficient of determination (R^2), F-ratio (F), lowest residual mean square and low Furnival index (FI). Models were selected for estimation of total volume overbark and total volume underbark to a top-end diameter of approximately 3.0 cm overbark. The selected models were also transformed for estimation of volume from girth at breast height (GBH,G).

Validation test procedure

The best suited regression models were tested with a set of independent data of 30-35 trees, collected and compiled in the same procedure. The actual volumes of these trees were collectively compared with the corresponding volumes predicted by the selected models. The independent tests for validation were the absolute deviation percent, paired t-test, chi-square test and 45 degree line test (Islam *et al.* 1992).

Results and discussions

The regression models for total volume over-bark (Vob) and total volume underbark (Vub) to a top-end diameter of approximately 3.0 cm overbark were selected after the validation of the selected models. The best fitted models were selected for estimation of volume on diameter at breast height (dbh, D), and volume on dbh and total height. The selected models are given as follows :

Akashmoni

1. (a) $\log (Vob) = -8.208 + 2.2389^* \log (D)$
   (b) $\log (vob) = -10.7709 + 2.2389^* \log (G)$
   $R^2 = 0.959$, F = 3228.84, FI = 0.0061

2. (a) $\log (Vob) = -9.125 + 1.918^* \log (D)$
        $+ 0.67988 * \log (H)$
   (b) $\log (Vob) = -11.3205 + 1.918^* \log (G)$
        $+ 0.67988^* \log (H)$
   $R^2 = 0.988$, F = 5810.5, FI = 0.0648

3. (a) $\log (Vub) = -9.187 + 2.468^* \log (D)$
   (b) $\log (Vub) = -12.0121 + 2.468^* \log (G)$
   $R^2 = 0.9688$, F = 4282.9, FI = 0.0059

4. (a) $\log (Vub) = -10.2398 + 2.100244^* \log (D)$
        $+ 0.780214^* \log (H)$
   (b) $\log (Vub) = -12.6440 + 2.100244^* \log (G)$
        $+ 0.780214 * \log (H)$
   $R^2 = 0.9773$, F = 2947.0, FI = 0.0048

Minjiri

1. (a) $\log (Vob) = -8.602 + 2.4038^* \log (D)$
   (b) $\log (Vob) = -11.3536 + 2.4038^* \log (G)$
   $R^2 = 0.9796$, F = 5669.8, FI = 0.0098

2. (a) $\log(\text{Vob}) = -9.514 + 1.871^* \log(D)$

$+ 0.897^* \log(H)$

(b) $\log(\text{Vob}) = -11.6557 + 1.871^* \log(G)$

$+ 0.897^* \log(H)$

$R^2 = 0.9898$, $F = 5697.0$, $FI = 0.0054$

3. (a) $\log(\text{Vub}) = -9.334 + 2.55686^* \log(D)$

(b) $\log(\text{Vub}) = -12.2632 + 2.55686^* \log(G)$

$R^2 = 0.976$, $F = 4851.89$, $FI = 0.0081$

4. (a) $\log(\text{Vub}) = -10.1766698 + 2.0641847^* \log(D)$

$+ 0.8290937^* \log(H)$

(b) $\log(\text{Vub}) = -12.5396 + 2.064187^* \log(G)$

$+ 0.8290937^* \log(H)$

$R^2 = 0.986$, $F = 4120.3$, $FI = 0.0049$

Pine

1. (a) $\log(\text{Vob}) = -8.7854 + 2.410755^* \log(D)$

(b) $\log(\text{Vob}) = -11.545 + 2.410755^* \log(G)$

$R^2 = 0.986$, $F = 8230.56$, $FI = 0.0020$

2. (a) $\log(\text{Vob}) = -9.39412 + 1.867386^* \log(D)$

$+ 0.839034^* \log(H)$

(b) $\log(\text{Vob}) = -11.5317 + 1.867386^* \log(G)$

$+ 0.839034^* \log(H)$

$R^2 = 0.9945$, $F = 10376.1$, $FI = 0.0052$

3. (a) $\log(\text{Vub}) = -9.11552 + 2.483187^* \log(D)$

(b) $\log(\text{vub}) = -11.9580 + 2.483187^* \log(G)$

$R^2 = 0.9858$, $F = 6889.44$, $FI = 0.0084$

4. (a) $\log(\text{Vub}) = -9.7505 + 1.935397^* \log(D)$

$+ 0.851715^* \log(H)$

(b) $\log(\text{Vub}) = -11.9660 + 1.935397^* \log(G)$

$+ 0.851715^* \log(H)$

$R^2 = 0.9933$, $F = 7281.44$, $FI = 0.0058$

Where :

D   =   diameter at breast height in cm,

G   =   girth at breast height in cm,

H   =   total height in meters,

Vob =   total volume overbark in cubic meters and

Vub =   total underbark volume to top end diameter of 3.0 cm in cubic meters.

Validation of the selected models

The co-efficients of determination of the selected models were closer to one. Similarly, F values were higher and FI values were less than one for the selected models.

The selected models satisfied all the validation criteria. The absolute deviation percents, and chi-square values were less than 10%, 2.0 and 17.71 respectively and estimated volumes tend to make an angle of approximately 45 degree with the actual volumes when plotted on graphs.

Therefore, the selected models may be used for the species within the data range used for preparation of the volume tables. After the validation test, volume tables were prepared for ready use and are presented in Tables 2-8.
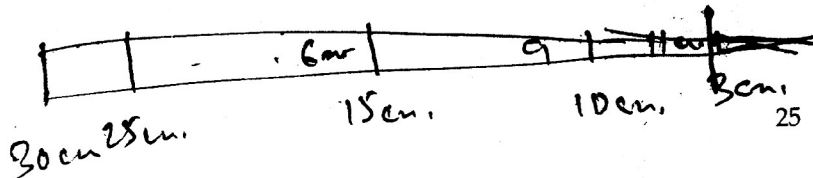
Table 2. One-way volumes for akashmoni, minjiri and pine trees in plantations of Bangladesh

DBH (cm)	GBH (cm)	Akashmoni vob (m^3)	Akashmoni Vub (m^3)	Minjiri Vob (m^3)	Minjiri Vub (m^3)	Pine Vob (m^3)	Pine Vub (m^3)
4	12.6	0.005	0.003	0.006	0.003	0.004	0.003
5	15.7	0.009	0.005	0.010	0.005	0.007	0.006
6	18.8	0.014	0.009	0.015	0.008	0.011	0.009
7	22.0	0.020	0.013	0.021	0.012	0.017	0.014
8	25.1	0.027	0.018	0.028	0.017	0.023	0.019
9	28.3	0.036	0.024	0.037	0.023	0.031	0.026
10	31.4	0.047	0.032	0.047	0.030	0.039	0.033
11	34.6	0.059	0.041	0.058	0.038	0.050	0.042
12	37.7	0.072	0.051	0.071	0.047	0.061	0.053
13	40.8	0.087	0.062	0.084	0.057	0.074	0.064
14	44.0	0.105	0.075	0.100	0.068	0.089	0.077
15	47.1	0.123	0.090	0.117	0.081	0.105	0.092
16	50.3	0.144	0.106	0.135	0.095	0.122	0.107
17	53.4	0.167	0.124	0.154	0.111	0.142	0.125
18	56.5	0.191	0.143	0.176	0.128	0.162	0.144
19	59.7	0.218	0.164	0.198	0.146	0.185	0.165
20	62.8	0.246	0.187	0.222	0.166	0.209	0.187

Table 3. Total volume overbark in cubic meters for akashmoni trees in plantations of Bangladesh

DBH (cm)	GBH (cm)	2	4	6	8	10	12	14	16	18	20
					volume in cubic meter						
3	9.4	0.001	0.002	0.003	0.003	0.004	0.004	0.005			
4	12.6	0.002	0.003	0.005	0.006	0.007	0.008	0.009			
5	15.7	0.003	0.006	0.008	0.009	0.011	0.012	0.014			
6	18.8	0.005	0.008	0.011	0.013	0.016	0.018	0.020	0.022		
7	22.0	0.007	0.011	0.015	0.018	0.021	0.024	0.027	0.029		
8	25.1	0.009	0.015	0.019	0.024	0.028	0.031	0.035	0.038		
9	28.3	0.011	0.018	0.024	0.030	0.035	0.039	0.044	0.048		
10	31.4	0.014	0.023	0.030	0.037	0.043	0.048	0.054	0.059		
11	34.6	0.017	0.027	0.036	0.044	0.051	0.058	0.065	0.071	0.077	
12	37.7	0.020	0.032	0.043	0.052	0.061	0.069	0.076	0.084	0.091	
13	40.8	0.023	0.038	0.050	0.061	0.071	0.080	0.089	0.098	0.106	
14	44.0	0.027	0.044	0.058	0.070	0.082	0.093	0.103	0.113	0.122	
15	47.1	0.031	0.050	0.066	0.080	0.093	0.106	0.118	0.129	0.140	
16	50.3		0.057	0.075	0.091	0.106	0.120	0.133	0.146	0.158	0.170
17	53.4		0.064	0.084	0.102	0.119	0.135	0.150	0.164	0.178	0.191
18	56.5		0.071	0.094	0.114	0.133	0.150	0.167	0.183	0.198	0.213
19	59.7		0.079	0.104	0.126	0.147	0.167	0.185	0.203	0.220	0.236
20	62.8		0.087	0.115	0.140	0.163	0.184	0.204	0.224	0.243	0.261

Header row for Table 3: HEIGHT IN METERS

Table 4. Total volume underbark for akashmoni trees in plantations of Bangladesh

HEIGHT IN METERS

volume in cubic meter

DBH (cm)	GBH (cm)	2	4	6	8	10	12	14	16	18	20
3	9.4	0.000	0.001	0.001	0.001	0.002	0.002	0.002			
4	12.6	0.001	0.001	0.002	0.003	0.003	0.004	0.005			
5	15.7	0.001	0.003	0.004	0.005	0.006	0.007	0.008			
6	18.8	0.002	0.004	0.006	0.007	0.009	0.010	0.012	0.013		
7	22.0	0.003	0.006	0.008	0.010	0.012	0.014	0.016	0.018		
8	25.1	0.004	0.008	0.011	0.014	0.016	0.019	0.022	0.024		
9	28.3	0.006	0.010	0.014	0.018	0.021	0.025	0.028	0.031		
10	31.4	0.007	0.013	0.018	0.022	0.027	0.031	0.035	0.039		
11	34.6	0.009	0.016	0.022	0.027	0.033	0.038	0.043	0.047	0.052	
12	37.7	0.011	0.019	0.026	0.033	0.039	0.045	0.051	0.057	0.062	
13	40.8	0.013	0.023	0.031	0.039	0.047	0.054	0.061	0.067	0.074	
14	44.0	0.015	0.026	0.036	0.046	0.054	0.063	0.071	0.079	0.086	
15	47.1	0.018	0.031	0.042	0.053	0.063	0.073	0.082	0.091	0.100	
16	50.3		0.035	0.048	0.061	0.072	0.083	0.094	0.105	0.115	0.125
17	53.4		0.040	0.055	0.069	0.082	0.095	0.107	0.119	0.130	0.141
18	56.5		0.045	0.062	0.078	0.093	0.107	0.121	0.134	0.147	0.160
19	59.7		0.051	0.070	0.087	0.104	0.120	0.135	0.150	0.165	0.179
20	62.8		0.056	0.078	0.097	0.116	0.134	0.151	0.167	0.183	0.199

Table 5. Total volume overbark for minjiri tree in plantations of Bangladesh

HEIGHT IN METERS

volume in cubic meter

DBH (cm)	GBH (cm)	2	4	6	8	10	12	14	16	18	20
2	6.3	0.001	0.001	0.001	0.002	0.002	0.003	0.003			
3	9.4	0.001	0.002	0.003	0.004	0.005	0.005	0.006			
4	12.6	0.002	0.003	0.005	0.006	0.008	0.009	0.011			
5	15.7	0.003	0.005	0.007	0.010	0.012	0.014	0.016			
6	18.8	0.004	0.007	0.011	0.014	0.017	0.020	0.020	0.025		
7	22.0	0.005	0.010	0.014	0.018	0.022	0.026	0.030	0.034		
8	25.1	0.007	0.013	0.018	0.023	0.028	0.034	0.039	0.043		
9	28.3	0.008	0.016	0.022	0.029	0.036	0.042	0.048	0.054		
10	31.4	0.010	0.019	0.027	0.035	0.043	0.051	0.059	0.066		
11	34.6	0.012	0.023	0.033	0.042	0.052	0.061	0.070	0.079	0.088	
12	37.7	0.014	0.027	0.038	0.050	0.061	0.072	0.082	0.093	0.103	
13	40.8	0.017	0.031	0.045	0.058	0.071	0.083	0.096	0.108	0.120	
14	44.0	0.019	0.036	0.051	0.066	0.081	0.096	0.110	0.124	0.138	
15	47.1	0.022	0.041	0.058	0.076	0.092	0.109	0.125	0.141	0.157	
16	50.3		0.046	0.066	0.085	0.104	0.123	0.141	0.159	0.177	0.194
17	53.4		0.051	0.074	0.096	0.117	0.138	0.158	0.178	0.198	0.217
18	56.5		0.057	0.082	0.106	0.130	0.153	0.176	0.198	0.220	0.242
19	59.7		0.063	0.091	0.118	0.144	0.169	0.194	0.219	0.244	0.268
20	62.8		0.070	0.100	0.130	0.158	0.186	0.214	0.241	0.268	0.295

Table 6. Total volume underbark for minjiri trees in plantations of Bangladesh

DBH (cm)	GBH (cm)	HEIGHT IN METERS									
		2	4	6	8	10	12	14	16	18	20
		volume in cubic meter									
2	6.3	0.000	0.001	0.001	0.001	0.001	0.001	0.001			
3	9.4	0.001	0.001	0.002	0.002	0.002	0.003	0.003			
4	12.6	0.001	0.002	0.003	0.004	0.004	0.005	0.006			
5	15.7	0.002	0.003	0.005	0.006	0.007	0.008	0.009			
6	18.8	0.003	0.005	0.007	0.009	0.010	0.012	0.014	0.015		
7	22.0	0.004	0.007	0.009	0.012	0.014	0.017	0.019	0.021		
8	25.1	0.005	0.009	0.012	0.016	0.019	0.022	0.025	0.028		
9	28.3	0.006	0.011	0.016	0.020	0.024	0.028	0.032	0.035		
10	31.4	0.008	0.014	0.019	0.025	0.030	0.035	0.039	0.044		
11	34.6	0.010	0.017	0.024	0.030	0.036	0.042	0.048	0.053	0.059	
12	37.7	0.011	0.020	0.028	0.036	0.043	0.050	0.057	0.064	0.071	
13	40.8	0.013	0.024	0.033	0.043	0.051	0.059	0.068	0.076	0.083	
14	44.0	0.016	0.028	0.039	0.050	0.060	0.069	0.079	0.088	0.097	
15	47.1	0.018	0.032	0.045	0.057	0.069	0.080	0.091	0.101	0.112	
16	50.3		0.037	0.051	0.065	0.079	0.091	0.104	0.116	0.128	0.139
17	53.4		0.042	0.058	0.074	0.089	0.104	0.118	0.131	0.145	0.158
18	56.5		0.047	0.066	0.083	0.100	0.116	0.132	0.148	0.163	0.178
19	59.7		0.052	0.073	0.093	0.112	0.130	0.148	0.165	0.182	0.199
20	62.8		0.058	0.081	0.103	0.124	0.145	0.164	0.184	0.203	0.221

Table 7. Total volume overbark for *Pinus caribaea* trees in plantations of Bangladesh

DBH (cm)	GBH (cm)	HEIGHT IN METERS									
		2	4	6	8	10	12	14	16	18	20
		volume in cubic meter									
4	12.6	0.002	0.004	0.005	0.006	0.008	0.009	0.010	0.011	0.013	0.014
5	15.7	0.003	0.005	0.008	0.010	0.012	0.014	0.015	0.017	0.019	0.021
6	18.8	0.004	0.008	0.011	0.014	0.016	0.019	0.022	0.024	0.027	0.029
7	22.0	0.006	0.010	0.014	0.018	0.022	0.025	0.029	0.032	0.036	0.039
8	25.1	0.007	0.013	0.018	0.023	0.028	0.033	0.037	0.041	0.046	0.050
9	28.3	0.009	0.016	0.023	0.029	0.035	0.041	0.046	0.052	0.057	0.062
10	31.4	0.011	0.020	0.028	0.035	0.042	0.049	0.056	0.063	0.069	0.076
11	34.6	0.013	0.023	0.033	0.042	0.051	0.059	0.067	0.075	0.083	0.090
12	37.7	0.015	0.028	0.039	0.049	0.059	0.069	0.079	0.088	0.097	0.106
13	40.8	0.018	0.032	0.045	0.057	0.069	0.081	0.092	0.102	0.113	0.124
14	44.0	0.021	0.037	0.052	0.066	0.079	0.092	0.105	0.0118	0.130	0.142
15	47.1	0.023	0.042	0.059	0.075	0.090	0.105	0.120	0.134	0.148	0.161
16	50.3	0.026	0.047	0.066	0.084	0.102	0.119	0.135	0.151	0.167	0.182
17	53.4	0.030	0.053	0.074	0.095	0.114	0.133	0.151	0.169	0.187	0.204
18	56.5	0.033	0.059	0.083	0.105	0.127	0.148	0.168	0.188	0.208	0.227
19	59.7	0.036	0.065	0.091	0.116	0.140	0.164	0.186	0.208	0.230	0.251
20	62.8	0.040	0.072	0.101	0.128	0.154	0.180	0.205	0.229	0.253	0.276
21	66.0	0.044	0.078	0.110	0.140	0.169	0.197	0.224	0.251	0.277	0.303
22	69.1	0.048	0.086	0.120	0.153	0.185	9.215	0.245	0.274	0.302	0.330
23	72.3	0.052	0.093	0.131	0.166	0.200	0.234	0.266	0.297	0.328	0.359
24	75.4	0.056	0.101	0.141	0.180	0.217	0.253	0.288	0.322	0.355	0.388

Table 8. Total volume underbark for *Pinus caribaea* trees in plantations of Bangladesh

DBH (cm)	GBH (cm)	HEIGHT IN METERS								
		4	6	8	10	12	14	16	18	20
		volume in cubic meter								
4	12.6	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011
5	15.7	0.004	0.006	0.008	0.009	0.011	0.012	0.014	0.015	0.017
6	18.8	0.006	0.009	0.011	0.013	0.016	0.018	0.020	0.022	0.024
7	22.0	0.008	0.012	0.015	0.018	0.021	0.024	0.027	0.030	0.032
8	25.1	0.011	0.015	0.019	0.023	0.027	0.031	0.035	0.038	0.042
9	28.3	0.013	0.019	0.024	0.029	0.034	0.039	0.043	0.038	0.042
10	31.4	0.016	0.023	0.030	0.036	0.042	0.048	0.053	0.048	0.053
11	34.6	0.020	0.028	0.035	0.043	0.050	0.057	0.064	0.059	0.064
12	37.7	0.023	0.033	0.042	0.051	0.059	0.068	0.076	0.071	0.077
13	40.8	0.027	0.038	0.049	0.059	0.069	0.079	0.088	0.084	0.092
14	44.0	0.031	0.044	0.057	0.068	0.080	0.091	0.102	0.098	0.107
15	47.1	0.036	0.051	0.065	0.078	0.091	0.104	0.117	0.113	0.124
16	50.3	0.041	0.057	0.073	0.089	0.104	0.118	0.132	0.129	0.141
17	53.4	0.046	0.065	0.082	0.100	0.116	0.133	0.149	0.146	0.160
18	56.5	0.051	0.072	0.092	0.111	0.130	0.148	0.166	0.164	0.180
19	59.7	0.057	0.080	0.102	0.124	0.144	0.165	0.184	0.184	0.201
20	62.8	0.063	0.088	0.113	0.137	0.159	0.182	0.204	0.204	0.223
21	66.0	0.069	0.097	0.124	0.150	0.175	0.200	0.224	0.225	0.246
22	69.1	0.075	0.106	0.136	0.164	0.192	0.219	0.245	0.247	0.271
23	72.3	0.082	0.116	0.148	0.179	0.209	0.238	0.267	0.271	0.296
24	75.4	0.089	0.126	0.161	0.194	0.227	0.259	0.290	0.295	0.323

Note: In the original the columns for DBH 18 onward appear shifted by a hand-drawn line; the 18 and 20 m columns read: 18 → 0.164, 0.184, 0.204, 0.225, 0.247, 0.271, 0.295, 0.320 and 20 → 0.180, 0.201, 0.223, 0.246, 0.271, 0.296, 0.323, 0.351 for rows 18–24.

Acknowledgement

References

Das. S.; Rahman, M. F.; Reza, N. A. and Latif, M. A. 1992. *Tree volume tables for Sal (Shorea robusta Gaertn. f.) in the plantations of Bangladesh.* Bulletin 7, Forest Inventory Division, Bangladesh Forest Research Institute. Chittagong. 11 pp.

Islam, S. S.; Waziullah, A. K. M. and Reza, N. A. 1992. Validation of the existing volume tables of Telyagarjan *(Dipterocarpus turbinatus)* in Bangladesh. *Bangladesh J. For. Sci.* 21(182) : 60-66.

Latif, M. A.; Habib, M. A. and Das, S. 1993. Tree volume tables for *Acacia mangium* in the plantations of Bangladesh. *Bangladesh J. For. Sci.* 22 (1 & 2) : 23-29.