

VOLUME TABLES FOR HORSE CHEST NUT (*Aesculus indica*) OF NWFP.

Mohammad Afzal Cheema

Raja Walayat Hussain*

Introduction

Horse chestnut (*Aesculus indica*) is a useful broad leaved tree and grows naturally in conifer forests of NWFP, Punjab and Azad Kashmir associated with other broad leaved and conifers. Its wood is pale pink, soft and used for light constructional work, packing cases, water troughs and furniture. The tree grows to a large size specially under favourable conditions. It is a moderate light demander and has a good coppicing power.

Basic Data

The volume tables are based on data collected from 110 trees ranging from 9 cms (3.5 inches) to 94 cm (37.0 inches) diameter at breast height from Galies Forest Division of N.W.F.P.

Method and Procedure

Trees were measured as per standard procedure for measurement of sample tree (6). Volume upto 5 cm (2 inches) diameter overbark at thin end of the stem including branches was taken as total volume of the tree. Total volume of timber (overbark) and smallwood of different logs of a tree were calculated using Huber formula and were summed to get volume of timber (o.b.) and smallwood separately for each tree. Total volume (o.b.) was obtained by adding total timber volume (o.b.) and total smallwood volume of a tree. Estimates of heights and volume (timber and total separately) against dbh classes were obtained using regression techniques.

Following mathematical models were used for estimating height, timber volume and total volume.

(i) Models for total height

$$H = a + b \log D$$

$$H = a + b D + c D^2$$

(ii) Models for timber (o.b.) volume.

$$V(\text{tim}) = a + b \frac{D^2 H}{100}$$

* The authors are Forest Mensuration Officer and Director, Forestry Research Division, Pakistan Forest Institute, Peshawar respectively.

$$V(\text{tim}) = a + b \log \frac{D^2 H}{100}$$

$$V(\text{tim}) = a + b D + c H$$

(iii) Models for total volume

$$V = a + b \frac{D^2 H}{100}$$

$$V = a + b \log \frac{D^2 H}{100}$$

where H stands for total height in feet,

D stands for diameter at breast height in inches,

V (tim) stands for total timber volume (o.b.) in cubic feet.

V stands for total volume (o.b.) in cft.

log stands for common logarithms (base 10)

The regression equations developed from the above models are given in Appendix I along with their measures of precision.

Height Estimation

Regression equations for height estimation are presented in Appendix I at serial No. 1 and 2. The measures of precision for both equations are not so strong due to much variation in heights of different sized trees. These measures i.e. correlation coefficient and SE of estimates are almost same for both equations 1 and 2.

The estimates were obtained using both equations 1 and 2. The estimates from equation 2 were not reliable for higher diameter classes and therefore equation 1 i.e. $H = -18.5952 + 68.7667 \log D$ was used for the estimation of heights against dbh classes (Appendix II). Estimated values were rounded to whole numbers.

Over bark timber volume estimation

On the basis of better measures of precision, regression equation number 3 of Appendix I, i.e.

$V(\text{tim}) = -2.8464 + 0.2307 \frac{D^2 H}{100}$ was used for estimation of timber (o.b.) volume (Appendices II and IV).

Total Volume Estimation

Combined variable equation number 6 of Appendix I i.e.

$V = 1.7759 + 0.2408 \frac{D^2 H}{100}$ was used to estimate the total volume against dbh classes. Estimations are given in Appendices II and IV.

Smallwood Estimation

Smallwood against dbh classes were obtained by subtracting timber volume (o.b.) from total volume and are given in Appendices II and IV.

Conversion to Metric Units

Finally selected equations for volume tables in the British units were converted to metric units. Volume tables in metric units were prepared using diameter breast height in centimetres and height in metres. The converted equations in metric units are:

$$H = -14.1532 + 20.9601 \log D$$

$$V \text{ (tim)} = -0.0806 + 0.0033 \frac{D^2 H}{100}$$

$$V \text{ (total)} = 0.0503 + 0.0035 \frac{D^2 H}{100}$$

Local Volume Tables

Volume tables were prepared by one inch diameter classes in the British units and two centimeter class intervals in metric units. These are reproduced in Appendices II and III respectively.

In these tables diameter classes are middle values between two ranges. For example, 20 inch dbh class includes trees ranging from 19.6 to 20.5. inches in the British units and 50 centimeter dbh class includes trees with dbh 49.1 to 51.0 centimeters in metric units. Figures in brackets are adjusted values.

Standard Volume Tables

Volume tables given in Appendices IV and V were prepared by one inch/2 centimeter diameter classes (as for local volume tables) and 5 feet/1.5 meters height classes in the British and metric units respectively. For example 60 feet height class includes trees having total

height ranging from 58 to 62 feet in the British units. In metric units, 21 meters height class includes trees with total height from 20.26 to 21.75 meters and 22.5 meter height class includes trees with total height ranging from 21.76 to 23.25 meters. Figures in brackets show adjusted values calculated proportionately on the bases of estimated height given in local volume tables.

Acknowledgement

The assistance rendered by M/s Fatehullah, S.H. Askari (Foresters) and T.M. Abbasi (Field Asstt) of Forest Mensuration Branch in collection and computation of data is appreciated. Neat typing of tables by Mr. Khushal Khan is commended.

BIBLIOGRAPHY

1. Abbas, S.H. and M.A. Cheema. 1981. Revised local and standard volume tables of Walnut in NWFP. Publication No. 55 Mensuration Branch of P.F.I. Peshawar.
2. Cheema, M.A. and R.W. Hussain. 1978. Local metric volume tables for forest tree species in Hazara. Pub. No. 43 Mensuration Branch P.F.I. Peshawar.
3. Cheema, M.A. and R.W. Hussain. 1981. Local and Standard volume tables of Kandi in Sind. Pub. No. 56 Forest Mensuration Branch P.F.I. Peshawar.
4. Cheema, M.A. and M.A.H. Fatime. 1985. Local and standard volume tables for maple (*Acer caesium*) of Azad Kashmir and NWFP. Pak. Jour. For. Vol. 35(4): 187-215.
5. Demarschalk, J.P. 1972. Conversion of taper and volume equations from English to Metric systems. Canadian Journal of Forest Research Volume 2 No. 3.
6. Griffith, A.L. and Jagdamba Parasad. 1949. The Silvicultural Research Code vol. 3 Forest Research Institute, Dehra Dun, India.
7. Qazi, I.A. and R.W. Hussain. 1974. Ready Reckoner for conversion of measurements with accessory tables. Pub. No. 27. Mensuration Branch P.F.I. Peshawar.

Appendix I

Regression equations for volume table of Horse-chestnut (*Aesculus indica*) in N.W.F.P. with measures of precision

S.No.	No. of observation	Regression Equation	Correlation Coefficient (R)	Coefficient of determination (R^2)	Standard error of estimate (SEE)	SE% of mean volume
1.	110	$H = -18.5952 + 68.7767 \log D$	0.7548	0.5697	11.50	19.10
2.	110	$H = -1.9371 + 5.7130 D - 0.1050 D^2$	0.7837	0.6142	10.94	18.16
3.	96	$V = -2.8464 + 0.2307 \frac{D^2 H}{100}$	0.9799	0.9602	10.31	21.01
4.	96	$V = -191.7138 + 111.1732 \log \frac{D^2 H}{100}$	0.8876	0.7878	23.81	48.52
5.	96	$V = -93.7833 + 6.6712 D + 0.5087 H$	0.9455	0.8940	16.92	32.48
6.	110	$V = 1.7759 + 0.2408 \frac{D^2 H}{100}$	0.9835	0.9673	9.58	19.26
7.	110	$V = -141.9422 + 93.3099 \log \frac{D^2 H}{100}$	0.8650	0.7482	26.94	53.37

Appendix II

Local volume table for *Aesculus indica* (Horse chest-nut) of
N.W.F.P. (British units)

D.B.H classes (inches)	Estimated height (ft)	Timber volume (o.b) (cft)	Total volume (o.b) (cft)	Smallwood vol. (o.b) (cft)
4	23	—	1.00	1.00
5	29	—	2.50	2.50
6	35	—	4.50	4.50
7	39	—	6.38	6.38
8	43	3.50	8.40	4.90
9	47	5.94	10.9	5.00
10	50	8.69	13.8	5.13
11	53	11.9	17.2	5.32
12	56	15.8	21.2	5.40
13	58	19.8	25.4	5.58
14	60	24.3	30.1	5.80
15	62	29.3	35.4	6.07
16	64	35.0	41.2	6.24
17	66	41.2	47.7	6.52
18	68	48.0	54.8	6.84
19	69	54.6	61.8	7.17
20	71	62.7	70.2	7.48
21	72	70.4	78.2	7.85
22	74	79.8	88.0	8.24
23	75	88.7	97.3	8.63
24	76	98.2	107	8.80
25	77	108	118	10.0
26	79	120	130	10.0
27	80	132	142	10.0
28	81	144	155	11.0
29	82	156	168	12.0
30	83	169	182	13.0
31	84	183	196	13.0
32	85	198	211	13.0
33	86	213	227	14.0
34	87	229	244	15.0
35	88	246	261	15.0
36	88	260	276	16.0
37	89	278	295	17.0

D.B.H classes (inches)	Estimated height (ft)	Timber volume (o.b) (cft)	Total volume (o.b) (cft)	Smallwood vol. (o.b) (cft)
38	90	297	315	18.0
39	91	316	335	19.0
40	92	337	356	19.0
41	92	354	374	20.0
42	93	376	397	21.0
43	94	398	420	22.0
44	94	417	440	23.0
45	95	441	465	24.0

Derived from:

$$H = -18.5952 + 68.7667 \log D$$

$$V(\text{tim}) = -2.8464 + 0.2307 \frac{D^2 H}{100}$$

$$V(\text{total}) = 1.7759 + 0.2408 \frac{D^2 H}{100}$$

Smallwood volume = Total volume — Timber volume

Where

$V(\text{timber})$ = Overbark volume of timber.

$V(\text{Total})$ = Overbark volume of Total (Timber + smallwood).

D = Diameter at breast height in inches.

H = Total height in feet.

$\log$ = Common logarithm

Appendix III

Local volume table for *Aesculus indica* (Horse chest-nut) of N.W.F.P. (Metric units).

D.B.H. Classes (cms)	Estimated height (m)	Timber volume (m ³)	Total volume (m ³)	Smallwood volume (m ³)
10	6.81	—	(0.028)	(0.028)
12	8.47	—	(0.071)	(0.071)
14	9.87	—	(0.099)	(0.099)
16	11.08	—	0.149	0.149
18	12.16	—	0.187	0.187
20	13.11	0.094	0.232	0.138
22	13.98	0.144	0.285	0.141
24	14.78	0.202	0.345	0.143
26	15.50	0.268	0.414	0.146
28	16.18	0.341	0.490	0.149
30	16.81	0.422	0.575	0.153
32	17.39	0.511	0.668	0.157
34	17.95	0.609	0.770	0.161
36	18.47	0.715	0.880	0.165
38	18.96	0.829	1.00	0.171
40	19.43	0.952	1.13	0.178
42	19.87	1.08	1.27	0.19
44	20.29	1.22	1.41	0.19
46	20.70	1.37	1.57	0.20
48	21.09	1.53	1.73	0.20
50	21.46	1.70	1.91	0.21
52	21.81	1.88	2.10	0.22
54	22.16	2.07	2.29	0.22
56	22.49	2.26	2.50	0.24
58	22.81	2.47	2.71	0.24
60	23.12	2.68	2.94	0.26
62	23.41	2.91	3.17	0.26
64	23.70	3.14	3.42	0.28
66	23.98	3.39	3.67	0.28
68	24.26	3.65	3.94	0.29
70	24.52	3.91	4.22	0.31
72	24.78	4.19	4.50	0.31
74	25.03	4.47	4.80	0.33
76	25.27	4.77	5.11	0.34
78	25.50	5.07	5.43	0.36

D.B.H. Classes (cms)	Estimated height (m)	Timber volume (m ³)	Total volume (m ³)	Smallwood volume (m ³)
80	25.74	5.39	5.76	0.37
82	25.96	5.72	6.10	0.38
84	26.18	6.06	6.46	0.40
86	26.39	6.40	6.82	0.42
88	26.60	6.76	7.19	0.43
90	26.81	7.14	7.58	0.44
92	27.01	7.52	7.98	0.46
94	27.20	7.91	8.38	0.47
96	27.39	8.31	8.80	0.49
98	27.58	8.72	9.24	0.52
100	27.77	9.15	9.68	0.53
102	27.95	9.58	10.1	0.52
104	28.12	10.0	10.6	0.60
106	28.30	10.5	11.1	0.60
108	28.47	10.9	11.6	0.70
110	28.63	11.4	12.1	0.70
112	28.80	11.9	12.6	0.70
114	29.00	12.4	13.1	0.70

Derived from

$$H = -14.1532 + 20.9601 \log D$$

$$V(\text{Tim}) = -0.0806 + 0.0033 \frac{D^2 H}{100}$$

$$V(\text{Total}) = 0.0503 + 0.0035 \frac{D^2 H}{100}$$

Where

H= Total height in meters

D= Diameter at breast height in centimeters

log= Common logarithm.

V(Tim)= Timber volume in cubic meters

V(Total)= Total volume in cubic meters (Tim+smallwood)

Appendix IV

Standard volume table of *Aesculus indica* (Horse chest nut) for N.W.F.P. (British system)

Dia classes (inches)	Form of volume	Height Classes (Feet)									
		15	20	25	30	35	40	45	50	55	60
Cubic volume (cft)											
4.	Timber	—	—	—	—	—	—	—	—	—	—
	S/Wood Total	2.35 2.35	2.55 2.55	2.74 2.74	2.93 2.93	3.12 3.12	3.32 3.32	—	—	—	—
5.	Timber	—	—	—	—	—	—	—	—	—	—
	S/Wood Total	—	2.98 2.98	3.28 3.28	3.58 3.58	3.88 3.88	4.18 4.18	4.49 4.49	4.79 4.79	—	—
6.	Timber	—	—	—	—	—	—	—	—	—	—
	S/Wood Total	—	—	3.94 3.94	4.38 4.38	4.81 4.81	5.24 5.24	5.68 5.68	6.11 6.11	6.54 6.54	—
7.	Timber	—	—	—	—	—	—	—	—	—	—
	S/Wood Total	—	—	4.73 4.73	5.32 5.32	5.91 5.91	6.50 6.50	7.09 7.09	7.68 7.68	8.27 8.27	8.86 8.86
8.	Timber	—	—	—	—	—	—	—	—	—	—
	S/Wood Total	—	—	0.84 4.79 5.63	1.58 4.82 6.40	2.32 4.85 7.17	3.06 4.88 7.94	3.80 4.91 8.71	4.54 4.94 9.48	5.28 4.96 10.24	6.01 4.99 11.0
9.	Timber	—	—	—	—	—	—	—	—	—	—
	S/Wood Total	—	—	1.82 4.83 6.65	2.76 4.87 7.63	3.69 4.91 8.60	4.63 4.95 9.58	5.56 5.04 10.6	6.50 5.00 11.5	7.43 5.07 12.5	8.37 5.13 13.5

Dia classes (inches)	Form of volume	Height classes (Feet)										Cubic volume (cft)			
		30	35	40	45	50	55	60	65	70	75		80	85	90
10.	Timber	4.08	5.23	6.38	7.54	8.69	9.84	11.0	12.1						
	S/Wood	4.92	4.97	5.02	5.06	5.11	5.16	5.2	5.3						
	Total	9.00	10.2	11.4	12.6	13.8	15.0	16.2	17.4						
11.	Timber	5.53	6.93	8.32	9.72	11.1	12.5	13.9	15.3	16.7					
	S/Wood	4.97	5.07	5.08	5.18	5.2	5.3	5.4	5.4	5.5					
	Total	10.5	12.0	13.4	14.9	16.3	17.8	19.3	20.7	22.2					
12.	Timber	8.78	10.4	12.1	13.8	15.4	17.1	18.7	20.4	22.1	23.7				
	S/Wood	5.12	5.2	5.3	5.3	5.4	5.5	5.5	5.6	5.7	5.8				
	Total	13.9	15.6	17.4	19.1	20.8	22.6	24.3	26.0	27.8	29.5				
13.	Timber	10.8	12.7	14.7	16.6	18.6	20.5	22.5	24.4	26.4	28.3	30.3			
	S/Wood	5.2	5.4	5.4	5.5	5.6	5.7	5.7	5.9	5.9	6.0	6.1			
	Total	16.0	18.1	20.1	22.1	24.2	26.2	28.2	30.3	32.3	34.3	36.4			
14.	Timber	15.2	17.5	19.8	22.0	24.3	26.5	28.8	31.1	33.3	35.6				
	S/Wood	5.5	5.5	5.6	5.7	5.8	6.0	6.0	6.1	6.2	6.3				
	Total	20.7	23.0	25.4	27.7	30.1	32.5	34.8	37.2	39.5	41.9				
15.	Timber	17.9	20.5	23.1	25.7	28.3	30.9	33.5	36.1	38.7	41.3	43.9			
	S/Wood	5.5	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6			
	Total	23.4	26.2	28.9	31.6	34.3	37.0	39.7	42.4	45.1	47.8	50.5			
16.	Timber	20.8	23.7	26.7	29.6	32.6	35.5	38.5	41.5	44.4	47.4	50.3	53.3		
	S/Wood	5.6	5.8	5.9	6.1	6.2	6.3	6.4	6.5	6.7	6.8	7.0	7.0		
	Total	26.4	29.5	32.6	35.7	38.8	41.8	44.9	48.0	51.1	54.2	57.3	60.3		

Dia classes inches	Form of volume	Height classes (feet)													
		40	45	50	55	60	65	70	75	80	85	90	95	100	105
Cubic volume (cft)															
17.	Timber	23.8	27.2	30.5	33.8	37.2	40.5	43.8	47.2	50.5	53.8	57.2	60.5		
	S/Wood	5.8	5.9	6.1	6.3	6.3	6.5	6.7	6.8	7.0	7.1	7.2	7.4		
	Total	29.6	33.1	36.6	40.1	43.5	47.0	50.5	54.0	57.5	60.9	64.4	67.9		
18.	Timber	27.1	30.8	34.5	38.3	42.0	45.8	49.5	53.2	57.0	60.7	64.4	68.2		
	S/Wood	5.9	6.1	6.3	6.4	6.6	6.7	6.9	7.1	7.2	7.4	7.6	7.7		
	Total	33.0	36.9	40.8	44.7	48.6	52.5	56.4	60.3	64.2	68.1	72.0	75.9		
19.	Timber	30.5	34.6	38.8	43.0	47.1	51.3	55.5	59.6	63.8	68.0	72.1	76.3		
	S/Wood	6.1	6.3	6.4	6.6	6.8	7.0	7.1	7.4	7.5	7.7	7.9	8.1		
	Total	36.6	40.9	45.2	49.6	53.9	58.3	62.6	67.0	71.3	75.7	80.0	84.4		
20.	Timber	38.7	43.3	47.9	52.5	57.1	61.8	66.4	71.0	75.6	80.2	84.8	89.4	94.1	
	S/Wood	6.4	6.6	6.9	7.1	7.3	7.4	7.6	7.8	8.1	8.3	8.5	8.7	8.9	
	Total	45.1	49.9	54.8	59.6	64.4	69.2	74.0	78.8	83.7	88.5	93.3	98.1	103	
21.	Timber	48.0	53.1	58.2	63.3	68.4	73.5	78.6	83.6	88.7	93.8	98.9	104		
	S/Wood	6.9	7.1	7.3	7.5	7.7	7.9	8.1	8.5	8.7	9.2	9.1	9.0		
	Total	54.9	60.2	65.5	70.8	76.1	81.4	86.7	92.1	97.4	103	108	113		
22.	Timber	58.6	64.2	69.7	75.3	80.9	86.5	92.1	97.7	103	109	114			
	S/Wood	7.3	7.5	7.8	8.1	8.3	8.5	8.9	9.3	9.0	9.0	10.0			
	Total	65.9	71.7	77.5	83.4	89.2	95.0	101	107	112	118	124			
23.	Timber	64.3	70.4	76.5	82.6	88.7	94.8	101	107	113	119	125			
	S/Wood	7.5	7.8	8.1	8.4	8.6	9.2	9.0	9.0	10.0	10.0	11.0			
	Total	71.8	78.2	84.6	91.0	97.3	104	110	116	123	129	136			

Dia classes inches	Form of volume	Height classes (feet)										Cubic volume (cft)	
		55	60	65	70	75	80	85	90	95	100		105
24.	Timber	70.2	76.9	83.5	90.2	96.8	103	110	117	123	130	137	
	S/Wood	7.9	8.1	8.4	8.7	9.2	10.0	10.0	10.0	10.0	10.0	10.0	
	Total	78.1	85.0	91.9	98.9	106	113	120	127	133	140	147	
25.	Timber	76.5	83.7	90.9	98.1	105	112	120	127	134	141	149	
	S/Wood	8.1	8.4	8.7	8.9	10.0	10.0	10.0	10.0	11.0	11.0	11.0	
	Total	84.6	92.1	99.6	107	115	122	130	137	145	152	160	
26.	Timber	82.9	90.7	98.5	106	114	122	130	137	145	153	161	
	S/Wood	8.4	8.8	9.5	10.0	10.0	10.0	10.0	11.0	11.0	12.0	12.0	
	Total	91.3	99.5	108	116	124	132	140	148	156	165	173	
27.	Timber	89.7	98.1	106	115	123	132	140	148	157	165	174	
	S/Wood	8.6	8.9	10.0	10.0	10.0	10.0	11.0	12.0	12.0	12.0	12.0	
	Total	98.3	107	116	125	133	142	151	160	169	177	186	
28.	Timber	96.6	106	115	124	133	142	151	160	169	178	187	
	S/Wood	9.4	9.0	9.0	10.0	11.0	11.0	11.0	12.0	12.0	13.0	13.0	
	Total	106	115	124	134	144	153	162	172	181	191	200	
29.	Timber	104	114	123	133	143	152	162	171	181	191	201	
	S/Wood	9.0	9.0	10.0	11.0	11.0	12.0	12.0	13.0	13.0	13.0	13.0	
	Total	113	123	133	144	154	164	174	184	194	204	214	
30.	Timber	111	122	132	142	153	163	174	184	194	205	215	
	S/Wood	10.0	10.0	11.0	11.0	11.0	12.0	12.0	13.0	14.0	14.0	14.0	
	Total	121	132	143	153	164	175	186	197	208	219	229	
31.	Timber	130	141	152	163	174	186	197	208	219	230	241	
	S/Wood	11.0	11.0	12.0	12.0	13.0	13.0	13.0	13.0	13.0	14.0	15.0	
	Total	141	152	164	175	187	199	210	221	233	245	256	

Dia. classes	Form of volume	Height classes (feet)											
		60	65	70	75	80	85	90	95	100	105	110	115
32.	Timber	139	151	163	174	186	198	210	222	233	245	257	
	S/Wood	11.0	11.0	11.0	13.0	13.0	13.0	14.0	14.0	15.0	16.0	16.0	
	Total	150	162	174	187	199	211	224	236	248	261	273	
33.	Timber	148	160	173	186	198	211	223	236	248	261	274	
	S/Wood	11.0	12.0	12.0	12.0	14.0	14.0	14.0	15.0	16.0	16.0	16.0	
	Total	159	172	185	198	212	225	237	251	264	277	290	
34.	Timber	157	170	184	197	210	224	237	251	264	277	291	
	S/Wood	12.0	13.0	13.0	14.0	14.0	14.0	15.0	15.0	16.0	17.0	17.0	
	Total	169	183	197	211	224	238	252	266	280	294	308	
35.	Timber	167	181	195	209	223	237	251	266	280	294	309	
	S/Wood	12.0	13.0	13.0	14.0	15.0	16.0	16.0	16.0	17.0	18.0	18.0	
	Total	179	194	208	223	238	253	267	282	297	312	327	
36.	Timber	191	191	206	221	236	251	266	281	296	311	326	341
	S/Wood	14.0	14.0	14.0	15.0	15.0	16.0	17.0	17.0	18.0	18.0	19.0	20.0
	Total	205	205	220	236	251	267	283	298	314	329	345	361
37.	Timber	202	202	218	234	250	266	281	297	313	329	345	360
	S/Wood	14.0	14.0	15.0	15.0	16.0	16.0	17.0	18.0	18.0	19.0	19.0	21.0
	Total	216	216	233	249	266	282	298	315	331	348	364	381
38.	Timber	214	214	230	247	264	280	297	314	330	347	364	380
	S/Wood	14.0	14.0	15.0	16.0	16.0	17.0	18.0	18.0	20.0	20.0	20.0	22.0
	Total	228	228	245	263	280	297	315	332	350	367	384	402
39.	Timber	225	225	243	260	278	295	313	331	348	366	383	401
	S/Wood	15.0	15.0	15.0	16.0	17.0	18.0	18.0	19.0	20.0	20.0	22.0	22.0
	Total	240	240	258	276	295	313	331	350	368	386	405	423

Dia. classes inches	Form of volume	Height classes (feet)										Cubic volume (cft)	
		65	70	75	80	85	90	95	100	105	110		115
40.	Timber	237	256	274	292	311	329	348	366	385	403	422	
	S/Wood	15.0	15.0	17.0	18.0	18.0	20.0	20.0	21.0	21.0	23.0	23.0	
	Total	252	271	291	310	329	349	368	387	406	426	445	
41.	Timber		269	288	307	327	346	366	385	404	424	443	463
	S/Wood		16.0	17.0	19.0	19.0	20.0	20.0	22.0	23.0	23.0	24.0	25.0
	Total		285	305	326	346	366	386	407	427	447	467	488
42.	Timber		282	302	323	343	363	384	404	424	445	465	486
	S/Wood		17.0	18.0	19.0	20.0	21.0	21.0	23.0	24.0	24.0	25.0	25.0
	Total		299	320	342	363	384	405	427	448	469	490	511
43.	Timber		296	317	338	360	381	402	424	445	466	488	509
	S/Wood		17.0	19.0	20.0	20.0	22.0	23.0	23.0	24.0	26.0	26.0	27.0
	Total		313	336	358	380	403	425	447	469	492	514	536
44.	Timber		310	332	354	377	399	421	444	466	488	511	533
	S/Wood		18.0	19.0	21.0	21.0	22.0	24.0	24.0	25.0	27.0	27.0	28.0
	Total		328	351	375	398	421	445	468	491	515	538	561
45.	Timber		324	348	371	394	418	441	464	488	511	534	558
	S/Wood		19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	29.0	29.0
	Total		343	368	392	416	441	465	489	514	538	563	587

Derived from:

$$\text{Timber} = -2.8464 + 0.2307 \frac{D^2 H}{100}$$

$$\text{Total} = 1.7759 + 0.2408 \frac{D^2 H}{100}$$

Smallwood volume = Total volume - Timber volume

Appendix V

Standard volume table of Horse chestnut (*Aesculus indica*) for N.W.F.P. (Metric units)

Dia. classes (cms)	Form of volume	Heights in meters											
		4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	16.5	18.0	19.5	21.0
(Volumes in cubic meters)													
10.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	0.066	0.072	0.076	0.081	0.087	0.092	—	—	—	—	—	—
	Total	0.066	0.072	0.076	0.081	0.087	0.092	—	—	—	—	—	—
12.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	—	0.080	0.088	0.095	0.103	0.110	0.118	0.125	—	—	—	—
	Total	—	0.080	0.088	0.095	0.103	0.110	0.118	0.125	—	—	—	—
14.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	—	0.101	0.101	0.111	0.764	0.132	0.142	0.152	0.162	0.173	—	—
	Total	—	0.101	0.101	0.111	0.764	0.132	0.142	0.152	0.162	0.173	—	—
16.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	—	0.117	0.117	0.130	0.143	0.157	0.170	0.183	0.197	0.210	—	—
	Total	—	0.117	0.117	0.130	0.143	0.157	0.170	0.183	0.197	0.210	—	—
18.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	—	0.135	0.135	0.151	0.168	0.185	0.202	0.219	0.236	0.252	—	—
	Total	—	0.135	0.135	0.151	0.168	0.185	0.202	0.219	0.236	0.252	—	—
20.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	—	0.019	0.019	0.039	0.059	0.079	0.099	0.119	0.139	0.159	0.179	—
	Total	—	0.019	0.019	0.039	0.059	0.079	0.099	0.119	0.139	0.159	0.179	—
22.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	—	0.040	0.040	0.064	0.088	0.112	0.136	0.161	0.185	0.209	0.233	—
	Total	—	0.040	0.040	0.064	0.088	0.112	0.136	0.161	0.185	0.209	0.233	—
24.	Timber	—	—	—	—	—	—	—	—	—	—	—	—
	S/Wood	—	0.138	0.138	0.140	0.140	0.141	0.142	0.144	0.145	0.146	0.147	0.149
	Total	—	0.230	0.230	0.260	0.260	0.290	0.320	0.350	0.380	0.410	0.440	0.470

Dia From classes of (cms) volume	Heights in meters													
	9.0	10.5	12.0	13.5	15.0	16.5	18.0	19.5	21.0	22.5	24.0	25.5	27.0	28.5
(Volumes in cubic meters)														
26	Timber	0.122	0.155	0.189	0.223	0.256	0.290	0.324	0.357	0.391				
	S/wood	0.139	0.141	0.143	0.144	0.146	0.147	0.149	0.150	0.152				
	Total	0.261	0.296	0.332	0.367	0.402	0.437	0.473	0.507	0.543				
28	Timber	0.154	0.193	0.232	0.271	0.310	0.349	0.388	0.427	0.466				
	S/wood	0.141	0.143	0.145	0.146	0.148	0.150	0.152	0.153	0.155				
	Total	0.295	0.336	0.377	0.417	0.458	0.499	0.540	0.580	0.621				
30	Timber		0.233	0.278	0.323	0.368	0.413	0.458	0.503	0.547	0.592	0.637	0.682	
	S/wood		0.145	0.147	0.149	0.150	0.152	0.154	0.156	0.159	0.161	0.162	0.164	
	Total		0.378	0.425	0.472	0.518	0.565	0.612	0.659	0.706	0.753	0.799	0.846	
32	Timber		0.277	0.328	0.379	0.430	0.481	0.532	0.583	0.634	0.685	0.736	0.787	0.838
	S/wood		0.146	0.150	0.151	0.153	0.155	0.157	0.160	0.162	0.164	0.167	0.169	0.172
	Total		0.423	0.478	0.530	0.583	0.636	0.689	0.743	0.796	0.849	0.903	0.956	1.01
34	Timber		0.323	0.380	0.438	0.496	0.553	0.611	0.668	0.726	0.784	0.841	0.899	0.957
	S/wood		0.148	0.151	0.153	0.156	0.159	0.161	0.164	0.166	0.168	0.169	0.171	0.173
	Total		0.471	0.531	0.591	0.652	0.712	0.772	0.832	0.892	0.952	1.01	1.07	1.13
36	Timber		0.372	0.436	0.501	0.565	0.630	0.695	0.759	0.824	0.888	0.953	1.02	1.08
	S/wood		0.150	0.154	0.156	0.160	0.162	0.164	0.168	0.170	0.172	0.177	0.180	0.180
	Total		0.522	0.590	0.657	0.725	0.792	0.859	0.927	0.994	1.06	1.13	1.20	1.26
38.	Timber			0.495	0.567	0.639	0.711	0.783	0.855	0.927	0.999	1.07	1.14	1.21
	S/wood			0.156	0.159	0.162	0.166	0.169	0.175	0.173	0.181	0.180	0.190	0.190
	Total			0.651	0.726	0.801	0.877	0.952	1.03	1.10	1.18	1.25	1.33	1.40

Dia. classes (cms)	Form of volume	Heights in metres														(Volume cubic metres)
		15.0	16.5	18.0	19.5	21.0	22.5	22.5	24.0	25.5	27.0	28.0	30.0	31.5	33.0	
56.	Timber	1.48	1.64	1.79	1.95	2.11	2.26	2.42	2.58	2.73	2.89	3.05	3.20	3.36		
	S/Wood	0.200	0.200	0.220	0.220	0.220	0.240	0.240	0.240	0.260	0.260	0.260	0.280	0.280		
	Total	1.68	1.84	2.01	2.17	2.33	2.50	2.66	2.82	2.99	3.15	3.31	3.48	3.64		
58.	Timber	1.76	1.93	2.10	2.27	2.43	2.60	2.77	2.94	3.10	3.27	3.44	3.61	3.61		
	S/Wood	0.210	0.220	0.220	0.230	0.240	0.250	0.250	0.250	0.260	0.270	0.280	0.280	0.290		
	Total	1.97	2.15	2.32	2.50	2.67	2.85	3.02	3.19	3.36	3.54	3.72	3.90	3.90		
60.	Timber	1.89	2.07	2.25	2.43	2.61	2.79	2.97	3.15	3.33	3.51	3.69	3.87	3.87		
	S/Wood	0.220	0.230	0.230	0.240	0.250	0.260	0.260	0.260	0.270	0.280	0.290	0.290	0.300		
	Total	2.11	2.30	2.48	2.67	2.86	3.05	3.23	3.42	3.61	3.80	3.98	4.17	4.17		
62.	Timber	2.03	2.22	2.41	2.60	2.79	2.98	3.18	3.37	3.56	3.75	3.94	4.13	4.13		
	S/Wood	0.220	0.230	0.240	0.250	0.260	0.260	0.270	0.280	0.290	0.300	0.310	0.310	0.320		
	Total	2.25	2.45	2.65	2.85	3.05	3.24	3.45	3.65	3.85	4.05	4.25	4.45	4.45		
64.	Timber	2.16	2.37	2.57	2.78	2.98	3.19	3.39	3.59	3.80	4.00	4.21	4.41	4.41		
	S/Wood	0.230	0.240	0.250	0.260	0.270	0.270	0.280	0.300	0.300	0.310	0.310	0.330	0.330		
	Total	2.39	2.61	2.82	3.03	3.25	3.46	3.67	3.89	4.10	4.31	4.52	4.74	4.74		
66.	Timber	2.31	2.52	2.74	2.96	3.18	3.39	3.61	3.83	4.04	4.26	4.48	4.70	4.70		
	S/Wood	0.230	0.230	0.260	0.260	0.270	0.290	0.290	0.300	0.320	0.320	0.330	0.330	0.330		
	Total	2.54	2.75	3.00	3.22	3.45	3.68	3.90	4.13	4.36	4.58	4.81	5.03	5.03		
68.	Timber	2.45	2.68	2.92	3.15	3.38	3.61	3.84	4.07	4.30	4.53	4.76	4.99	4.99		
	S/Wood	0.250	0.260	0.260	0.260	0.280	0.290	0.300	0.310	0.320	0.330	0.340	0.350	0.350		
	Total	2.70	2.94	3.18	3.41	3.66	3.90	4.14	4.38	4.62	4.86	5.10	5.34	5.34		
70.	Timber	2.85	3.09	3.34	3.58	3.83	4.07	4.32	4.56	4.80	5.05	5.29	5.54	5.54		
	S/Wood	0.260	0.270	0.280	0.290	0.300	0.310	0.320	0.330	0.350	0.350	0.370	0.370	0.370		
	Total	3.11	3.36	3.62	3.87	4.13	4.38	4.64	4.89	5.15	5.40	5.66	5.91	5.91		

Dia. classes (cms)	Form of volume	(Heights in metres)												34.5	36.0
		18.0	19.5	21.0	22.5	24.0	25.5	27.0	28.5	30.0	31.5	33.0			
Volumes in cubic metres															
72.	Timber	3.02	3.28	3.54	3.79	4.05	4.31	4.57	4.83	5.09	5.35	5.60	5.86		
	S/Wood	0.270	0.280	0.290	0.300	0.310	0.320	0.330	0.340	0.350	0.360	0.380	0.390		
	Total	3.29	3.56	3.83	4.09	4.36	4.63	4.90	5.17	5.44	5.71	5.98	6.25		
74.	Timber	3.19	3.47	3.74	4.01	4.29	4.56	4.83	5.10	5.38	5.65	5.92	6.20		
	S/Wood	0.280	0.280	0.300	0.310	0.320	0.330	0.350	0.360	0.370	0.380	0.400	0.400		
	Total	3.47	3.75	4.04	4.32	4.61	4.89	5.18	5.46	5.75	6.03	6.32	6.60		
76.	Timber	3.37	3.66	3.95	4.24	4.53	4.81	5.10	5.39	5.68	5.96	6.25	6.54		
	S/Wood	0.290	0.300	0.300	0.320	0.330	0.350	0.360	0.370	0.380	0.400	0.410	0.420		
	Total	3.66	3.96	4.25	4.56	4.86	5.16	5.46	5.76	6.06	6.36	6.66	6.96		
78.	Timber	3.56	3.86	4.16	4.47	4.77	5.07	5.38	5.68	5.98	6.29	6.59	6.89		
	S/Wood	0.290	0.300	0.320	0.330	0.340	0.360	0.370	0.380	0.400	0.410	0.420	0.400		
	Total	3.85	4.16	4.48	4.80	5.11	5.43	5.75	6.06	6.38	6.70	7.01	7.29		
80.	Timber	3.75	4.07	4.38	4.70	5.02	5.34	5.66	5.98	6.30	6.62	6.94	7.26		
	S/Wood	0.290	0.320	0.330	0.340	0.360	0.370	0.380	0.400	0.410	0.420	0.430	0.450		
	Total	4.04	4.39	4.71	5.04	5.38	5.71	6.04	6.38	6.71	7.04	7.37	7.71		
82.	Timber	3.94	4.28	4.61	4.95	5.28	5.62	5.95	6.29	6.62	6.96	7.30	7.63	7.96	
	S/Wood	0.310	0.320	0.340	0.350	0.370	0.380	0.400	0.410	0.430	0.440	0.440	0.460	0.480	
	Total	4.25	4.60	4.95	5.30	5.65	6.00	6.35	6.70	7.05	7.40	7.74	8.09	8.44	
84.	Timber	4.14	4.49	4.84	5.19	5.55	5.90	6.26	6.60	6.95	7.30	7.66	8.01	8.36	
	S/Wood	0.310	0.330	0.350	0.370	0.370	0.390	0.410	0.420	0.440	0.460	0.460	0.480	0.500	
	Total	4.45	4.82	5.19	5.56	5.92	6.29	6.67	7.02	7.39	7.76	8.12	8.49	8.86	
86.	Timber		4.71	5.08	5.45	5.82	6.19	6.55	6.92	7.29	7.66	8.03	8.40	8.77	
	S/Wood		0.340	0.360	0.370	0.390	0.400	0.430	0.440	0.450	0.470	0.480	0.500	0.510	
	Total		5.05	5.44	5.82	6.21	6.59	6.98	7.36	7.74	8.13	8.51	8.90	9.28	
88.	Timber		4.94	5.32	5.71	6.09	6.48	6.87	7.25	7.64	8.02	8.41	8.80	9.18	
	S/Wood		0.350	0.370	0.380	0.400	0.420	0.430	0.450	0.470	0.490	0.500	0.520	0.540	
	Total		5.29	5.69	6.09	6.49	6.90	7.30	7.70	8.11	8.51	8.91	9.32	9.72	

Dia. classes (cms)	Form of volume	Heights in metres											37.5	
		19.5	2.10	22.5	24.0	25.5	27.0	28.5	30.0	31.5	33.0	34.5		36.0
(Volumes in cubic metres)														
90.	Timber	5.17	5.57	5.98	6.37	6.78	7.19	7.59	7.99	8.40	8.80	9.20	9.61	13.92
	S/Wood	0.360	0.380	0.390	0.420	0.430	0.440	0.470	0.490	0.500	0.520	0.540	0.590	
	Total	5.53	5.95	6.37	6.79	7.21	7.63	8.06	8.48	8.90	9.32	9.74	10.2	
92.	Timber	5.40	5.83	6.25	6.67	7.09	7.51	7.93	8.36	8.78	9.20	9.62	10.0	13.92
	S/Wood	0.370	0.380	0.400	0.420	0.400	0.470	0.490	0.500	0.520	0.540	0.580	0.600	
	Total	5.77	6.21	6.65	7.09	7.49	7.98	8.42	8.86	9.30	9.74	10.2	10.6	
94.	Timber	5.64	6.08	6.53	6.97	7.41	7.85	8.29	8.73	9.17	9.61	10.0	10.5	13.92
	S/Wood	0.390	0.400	0.410	0.430	0.450	0.470	0.490	0.510	0.530	0.590	0.600	0.600	
	Total	6.03	6.48	6.94	7.40	7.86	8.32	8.78	9.24	9.70	10.2	10.6	11.1	
96.	Timber	5.89	6.35	6.81	7.27	7.73	8.19	8.65	9.11	9.57	10.0	10.5	10.9	13.92
	S/Wood	0.390	0.410	0.430	0.450	0.470	0.490	0.510	0.530	0.530	0.600	0.600	0.700	
	Total	6.28	6.76	7.24	7.72	8.20	8.68	9.16	9.64	10.1	10.6	11.1	11.6	
98.	Timber		6.62	7.10	7.58	8.06	8.54	9.01	9.49	9.97	10.4	10.9	11.4	13.92
	S/Wood		0.420	0.440	0.460	0.480	0.500	0.530	0.510	0.570	0.600	0.600	0.600	
	Total		7.04	7.54	8.04	8.54	9.04	9.54	10.0	10.54	11.0	11.5	12.0	
100.	Timber		6.90	7.40	7.89	8.39	8.89	9.39	9.89	10.4	10.9	11.4	11.9	13.92
	S/Wood		0.430	0.450	0.490	0.500	0.520	0.540	0.510	0.600	0.600	0.610	0.600	
	Total		7.33	7.85	8.38	8.89	9.41	9.93	10.4	11.0	11.5	12.01	12.5	
102.	Timber		7.18	7.70	8.22	8.74	9.25	9.77	10.29	10.81	11.33	11.85	12.37	13.92
	S/Wood		0.45	0.70	0.48	0.51	0.54	0.56	0.58	0.61	0.63	0.65	0.67	
	Total		7.63	8.40	8.70	9.25	9.79	10.33	10.87	11.42	11.96	12.50	13.04	
104.	Timber		7.47	8.01	8.55	9.08	9.62	10.16	10.70	11.24	11.78	12.32	12.86	13.40
	S/Wood		0.46	0.48	0.50	0.54	0.56	0.58	0.60	0.62	0.65	0.67	0.69	
	Total		7.93	8.49	9.05	9.62	10.18	10.74	11.30	11.86	12.43	12.99	13.55	
106.	Timber		7.76	8.32	8.88	9.44	10.00	10.56	11.12	11.68	12.24	12.80	13.36	13.92
	S/Wood		0.47	0.50	0.52	0.55	0.57	0.60	0.62	0.64	0.67	0.69	0.72	
	Total		8.23	8.82	9.40	9.99	10.57	11.16	11.74	12.32	12.91	13.49	14.08	

Dia.	Form of volume classes (cms)	Heights in metres											
		21.0	22.5	24.0	25.5	27.0	28.5	30.0	31.5	33.0	34.5	36.0	37.5
(Volumes in cubic metres)													
108.	Timber	8.06	8.64	9.22	9.80	10.38	10.97	11.55	12.13	12.71	13.29	13.87	14.45
	S/Wood	0.48	0.51	0.54	0.57	0.59	0.61	0.64	0.66	0.69	0.72	0.74	0.77
	Total	8.54	9.15	9.76	10.37	10.97	11.58	12.19	12.79	13.40	14.01	14.61	15.22
110.	Timber	8.36	9.97	9.57	10.17	10.78	11.38	11.98	12.49	13.19	13.79	14.39	15.00
	S/Wood	0.50	0.52	0.55	0.58	0.60	0.63	0.66	0.68	0.71	0.74	0.72	0.79
	Total	8.86	9.49	10.12	10.75	11.38	12.01	12.64	13.17	13.90	14.53	15.11	15.79
112.	Timber	8.67	9.30	9.92	10.55	11.17	11.80	12.42	13.05	13.68	14.30	14.93	15.55
	S/Wood	0.52	0.54	0.57	0.59	0.63	0.65	0.68	0.70	0.73	0.76	0.78	0.81
	Total	9.19	9.84	10.49	11.14	11.80	12.45	13.10	13.75	14.41	15.06	15.71	16.36
114.	Timber	8.99	9.64	10.28	10.93	11.58	12.23	12.88	13.52	14.17	14.82	15.47	16.11
	S/Wood	0.52	0.55	0.59	0.61	0.64	0.67	0.69	0.73	0.75	0.78	0.81	0.84
	Total	7.51	10.19	10.87	11.54	12.22	12.90	13.57	14.25	14.92	15.60	16.28	16.95
116.	Timber	9.31	9.98	10.65	11.32	11.99	12.66	13.33	14.00	14.68	15.35	16.02	16.69
	S/Wood	0.54	0.57	0.60	0.63	0.66	0.69	0.72	0.75	0.77	0.80	0.83	0.86
	Total	9.85	10.55	11.25	11.95	12.65	13.35	14.05	14.75	15.45	16.15	16.85	17.55