MINNESOTA FORESTRY NOTES

No. 170
April 15, 1966

CONSTRUCTION OF LOCAL AERIAL STAND VOLUME TABLES[1/]

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A major obstacle to the incorporation of aerial photo measurements into estimations of forest stand volume is the lack of suitable local aerial stand volume tables. The application of regional or composite tables can seldom be accomplished without prior testing and the probable necessity for establishment of correction factors due to differences in local species, aerial photography or interpreters. Actual development of a local table by classical, sophisticated electronic computer methods may not be possible because the necessary facilities are either lacking or too expensive.

The objective of this study was to determine whether a satisfactory local aerial table could be fabricated using a minimum of time, a desk calculator, and approximately the same number of plots normally required to correct a regional or composite table for local use. The test results were most encouraging and the resulting procedure for developing such a table is presented below.

A. Personnel, Equipment and Information Requirements

1. Two or more interpreters familiar with the local area and who, preferably, will be the individuals to ultimately use the table.
2. A stereoscope, parallax bar or wedge, and a crown density scale (1).
3. Recent aerial photography at a scale of 1:20,000 or larger.
4. Fifty or more plots representative of local stand conditions which are accurately located on the photographs. Plots may be CFI or volume cruise plots 1/7-acre or larger.

B. Procedure for Table Construction

1. Average the photo heights and densities of all interpreters and plot these against ground volume to determine the best variable to use. Where photo height is not curvilinear with respect to volume, HD (photo height x crown density) may suffice. In most even-aged stands, however, H^2D (photo height^2 x crown density) will be best.
2. Set up the volume table work form illustrated in the figure below, annotate and post the photo and ground measurement data.
3. Calculate the aerial volume table formula. In the example provided, a local aerial volume table was constructed using 62 ground-photo measured 1/7-acre jack pine plots located near Brainerd, Minnesota. The photo measurements represent the average of 5 interpreters and the independent regression variable chosen was H^2D (i.e., relationship of photo height to ground volume on the 62 plots was considered to be curvilinear).

1/ This project was made possible through a Graduate Fellowship grant from the Northwest Paper Company Foundation and the assistance and cooperation of the Northwest Paper Company Forestry Staff.

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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

4. Using the completed equation, construct a volume table by introducing various 5-foot height and 20 per cent crown class combinations. In view of the high standard error of estimate, further table accuracy is meaningless. Also, extension of the table far beyond the range of the basic data is not advisable as the equation is only an approximation for the range of data utilized.

5. Check the completed local table against possible existing regional or composite aerial tables in order to be sure the results are reasonable.

6. In the future, the table can be progressively strengthened through the incorporation of additional ground-photo measured plots into the data "pool" and recomputation of the formula and table.

Figure. Local aerial stand volume table computation form.

Plot	Photo ht. (ft)	Photo ht. squared	Photo density (%)	(Photo ht)^2 x Photo density x 10^{-3}	$(H^2D \times 10^{-3})^2$	Ground volume in cords	Ground volume squared	$(H^2D \times 10^{-3})$ x Ground vol.
	(H)	(H^2)	(D)	(X)	(X^2)	(Y)	(Y^2)	(XY)
1	62	3844	67	258	66,564	39.3	1544.5	10,139.4
2	23	529	35	19	361	3.5	12.2	66.5
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62	39	1521	71	108	11,664	2.9	8.4	313.2
SUM (n) 62	******	******	*******	(ΣX) 8636	(ΣX^2) 637,466	(ΣY) 783.4	(ΣY^2) 15,902	(ΣXY) 146,943
MEAN ***	******	******	*******	($\bar{X}$) 139.29	**********	($\bar{Y}$) 12.64	********	**********
SUM^2 ***	******	******	*******	$(\Sigma X)^2$ 74,580,496	**********	$(\Sigma Y)^2$ 613,716	********	**********

Volume Equation Computations

Step 1: $\Sigma y^2 = \Sigma Y^2 - (\Sigma Y)^2/n =$ 6004

Step 2: $\Sigma x^2 = \Sigma X^2 - (\Sigma X)^2/n =$ 434,555

Step 3: $\Sigma xy = \Sigma XY - (\Sigma X)(\Sigma Y)/n =$ 37,823

Step 4: $b = \frac{\Sigma xy}{\Sigma x^2} =$ .087

Step 5: $a = \bar{Y} - b(\bar{X}) =$ .517

Step 6: Photo volume = .517 + .087 $(H^2D \times 10^{-3})$

Step 7: $r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}} =$ .740

Step 8: Std. error of estimate $= \sqrt{\frac{\Sigma y^2 - \frac{(\Sigma xy)^2}{\Sigma x^2}}{n-2}} =$ 6.7 cords

In order to test the local aerial volume table prediction formula developed for the Brainerd area, an additional 126 1/7-acre jack pine plots were ground- and photo-measured. The local table was then tested against these 126 plots, as were two tables from northeastern Minnesota -- a composite table (2) and a conifer table (3). As the table below indicates, the local table achieved a considerably lower error of estimate than the two regional tables.

Table. Comparative volume estimates and correlations achieved with the Brainerd local aerial volume table and two regional tables on 126 1/7-acre jack pine plots.

	Aerial stand volume table		
	Local table	Composite table	Conifer table
Correlation between photo and ground volume	.759	.752	.739
Difference: ground-photo vol. (percent of ground vol.)	10.7%	28.9%	37.3%

Literature Cited

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Published as Sci. Jour. Ser. Paper No. 5968 of the Minnesota Agr. Expt. Sta.