GROWING STOCK WITH AERIAL PHOTOGRAPHS
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ABSTRACT
For assessment of growing stock, the role of aerial photographs mainly consists of volume class stratification, knowing proportion of various stratum and in providing layout for ground sample plots along with their precise location on the ground. Plain Sal stratum was stratified into three volume classes on the basis of volume stereograms and standard deviation in each stratum estimated on the basis of reconnaissance data. 63 ground plots were needed for ± 5 cum (E = ± 5) accuracy for optimum allocation. Volume in 0.1 hectare circular plots was obtained from measurement of all trees above 10 cm dbh. The mean volume was 124 cum per hectare ± 9.55 cum at 95% probability level. A comparison with Working Plan figures revealed a close similarity. Advantage in time and cost for getting information on growing stock by the use of aerial photographs have been highlighted.

INTRODUCTION
The usefulness of aerial photographs in getting the necessary data either for management planning or resource evaluation is now well known. Panchromatic black and white photographs on medium to large scales have been used for preparation of forest type maps based on species, height and density classification, area of forest types etc. For growing stock determination, area of forest type and mean volume per unit area are required. Aerial photographs are an important tool in getting the information on growing stock of the forests. Direct estimation of volume per unit area has been tried on aerial photographs with subsequent adjustment by regression analysis, but the confidence limits are too wide with medium scale photographs and the data are only suitable for reconnaissance purposes.

Information on growing stock is best collected by a combination of aerial photographs and ground survey in which the role of aerial photographs is:

(i) Volume class stratification, thereby making homogeneous volume units which require less number of ground plots for the desired accuracy, resulting in saving of cost and time.

(ii) For determinitation of proportions of various volume strata by suitable dot grid sampling (for nearly plain areas).

(iii) For providing a suitable layout for ground sample plots and their precise location on the ground.

(iv) For getting an idea of the general variability of the crop in each volume classes.
In addition to getting quantitative information about growing stock, a volume class distribution map can also be obtained easily by transferring the details from photo onto base map. This volume class map depicts the areas of resource concentration so vital for planning purposes and may be used for allocating areas for annual cuts.

For volume class stratification, use is made of either tree or stand aerial volume tables (if available) in which volume per unit area can be estimated by means of photoparameters (photo tree height and crown closure or number of trees) or volume stereograms covering the entire range may be prepared by a quick reconnaissance of the area and used. Since stratification is done for a class, the above aids give satisfactory results.

Location of ground sample plots through the help of aerial photographs is easy and leaving aside a few cases in dense forest with no identifiable features, ground plots can be located with the photo image of the surroundings. Small changes in the crop pattern, nala bends and crossings, isolated trees, footpaths help in precise location of the sample plot on the ground. Circular plots are preferred as in that case only one point requires location.

An area of nearly 5700 ha. of Sal forest in West Dehra Dun Forest Division was taken for carrying out an assessment of growing stock of Sal (Shorea robusta) trees above 10 cm dbh with the help of aerial photographs. Vertical air photos flown in December, 1967 on nearly 1:20,000 scale with RC5 (a) camera and panchromatic black and white films were available. Fortythree photographs on 18cm × 18cm format size provided the coverage.

RECONNAISSANCE

A reconnaissance of the area lasting for two man days was carried out to collect data for preparation of photointerpretation key and volume stereograms covering the entire range of volume. Photo tree height and crown closure are closely related to stand volume and fifteen photo plots in three classes were marked and volume in 0.1 ha circular plot was measured for trees upto 10 cm dbh. (Volume of individual trees was calculated by CHATURVEDI'S REGRESSION EQUATION for Sal). Suitable stereograms for volume class stratification of the area were made. The range of volume obtained was 40 cum to 328 cum per hectare. The actual scale of photo on mid terrain was found as 1:22,000.

PHOTO INTERPRETATION AND VOLUME CLASS STRATIFICATION

The photographs were interpreted inside the effective area of each photograph and three forest types namely Plain Sal, Hill Sal and Miscellaneous type were delineated. Identification of Sal trees posed no difficulty which appeared in dark tone, coarse texture and well defined round crowns. Assessment of growing stock was confined to Plain Sal stratum and the following three volume classes were made:

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Symbol</th>
<th>Range of volume in cum/hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>S₁</td>
<td>Above 200 cum</td>
</tr>
<tr>
<td>Medium</td>
<td>S₂</td>
<td>100-200 cum</td>
</tr>
<tr>
<td>Low</td>
<td>S₃</td>
<td>Below 100 cum</td>
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Assignment of class limits of volume to each stratum depends upon the range,