MINNESOTA FORESTRY NOTES

No. 173
July 15, 1966

CONSTRUCTION OF A LOCAL AERIAL STAND VOLUME TABLE FROM THE PHOTO MEASUREMENTS OF ONE INTERPRETER [1]

Garry W. Frits and Merle P. Meyer [2]

To test the feasibility of constructing a local aerial photo volume table from a small number of plots with one interpreter, four volume regression equations were computed from 62 ground- and photo-measured plots. Three of these equations employed photo measurements and estimates of each of three interpreters while the fourth employed the measurements of a combination of two interpreters. The four regression equations were computed using multiple linear regression program Umstat 50 (1) and employing the same data and independent variables used by Ek and Meyer (2) in their volume formula for 62 plots.

The results of the regression analysis are partially shown in Table 1. Regression formulae employing only one variable were chosen because of the lack of significantly higher correlation when additional variables were used.

Table 1. Multiple linear correlation coefficients for single interpreter and two interpreter volume equations based on 62 plots.

Photo interpreter	Correlation coefficients 62 plots - one variable H^2D	H^3D	Best overall corr., all variables
I	<u>.572</u>	.535	.596
II	.757	<u>.776</u>	.779
III	<u>.652</u>	.636	.689
I & III	<u>.654</u>	.628	.680
All*	.741	<u>.757</u>	.772

*From a study by Ek and Meyer (2).
The highest correlation for each interpreter or combination of interpreters based on a single variable equation is underlined.

The results indicate a very high correlation for Interpreter II, whose measurements were used to construct the local volume table shown in Table 2. The individual and combined measurements of Interpreters I and III also had good correlations -- all of which were substantially higher than those found in a previous study where most correlations were less than .500 (3).

---

[1] Data provided by the 1965-65 Northwest Paper Company Foundation's Forestry Graduate Fellowship Project.

[2] Research Fellow and Professor, respectively, Univ. of Minn. School of Forestry.

Published by the School of Forestry, University of Minnesota, St. Paul 1, Minnesota, cooperating with the Division of Forestry, Minnesota Conservation Department, and Forest Industries of Minnesota

Table 2. A local (one-interpreter) aerial stand volume table for jack pine in the Brainerd area, Minnesota.

Photo height (feet)	Crown density (per cent) 5	15	25	35	45	55	65	75	85	95
	Gross rough cords per acre x 10									
25	15	15	20	20	20	25	25	25	30	30
30	15	20	20	25	25	30	35	35	40	40
35	15	20	25	30	35	40	45	50	50	55
40	20	25	30	40	45	50	55	65	70	75
45	20	30	40	50	60	65	75	85	95	105
50	20	35	45	60	70	85	100	110	125	135
55	25	40	55	75	90	110	125	145	160	175
60	25	50	70	90	115	135	160	180	205	225
65	30	55	85	115	140	170	200	225	255	280
70	35	70	105	140	175	210	245	280	315	350
75	35	80	125	165	210	250	295	340	380	425
80	40	95	145	200	250	305	355	405	460	510

Volume table prepared from 62 ground- and photo-measured 1/7-acre plots.
Photo measurements obtained from a single interpreter familiar with the area and species under study.
Gross volumes in rough cords and include trees 4.95 inches dbh and larger from a 1-foot stump to a top diameter not less than 4.0 inches inside bark.
Heavy lines indicate extent of the basic data.

Equation:

$$\text{Photo Volume} = 1.497514991 + .000001022H^3D$$

where: H is photo height, and
D is estimate of photo crown density

It is essential that the following assumptions be made prior to an attempt to construct a local aerial photo volume table from a small number of plots and a minimum of interpreters:

1. The same interpreters whose measurements are used in the construction of a local volume table will be those who will employ the table for future volume estimates.
2. There will be no significant interpreter errors going into the construction of the table and any interpreter bias will remain constant over future measurements.
3. The completed volume table will be restricted in use to the local area and species for which it was constructed.
4. The aerial photography upon which future volume estimates will be made must be comparable in quality to that photography used in the construction of the local volume table.

LITERATURE CITED

1. Milton, Roy C., ed. 1964. Umstat computer programs manual. Numerical Analysis Center, University of Minnesota, Minneapolis, Minnesota.
2. Ek, Alan R. and M. P. Meyer. 1966. Construction of local aerial stand volume tables. Minn. Forestry Note No. 170, Univ. of Minn., St. Paul.
3. Lamont, R. H., R. C. Trochlil, and M. P. Meyer. 1966. A test of a composite local aerial stand volume table outside the locality of origin. Minn. Forestry Note No. 168, Univ. of Minn., St. Paul.

Published as Sci. Jour. Ser. Paper No. 6034 of the Minnesota Agr. Expt. Sta.