

PHOTOGRAMMETRIC INSTRUCTION IN THE FOUR-YEAR FORESTRY CURRICULA AT THE UNIVERSITY OF NEW HAMPSHIRE*

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MEMBERS of the Forestry Department at the University of New Hampshire have, for several years, felt that instruction in the use of aerial photographs should be a necessary part of any curricula designed to train technical foresters. Circumstances beyond our control prevented the inclusion of such instruction in the regular schedule of forestry courses during that interval, other than the mention of its value where applicable and the occasional use of actual photographs in a few of the courses. These difficulties have been in part resolved, and the Department is offering a one semester, 3 credit course (2 lectures and 1 lab) to a group of selected undergraduates this fall. In addition, we will inaugurate a stepped-up program of using aerial photographs wherever practical and possible in other forestry courses.

We plan to incorporate forest photogrammetry into the regular 4 year curricula beginning with the 1948-49 academic year. The manner in which this will be done, so far as concerns the number of courses offered, the course credit, prerequisites necessary, whether a course shall be required or elective, course content, manner of presentation, equipment necessary for instructional purposes, and etc., will be influenced by our experience with the aforementioned course and by our desire to turn out graduates who are aware of and acquainted with the use of photogrammetry as a professional tool.

We believe that this manner of handling the instruction will best meet our particular needs. Among other things, this year it will allow us to provide some instruction to a few students who we feel possess the greatest aptitude and who have shown the most interest in the subject. At the same time it will give us an ideal set of conditions so far as numbers and type of students are concerned for testing out a new course in a new field. It will allow us to do all this on a minimum budget, which is particularly important at the present. Due to increased enrollment, our budget for the present fiscal year, though the largest ever, included a heavy outlay in capital expenditures for additional equipment in basic forestry courses. Also added expenditures were required to replace the balance of our equipment lost in a departmental fire before the war. This leaves little available for purchase of photogrammetric equipment and none for having aerial photography flown to our specifications on the portion of University lands from which we shall draw our classroom and field exercises. We are of the opinion that the latter is an important consideration in successfully teaching forest photogrammetry. Such limitation to our budget for this year will necessitate improvisations of some items of equipment and the use of existing government coverage so far as is possible in teaching the course. Here too, this can be done to the best advantage with a small group, where individual instruction can be afforded as difficulties arise.

However, we have reason to believe that our budget will continue on a high level, in which case we shall be able to purchase a substantial amount of equipment during the next fiscal year as well as make a start toward securing adequate photographic coverage for teaching and administrative purposes on all Uni-

* Information regarding Education in Photogrammetry which was not available for the symposium published in the September 1947 issue.

versity holdings. In respect to the last, it is our ultimate goal to cover the area with a series of photographs having scales ranging from about 1:6,000 to 1:30,000 and taken on panchromatic film at the height of the foliage coloration period in the fall. Two of the series, 1:12,000 and 1:20,000, will include photos taken during each of the four seasons on the same type of film, and also during the summer using infra red film. We feel that such a wide selection of material, available for comparative purposes will greatly increase the value of any instruction we can offer, as well as being available for various types of scientific studies.

The photogrammetry course which we are offering this fall will be given six to eight students selected on the basis of their interest in the subject and for their above average work in Forest Surveying, Forest Mensuration, and Mathematics.

We shall use as a text, if off the press by October, the new book on this subject by Professor Stephen H. Spurr of the Harvard Forestry Department. If not available, then the *Manual of Photogrammetry*, supplemented by assignments in such periodicals as PHOTOGRAMMETRIC ENGINEERING and the *Journal of Forestry*, and standard reference texts on photogrammetry.

Available for this course as well as for use in the other forestry courses, will be all of the government coverage of University lands. This area has been completely covered by three government agencies, The Geological Survey, The Coast and Geodetic Survey, and the Army Air Forces. Coverage by USGS comprises only a small portion of the area and is at a scale of approximately 1:24,000. It is the only coverage for which we can purchase enlargements. The USC&GS photos cover about $\frac{1}{3}$ of the area and furnish duplicate coverage with 9X9 verticals and large composites derived from their 9-lens camera photography. Both sets are at 1:20,000 scale. AAF photos cover the balance, and it too is at a 1:20,000 scale. Also available for demonstrational purposes, will be a set of contact prints taken of a single area on the Harvard Forest. This set covers a wide range of photo scales as well as furnishing examples of several film-filter combinations used at different seasons of the year. All photographs mentioned above are vertical prints. We shall not cover oblique theory in this first course.

Students will be required to purchase a small group of adjoining AAF photographs that cover University land adjacent to the college proper; and a small set of Harvard Forest photos at the 1:12,000 scale, it is thought that the latter will serve better as instructional material until the student acquires sufficient technique and facility in photo interpretation to go ahead on the smaller scale prints of the University properties.

We have for equipment a sufficient number of lens stereoscopes, one mirror-lens stereoscope without binoculars, a parallax bar, and the usual drafting room accessories. We plan to purchase one or two pieces of equipment for transferring photo detail to base maps, such as a vertical sketchmaster, multiscope, rectoplanagraph, etc. Any other pieces of equipment that may be necessary will probably have to be made.

Students will be asked to purchase, in addition to the photographs mentioned above, USGS quadrangles of the areas for which the photographs apply, miscellaneous drawing materials, and film positives of the three following items: dot grids for measuring areas on photographs, parallax wedges for measuring tree heights, and small scaled circles that represent $\frac{1}{4}$ acre circular plots at a given photo scale.

The course content will parallel generally that presented in the "Two Week Short Course in the Use of Aerial Photographs in Forestry," conducted by the

Harvard University Forestry Department at the Harvard Forest frequently during the past two years for foresters, forest owners, forest managers, timber cruisers, etc.

Roughly about one half of the lecture portion of the course will be concerned with basic principles of photogrammetry and the remainder with the specific application of aerial photographs to the solution of forest problems. The first phase will cover characteristics of aerial photographs and their specifications for forestry purposes, principles of stereoscopy, geometric principles of aerial photographs, principles of radial line plotting, parallax measurements as applied to rough mapping, and photo interpretation applicable to forest studies. The second phase will cover photogrammetric measurements of trees and forest stands, forest stand mapping from aerial photographs, timber cruising from aerial photographs by the several widely used methods, and discussion of the value of aerial photographs in solving miscellaneous forest problems.

Laboratory work is designed to give the students practice in applying the above concepts in accordance with generally accepted methods of procedure. Emphasis will be placed on actual use of the photographs in the field. Each student will be required to make a rough topographic map of the area covered by their photos, a series of forest stand measurements, a forest stand map of a portion of the area, and a timber cruise of the area from their photographs complete with a percentage field check to determine its accuracy.

As to the use of aerial photographs in the other forestry courses, we plan to emphasize value and method of use rather than theory. In our Forest Management Course for the coming year, students will be required to purchase coverage on an area for which they will develop a management plan, using the photos for making a rough vegetative type map to expedite forest stand analysis in the field. Also they will use them in evaluating land utilization problems on the area. We also plan to make extensive use of them next year in our Forest Surveying and Forest Mensuration Courses both to aid the student in laying out his field work to the best advantage, and in furnishing him a gross check on the accuracy of the completed job.

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