Logging and Sawmilling

Symposium Reports Progress In Utilization Of Off-Site Hardwoods

By PETE t KOCH*

On March 10 of this year, 240 industrialists and researchers from both private and public sectors gathered for three and a half days in Alexandria, Louisiana, for intensive discussions aimed at increasing utilization of small hardwoods. The symposium, "Utilization of Hardwoods Growing on Southern Pine Sites", was jointly sponsored by the Southern Forest Experiment Station, U. S. Forest Service, and the Mid-South Section of the Forest Products Research Society.

The symposium was timely because industrialists are beginning to realize that these hardwoods constitute a very large under-utilized resource. For every cubic foot of Southern pine now standing, there is 0.8 cubic foot of hardwood on the same sites. More than 95 per cent of the hardwood volume on these sites is comprised of 22 species, 11 of which are oak. Much of the volume is in small trees; for this and other reasons, profitable utilization is difficult.

The symposium commenced with a four-hour general session, followed by 47 papers related to improved processing and 18 papers characterizing these hardwoods as industrial raw material. Following are abstracts of the presentations.

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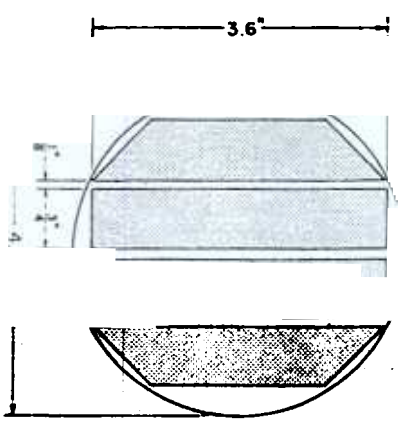
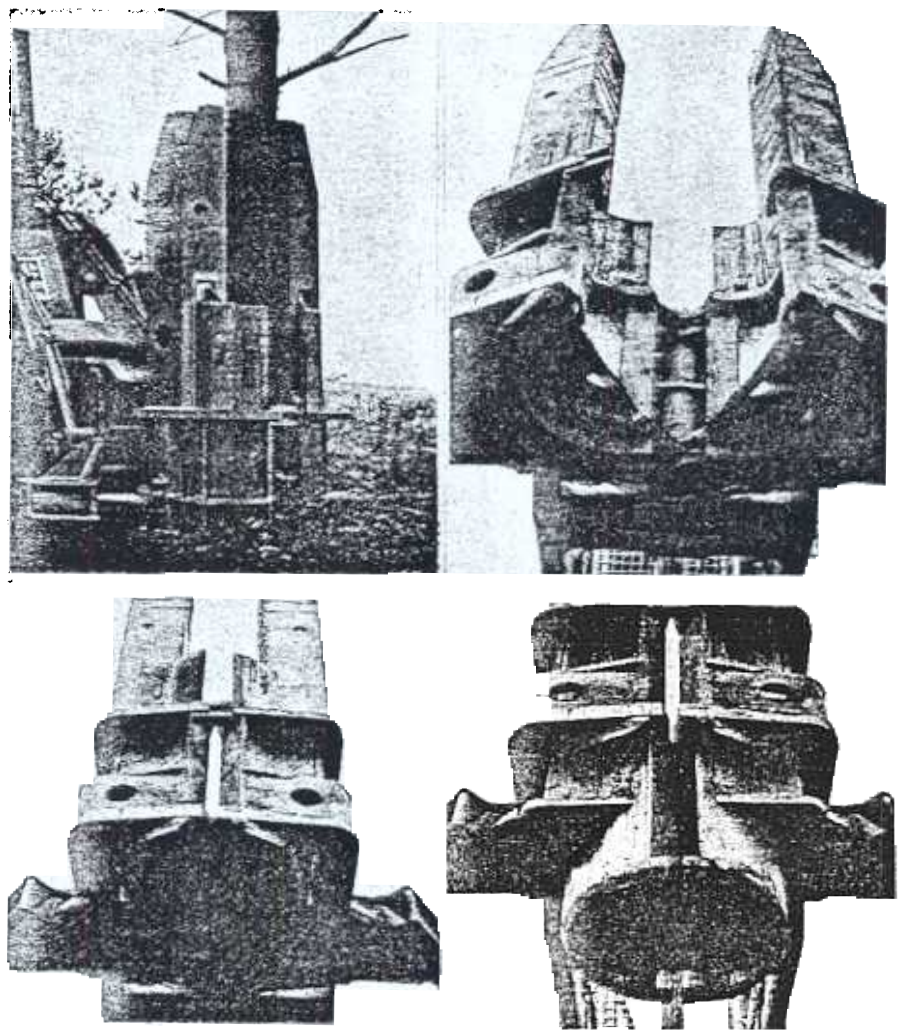


Sawing pattern whereby square-edged pallet deckboards can be ripped from the central portion of octagonal cants, and bevel-edged deckboards cut from outer portions. By this pattern, lumber recovery can be as much as 14 board feet per cubic foot of log.

William M. Bair, chairman of the Mid-South Section of the Forest Products Research Society, opened the symposium. Moderator William R. Ganser, Jr., in his introductory remarks, noted that economic utilization of hardwoods growing on Southern pine sites is a major problem that has defied solution for decades. He further observed that the South produces half of this nation's hardwood lumber (nearly four billion board feet each year) and manufactures about 45% of the nation's hardwood plywood (more than one billion square feet a year).

In the keynote address, John C. Barber, Director of the Southern Forest Experiment Station, observed that hardwoods on Southern pine sites have generally been considered liabilities because of low quality, small size, and slow growth. Typically they represent residual trees from pine harvesting operations. But in the long run, these hardwoods will likely prove to be an asset because their large total volume



Experimental commercial lateral root shear: (Top left)—Rome TX-1600 harvester mounted on a conventional four-wheel-drive articulated loader, with hinged grip closed on tree to be harvested. (Top right)—View of grip in open position with shear retracted. (Bottom left)—Grip closed; in operation the knives grip the tree stem at ground level. (Bottom right)—Grip closed and tubular shear fully extended 20 inches. Steps that bear against soil surfaces during last nine inches of extension are visible on opposite outer sides of the shear tube. Side of the tube is independently driven through its 20-inch stroke by a six-inch hydraulic cylinder housed in the vertical column.

and wide distribution can provide raw material for new products and new industries. Harvest and utilization of this resource will improve softwood supplies through product substitution and by reducing costs of stand rehabilitation and conversion to pine.

Paul A. Murphy, also of the Southern Forest Experiment Station, described the resource. Of about 138 million acres of pine sites in the South, 53 per cent are covered with forests containing primarily hardwoods; only in the eastern Gulf States are the majority of pine sites dominated by pine types. Hardwood volume on pine sites totals about 54 billion cubic feet, and is increasing. More than half of this inventory is oak, and 45 per cent is in trees less than 11 inches dbh.

A photographic review of identifying features of the 22 species was presented by C. A. Brown and Harold E. Grelen; and Donald D. Hook described their physiology. Winter silhouettes of each species were viewed with considerable interest by the loggers and sawmillers in the audience.

Samuel J. Coughran said that Rome Industries' new tree puller can harvest 35 per cent more wood (basis of oven-dry weight) from each tree than can be obtained by conventional felling methods. In mixed hardwood stands with stems not exceeding eight inches, the machine can fell and bunch about 1.5 trees per minute.

Ralmond J. Smiltneek described progress by Techwood, Inc., in designing a debarker for hardwood root-wood and bolt-wood. The machine is comprised of a rotating drum in which steel balls are impacted against the tumbling wood. In short test runs, nearly 100 per cent of the bark was removed from oak roots and winter-cut hickory bolts.

To conclude the general session, John M. Blackford and James A. Parker described a merchandising deck capable of processing one to two stems of hardwood (20 to 40 feet in length) per minute into pulpwood, cross-tie logs, and saw-logs. Installed cost of the equipment is about $150,000, including $50,000 for a drum chipper to dispose of cull butt pieces. The rosser-head barker in the lay-out cost an additional $25,000, installed.

Processing Sessions

In a review of harvesting systems in the Southern pine region, James A. Altman noted that stump-to-stump shortwood logging with a bob-tailed truck is labor-intensive but probably the cheapest system for harvesting cordwood. Long-log logging and whole-tree chipping systems require less labor but more capital and management skill. Altman presented formulae showing that logging costs per cord are negatively correlated with tree diameter and stand density.

John R. Erickson explained how a system of nip rolls coupled with screens can remove most of the bark from mixed hardwoods chipped entire and then steamed. After processing, such chips should contain only three to five per cent bark by weight (oven-dry basis). The cost for debarking is estimated at $1.50 to $2 per green ton of barky chips for production-sized plants.

Richard E. O'Brien, Tom Richardson, and Kent B. Nerbonne (with W. N. Thompson) described experience with drum debarkers, ring debarkers, and rosser-head debarkers in processing mixed hardwoods. Hickory cut in the dormant season is probably the most difficult species to debark; each of the three systems can successfully debark hickory if equipment is correctly specified and applied.

Structural exterior flakeboard

The staff of the Southern Forest Experiment Station's Wood Utilization Research Project described the shaping-lathe headrig. Now in the final stages of commercialization, this machine is a key to utilizing small mixed hardwoods for pallets and industrial lumber. It is particularly adapted to short logs of irregular contour, since it relies for work-piece position on end-chucks rather than through-feed chains or rolls. Smoothness of machined surfaces approaches that of millwork. In contrast to other headrigs, this version can readily produce rounds, hexagons, octagons, and trapezoids as well as square or rectangular cants. It lends itself to the manufacture of pallet parts and other industrial lumber, together with posts and rails for fencing. Lathe residues in the form of flakes can be the raw material for a new major industry manufacturing exterior structural flakeboard, competitive in price and function with sheathing grades of plywood. Other likely uses for lathe residues include manufacture of pulp, medium-density particleboard, and molded composites of foamed resin and match-size wood particles.

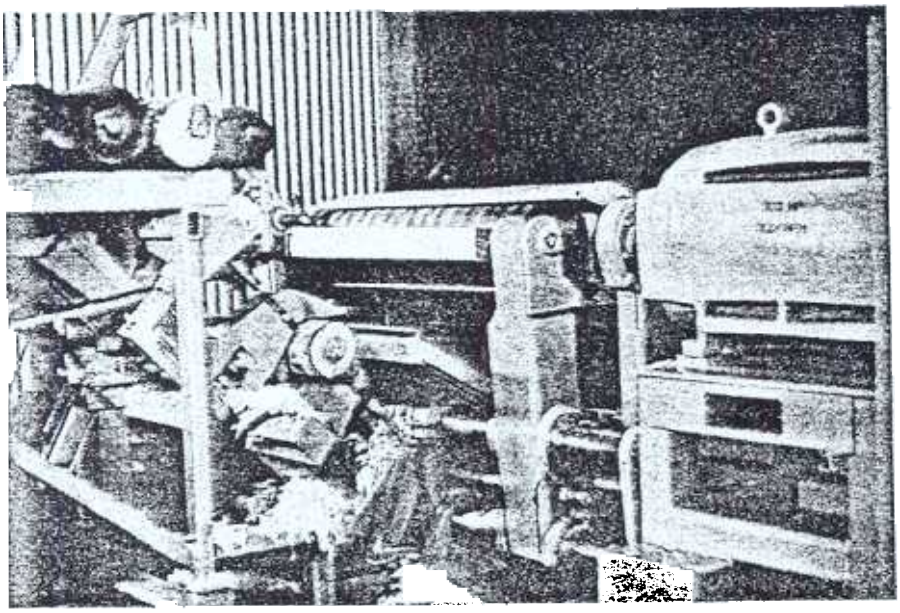
Richard N. Jorgensen concluded the three-hour session on structural exterior particleboard by reviewing U.S. experience in application of this new product.

Posts, cross-ties, and pallets

Charles J. Gatchell described factors controlling the market for guard-rail posts of red oak and Southern pine. The degree of application is dependent on success in getting them specified by State and Federal highway departments.

John P. Howe noted that U.S. railroads must soon substantially increase their purchases of cross-ties if roadbeds are to be maintained adequately. Fifty million ties are needed per year, whereas less than 20 million have been installed annually in recent years. Howe described a system of manufacturing 7- by 9-inch ties from pairs of 4.5- by 7-inch cants laminated with three pairs of ½-inch spiral steel dowels. Track tests have been favorable. Because the two-piece ties can be made from logs as small as 8.5 inches in diameter, timber supplies are adequate. It is likely that the system will be increasingly used.

E. George Stern, William B. Nelson, Jr., J. N. Brown, and Walter B. Wallin all spoke on various aspects of manufacturing and marketing pallets. Approximately 14 per cent of the lumber cut in the United States is now used in pallets and containers, and consumption is increasing. Although the pallet business is highly competitive, usage of hardwood lumber will increase and new sources are needed. The newly developed shaping-lathe headrig should substantially increase the efficiency with which pallet lumber is manufactured.



Commercial version of the shaping-lathe head-rig, including log deck, centering device, charger and take-away conveyor for machined cants. Flakes are blown from the cutterhead hood for conveying to flakeboard plant. Design feed rate is six logs per minute. Smoothly machined cants have the shape and dimensions of replaceable cams mounted on the workpiece spindle. The 40-inch-long 4" by 4" cant shown, has been completely machined and is poised just prior to chuck withdrawal and discharge to the take-away belt. (Photo from Stetson-Ross, Seattle.)

All species of Southern hardwoods can be utilized.

Sawmilling and chipping

Chandler W. Jones described Kimberly-Clark Corporation's experience at Waynesboro, Georgia, in converting Southern hardwoods with a double-taper chipper-canter. This chipping headrig feeds at 100 feet per minute on hardwood. It is in its start-up phase and to date has produced as much as 125,000 board feet of pine and 67,000 board feet of hardwood per eight-hour shift. It costs about $250,000, and has a unique feed-works arrangement for opening two faces parallel to the bark and at right angles to each other. It appears to have partially solved one of the most difficult of all sawmilling problems—application of a chipping headrig to random-length hardwoods of varying diameters from 6 to 20 inches. Studies indicate that the lumber recovery factor should be about eight board feet per cubic foot of log in-put and that in most cutting programs the double-taper pattern probably yields more lumber than other patterns of break-downs.

Some considerations in converting small Southern hardwoods with multiple high-strain bandmills were discussed by F. Edwin Allen and David Seffens. The mill described has four sets of six-foot twin bandsaws, each carrying saws 12 inches wide. Each saw is driven by a 200-horsepower motor. On logs averaging 12 to 13 inches in diameter and 14 feet long, hourly production is about 15,000 board feet.

Experience in starting up a computer-controlled carriage and band headrig cutting Southern hardwoods was recounted by Robert W. Worley. The sawmill operates with 11 men on the mill floor. As it has been operating for only a short time, reliable production figures are not yet available. In reviewing the function of the linebar resaw in mills cutting small Southern hardwoods, Robert K. Detjen noted that addition of such a resaw will usually increase capital costs and work force only 10 per cent, while doubling output.

Roy L. Sage summarized techniques by which hardwood cants three feet in length can be ripped into pallet lumber with circular gang-saws cutting a 3/16-inch kerf and feeding at 80 feet per minute. Production per 8-hour shift on 4 by 4's and 4 by 6's is about 80,000 board feet.

A new process for chipping small hardwoods into pulp-chips or fingerlings for ring flakers was described by John R. Erickson. For fingerlings, specific cutting energy is about nine horsepower minutes per cubic foot of hardwood chipped. The equipment is not yet in commercial production, but development is well advanced.

Fiberboards

W. M. McNeil, formerly of Bauer Bros., and Duane Keck of Sprout Waldron and Co., Inc., discussed effects of machine parameters on disk-refined fiber from Southern hardwood chips. Machines are available that give near 100-per cent yield of mechanical fiber from such chips. The fibers, which require about 5 to 10 hp days per ton (dry basis) to produce, are useful in a wide range of fiberboard products. Addition of steam under pressure to the refining zone increases the completeness of defibration. Over the years, machines have been designed with ever-increasing power. The largest are for refiner groundwood (i.e., fiber for paper) and carry disks 50 inches in diameter or slightly larger. They are driven by motors of 2,000 to 10,000 horsepower and can produce in excess of 100 tons of fiber for paper (oven-dry basis) per 24-hour day from mixed hardwood chips. Fiber for paper requires substantially more energy to refine than fiber for board products.

Arthur B. Bush noted that mixed Southern and Eastern hardwoods are being increasingly used in roofing felt, insulation board, medium-density fiberboard, and hardboard. Long-term forecasts indicate substantial growth in output—particularly in medium-density fiberboard for use as furniture panels, and hardboard for siding and other uses.

Otto Suchsland, George E. Woodson, and Robert R. Stevens explored in substantial depth the effects of species and processing variables on properties of medium-density fiberboards. They concluded that mixed Southern hardwoods can yield a highly satisfactory product. Inclusion of bark into the boards somewhat diminishes their modulus of rupture and modulus of elasticity. The

Suchsland-Woodson data showed that hot-pressed panels can be made to have a density profile identical to panels cured with high-frequency electrical energy.

Drying

Harry A. Raddin summarized techniques for drying hardwood flakes and fibers, and John F. Lutz reviewed manufacturing, drying, and use of hardwood veneers.

The drying of hardwood lumber was discussed at length. John L. Hill provided models for predicting moisture and straining gradients in red oak. Eugene M. Wengert reviewed procedures for air-drying, accelerated air-drying, and intermediate and high-temperature kilning of 4/4 through 8/4 Southern pine lumber. Observations on various drying methods for Southern hardwoods were provided by Stephen Hanover, Robert C. Gilmore, and Roy M. Carter. Finally, Bernard H. Shunk reviewed procedures for drying hardwood timbers, cross-ties, and posts.

Composites

Alan A. Marra described a new product—moldable wood-foam composites made of matchstick-size hardwood particles and urethane resin. The process he has developed is near commercialization; and he reviewed manufacturing techniques, properties, and markets.

Chung-Yun Hse summarized experimentation resulting in a sheathing panel with hardwood flake core and pine veneer faces. Such panels can significantly extend supplies of veneer and should be competitive in price and function with conventional Southern pine or Doglas-fir plywood sheathing.

Pulping

Y. S. Chao described the experiences of Olinkraft in pulping mixed Southern hardwoods chipped entire. In proportions up to 15 per cent of the furnish, such barky chips did not adversely affect pulping procedures or properties of the kraft corrugating medium.

A review of the techniques for making mechanical and semi-chemical pulp from Southern hardwoods was provided by John N. McGovern. He noted that markets for such pulps are likely to increase and that properties of the pulps are being improved through research.

Herbert A. Schroeder reviewed the use of Southern hardwoods for chemical pulps, and outlined areas in which hardwoods hold distinct advantages over pines in terms of pulping rate and chemical recovery, pulp properties, and process adaptability to use of whole-tree chips. Of all kraft pulp made in the South, 25% is derived from hardwoods. Bleached kraft pulps account for 79% of hardwood pulp manufacture. Unbleached kraft production currently amounts to only 7%, but increased use of hardwoods in linerboard furnish is expected to double this proportion. Semi-chemical pulps will continue to account for about 14% of hardwood pulp production, owing to their use in corrugating medium. The papermakers' strong interest in hardwoods was evident in their excellent response to an industry-wide questionnaire.

Donald F. Durso compared normal procedures for making cellulose derivatives from dissolving pulp with a new process for direct preparation from defibrated Southern hardwoods.

Characterization Sessions

Eighteen papers were devoted to a comprehensive description of pine-site hardwoods as an industrial material.

Anatomy was delineated by F. G. Manwiller, Fred W. Taylor, and Richard J. Thomas. Dean W. Einspahr reported on bark properties of importance to fiber products, and Julian R. Beckwith III described wood colors.

In a session on physical and mechanical properties, Elvin T. Choong reviewed information on permeability and equilibrium moisture content of 22 species, Manwiller provided data on specific gravity and moisture content, and Robert L. Ethington and B. Alan Bendtsen reported on wood strengths. Sorption isotherms of wood and bark were described by Christian Skaar and Kwami I. A. Okoh; a second paper by these authors reported electrical resistance of wood.

Chemical characterization of pine-site hardwoods was the subject of three review papers—by J. K. N. Jones on hemi-celluloses, by John M. Harkin on lignin, and by John W. Rowe on extractives. In addition, Manwiller reported chemical analyses, and Eugene Zavarin described the biochemistry of terpenoids.

Resistance of pine-site hardwoods to termites and decay was the subject of papers by Fairie Lyn Carter in collaboration with Terry L. Amburgey and by Rodney C. De Groot in collaboration with Francis I. McCracken.

Information Retrieval

In one of the most significant and interesting presentations of the symposium, Arthur B. Brauner, editor of the Forest Products Research Society, described the workings of the Society's new *Abstract Information Digest Service* (AIDS). This system is powerful, quick, economical, and simple to operate. Through use of AIDS, a subscriber can retrieve information on any subject or species in the world literature on wood utilization. Typical inquiries might include:

- What is known about the dulling of knives when machining particleboard?
- What articles review the concept of complete-tree utilization?
- How can one accelerate the kiln-drying of red oak?
- How are fibers produced for medium-density fiberboard?
- What is a good technique for staining rough-sawn Southern pine siding?

Access to the system is simple and may be accomplished in a number of ways to suit the needs of the user. For further information, the reader is advised to correspond with Mr. Brauner, at 2801 Marshall Court, Madison, Wisconsin 53705.

Conclusions

At the banquet following the technical sessions, Richard F. Blomquist, president of the Forest Products Research Society, traced the history of the Society and predicted that it would continue to be a major factor in development of the forest products industry.

After the formal sessions closed, about 60 of the symposium participants toured the laboratories of the Forest Products Utilization Project of the Southern Forest Experiment Station. The tour and the symposium ended at noon March 14.

No proceedings from the symposium will be issued, but it is hoped that most papers will be published individually in the *Forest Products Journal*, *Wood Science*, or in a variety of trade journals such as the SOUTHERN LUMBERMAN. A few wil be printed as university bulletins. Ultimately, all of the information presented, plus a good deal of additional data, will be published by the Southern Forest Experiment Station as a U.S. Department of Agriculture Handbook.

Direct Seeding Workshops

ATLANTA, Ga., April 15.—The Southern Forest Institute, with headquarters in Atlanta, is planning a series of area meetings in the South to provide "an arena for discussion" of the general subject of direct seeding.

Answers will be sought to such questions as: "Is direct seeding one of the tools a forester should have available in his bag of tricks. Could direct seeding be part of the answer to meeting the Third Forest goals? How effective has direct seeding been in certain areas of the South? How expensive is it to direct seed? What are the limitations of direct seeding?"

At these area meetings these and many other questions will be explored, with time to examine reports, surveys and research that has been done on direct seeding. Each of these meetings will be a "workshop", with some time for input from those in attendance.

Date and place of these three meetings have been announced as follows: Area I, May 29-30, Sheraton-Biloxi Motor Inn, Biloxi, Miss.; Area II, May 15-16, Sheraton Beach Motel, Panama City, Fla.; Area III, June 26-27, Rodeway Inn, Asheville, N. C.

Track-Type Loaders

Caterpillar Tractor Co. has recently published a brochure entitled, "Caterpillar Track-Type Loaders." This six-page, four-color piece gives a complete and up-to-date listing of machine specifications and attachments for the six track loader models offered in the product line.

Advantages and benefits of the many features of the Cat track loader line are also high-lighted.

Copies of the brochure (Form AEDC6035) are available at your local Caterpillar dealer.