VOLUME TABLES FOR BIRD CHERRY *(Prunus padus)* OF N.W.F.P.

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Introduction:

Bird cherry *(prunus Padus)* is a useful broad leaved tree and grows naturally in coniferous forests of N.W.F.P and Azad Kashmir associated with other broad leaved. Wood of this species is used for furniture, carriages, small table tops, toys, and solid wheels of country carts. The tree grows to a large size specially under favourable conditions.

Basic Data:

Data on 93 trees ranging from 12 cms (5 inche) to 71 cms (28 inches) from Galies and Kaghan Forest divisions were used in the preparation of these volume tables.

Method and Procedure:

Trees were measured as per standard procedure for measurement of sample tree (7). Volume upto 5 cm (2 inches) diameter overbark at thin end of the stem including branches was taken as total volume of the tree. Both timber and smallwood volume (o.b.) of a tree were calculated using Huber formula. Total volume was obtained by adding timber volume and smallwood volume of a tree. Similarly total under bark volume of a tree was obtained by adding timber volume (u.b) and small wood volume (u.b) of a tree. The 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 (o.b.) and total volume (o.b.).

(i) Models for height

$H = a + b \log D$

$H = a + b D$

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

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

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

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

(iii) Models for total volume (o.b.)

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

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

where
H stands for total height.
D stands for diameter at breast height.
V(tim) stands for total timber volume (o.b.)
V stands for total volume (o.b.)

The regression equations developed from the above modles are given in Appendix I alongwith their measures of precision.

Height Estimation:

Regression equations for height estimation are presented in Appendix I at serial No. 1 and 2. On the basis of measures of precision equation No. 1 i.e.

$H = -17.8028 + 66.2540 \log D$

was selected for the estimation of heights against dbh classes. Estimated values were rounded to whole numbers (Appendix II).

Over Bank Timber Volume Estimation:

Estimates were obtained from two equations viz., 3 and 5 of Appendix I. The estimated values from both the equations were compared with actual average values for different dbh classes. It was observed that estimates from equation No. 3 i.e.

$$V(tim) = -3.8578 + 0.2272 \frac{D^2H}{100}$$

were more accurate. Therefore estimates for timber volume (o.b.) were obtained form the above equation No. 3 and are produced in Appendix II.

Total Volume (O.B.) Estimation:

Estimates of total volume (o.b.) were obtained using two better equations No. 6 and 8 of Appendix I. Estimates from both the equations were almost similar. However, estimates form equation No. 8 i.e. $\log V = -0.60510 + 0.9917 \log \frac{D^2H}{100}$ were foxnd to be nearer to actual average values. Therefore this equation was used to estimate the total volume against dbh classes. The estimates are given in Appendix II.

Smallwood Estimation:

Smallwood against dbh classes were obtained by subtracting timber volume (o.b.) form total volume and are shown in Appendix II.

Conversion to Metric Units:

Finally selected equations for volume table in the British units were converted into metric units. Volume table in metric units was prepared using diameter breast height in centimetres and height in meters. The converted equations in metric unit are:

$$H = -13.6014 + 20.1942 \log D$$

$$V(tim) = -0.10924 + 0.00327 \frac{D^2H}{100}$$

$$\text{Log } V = -4.4276 + 0.9917 \log D^2H$$

Local Volume Tables:

Local volume tables given in Appendices II and III were prepared by one inch diameter classes in the British units and two centimeter class intervals in metric units. In these tables diameter classes are middle values between two ranges. For example, 20 inch dbh class include trees ranging from 19.6 to 20.5 inches in the British units and 50 centimetre dbh class includes trees with dbh 49.1 to 51.0 centimeters in metric units.

Under Bark Volume Conversion:

To convert overbark timber to under bark timber volume multiply with 0.8893 and to convert overbark total voluem to under bark total volume multiply with 0.8946 against any dbh class in both systems of measurements (British and metric). The above two factors were obtained by taking the average values of ratios of available data separrately for under bark volume of timber to over bark volume of timber and under bark total volume to over bark total volume.

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Appendix I

Bird Cherry (*Prunus padus*) height and volume equations with precision measures.

S.No.	Regression equations	Correlation coefficient (R)	Coefficient of determination (R^2)	Standard error of estimates (SEE)	SE%	No. of observations
1.	$H = -17.8028 + 66.2540 \log D$	0.7621*	0.5808*	10.20*	18.98*	93
2.	$H = 26.7717 + 2.0928 D$	0.7016	0.4922	11.23	20.89	93
3.	$V(tim) = -3.8578 + 0.2272 \frac{D^2H}{100}$	0.9856	0.9714	4.94	17.10	77
4.	$V(tim) = -120.0580 + 73.4701 \log \frac{D^2H}{100}$	0.8626*	0.7441*	14.77*	51.14*	77
5.	$\log V(tim) = -1.2491 + 1.2419 \log \frac{D^2H}{100}$	0.9636*	0.9285*	0.12*	9.32*	77
6.	$V = 0.4743 + 0.2336 \frac{D^2H}{100}$	0.9913	0.9813	3.87	13.40	93
7.	$V = -66.6069 + 51.0838 \log \frac{D^2H}{100}$	0.8213*	0.6745*	16.83*	58.20*	93
8.	$\log V = -0.6050 + 0.9917 \log \frac{D^2H}{100}$	0.9922*	0.9845*	0.06*	4.72*	93

* Not in original units.

Appendix II

Local volume table of Bird cherry (*Prunus padus*) for N.W.F.P.
(British Units)

D.B.H. classes (inches)	Height (feet)	Total volume (o.b.) (cft)	Timber volume (o.b.) (cft)	Smallwood volume (o.b.) (cft)
5	28	1.71	–	1.71
6	34	2.98	–	2.98
7	38	4.51	–	4.51
8	42	6.49	2.25	4.24
9	45	8.78	4.42	4.36
10	48	11.5	7.05	4.45
11	51	14.8	10.2	4.60
12	54	18.6	13.8	4.80
13	56	22.6	17.6	5.00
14	58	27.1	22.0	5.10
15	60	32.2	26.8	5.40
16	62	37.8	32.2	5.60
17	64	44.0	38.2	5.80
18	65	50.0	44.0	6.00
19	67	57.4	51.1	6.30
20	68	64.5	57.9	6.60
21	70	73.1	66.3	6.80
22	71	81.3	74.2	7.10
23	72	90.0	82.7	7.30
24	74	101	93.0	8.00
25	75	111	103	8.00
26	76	121	113	8.00
27	77	132	124	8.00
28	78	144	135	9.00
29	79	156	147	9.00
30	80	169	159	10.00
31	81	183	173	10.00
32	82	197	198	10.00
33	83	212	202	10.00
34	84	228	217	11.00
35	84	241	230	11.00
36	85	258	246	12.00
37	86	276	264	12.00
38	87	294	281	13.00

D.B H. classes (Inches)	Height (feet)	Total volume (o.b.) (cft)	Timber volume (o.b.) (cft)	Smallwood volume (o.b.) (cft)
39	88	313	300	13.00
40	88	329	316	13.00

Based on 93 trees

Derived from:–

$H = -17\ 80238 + 66.2540 \log D$

$V(tim) = -3.8578 + 0.2272 \frac{D^2H}{100}$

$\log V = -0.6050 + 9917 \log \frac{D^2H}{100}$

Small wood volume (o.b.) = Total volume (o.b.) – Timber volume (o.b.) to find timber volume (u.b.) multiply timber volume (o.b.) with 0.8893. To find total volume (u.b.) multiply total volume (o.b.) with 0.8946.

Appendix III

Local volume table of Bird cherry (*Prunus padus*) for N.W.F.P.
(Metric units)

D.B.H. classes (cms)	Height (m)	Total volume (o.b.) (m^3)	Timber volume (o.b.) (m^3)	Smallwood volume (o.b.) (m^3)
12	8.19	0.0415	–	0.0415
14	9.54	0.0656	–	0.0656
16	10.71	0.0959	–	0.0959
18	11.75	0.1328	–	0.1328
20	12.67	0.1764	0.0566	0.1198
22	13.51	0.2271	0.1047	0.1224
24	14.27	0.2849	0.1597	0.1252
26	14.97	0.3502	0.2218	0.1284
28	15.62	0.4231	0.2914	0.1317
30	16.23	0.5039	0.3686	0.1352
32	16.79	0.5924	0.4532	0.1392
34	17.33	0.6893	0.5461	0.1432
36	17.83	0.7942	0.6467	0.1475
38	18.30	0.9072	0.7552	0.1520
40	18.75	1.029	0.8722	0.1568
42	19.18	1.159	0.9976	0.1614
44	19.59	1.298	1.131	0.167
46	19.98	1.446	1.274	0.172
48	20.35	1.602	1.425	0.177
50	20.71	1.768	1.585	0.183
52	21.05	1.942	1.753	0.189
54	21.38	2.125	1.930	0.195
56	21.70	2.318	2.117	0.201
58	22.01	2.520	2.313	0.207
60	22.31	2.732	2.518	0.214
62	22.59	2.952	2.732	0.220
64	22.87	3.182	2.955	0.227
66	23.14	3.422	3.188	0.234
68	23.40	3.671	3.430	0.241
70	23.66	3.932	3.683	0.249
72	23.91	4.201	3.946	0.255
74	24.15	4.480	4.217	0.263
76	24.38	4.768	4.498	0.270
78	24.61	5.067	4.789	0.278
80	24.83	5.375	5.089	0.286

D.B.H. classes (cms)	Height (m)	Total volume (o.b.) (m^3)	Timber volume (o.b.) (m^3)	Smallwood volume (o.b.) (m^3)
82	25.05	5.694	5.401	0.293
84	25.26	6.023	5.722	0.301
86	25.46	6.360	6.051	0.309
88	25.67	6.711	6.394	0.317
90	25.86	7.069	6.743	0.326
92	26.06	7.440	7.107	0.333
94	26.24	7.818	7.476	0.342
96	26.43	8.210	7.859	0.351
98	26.61	8.610	8.251	0.359
100	26.79	9.022	8.655	0.367

Derived from:

$H = -13.6014 + 20.1942 \log D$

(Total vol) $\log V = -4.4276 + 0.9917 \log D^2 H$

(Timber vol) $V = -0.1092 + 0.00327 \frac{D^2H}{100}$

To find under bark total volume multiply with 0.8946

To find under bark timber volume multiply with 0.8893