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AN EVALUATION OF LITHOGRAPHED FOREST STEREOGRAMS

by

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EDITOR'S
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Aerial photo stereograms are valuable for showing neophyte photo interpreters the stereoscopic appearance of common objects and conditions. They are also useful for instruction in measuring heights, horizontal distances, and angles on photos. Collections of stereograms of known conditions are worthwhile reference material for interpretation work in unknown areas.

Photography is the usual process for producing a forest stereogram. Interpreters feel that only photo copies provide the amount of detail necessary for successful interpretation. However, photographs are expensive. There is a need for a method of reproducing satisfactory stereograms at less cost. Printing may serve this need.

The two main types of printing are letterpress and lithography. Stereograms printed by letterpress, usually a comparatively coarse (120-line) screen printing process, are unsatisfactory except for the broadest illustrative purposes. Under the 2-power stereoscope usually employed in forest photo interpretation, letterpress stereograms appear as a disturbing pattern of dots. It is difficult to interpret details

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on this medium. On the other hand, this dot pattern is not apparent on fine (300-line) screen lithography. This suggests a possible solution to the problem of making economical, high-quality reproductions of photographic images.

Stereograms made by lithography are about one-tenth as expensive as those made by photography. However, not much is known about the quality of reproduction and how this might affect the forestry uses. For this reason we have made some interesting tests to determine the suitability of lithographed stereograms for a variety of forestry uses.

Experienced Interpreters Judge Lithographs

Four experienced forest photo interpreters were asked to interpret objects and conditions and measure photo scale, angles, distances, heights, and crown density on stereograms prepared both photographically and by fine-screen lithography. Also, a pair of 9- by 9-inch aerial photos was reproduced by lithography and used for part of the test. All stereograms and photos were at a scale of approximately 1:12,000.

First, they examined the photo and lithograph copies side by side in order to decide whether the lithographs satisfactorily served the training purpose of stereograms. Then they made photo measurements on both in order to compare consistency and ease of measuring objects.

Broad Details Can Be Interpreted

Stereograms covering six different problems in field route planning and one on reference tree location were first used to test interpretation (fig. 1). The route planning stereograms were originally designed for aerial photo training sessions to give students practice in choosing the most logical cross-country route through a variety of forest and terrain conditions. The reference tree problem involved the selection of a tree to be used as the reference point of a premarked inventory field plot. Each of the interpreters judged that lithograph copies were satisfactory for all these purposes. Although some fine detail was lost, topography, tree cover, brush, and other conditions were observed with sufficient clarity.

The interpreters then examined 10 stereograms illustrating land forms and soil conditions, such as dissected slopes, land flows,

slumps, and slides (fig. 2). Again, the interpreters found the lithographs acceptable although not as sharp as the photo copy.

Some important forest types in the Pacific Northwest were illustrated on six additional stereograms (fig. 3). Here, the interpreters decided that lithographs would not do the job. In some cases, tree details showed up on lithographs as well as they did on the photo copy. However, in most cases, the lack of detail made it difficult to distinguish type differences.

The interpreters concluded that lithographs could be used in situations where interpretation of fine detail is not necessary. For instance, when the object of the stereograms is to show contrasting size classes and their ground appearance, as in figures 4 and 5, lithography is satisfactory. In similar situations, fine-screen lithography would certainly add a great deal more to understanding than the coarse-screen reproductions of stereograms usually found in publications.

Distances and Bearings Can Be Measured

Exercises in photo scale determination and in location of principal and conjugate points were set up on the stereo pair. The lithographs were judged to be as satisfactory as the photos for this type of training. Lithography was also found to be satisfactory for use in exercises in determination of distances and bearings on aerial photos.

Tree Heights Can Be Measured

Individual tree heights were then measured on stereograms of a set of tree models used to teach the technique of tree height measurements on photos (fig. 6). The photos of this stereogram had previously been effective in developing the ability of interpreters to repeatedly measure an object with consistent results and to give them a feeling of confidence in their measurements. To check the effectiveness of lithograph stereograms for this purpose--both by an interpreter and among interpreters--eight different trees were measured twice each on both the photo copy and the lithograph copy.

—But Not Easily Enough for Training Purposes

Statistical tests indicated no significant difference between photo and lithograph copies as far as consistent measurements were concerned. However, all the interpreters reported difficulty in

resolving the tree top and the ground and a lack of confidence in the measurements they made on the lithograph copy. This difficulty defeated one of the purposes of this training exercise. Therefore, even though height measurements can be made as consistently on lithograph copies as on photo copies, lithograph copies are not considered a suitable medium for training photo interpreters in individual tree measurements.

Stand Height and Density Difficult to Estimate

Stand heights and crown closure were measured on five 1/5-acre plots. A number of difficulties were encountered when the lithographs were used for stand height measurements. Some interpreters described the lithographs as being too fuzzy to resolve the tree crowns properly. Others had difficulty finding suitable openings in the crown canopy for ground readings. All felt more at ease with the photos. However, as with individual tree measurements, a statistical test showed the interpreters to be no more consistent in their stand height measurements on the photos than on the lithographs.

Crown closure estimates on lithographs drew the same reaction as stand height measurement. The openings in the crown canopy were difficult to judge, individual crowns did not resolve well, and wild guesses were made in crown closure. A statistical test indicated that interpreters made more consistent crown closure estimates on the photos than on the lithographs.

The verdict of the interpreters was that lithographs were unsatisfactory for training in measurement of stand height and crown closure.

The Final Judgment

In this study, four experienced forest photo interpreters tested the suitability of fine-screen lithographic copies as substitutes for photographic prints of forest stereograms. They found that lithographs were suitable for field route planning, identifying land forms, determining photo scale, and measuring angles and bearings. Since lithographs can be produced for about one-tenth the cost of photographic prints, we recommend them as substitutes for photos for training and demonstration of these uses. But the lithographs were not suitable for identifying forest types nor for measuring tree heights and crown closure, and are not recommended for these purposes.

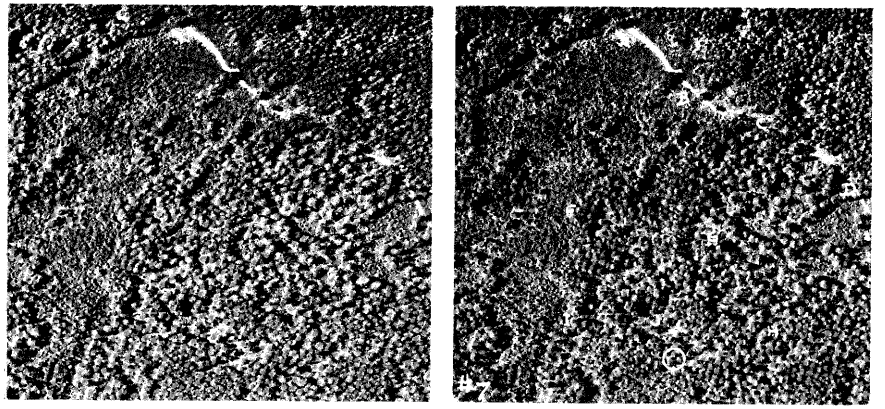


Figure 1.--Field route planning exercise.

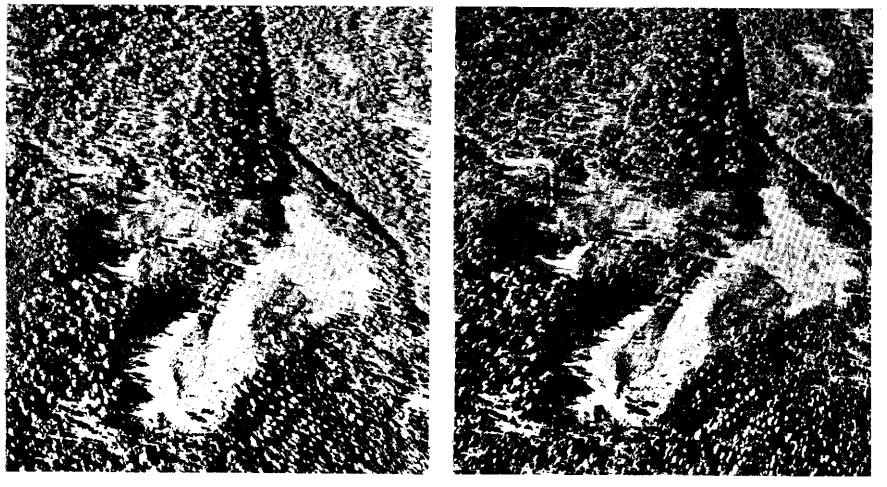


Figure 2.--Land form identification--headland, alluvial fan, terrace.

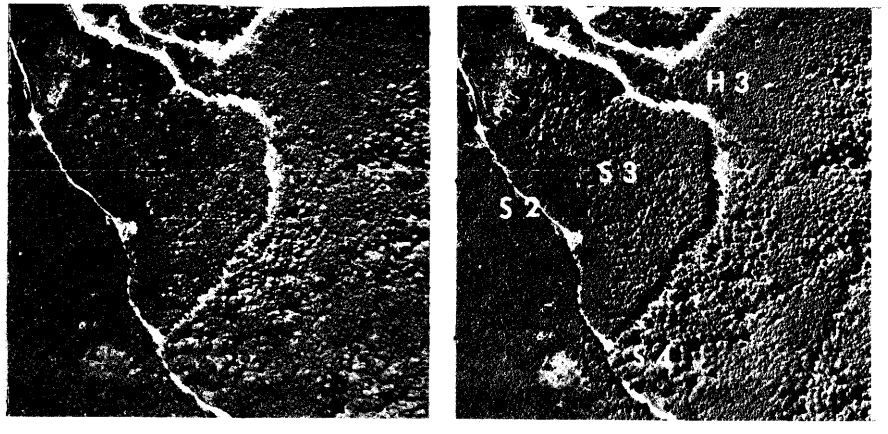
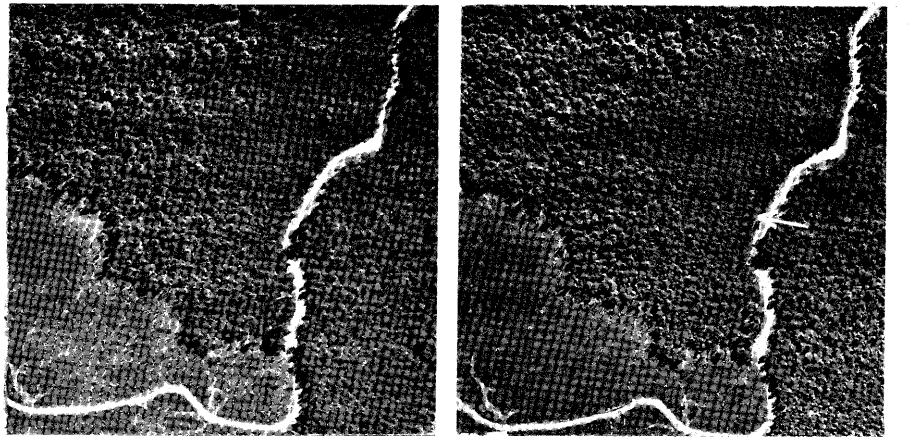
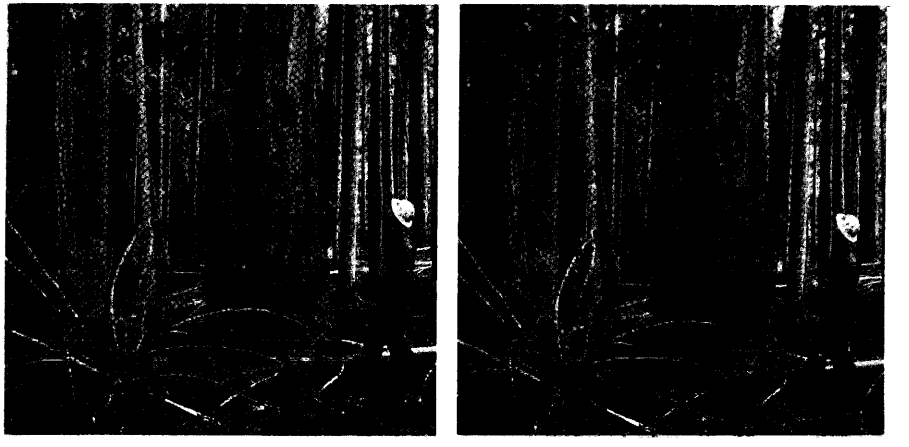


Figure 3.--Forest type identification--Sitka spruce and hemlock types.





Figures 4 and 5.--Forest type identification, two-story types--old-growth Douglas-fir over hemlock and silver fir poles.

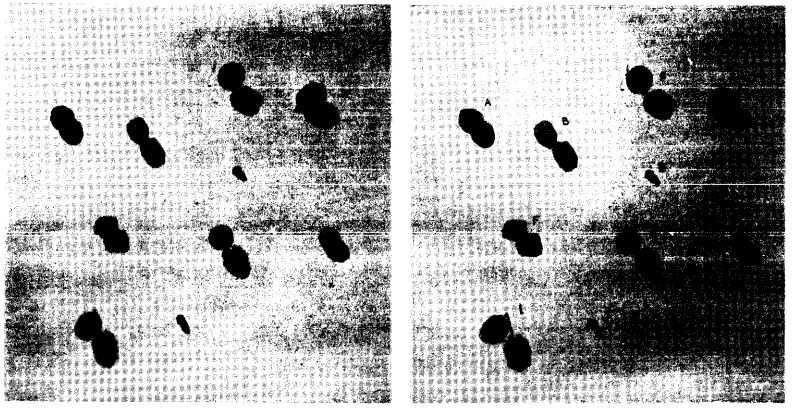


Figure 6.--Tree height measurement exercise.