

# Cooperative Forestry Research In The Tennessee Valley

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**P**UBLIC recognition has been given to the part our national forest research program played in assuring the production of critical forest products needed for the recent war effort and in solving transport problems that were the bottlenecks to supply of war and lend-lease equipment and materials. Locally, this new consciousness has been evidenced in the interest and active support of industry and conservation groups to obtain congressional approval of appropriations that will permit expansion of the Federal Forest Research Program in the South. These groups have also been actively supporting the establishment and expansion of state research work centers in schools and State Agricultural Experiment Stations.

Paralleling this general surge of interest in forestry research and development of regional forestry resources throughout the South as a whole has been a like development within the Tennessee Valley. During the past year, requests for information and assistance in forestry problems brought to the attention of the Tennessee Valley Authority increased some 40 percent over the previous year. For the most part, these inquiries concerned requests for data pertinent to problems of the Valley on production, concentration and transportation of forest products; assistance to state and local planning groups in evaluating the economic importance of local forest resources; and assistance in appraising the opportunities for establishing new wood-using industries. Some requests, however, came from outside the Valley and from foreign countries.

## **Position and Interest of the Tennessee Valley Authority in Forestry Research for the Valley**

The need and opportunity for forestry research and development of a sound forest management program as visualized for the Tennessee Valley by the Tennessee Valley Authority is illustrated in Figure 1, on page 36, comparing present and possible development of the resource.

As a government corporation, the Authority is charged by Congress with the responsibility for fostering the unified development of the Tennessee River system including programs for flood control, navigation, and power development. To work out means to this end, it is authorized to conduct surveys and investigations and prepare plans as needed for the orderly development of the physical resources in the river system. In conducting this program, the Authority has adhered to and sponsored the "grass roots" approach in working cooperatively with the states concerned or with other agencies in the Valley. Wherever institutions or agencies are established, the Authority seeks their participation in the initiation and conduct of activities of social and economic importance to the Valley community. As in other programs, forestry research projects are coordinated with research and administrative units of other agencies in the Valley. Projects undertaken by the Authority alone include only those that will fill in the gaps for needed information where other agencies do not have the facilities or personnel to handle the work.

The Authority's forestry research program is carried out by the Forestry Investigations Division of the Forestry Relations Department. This division is further subdivided into three sections that promote the development of Valleywide forestry research and work in the fields of: (1) Economic Investigations, including resource surveys; tax and credit studies; land ownership and tenure surveys; studies of timber industry equipment and techniques; and marketing and consumption studies; (2) Forest Products Investigations, including studies of tree crops trees; nursery practices; and chemical utilization studies involving tannins, essential oils, medicinals, and hydrolysis products; and (3) Forest Management Investigations, promoting studies, tests, and demonstrations in management, forest influences, silviculture, and protection.

#### **Prewar Research Activities and Advisory Services Furnished During War Years**

In the initial effort to organize Valley interest and action in a forest development program, the Authority realized the basic need for factual information as to what made up the problem. A Valleywide inventory and analysis was conducted to make available information on the type, volume, quality, growth, and distribution of forest resources. An inventory of wood-using industries was also made to determine the rate and types of industrial utilization, the dependence of these industries on the resource, and the possibilities and re-

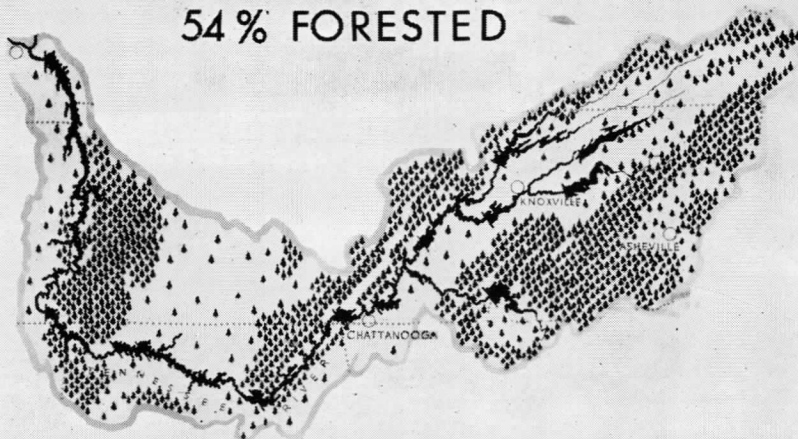
quirements for industrial expansion. Some studies were started to test and refine forestry techniques in management and silviculture. More notable of these was a Cooperative Reforestation Project carried out jointly with the Southeastern (formerly Appalachian) Forest Experiment Station in 1938-39 to test the suitability of certain species for artificial reforestation of submarginal lands in the Great Appalachian Valley.

Analysis of initial results from the reforestation study led to the cooperative development of a preliminary planting guide for use in classifying the various planting chances encountered in the eastern portion of the Valley. In 1940, a 722-acre Pilot Plant Reforestation Project was cooperatively established on Norris Reservoir to test the guide before its general release and use by the Authority and other agencies developing reforestation programs in the Valley. Planting guide releases have since been developed for the Virginia and east Tennessee portion of the Valley from three-year data obtained from this testing area. It is estimated that the guide developed for the Virginia portion of the Valley may save forestry agencies and landowners in this planting area up to \$400,000 in future planting costs.

Data obtained by the Authority from the Valleywide forest inventory conducted prior to the recent war revealed the average wooded acre in the Tennessee Valley watershed contained some 900 board feet of sawtimber size trees plus about 5 cords of cordwood. Under proper management, it is believed the normal stand in the Valley should average at least 5,000 board feet per acre. Approximately 30 percent of all wood in forest stands of the Valley today is defective or rough and crooked and unsuited to industrial use. This condition has been built up by the repeated high-grading of most hardwood stands by logging of only the best formed and higher valued tree species or by subsequent fire damage to cutover or grazed stands.

The Authority was early to recognize that the removal of inferior species and defective volume from most stands has been limited because current logging and processing methods generally do not offer an economic return. In an effort to convert such timber into profitable commodities and thereby eliminate one of the factors limiting desirable forest resource development, the Authority consulted with the Forest Products Laboratory of the U. S. Department of Agriculture at Madison, Wisconsin, as to possibilities for developing new processing methods. Of the projects under investigation at

# THE TENNESSEE VALLEY IS 54% FORESTED



## Significance of the Forest Resource

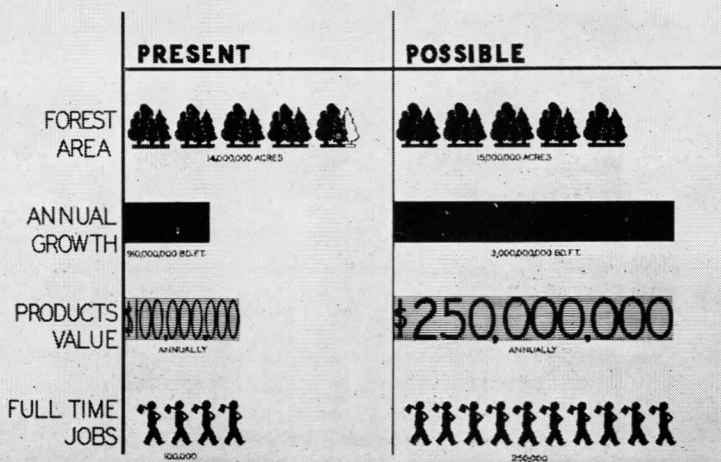


Fig. 1

the Forest Products Laboratory, the one offering a promising outlet for use of defective and low-value timber involved the production of a 25/32-inch by 12-inch cross-laminated board of any desired length by gluing together small strips cut from defective and cull logs. The board is made of three plies with top and bottom 3-inch strips parallel and the center strips at right angles to the length of the board.

In the initial attack to develop suitable machines and improvement of materials-handling methods to produce a laminated board, engineers of the Authority's Commerce Department had to take into consideration: (1) the sawing of slabs, (2) surfacing to close tolerances, and (3) development of a continuous gluing machine. Several years of experimental effort resulted in the construction and testing of a processing pilot plant in Knoxville, Tennessee. Although machine design and operation may continue to be improved in order to secure the best results, the development and check runs made to date are considered sufficient to warrant commercial application. A contract has been signed with TVA whereby the pilot plant is to be taken over by Laminated Wood Products, Incorporated, and placed in commercial operation. Further commercial expansion will, of course, depend upon the success of these initial operations. Laboratory tests run in cooperation with the Forest Products Laboratory, the wood research laboratories of Virginia Polytechnic Institute, and the Pierce Foundation in New Haven, Connecticut, and installation tests in rural and city residences and department stores have shown favorable results.

The laminated board has been used as flooring, with and without a subfloor, and for prefinished wall construction. The board is fitted with a tongue and groove as it comes from the continuous hydraulic press. If desired, the continuous board may be cut to the exact dimension of the room for which it is planned, thereby saving cutting labor and waste on the job. It is laid rapidly because of its 12-inch width. The tendency to warp and cup is reduced to a minimum since it is cross-laminated and, due to the method of assembly, it does not require a subfloor, thereby saving additional materials and labor costs. The board's salient feature is that it will grade 95 percent select or better on the upper surface, whereas ordinary flooring manufactured from mill-run rough lumber or average logs yields only about 35 percent select or better.

Most of the experimental work on the laminated board to date has been confined to oak, although ash, hickory and other

hardwoods have also been used. Considering the advantages listed above for the laminated board and expected production costs in relation to market value, the economic margin is thought sufficient to warrant removal and utilization of defective and cull material heretofore left in the woods. The stand improvement and increased utilization made possible through this process is expected to assist materially in realizing the possible physical and economic development of forest resources as portrayed in Figure 1.

Other forestry investigations started prior to 1941 that feature the utilization and development of minor forest products include the study of the black walnut as a nut-bearing and pasture shade tree native throughout the Tennessee Valley. Phases of the study cover experiment nursery, tree crops, and products projects. Early work by the Authority stressed experimental production of all black walnut species and nut-testing of 500 selections. To increase the use on farms of black walnut bearing superior nuts, some 12,000 grafted walnut have been produced since 1935 in the Norris Nursery for the following purposes: (1) To familiarize farmers with superior trees and stimulate the demand for commercial production, the State Agricultural Extension Services have cooperated in establishing 3,329 demonstration plantings in 92 Valley counties to date; (2) To determine the varieties with best yields and their adaptation to the various sections of the region, 21 test plantings involving 35 varieties have been established in cooperation with state colleges and experiment stations; and (3) To determine efficient methods of budding and grafting walnut and to provide a guide for commercial nurserymen in undertaking quantity production to meet probable demand of private landowners, there has been active cooperation with several commercial nurseries.

Products projects carried out in conjunction with black walnut improvement studies included investigations of walnut shell waste utilization. Approximately 1,000,000 bearing, open-grown walnut trees are found in the Valley. Yield records from 160 sample trees indicate a normal annual yield of some 25,000,000 pounds of dry hulled nuts. It is estimated that nearly half of this annual yield is harvested and marketed to cracking plants serving the region. Some 1,500,000 pounds of kernels are produced annually, leaving 8,000,000 pounds of shell waste. Since the close of war hostilities, shell waste is no longer marketable for gas mask charcoal production. With a view of maintaining and expanding the interest in harvest-

ing and utilizing the wild walnut crop, by-product utilization of shell waste as shell flour for plastics, glue extenders, and insecticide spreader is being cooperatively investigated with the University of Michigan, the U. S. Forest Products Laboratory, and the Commerce Department of the Authority.

During the war, most of the Authority's going forestry investigations were handled only on a maintenance basis. As with other agencies, emphasis was placed in pushing those projects that were of immediate, direct benefit to the war effort. Most of the facilities and staff were devoted to providing an advisory service for high priority war projects handled in cooperation with other departments within the Authority and with other agencies outside the Authority. Other contemplated but secondary investigative projects were shelved for postwar consideration.

The critical demand for forest products and especially lumber led to the development of agreements with the U. S. Forest Service, whereby the War Production Board, and later the Civilian Production Administration, were assisted in the collection and analysis of information required to meet problems of production, distribution, pricing and priorities. Collection and analysis of lumber, lath and shingle production data for the Valley was carried out cooperatively with the Southeastern, Southern and Central States Forest Experiment Stations. Direct assistance was also given the Office of Price Administration and cooperating state and local agencies and industries on problems of production, transportation, and costs and prices in order to stimulate production and movement of necessary forest products.

As mentioned before, few new investigative projects were started during the recent period of hostilities. Foresight on some problems, however, led to the conclusion some studies would have to be initiated during the war so the "know how" of newly developed processes would be available to industry in the expected postwar period. In cooperation with other agencies, studies were undertaken in extraction and wood hydrolysis in an effort to more fully utilize the by-products of lumbering. Further studies in tannin extraction are being made to save a going industry, while investigations in wood hydrolysis are set up to provide the answers that will permit expansion or development of new industries in the Valley and Nation.

The most optimistic estimate holds that reserves of the blight-killed native chestnut will not last more than 12 years





Fig. 2.—Feeding mechanism for continuous hydraulic glue press.

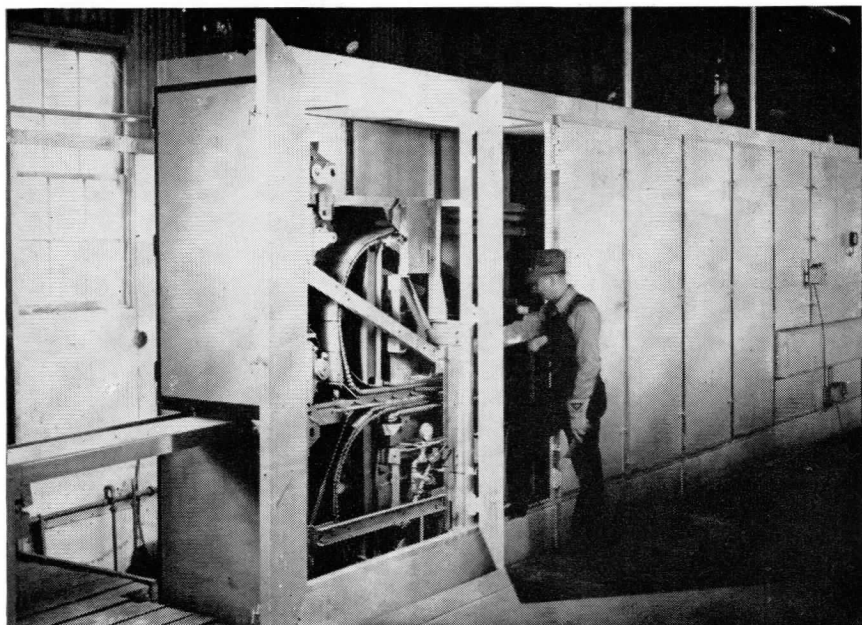


Fig. 3.—Continuous hydraulic press with inspection doors open to view mechanism of discharge end.



and South American quebracho reserves will be consumed in some 40 years. These two species make up some 90 percent of the vegetable resource used for leather tannins. In anticipating the pressure of industry for a practical substitute and at the same time hitting a lick for more complete wood waste utilization, the Authority, contracting with a representative of the University of North Carolina, initiated studies to test the content and characteristics of tannin extracted from mill-waste oak slabs and pulp-mill bark rossings from native pine. It is estimated that 13,000,000 pounds of good quality tannin could be obtained from 128,000 cords of oak slabs produced annually in the Valley area. Pulp-mill bark rossings from native pine were found to contain 5.5 percent tannin which produced light leather of good quality. Additional tests are under way to determine the effect of age, diameter, and bark thickness on the tannin content of barks of major pine species in the Valley. Should the use of oak slabs and pine bark rossings prove satisfactory for commercial extraction and leather production, a sizeable reduction in mill waste would follow, and the large extract industry in the Valley and Nation would be stabilized at the same time.

Studies of the place of wood hydrolysis plants in the Valley were undertaken in cooperation with the Chemical Engineering Department of the Authority and with the U. S. Forest Products Laboratory. Preliminary results offer considerable promise for the partial utilization of the large quantities of wood waste available annually in the Tennessee Valley, resulting from lumbering and secondary manufacture. To translate this waste figure into word-pictures more easily grasped would be to conceive of an annual sawdust production filling 16,000 freight cars and a slab pile resulting from a year's production of lumber covering an area of 300 acres to a depth of 4 feet. With such impressive figures in mind, by necessity the challenge must be met to develop wood-waste utilization methods, if standards attained in Europe, where only 10 to 15 percent of the standing timber is actually wasted, are to be approached.

#### **Postwar Opportunities to Integrate and Build a Unified Research Program in the Valley**

As mentioned before, considerable encouragement is offered by the recent surge of public interest in proper resource development and the growing concept that well-founded research should precede and guide effort to carry out an action program. The primary postwar objective of the Authority is

to mobilize this interest within the Valley for action—to assist in the coordination of research programs of various agencies so that the whole will be molded into a unified machine working out major regional problems. The need for establishing additional projects to work out refinements in forestry techniques is considered of secondary importance in most instances.

Attention of the Authority in the postwar research development program will be devoted to: (1) development and release of essential factual information at hand that may provide a basis for program activities; (2) development of active participation of other agencies so they may eventually become organized and equipped to take over the Valley needs in forestry research; (3) development of studies in which the Authority is able to make outstanding contributions because of its current organization and capabilities; and (4) development of information urgently needed which cannot be obtained elsewhere.

Releases of factual information needed for planning further program activities that will be developed from projects under way include: 1945 lumber production reports by Valley counties; lumber production maps by species and county; a wood-waste survey showing volume and kinds of waste by industry and by geographic concentrations; land ownership by county and agency and an inquiry into the outlook of owners on forest management, protection, reasons for ownership, and obstacles to management; analysis of the Valleywide reforestation program to date, and the development of tree planting guides for the planting regions in west Tennessee and northern Alabama to permit practical reforestation of the remaining one million acres of submarginal land in the Valley; an evaluation of the fire protection program for the Valley to effect a reduction in the average annual burn from 5 percent (700,000 acres) to less than 1 percent; tannin and waste utilization developments; tree crops developments, including nursery techniques and nut quality evaluation in producing improved black walnut and other tree crops species; and hydrologic reports on existing watershed and forest influences studies, including water control methods and results in the Copper Basin.

Arrangements are being worked out for the cooperative use or transfer of certain TVA lands suitable for conducting further forestry research projects. Some areas are under consideration for use as adjuncts to the research centers being expanded by the U. S. Forest Service, forestry departments

of the various Valley States, and by forestry schools. Up to 1945, forestry investigations of the Authority had been conducted on some 11,000 acres of TVA land distributed in several study units throughout the Valley. Recently, additional units have been added so that 40,000 acres have now been set aside for use of the Authority and cooperating agencies for forestry research.

Priority attention will be given to completion of additional agreements under consideration to help cooperating groups within and outside the Authority get under way and stimulate their expanding interest in forestry research. Such cooperative work will involve working with three U. S. Forest experiment stations, the Forest Products Laboratory, the agricultural experiment stations of seven states, four federal departments, seven state foresters, two forestry schools, several other institutions interested in special fields, as well as eight organizational units within the Authority. The forestry research problem of the Valley is of considerable proportion.

The Tennessee Valley Authority's approach is unique in that the pattern of action laid out will in due time result in the development of a complete program of forestry research by the institutions mentioned above and thus enable these local agencies to fully assume responsibilities which will lead to the better use and development of the forests of the area.

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