Problems of a Forest Inventory on Scattered Ownership Using Aerial Photographs

LOUIS W. POWELL
College of Forestry
University of Washington
Seattle, Washington

THE PURPOSE OF this paper is to acquaint the reader with some of the problems involved in a forest inventory with the use of aerial photographs. The problems to be discussed are: (1) The location of scattered ownership; (2) typing; and (3) volume estimation. It is hoped that the solutions of these problems may help others with similar problems and create an exchange of ideas.

The area inventoried is in Clatsop County, located in the northwest corner of Oregon. The county is bounded on the north by the Columbia River; on the west by the Pacific Ocean. The coast range of mountains divides the county into a western forest type of western hemlock (*Tsuga heterophylla* (Rafn.) Sarg.) and Sitka spruce (*Picea sitchensis* (Bong.) Carr.) and an eastern forest type of Douglas fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*). Hemlock and spruce also grow along the north boundary near the Columbia River. The state of Oregon owns 140,000 acres of forest land in the county.

In July, 1951, members of the Management Division in the State Forestry Department began an inventory of these 140,000 acres. It was the state's first attempt at large-scale inventory using aerial photographs. The purpose of the inventory was to gather information to enable the Management Division to make a management plan. It was necessary to compile forest-type maps and to make estimations of the volume of timber.

Photography was obtained from two principal sources. Photos of the eastern half of the county had been taken in 1950 for the Rehabilitation Division of the State Forestry Department. Copies of Crown Zellerbach Corporation photos covering the western half of the county were obtained, most of these photos being taken in 1949 or 1950 with an average scale of 1:12,000.

The processing of the photos came next. First, a photo index was plotted on a large county wall map. Then the photos were filed in township folders by flight lines. The photo center governed in which township folder the

photos were placed. The township, range, and section were marked on the north edge on the back of each photo. In these folders a small township index map also was placed. The map was cut out of a United States Geological Survey Quadrangle map and mounted on 9-by-9-inch cardboard (the same dimensions as the photos). This made it a handy map in the field to be carried along with the photos in a clear celluloid envelope. After the indexing, effective areas were marked on the photos in black grease pencil.

Then came the problem of delineating ownership on the photos. The largest single unit of ownership was a township lacking one or two sections. There were many isolated sections and forties. All photos in whose effective area there was 100-per-cent state ownership were marked with a large "S" in red grease pencil at the north end of the effective area. These photos could then be eliminated in considering areas requiring ownership lines. Photos with less than 100-per-cent ownership in the effective area were marked before typing with a small red "s" within the ownership boundaries. Prior to marking the photos in the above manner it was of course necessary to obtain enough horizontal control to draw in ownership boundaries on the aerial photos.

The control amounted to tying down the ownership on the Public Land Survey Grid. The sources of information for this control were:

1. County cruiser.
2. County assessor.
3. Private timber companies.
   a. Crown Zellerbach Corporation
   b. St. Helens Pulp & Paper Co.
4. State highway strip maps.
5. Bonneville Power Administration right-of-way maps.
6. Quadrangle maps of the U.S. Geological Survey.
7. Landowners.
8. Rehabilitation Division and Protective Division of the State Forestry Department.
9. Projection and field control work of the inventory crew to fill in gaps.

Certain methods were used in marking the Public Land Survey Corners on the photos. Corners located precisely in the field were pinpricked and marked with a red diamond on the front of the photo. On the back the customary open diamond and section indications were marked in hard pencil. The orientation of the sections was backward to match the true representation when looking at the front of the photo. Corners established by projection or otherwise indefinitely located were marked with a red dot on the front and a

dot and sections on the back. Corners that were identified on the ground but couldn't be pinpointed (heavy canopy of trees for instance) were marked by a red circle on the front and a circle plus section indications on the back. Evidence found at the corner was also indicated on the back of the photo. This would include the type of monument—iron pipe, stone, cedar stake, etc. —and number of bearing trees or bearing objects. Section-line crossings were pinpointed and marked with a red "X" on the front. On the back an X indicated the pinhole while an arrow from the pinhole indicated the direction to the nearest corner. The distance, direction, and corner were also noted. As the type mapping and sample cruising, which was necessary, progressed, additional corners were marked on the photos, and faulty ownership lines were corrected.

The type mapping began after the state ownership was marked on the photos. This required some preliminary training to become acquainted with the forest types in the county. Type lines were drawn as red dashed lines on the photos. The preliminary training enabled the inventory crew to type some areas merely by comparison with stands that had already been visited in the field. Open or barren-looking areas on the photos had to be inspected in the field. A visual check was made if trees were large enough to be evident on the ground but not on the photos. A stocking survey was necessary when the trees were of seedling size. Type symbols used were those standard for Region 6 of the U.S. Forest Service with minor modifications. Thus the species composition, size class, density, and birthdate (to the nearest ten years) were indicated.

All type islands down to ten acres in size were delineated on the photos. In some instances where stands were of high value they were typed out though less than ten acres in area. A concentration of large old-growth Sitka spruce in a creek bottom would be an example.

Most of the typing was done in conjunction with the sample cruising. It was necessary to visit isolated spots specifically for typing when no sample plots fell near them.

In all stands of sawtimber size (11.0″ d.b.h. or more) an estimate of the volume per acre was made. When sample cruise plots fell within a sawtimber type the volume estimation was simple. The problem arose when an estimate had to be made in the other sawtimber types. To develop the ability to quickly estimate volumes, the crew made a practice of individually estimating volumes on all sawtimber sample plots. After a few months' experience, volume estimations could be made with a quick look at the stand and a few

increment borings to check age. A later check showed the estimates to be fairly accurate though usually a little low.

Thus with this information on forest types and volume, the Management Division had the data necessary to calculate an allowable annual cut and develop a management plan. The project proved that the aerial photograph is a valuable tool in forest inventory and management planning.

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