Industrial Development Opportunities For Wood Products In Virginia

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The forest-based industry in Virginia, with some 65,000 employees, is already a significant contributor to the state's economy. But the forest resources of the Old Dominion, which cover 61 percent of its land area ranging from the mountains to the sea, are still underutilized. It is this under-used portion that holds opportunities for more industrial development and additional employment. Also, increased utilization would provide for increased forest and land management opportunities, thus improving the future potential of these forests.

This report discusses some of the opportunities for industrial expansion in Virginia's forest products industry. These opportunities are not unrealistic; in fact, all of them are either close to commercialization or already in production. Some of them would bring into production species and grades of timber that are not now being fully utilized. Others would add value to products already being manufactured. Some call for expansion of existing production; a few are completely new products.

The approximate investment requirements of these selected opportunities range from $50,000 to $40,000,000. Many entrepreneurs should find such product opportunities attractive.

That, in essence, is the purpose of this report. By flagging some specific forest product opportunities, we hope to pique the interest of entrepreneurs so they will seek further information. Be assured that the School of Forestry and Wildlife Resources stands ready to assist. This report should also be of interest to economic development professionals who are looking for potential investment and employment situations for their jurisdictions.

THE FOREST PRODUCTS INDUSTRY'S ROLE IN THE ECONOMY OF THE COMMONWEALTH

How important is forestry and the forest products industry to the economy of Virginia? Answer: Much more important than most people probably realize.

Logs, pulpwood, fuelwood, and other primary products provide more income for landowners and harvesters than any other agricultural crop in Virginia. In fact, as shown in Figure 1, the value of these timber products at the first point of delivery after harvest exceeded the combined value of tobacco, corn, and soybeans, the three most important cash crops produced in the state. Seventy-three percent of the volume of timber harvested was from farm and other non-industrial private landownerships. Presumably, a similar share of the value received for primary products went to those landowners and the people who harvested their timber.

After the first point of delivery, further processing by the forest products industry continues adding value to the wood raw material. Nationally, the lumber, furniture, and paper industries account for 8.5 percent of all the people employed in manufacturing. But in Virginia, the timber-based industries directly employ 65,000 people and account for 15 percent of all manufacturing employment in the state. These workers are employed by 1,400 manufacturing establishments with shipments valued at $3.8 billion and an annual payroll of $793 million. But it does not end there. When the people who owe their jobs to the transportation and marketing of forest products and to the use of these products in such areas as construction are added to the direct industry employment, the estimated total impact of the forest products industry in Virginia is 140,000 jobs.

VIRGINIA'S TIMBER RESOURCES

Of the 25.4 million acres of land in the Old Dominion, 15.4 million (61 percent) are commercial timberland. That does not include almost 500,000 acres of forested land set aside in parks, wilderness areas, or other reserved uses, or the 61,000 acres of woodland not capable of growing a minimum twenty cubic feet of wood per acre per year.

Twelve percent of the commercial timberland in Virginia is owned by the forest industry. By far the largest share, 75 percent, is owned by farmers and other individuals, estates, mining companies, railroads, and other private owners not in the forest industry. Federal, state, and local governments own and control the remaining 13 percent. Forest industry ownership is heaviest in the coastal plain, while national forests holdings are concentrated in the mountains of western Virginia.

From the mountains to the sea, the wide range of growing conditions provides a wide variety of timber species. The distribution of softwood and hardwood sawtimber volumes among the state's five timber survey regions is shown in Figure 2. While all oaks combined account for the greatest volume of timber and while yellow pines provide the largest volume harvested, yellow-poplar is the most abundant single species (Figure 3).

Between 1977 and 1986 the volume of pines and other softwood species increased five percent, and-the inventory of hardwoods increased eleven percent — this despite the reduction in total timberland acreage. While the total volumes may have increased, imbalances have developed between the growth and removals of particular species. As shown in Figure 4, harvests of softwoods — mostly yellow pines — in the coastal plain greatly exceed the annual growth of those species.

This condition can be rectified in time by a reduction of harvest levels and / or acceleration of reforestation and other cultural measures. Surpluses of softwood sawtimber growth in the other

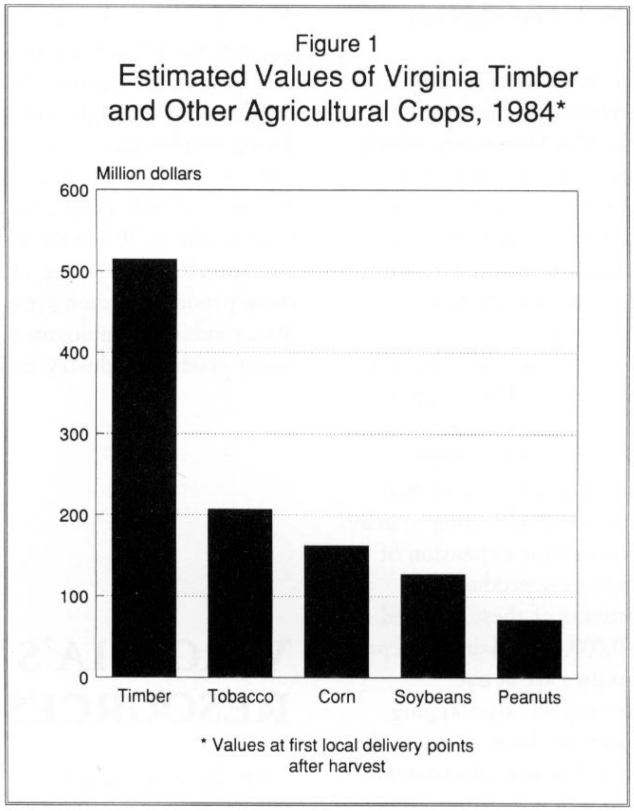


Figure 1
Estimated Values of Virginia Timber and Other Agricultural Crops, 1984*
Million dollars
600
500
400
300
200
100
0
Timber
Tobacco
Corn
Soybeans
Peanuts
* Values at first local delivery points after harvest

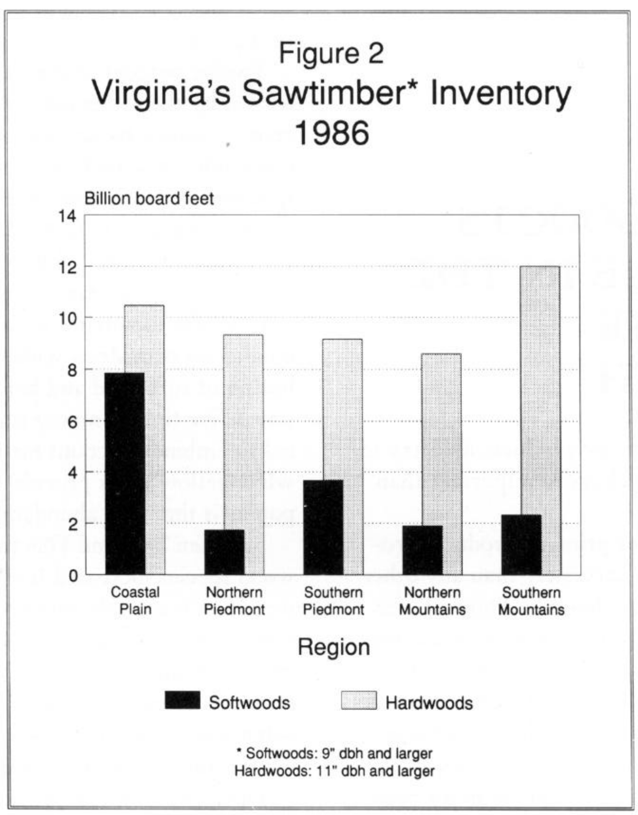


Figure 2
Virginia's Sawtimber* Inventory 1986
Billion board feet
14
12
10
8
6
4
2
0
Coastal Plain
Northern Piedmont
Southern Piedmont
Northern Mountains
Southern Mountains
Region
Softwoods
Hardwoods
* Softwoods: 9" dbh and larger
Hardwoods: 11" dbh and larger

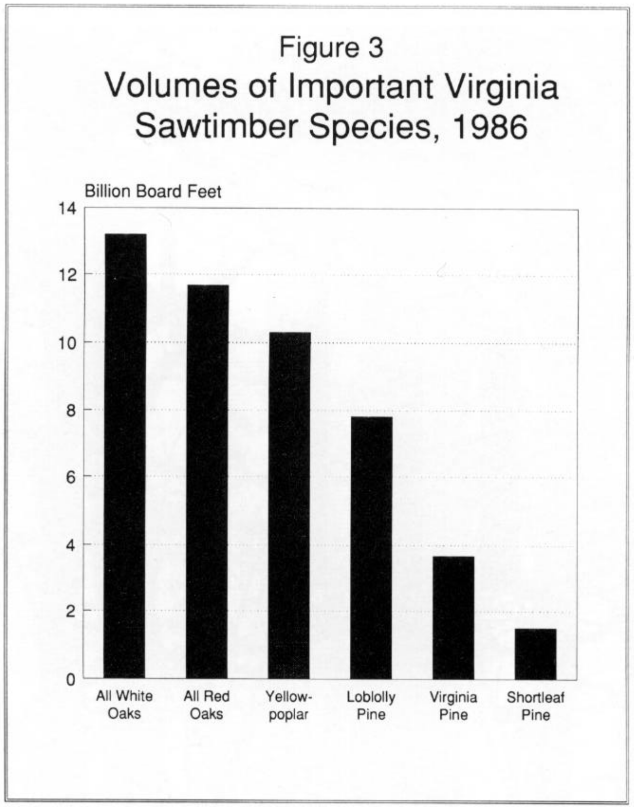


Figure 3
Volumes of Important Virginia Sawtimber Species, 1986

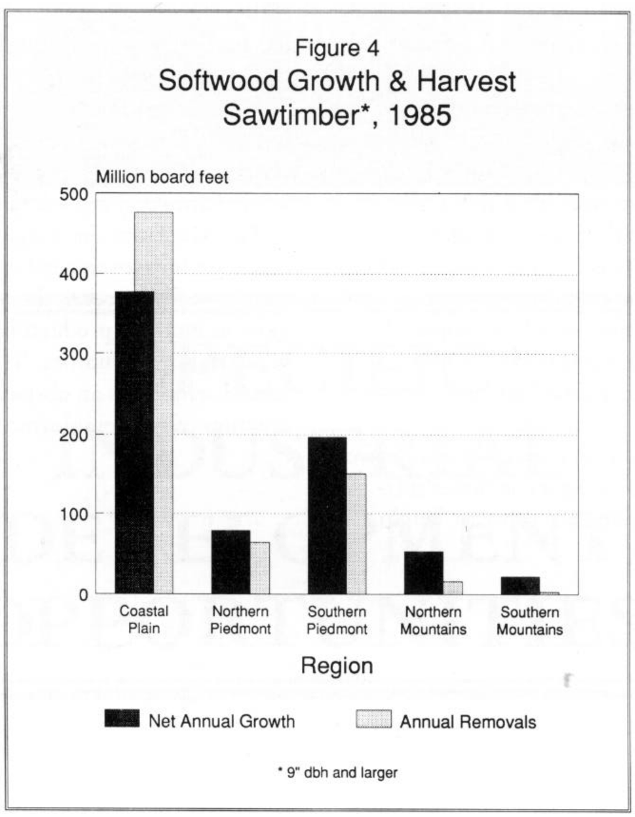
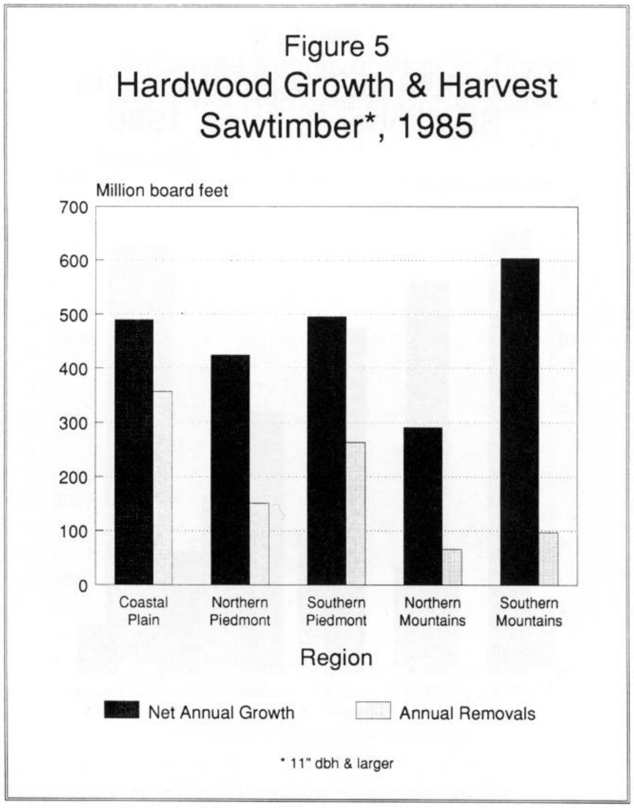


Figure 4
Softwood Growth & Harvest Sawtimber*, 1985

* 9" dbh and larger

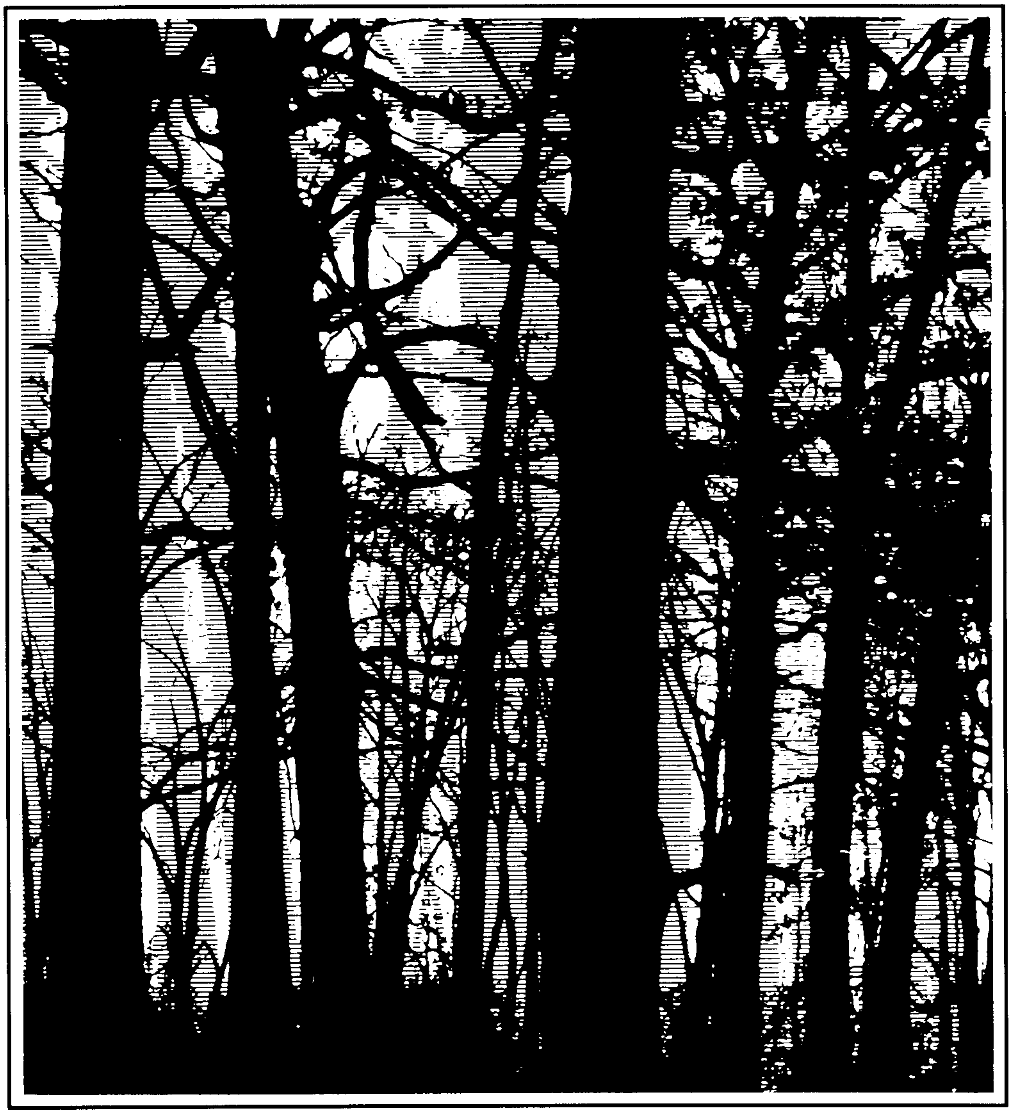


regions are largely the result of rapidly accumulating inventories of eastern white pine, especially in the northern and southern mountains regions.

The picture for the hardwood growth-removals balance is more consistently favorable for industrial development. Annual growth of hardwood sawtimber exceeds harvest volume in every region (Figure 5). Statewide, total sawtimber growth for all hardwood species is two-and-one-half times the rate of removals. Even with the highly demanded select red and white oaks, annual growth is twice the annual removals. But the species most responsible for the surplus of growth is yellow-poplar. Its growth rate statewide is three times its harvest rate. In the southern mountains, where it is the most abundant single species, its growth is eight times the rate of harvest.

The U.S. Forest Service's timber surveys measure trees in two overlapping categories. The sawtimber category includes softwood trees nine inches and larger in diameter at breast height (DBH) and hardwood trees eleven inches and larger. The growing stock category includes all trees five inches DBH and larger and their volume is expressed in cubic feet rather than board feet. Although this resource discussion has focused on sawtimber, the situation for growing stock would be similar: the ratio of softwood growth to removals is in approximate balance, while hardwood growth is about twice the volume of removals.

The data from the Virginia timber survey are clear: although there are unfavorable balances in the growth-removals relationships of a few species, there are abundant opportunities in Virginia to increase production of timber products and develop new industrial opportunities. The availability of timber raw materials should seldom be an obstacle to industrial investment and the creation of new employment opportunities in Virginia.



SPECIFIC INDUSTRIAL DEVELOPMENT OPPORTUNITIES

YELLOW-POPLAR STRUCTURAL LUMBER

Description of Product and Uses

The potential of yellow-poplar structural lumber results from efforts almost two decades ago to find markets for the Lake States' aspen timber. Researchers have developed the technology for producing construction lumber from aspen, yellow-poplar, and other low- and medium-density hardwoods. After the development of a grading system for the product and certification by the grading agencies, the use of construction lumber from low- and medium-density hardwoods was approved nationwide by the four model building codes and was accepted for use in homes having mortgage insurance from the Federal Housing Administration and the Veterans Administration.

Market Outlook

Demands for construction lumber are rising with population growth and GNP. Export markets for softwood products are expanding even more rapidly. But reforestation efforts in the major softwood lumber producing regions in the South, the West, and in Canada have lagged behind harvesting rates. Furthermore, preservationist pressures threaten to remove significant areas of forest land containing mature softwood timber from the industry's remaining timber base.

How will the industry react to the changing resource and market situation? As it has done historically, the lumber industry will seek new regions for investment and new species to supply its mills. And the market, as it has done historically, will adjust to use new species that are technically suitable and competitively priced. Virginia and the Central Appalachians could benefit from the creation of an industry based on yellow-poplar.

Resource Requirements

Yellow-poplar construction lumber can be produced from lower grade logs and from the centers of upper grade logs, thus making good use of the grades less preferred in hardwood lumber markets.

There is more yellow-poplar sawtimber in Virginia than the combined volumes of loblolly and shortleaf pines (Figure 3). And while those pine species provide the raw material for a substantial industry, their harvest rates are now greater than their rates of growth. But yellow-poplar in Virginia is growing three times faster than it is being harvested. Southwestern Virginia carries the state's largest volume of yellow-poplar sawtimber and its growth rate there exceeds its harvest by eight times.

Description of Production Process

Yellow-poplar structural lumber can be produced using conventional sawmill technologies. But if straight lumber is to be produced, care must be taken to relieve the natural growth stresses in the wood. After the better-grade side lumber is sawn from the log, the remaining center flitch can be dried and then ripped into 2x4, 2x6, or larger dimension structural lumber sizes (the saw-dry-rip or SDR process). An alternative method is to gang rip the center flitch before drying the lumber.

The marketing process is as important to success as the production process. The typical hardwood lumber mill — producing perhaps 2 to 5 million board feet of mixed species per year — probably could not generate enough volume of yellow-poplar structural lumber to be effective in the direct marketing of that product. A facility concentrating and perhaps drying, resawing, and grading the structural lumber production of several smaller sawmills might be necessary. In areas where yellow-poplar timber is most abundant, high speed, high volume sawmills dedicated to that species and similar to those used for softwood lumber production could be constructed. These larger mills could produce enough volume to be competitive with softwood producers in the construction lumber market. Softwood lumber mills, already in the structural lumber market but facing softwood log supply problems, could process yellow-poplar logs and sell their product in the usual manner.

In the opinion of market experts and of builders who have used yellow-poplar construction lumber, a well manufactured, straight, and competitively priced product should be able to compete in the market with softwood products.

Investment Required, Return, and Employment

The investment requirements for production of yellow-poplar structural lumber would depend on the scale of operations and whether the mill was new or a modified existing mill. It has been estimated that an existing hardwood mill could be converted to produce both structural lumber and standard hardwood grade lumber for $775,000. The return on investment would range from 32 to 51 percent (1980 costs and prices), depending on the grade mix of the log supply. This mill would have an annual production of 5 million board feet and employ twenty people.

A new mill with a two-shift annual capacity of 60 million board feet has been estimated to cost $11.8 million and return about 53 percent on the investment (1980 costs and prices). This mill would employ eighty-four persons.

prepared by:
John Muench

Figure 6. A house framed with yellow-poplar lumber being built by the Vocational School in Tazewell, VA.

CUT-TO-SIZE PALLET PARTS

Description of Products and Use

Pallet parts are solid wood deckboards, stringers, and blocks used in the fabrication of wood pallets. The moisture content of the wood parts varies from green to air-dried, and the size of deckboards are typically 1/2 to 7/8 inches thick by 3-1/2 to 6 inches wide by 3 to 5 feet in length. Stringers are typically 1-1/4 to 2-1/2 inches wide by 3-1/2 to 4 inches high by 3 to 5 feet in length. Stringers are sometimes notched and deckboards chamfered. Blocks are usually 3-1/2 inches wide by 3-1/2-inches high by 4-inches long. Part thickness will vary in l/6-inch increments, width in l/4-inch increments, and length every inch. occasionally parts are sold according to species. The parts are nailed together as pallets that are the base for the unit-load material handling system by which most products are stored and transported.

Market Potential

The pallet and container industry in the United States produces 450 million pallets a year, containing an average of 13.89 board feet of parts. This is approximately 6.25 billion board feet of cut parts. These cut parts, manufactured close to the raw material source, would be shipped and sold to pallet assembly mills located near markets in metropolitan regions. One of the principal markets for parts from Virginia is the northeast metropolitan corridor from Washington, DC to New York. Pallet parts are fabricated from low grade hardwood and softwood timber of any of the commercially available species within a region.

Description of the Production Process

Two processes for manufacturing these parts are common, depending on the form of the raw material. The raw material typically takes two forms: logs or cants and lumber. The log-base system would include a debarker, log cut-off saw, scragg sawmill, a double arbor circle gang saw, and a notcher and chamferer. The cant or lumber-base system would include cant or board trim saws, a double arbor circle gang saw, and a rip saw, notcher, and chamferer.

Investment

A cant or lumber-based processing system could be an expansion of an existing sawmill. Labor requirements would be ten to fifteen individuals producing 20 to 30 thousand board feet per day of parts. Approximately 4,000 to 5,000 square feet of building space is required for a cant or lumber base system and 8,000 to 10,000 square feet for a log-base system. The capital required for the cant or lumber based system would be $500,000 to $800,000; the log-base system would be approximately $900,000 to $1,500,000.

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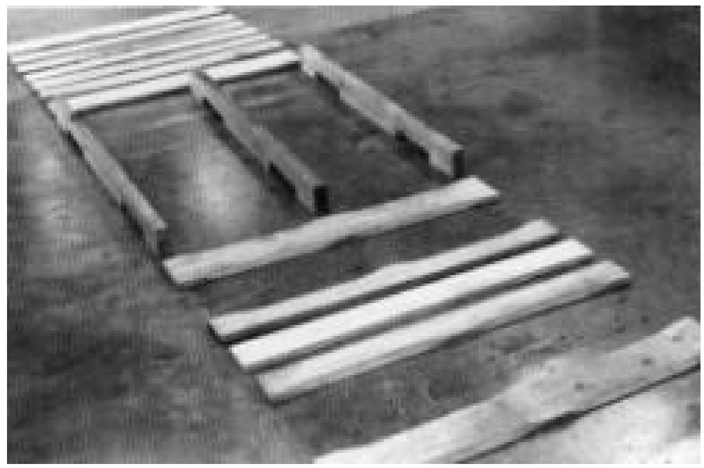
Marshall White



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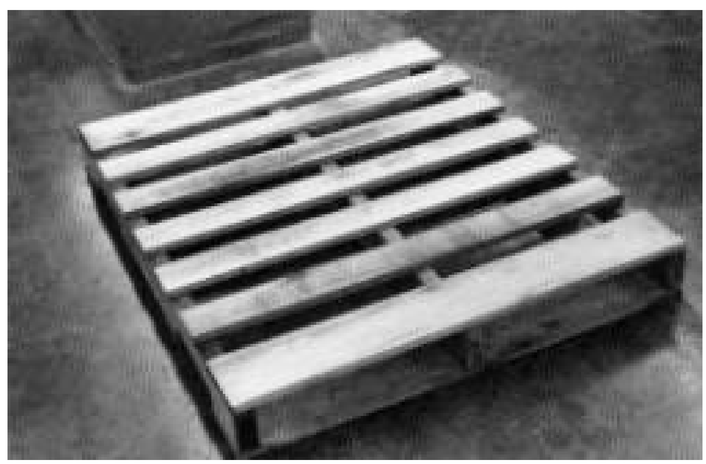

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Figure 7. A. Cut pallet parts ready for assembly.
B. An assembled warehouse pallet.

HARDWOOD DIMENSION STOCK AND FURNITURE PARTS INCLUDING EXPORT OPPORTUNITIES

Description of Products and Uses

Hardwood dimension stock is kiln-dried material that has been processed to a size and quality that permits maximum utility by users in assembling their products. The users of this material are typically companies that produce furniture, cabinets, millwork, toys, novelties, and other similar woodworking operations. The material is produced in specified thicknesses, widths, and lengths; it may be solid or glued up, including panels. Furniture dimension stock may be classified as rough, semi-finished, or finished. Manufacturing operations can be designed to produce rough and semi-finished dimension stock.

Rough dimension stock consists of rectangular pieces of wood cut and ripped to specific sizes and normally rough surfaced on two faces. Edge-glued panels would be included in this category.

Semi-finished dimension stock is rough stock that is machined one or more steps further in the manufacturing process. It may include such steps as re-ripping, finish surfacing, moulding, trimming, shaping, and mitering.

Market Potential

The market potential for dimension stock and furniture parts is growing in the domestic and international marketplaces. Locally, North Carolina and Virginia are the two largest wood household furniture manufacturing states. The regional production of cabinets is also substantial. While furniture and cabinet imports have increased in the past ten years, the long term outlook is for U.S. manufacturers to increase their competitiveness and reverse these trends. These factors, along with increased interest by furniture and cabinet manufacturers to expand their purchases of dimension stock and furniture parts, translate into opportunities for areas rich in timber resources to develop and expand dimension stock manufacturing facilities.

Hardwood exports have increased throughout the past fifteen years as the United States has become a major supplier of hardwood products in the international marketplace. Most of these exports have been in lumber, veneer, and unprocessed log form. Exports of further manufactured products such as rough and finished dimension materials have been limited, while the potential to supply such products seems to be excellent. Virginia has abundant resources and the potential to add more kiln-drying and dimension production capacity.

The potential demand for U.S. dimension stock, especially in Europe and Japan, appears to be excellent based on the demand for U.S. lumber and inquiries for rough dimension, strip stock, squares, and finished dimension. A set of potential standard sizes of rough dimension for the export market has also been developed.

Description of the Production Process

Hardwood lumber is delivered by truck and unloaded with a forklift. The lumber is graded and then stacked and stickered by hand and moved to an air-dry yard. As soon as possible, the lumber would be placed in dehumidification dryers for kiln drying. After drying, the lumber is transported to a dry lumber storage area in the plant. A drying system for larger operations would be a predryer followed by standard kiln drying.

As needed, dry lumber is moved from the dry storage area to an unstacker that feeds the cut and rip line. A cut-off saw equipped with a back gauge is used to cut the lumber into pieces. A conveyer carries the pieces through a rough planer. The material then moves to a sorting table and individual lengths are packed off onto carts. The carts are moved to straight line rip saws for ripping the pieces into fixed and random widths. This material is also packed off onto carts. A salvage saw will recover parts from the waste material.

The random width material goes to the edge-glued panel operation. Here, the material moves by conveyor over the glue rolls and the pieces are placed into panels and clamped in a clamp carrier. After gluing, the material is stored for final curing and then surfaced on two faces and end trimmed square.

The fixed width stock, if going into semi-finished dimension stock, will be further processed through a moulder and end trimmed or mitered. Also, panels can be ripped to the fixed width pieces for moulding or further processing.

All of the material will then move to a dry storage area to await packaging and shipping.

Investment

The capital costs can range from $200,000 to over $3,000,000 depending on facility size and production capacity. In the smallest facility, lumber would be purchased kiln dried and processing would be limited to the production of rough dimension stock for domestic or export customers, Six workers, plus two administrative people would be needed. Internal rates of return could average from 20 to 40 percent depending on output product prices and species processed.

A larger facility that has dry kilns and the equipment to process 32,000 board feet per day into rough dimension stock in a two-shift operation would cost about $3,000,000. This facility could employ seventy people and could generate internal rates of return of 40 percent after the initial start-up years of operation. As with the smaller facility, species processed, product prices, and sales would affect actual internal rates of return.

The addition of moulders, trim saws, and other equipment needed to produce semi-finished dimension could cost an additional $100,000 to $1,000,000. The additional employees required to operate this equipment would need increased training.

Prepared by:
Philip Araman
Fred Lamb

Figure 8. An example of various types of hardwood dimension stock and furniture parts.

WOOD WASTE RECYCLING

Description of Products and Uses

Nationally, 500 million tons of municipal solid waste are created annually. About 7 percent (or 35 million tons) is solid wood, principally from solid wood packaging, urban horticultural practices, and the demolition of buildings and related structures.

This wood accumulates in metropolitan areas where disposal problems are the greatest. The material can be recycled by reforming the wood. This includes dismantling broken structures, cutting the components, and refabricating structures with nailing machines. Non recyclable material would be ground into particles. Such operations can recycle discarded wood packaging and structures into new packaging and building components, as well as wood particle based products such as residential and industrial fuel, animal bedding, mulch, extenders for plastics, and comporting media, to name just a few.

Market Potential

Many municipalities are requiring source separation of their municipal waste. This would reduce the segregation cost to the recycler of solid wood. Raw material cost to the recycler can be negligible and in some cases, landfills will actually pay to have this solid wood material removed from waste sites. Also, certain metropolitan areas institute tax incentives for companies to enter the recycling business. Excellent opportunities, therefore, exist in metropolitan regions of Virginia to set up a company dedicated to solid wood waste recycling. One such operation is already successful in the Richmond area.

Description of the production Process

These facilities would include collection, receiving, processing, and shipping functions. Collection vans can be located at municipal dump sites to receive solid waste. Some separation can be performed at this location. For example, the separation of paper fiber from solid wood.

The receiving area at the manufacturing site would include raw material storage, dumping, and transfer facilities. Processing of this material would typically include dismantling, sawing, and re-nailing equipment as well as shredding and grinding machinery. For certain products, cleaning of the recycled material would be required. This can be done with dust collection systems as well as magnets to remove metal (usually nails or staples). Shipping would include a finished product storage facility as well as loading and transportation system.

Investment

Such a facility could be an expansion of an existing pallet recycling operation or a municipal landfill site. The recycling facility would employ twelve to-twenty individuals, recycling 10,000 to 20,000 board feet of lumber and grinding an additional 200 to 250 tons per day. The capital required for a primary recycling and grinding operation would be $1 to $1.3 million.

Prepared by:
Marshall White

A

B

Figure 9. A. The infeed line of a wood recycling plant.
B. The output: recycled wood particles.

COAL/WOOD COMBINATION FUEL PELLETS

Description of Products and Uses

Pelletized coal fines with wood or bark as a binder can be a valuable fuel resource. Wood — and specifically steam hydrolyzed wood (steam-explosion) — can act as an excellent binder for producing a durable, relatively low cost, high BTU combination coal / wood fuel pellet. Wood and bark fines can be used as a binder at between 30 and 40 percent of the total pellet weight. Binders from steam hydrolyzed wood yield a more durable pellet at a lower wood content (down to 5 percent) giving a higher BTU fuel pellet due to the larger percentage of coal

Market Potential

Currently large quantities of coal fines are wasted in the processing of coal in washing operations, coal slurry pipe lines, and other processes involving the cleaning and processing of coal.

In long-wall mining, up to 50 percent of the coal mined is wasted and in Virginia about 25 percent of all coal mining operations are long-wall. Long-wall mine tailing pit coal fines can have up to 50 percent shale in them, so estimates of the available useable fuel coal from these sources should be tempered. Fines from other coal processing operations will produce a cleaner, higher BTU value, lower ash fuel. With over 45 million tons of coal mined in Virginia each year, there is the potential for several million tons of useable, high BTU value coal fines for fuel pellets.

Coal, as an energy fuel, currently sells for up to $80 per ton on the retail (home and commercial) level. The price drops to between $40 and $45 per ton (delivered) for industrial and utility use. National and international coal prices are depressed along with most energy commodities. As petroleum prices rise, more upward pressure will be put on coal prices, making any coal waste recovery more attractive.

Coal fines from waste pits and piles can possibly be obtained free because of the negative value associated with the environmental costs related to their disposal or tailing pond leachate treatment. The costs for using this coal resource are those associated with dredging and hauling or conveying the coal to a pelletizing facility. By locating the pelletizing operation near the coal resource, these costs could be minimized.

The wood raw material necessary for this operation is readily available throughout Southwest Virginia where the majority of the coal waste resource is located. Under-valued hardwood sawdust and hogged bark fines are the least expensive. Hardwood chips processed by steam hydrolysis will be more expensive but will produce a more durable and higher BTU fuel pellet.

Markets for pelletized wood and pelletized coal fuels already exist in the upper Midwestern U.S. Some market development for coal / wood fuel pellets in the southern U.S. will have to be done. Demand for coal fuels is good in Southwest Virginia and neighboring regions and will improve as the prices for imported oil products rise.

Description of the Production Process

The process for producing pelletized coal with a wood binder is a simple one. Coal fines from tailing pits or piles are mixed in a tumble-type mixer with wood fines or steam hydrolyzed wood and then augured through a standard pellet mill. Some dewatering of the coal fines may be necessary-before pelletizing. This can be done by heating the tumble mixer (as a rotary dryer). The coal / wood fuel pellets can then be bulk stored for industrial or utility fuel or bagged for retail distribution.

Pelletizing technology exists in many industries from food and feed to the production of pelletized catalysts for the conversion of crude oil to gasoline. Pelletized coal and wood products are already being produced separately in similar operations using petroleum-based binders. The replacement of these petroleum-based binders will allow lower cost processing and more fully utilize Virginia forest resources.

Investment

The capital investment necessary for a moderately sized (one to two tons of pellets per hour) operation, including equipment, wood raw material, and pellet product storage facilities, and material handling, and built on a coal waste site with no land cost would be approximately $350,000 to $450,000. A facility located at the wood source may be up to 25 percent higher due to the need for storage and handling of the coal. A stand-alone facility that would require both wood and coal storage and handling could be up to 50 percent higher.

Operating costs for a one to two ton per hour facility would be about $30 to $40 per ton excluding the wood or coal cost. Expected approximate return on investment could be reasonable if the coal waste can be free. With a combination of 35 percent wood / 65 percent coal fuel product selling for $50 a ton and wood waste at $20 a green ton, a margin of $10 to $15 per ton could be realized.

Employment potential can be good for the complete operation, including pellet mill operators, truck drivers, and coal waste collection personnel. The operation, including state-of-the- art coal waste pit reclamation practices will require a mix of highly skilled and moderately skilled workers.

Prepared by:
Brecc Avellar

Figure 10. Steam-exploded wood fiber for use in a coal-wood fuel pellet operation..

REDRYING SOUTHERN YELLOW PINE AFTER TREATMENT

Description of Product, Use, and Market Potential

Approximately 50 percent of all southern pine lumber is treated with fire retardants or CCA wood preservatives after the initial drying and planing but before the lumber is used. These treatments, because they are water-based, result in an increase of moisture content after treatment to over 80 percent moisture content (MC). This means that a load of lumber that weighs 2,200 pounds per thousand board feet at 15 percent MC after drying and planing but before treatment will weigh over 3,450 pounds after treatment. Decreasing the MC after treatment will result in less weight per thousand board feet, which in turn will mean lower shipping costs (a typical savings can be $0.05 to $0.10 per mile per thousand board feet) by being able to load more lumber onto a truck before the weight limit is reached.

Along with the weight increase of 1,250 pounds, the lumber will also swell in thickness and width by 4 to 6 percent during treatment. Because wet, treated lumber put into use will eventually dry to an average 15 percent MC (except when used for marine structures), the treated pieces will subsequently shrink in-use (i. e., after installation) as they achieve moisture equilibrium with their environment. Drying after treatment, but before installation or use, will mean that there will be less shrinkage of the product after it is installed, which in turn means smaller cracks between pieces when used as decking and less likelihood of nail heads popping up above the surface.

If conventional steam equipment is used for redrying, the cost is in excess of $25 per thousand board feet assuming that energy costs are $5 per million BTU. Unless a boiler is available, capital costs for a new system can exceed $5 per board foot of capacity. An electric dehumidification system can also be used, with drying costs being slightly higher, but capital expense being only $3 per board foot of capacity. Both of these systems can produce dry pine lumber in 5 days or less. However, recent research has indicated that there is a substantial risk of strength loss when redrying lumber if the dryer temperature exceeds 140 degrees F; this lower temperature drying, required when maximum lumber strength is required, may extend drying time by another day.

Description of Process

As an alternative to these high capital and high operating cost systems, Virginia Tech has worked with Summerell Corporation in Roanoke, Virginia, and with several wood-treating firms in the Commonwealth, in developing a forced-air air-drying method of redrying treated pine. This system involves stacking lumber in a conventional manner for drying. The lumber is then put into a shed that has one wall (often the south wall) open (for loading) and the two end walls (east and west ends) closed. The fourth wall (north side) has a battery of fans that pull air through the load of lumber. Because the temperature used is outside air temperature, seldom exceeding 90 degrees F, maximum wood strength is maintained in a forced-air air-drying system.

Low MC (under 20 percent) can easily be obtained, with drying times averaging ten to twelve days in warm weather (as short as seven days in the summer). Wintertime drying is quite slow when temperatures are under 50 degrees F.

The forced-air air-dryer protects the lumber from rain and direct sunlight —the causes of much checking, splitting, and warp. Drying quality is therefore very good. With air velocities over 600 feet per minute, drying rates are quite rapid and final MC is quite uniform. For best results, the depth of the dryer (i.e., the air flow path direction) should not exceed 24 feet; better performance will be achieved with a depth of only 16 feet. The dryer is as long as needed to accommodate the required production. The dryer can be of any height. As a rough rule of thumb, there is 1 horsepower of fan power for each 6 thousand board feet in the dryer. Electrical energy consumption is about $10 per thousand board feet.

Investment

The cost of operating one of these dryers is under $15 per thousand board feet with the major cost component being electricity for the fans. The capital cost varies greatly, but a typical cost is $0.50 per board foot of capacity. Equipment required include a shed and the fans.

The suitability of these forced-air air-dryers for treated pine is attested to in that several firms in the Commonwealth have built them and subsequently added more units. There are over twenty treating plants in the Commonwealth, and there is an annual production of southern pine lumber in excess of 700 million board feet. Our relatively warm climate makes the forced-air air-dryer an especially attractive investment in Virginia.

In addition to expanded market opportunities available with lumber dried after treatment, the lower shipping weight per thousand board feet, will result in transportation savings. Using a savings of $0.075 per mile per thousand board feet, and using a drying cost of $15 per thousand board feet, for any haul over 200 miles, forced-air air-drying will be financially profitable as a result of shipping cost savings alone.

Prepared by:
Eugene Wengert

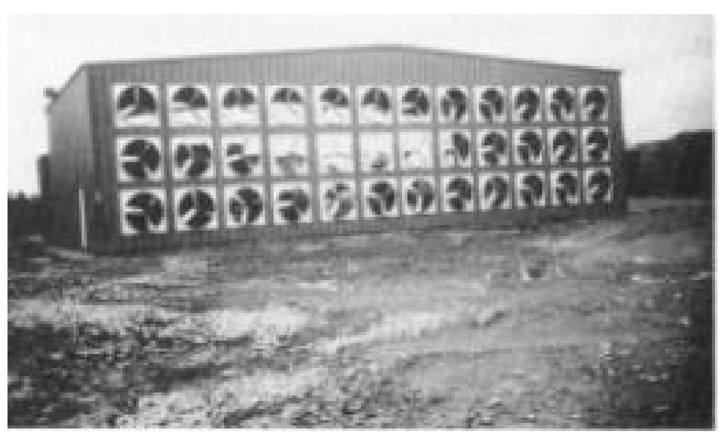


Figure 11. A forced-air drying shed for redrying CCA treated lumber.

OPPORTUNITIES FOR DEHUMIDIFICATION DRYING OF HARDWOOD LUMBER

Description of the Product, Use, and Marketing Potential

In recent years many hardwood sawmills, cabinet shops, and furniture shops have considered the opportunity for increasing the amount of processing that they do and thereby potentially increase their profitability. One processing area that is extremely attractive is lumber drying. The price difference between green lumber and kiln dried lumber is, for many species and thicknesses, in excess of $300 per thousand board feet. Drying costs, including everything from amortization of equipment, degrade, and energy down to lighting and snow removal, are seldom over $150 per thousand board feet (and are often much less).

In addition to the present demand and markets for kiln dried hardwood lumber in Virginia, forecasts are that our hardwood forests will be under increased pressure to provide larger and larger amounts of timber for the growing world demand. As all furniture and cabinet uses of hardwoods require kiln dried lumber (rather than green or air-dried), there will be a growing need for more kiln capacity to dry this increased lumber production. It would seem wise to encourage this drying to be done within Virginia rather than out-of-state.

Traditionally, kiln drying has required a steam boiler, and as a result, a substantial capital investment. Therefore, as a rule of thumb, it is difficult to economically justify a steam kiln operation for volumes under 2 million board feet per year. However, in the past decade a new drying system — dehumidification drying — relying on electrical power has been developed and today provides an excellent alternative drying method for the small (under 2 million board feet per year) producer.

Description of the Process

Dehumidification (DH) drying is an electrical heat pump process for controlling the temperature and humidity of air in a kiln. Lumber is stacked using stickers, typically 3/4-inches thick, and placed in an insulated building. Because of the low temperatures used in dehumidification drying, the building can be a wooden structure — 2x8 or 2x10 wood framing, 16-inches on center, with insulation between the framing members and plywood covering the interior and exterior walls.

Kiln size can vary, depending on the needs and resources of the company. There are units in Virginia under 20 thousand board feet and units over 75 thousand board feet. A typical industrial size building is 24 feet deep, 34 feet wide, and 24 feet high. This will hold 2 six-foot wide packages (total lumber depth of 12 feet) with 6 feet between the edge of the lumber piles and the front and back walls. The 34-foot width of the dryer can accommodate two piles of 16 feet long lumber, two 12-foot and an 8-foot, or several other combinations. The lumber pile height is nominally 18 feet, with the remaining six feet of height being used for the fans, which are mounted overhead. A dryer of this size will hold approximately 35 thousand board feet of lumber using 3/4-inch thick stickers.

The compressor is usually sized so that there is 1 horsepower for every 1 thousand board feet of lumber. For oak or other slow drying wood, the ratio can be decreased to 0.75 or slightly smaller; for fast drying wood such as pine, ash, and basswood, the ratio should be increased to 2 horsepower per thousand board feet.

A report recently prepared by Virginia Tech *(Opportunities for Dehumidification Drying of Hardwood Lumber in Virginia)* and available from the Lumber Manufacturers Association of Virginia, discusses all the possibilities for drying hardwood lumber. The electricity and labor requirements for DH drying are also discussed. In short, the report presents a positive opportunity for DH drying in Virginia. The economics are positive for almost all hardwood species.

Investment

An investment analysis is presented in the Virginia Tech report for a 50 thousand board feet dryer in Virginia drying 4/4 red oak from green to 6 percent MC. This analysis indicates that for a difference in price between green and kiln dried lumber of $200, the internal rate of return (after taxes) is 12.7 percent. This is certainly a very acceptable rate of return. The investment level is $144,000 for the kiln building, compressor, and auxiliary equipment. Included in this analysis is a total drying cost of $142.90 per thousand board feet (average of $4 per day). It is also noted that with a price difference of $300, the rate of return is 35 percent.

There are already about twelve DH installations in Virginia. Many of these installations have expanded their drying facilities after the first investment. Profitable operations in Virginia include both custom kiln drying operations and medium and small sawmill operations. There are potentially over 200 mills in Virginia that could expand into DH drying. Virginia Tech offers frequent operator training classes, as well as management classes.

Prepared by:
Eugene Wengert

Figure 12. A dehumidification dryer under construction.

LAMINATED VENEER LUMBER AND COMPOSITE I-BEAM

Description of the product or Uses

Laminated veneer lumber (LVL) is a structural lumber substitute that is produced from veneer. The veneer is oriented in a parallel arrangement and bonded using a waterproof adhesive. The primary advantage of LVL over solid sawn lumber is that LVL is less variable, therefore it has a larger allowable stress rating for structural uses. In addition, LVL can be produced in lengths that are several times longer than the log from which it is produced, with the only practical limit being the ability to transport the long lengths. These attributes make LVL a higher value product than solid sawn lumber.

Oriented strand board (OSB) is a structural panel produced from wood strands. The strands are oriented in a specific direction, in various layers throughout the panel, in order to optimize bending and shear properties. A waterproof adhesive is used. OSB competes directly with sheathing grades of plywood and makes an excellent web material for wood I-beams.

Wood I-beams are used for structural support members where long spans and light weight are required. This product can be made from LVL for the flanges and OSB for the web. The LVL/OSB I-beam is commercially available in the United States; however, a plywood web is more common. This product can be used for structural support with clear spans over 30 feet. The manufacture of wood I-beams is another value-added step in the utilization of low grade logs.

All of these products can be produced from small diameter trees and low-grade logs. Southern pine and Douglas-fir are the preferred species for LVL because of their high strength, relatively low density, high gluability, and well-developed veneer market. Yellow-poplar generally meets these criteria. OSB can be produced from a variety of species, although lower density species are preferred. Yellow-poplar is commonly used to produce OSB in the southeastern United States. Other low density hardwoods are also used, including sweetgum, tupelo, and blackgum. Southern pine is a commonly used species for OSB. Some high-density hardwoods, such as hickory and oak, are being mixed in small quantities in an OSB product produced in Louisiana. Because of its low density, white pine would probably be an excellent species for OSB. However, the lower strength and stiffness of white pine would not be desirable for LVL.

All of the technology required to produce these products is commercially available. These products have been accepted by the major building codes for residential and light commercial construction.

Markets

Extensive marketing channels have already been developed. Industrial LVL production in the U.S. started in the early 1970s. Currently, there are three companies producing this product domestically, with an annual capacity of approximately 13 million cubic feet. The world's largest LVL production is in Finland, which exports a significant amount of its product to North America.

LVL is a versatile product that is engineered for specific end uses. It is used where superior strength and light construction are required. LVL competes in the marketplace with steel, aluminum, and concrete, as well as with solid lumber and glulam beams. Applications include: headers, scaffold plank, truck beds, structural furniture parts, trusses, joists, and flange material for I-beams. The advantages of LVL are: the availability of dimensions that are not limited by log size, high strength to weight ratio (greater than concrete or steel), low variability, better dimensional stability than solid wood, and competitive price for larger dimensions.

The use of LVL in an all wood I-beam was first commercialized in 1980. Currently, there are twelve companies producing wood I-beams; this includes I-beams made with solid wood flanges. Annual production is roughly 130 million linear feet. The markets are residential construction, agricultural buildings, and light commercial construction. The primary attribute of wood I-beams, in addition to those listed for LVL, is an even greater strength to weight ratio than LVL. The primary uses are for roof and floor joists, and structural support beams.

Description of the Production Process

There are alternative manufacturing configurations for producing LVL and wood I-beams. The LVL and wood I-beam plants could be built on the same site in Southwest Virginia. The OSB would be purchased. Possible local suppliers of OSB are in Dungannon and Skippers, Virginia and in Elkin, North Carolina,

The construction of an OSB plant, in order to supply the web material for the I-beam plant, deserves consideration. Such a facility would provide an additional use for low-grade logs and also utilize some of the by-products from the LVL plant. As a part of a manufacturing complex, the addition of an OSB plant, along with the LVL plant, would allow for a log merchandising approach, thus optimizing the log resource. The better quality yellow-poplar logs would be directed toward the LVL plant, while the lower quality logs and mixed species would feed the OSB plant. However, current practice in OSB manufacture suggests that the smallest OSB plant that could be economically feasible has an annual capacity of about 90 million square feet (3/8-inch basis). This is 3.6 times the projected requirement for the I-beam plant. Markets for the additional OSB capacity would have to be found. The capital investment for a 90 million square feet OSB plant would be approximately $35 million. The return on investment for a commodity sheathing product is roughly 5 to 10 percent. A smaller capacity OSB plant may be possible, with a design that incorporates the emerging continuous pressing technology.

The primary raw materials for these manufacturing facilities include veneer quality yellow-poplar logs, OSB, and phenolic-based adhesives. The LVL plant would require 9 million cubic feet of yellow-poplar per year (other species could be added to the mix for specific product applications). Approximately 25 million square feet of 3/8 inch thick OSB would be required for the wood I-beams. Fifty percent of the LVL plant's production would be used by the I-beam plant for the flange material.

Investment

The estimated capital investment for the LVL plant is $40 million. The capacity would be 4 million cubic feet-per year, with four continuous press lines and twenty shifts per week. The LVL plant would employ approximately 120 people, including the office personnel. Existing LVL manufacturers have realized a return on investment of approximately 20 percent.

The estimated capital investment for the wood I-beam plant is $5 million. The capacity would be 25 million linear feet per year, assuming an average beam depth of 12 inches, and twenty shifts per week. The I-beam plant would employ approximately eighty-five people, including the office personnel. Existing wood I-beam manufacturers have realized a return on investment of approximately 25 percent.

Prepared by:
Frederick Kamke

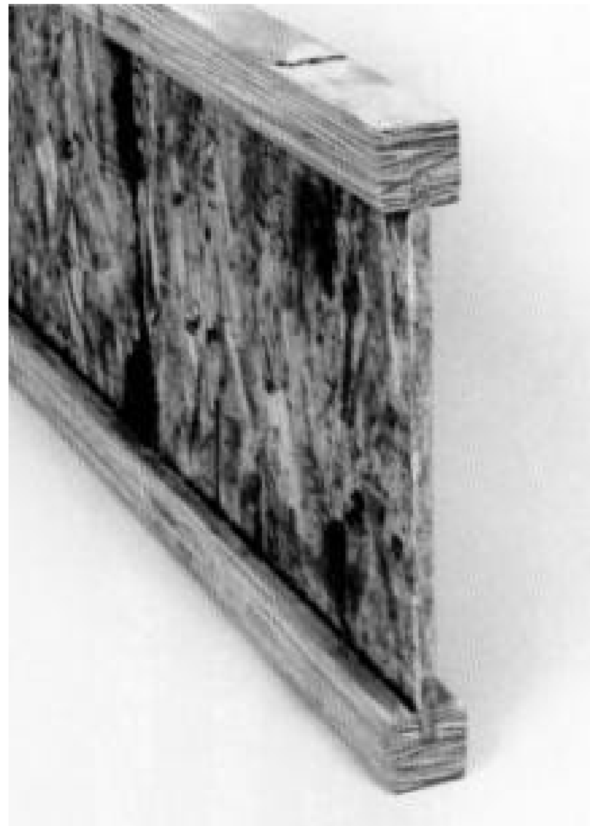
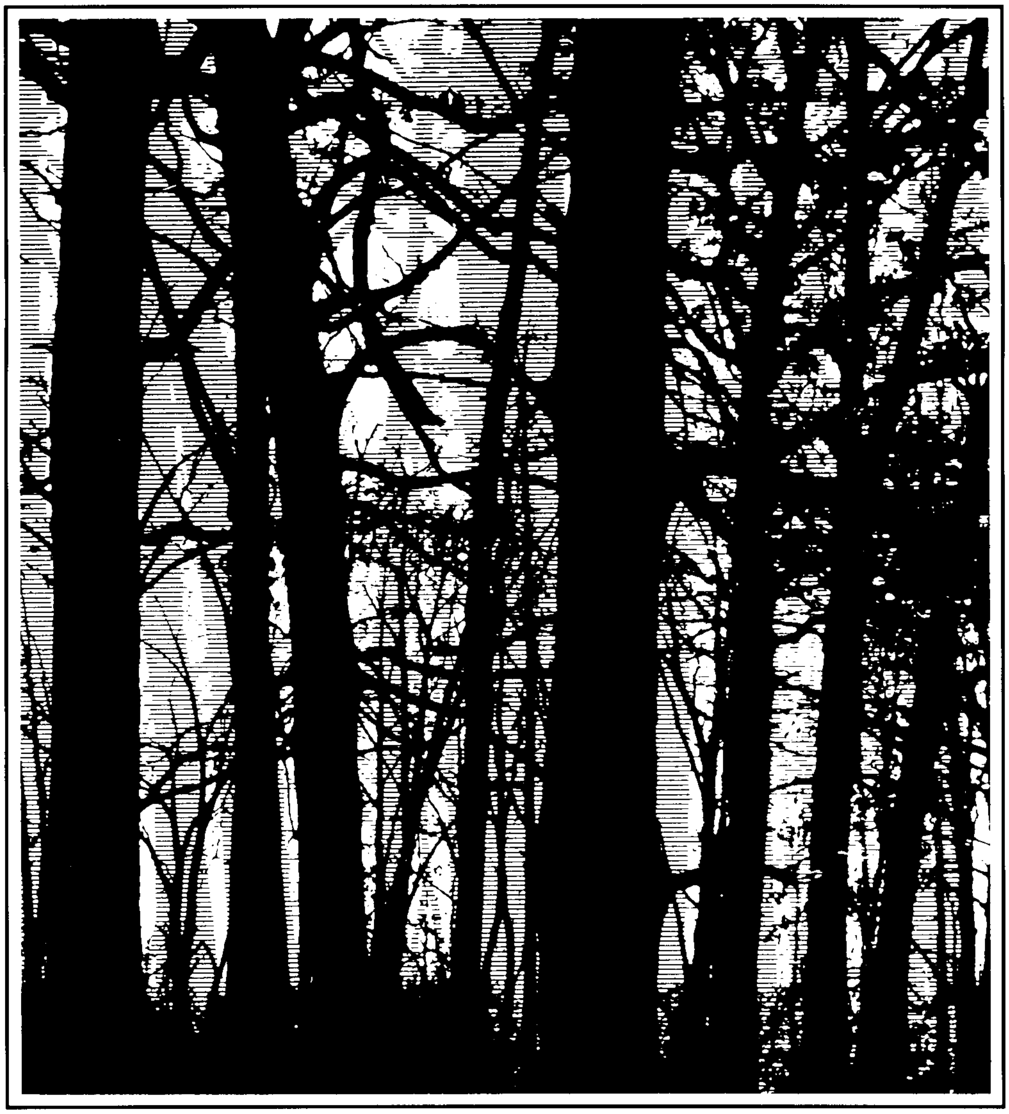


Figure 13. A wood I-beam with LVL flanges and an OSB web.



OTHER OPPORTUNITIES DESERVING CONSIDERATION

OTHER OPPORTUNITIES DESERVING CONSIDERATION

The products described in the previous pages all appear to have a good chance for commercial success in Virginia. But certainly these are not the only ones. Listed below are several other products that deserve consideration and further investigation by the reader looking for new opportunities.

Millwork and Mouldings

Little use is being made of eastern white pine timber in the western part of the state where the sawtimber inventory is more than one billion board feet and annual growth is more than twelve times the rate of removals. Wood quality is improving with accumulating tree growth. A sawmill-planing mill, possibly with finger-jointing capacity, could produce millwork that would compete favorably with that produced by the western mills. yellow-poplar would also provide suitable raw material for these products.

Pressure-Treated Southern Pine Shakes

The Texas Forest Service's Forest Products Laboratory pioneered the research for production of CCA treated southern pine shakes. The grading system they developed led to the product being approved for residential and other uses by the model building codes, including the code used in Virginia. Two mills in Texas and one in Missouri are currently in production. At least two other mills are under construction.

Panel Laminating

The use of panel materials within the furniture and cabinet industries continues to grow. A company can be established to provide a range of such panels. The company would buy cut-to-size particleboard and medium-density fiberboard (MDF) and laminate them with veneer or one of the high-pressure-laminate materials, panels could also be vinyl or veneer wrapped.

Incubator Facility for Small, Custom Furniture Makers

A hardwood furniture parts manufacturing facility, as described in the preceding section, could also act as an incubator facility for small, custum furniture makers. These custom furniture makers could rent or lease space from the parts manufacturer. There may also be a pool of machinery in a common area that the furniture makers could use. The parts manufacturer would be able to provide a ready source of dry lumber, because its operation includes a drying facility. Centralized accounting and business record services could also be made available to the furniture makers. Through its own production and marketing, the parts manufacturer could provide stability to the operation while providing an opportunity for the custom furniture makers to develop their individual businesses.

SELECTED FACILITIES OF THE SCHOOL OF FORESTRY AND WILDLIFE RESOURCES

SELECTED FACILITIES OF THE SCHOOL OF FORESTRY AND WILDLIFE RESOURCES

The forestry and wildlife program at Virginia Tech started in 1925 with the employment of the first Extension Forester. The teaching and research programs started in 1936 in the Biology Department.

In 1959 a separate Department of Forestry and Wildlife was established, and the decision was made to develop a fully-accredited program. At that time, the new department also became responsible for all activities in the renewable natural resources field, including cooperative extension and research. In 1976 a School of Forestry and Wildlife Resources was established. Currently the school is comprised of three separate departments: Department of Forestry, Department of Wood Science and Forest Products, and Department of Fisheries and Wildlife. Program specializations include forest resources management, wildlife, fisheries, forest products utilization, forest products marketing, industrial forestry operations, outdoor recreation, and environmental conservation.

Commonwealth Center for Excellence in Wood Science and Technology

Upon recommendation by the State Council of Higher Education for Virginia (SCHEV), the Governor requested funding for seven centers of excellence from the 1988 Virginia General Assembly. Funds were appropriated as requested and the seven centers were established in July, 1988 at four state-supported universities. One of the seven centers established and funded was the Commonwealth Center for Wood Science and Technology.

A major goal of these centers is to encourage and foster an effective scholarly environment vital to the continued strong growth of the commonwealth's academic establishment. But the impact of these centers is in their emphasis upon a wide spectrum of problems and concerns is not confined within the borders of Virginia. The expanding role of Commonwealth Centers encompasses both the national and international arenas. In establishing the Commonwealth Center for Wood Science and Technology, SCHEV released the following:

> Wood science and technology at Virginia Polytechnic Institute and State University has gained national and international prominence on the basis of applied research and technology transfer. Building on this established reputation, the newly created Commonwealth Center for Wood Science and Technology at this land-grant institution is creating a comprehensive program of excellence in wood science and technology research.
>
> The general objective of the center is to help position Virginia Tech as a leading institution in research and teaching at both national and international levels. In attaining this objective, faculty at the center will focus on fundamental research and undergraduate and graduate instruction. Specific areas of research and instruction will involve:
>
> 1. Research
>   a. Forest harvesting
>   b. Process automation for wood products manufacturing
>   c. Wood-based composite materials
>   d. Chemical and biochemical conversion of wood
>
> 2. Instruction
>   a. Undergraduate education in wood technology
>   b. Graduate education in wood science

The Thomas M. Brooks Forest Products Center

The Thomas M. Brooks Forest Products Center is one of the largest university wood research facilities in the U.S. It is named after the late Thomas M. Brooks, a lumberman from Quinton, Virginia, who was committed to the proper use of Virginia's forest resources. Construction of the first unit — the William H. Sardo, Jr. Pallet and Container Research Laboratory — was a milestone in the development of the Center in its present form. Funds for the 7,300 sq. ft. laboratory were provided by the National Wooden Pallet and Container Association in 1975. The second phase of construction — the 14,700 sq. ft. Wood Products Processing Laboratory —was completed in 1978 with private funds primarily from Thomas M. Brooks and Julian N. Cheatham. The final units of the Center, totaling 15,000 sq. ft., were completed in 1987. The latter units consist of the Forest Harvesting Research Laboratory, a classroom, and a wood engineering research facility. Funds for the final phase of construction were provided by the Virginia General Assembly in the form of a special capital appropriation. The primary mission of the Center is to assist the wood industry in developing cost-effective methods for the conversion of wood to consumer products. The educational mission includes formal undergraduate and graduate teaching, as well as continuing education for employees of Virginia's wood products industry.

RELEVANT FACULTY EXPERTISE

Many of the faculty members of the School of Forestry and Wildlife Resources have expertise and interests relevant to industrial and economic development. The reader is invited to consult with them about the industrial development opportunities described in this publication.

Department of Wood Science and Forest Products

Philip A. Araman (703) 231-5341
primary wood utilization; hardwood processing and utilization; hardwood export products; international opportunities.

Brecc Avellar (703) 231-5370
Technology development and transfer in wood-based chemicals and polymers.

Wolfgang G. Glasser (703) 231-4403
Structure-property relationships of biopolymers and biocomposites; structure, reactivity, and utilization of lignin.

Frederick A. Kamke (703) 231-7100
Heat and mass transfer in wood and wood products; wood-base composite materials.

D. Earl Kline (703) 231-8841
Industrial engineering; wood process control and automation; expert systems; machine vision.

Fred M. Lamb (703) 231-7256
Wood processing and machining; furniture manufacturing; industrial noise; occupational safety and health.

Joseph R. Loferski (703) 231-4405
Design of wood structures; computer-aided structural design; probabilistic design methods; architectural preservation technology.

John Muench (703) 231-7656
Industrial and economic development; forest products markets and international trade; timber resource statistics.

Steven A. Sinclair (703) 231-4941
Marketing of wood products; strategic management issues in the forest products industry.

Eugene M. Wengert (703) 231-5560
Primary processing; sawmilling, grading, lumber drying, moisture relations; solar drying.

Marshall S. White (703) 231-7134
primary wood processing; pallet and container design and performance; bio-mass conversion to process energy.

Department of Forestry

Harry L. Haney, Jr. (703) 231-5212
Management of non-industrial private forests; forest taxation.

W. David Klemperer (703) 231-7267
Forest investment analysis and taxation; risk analysis; optimizing timber management regimes.

William A. Leuschner (703) 231-5484
Economics of industrial forestry; economic impact analysis; international forestry.

Thomas W. Reisinger (703) 231-4523
Harvest planning; applications of geographic information/decision support systems to industrial problems.

Robert M. Shaffer (703) 231-7744
Timber harvesting; timber procurement; economic analysis of industrial forestry operations.

William B. Stuart (703) 231-7674
Timber harvesting and transport methodologies.

Jay Sullivan (703) 231-4356
Role of forestry activities in local economic development; multiple-use management of public forest lands.

Harold W. Wisdom (703) 231-7266
International trade, international forestry; econometric models.

SOURCES OF BUSINESS ASSISTANCE IN VIRGINIA

SOURCES OF BUSINESS ASSISTANCE IN VIRGINIA

There are many sources of assistance in Virginia for the individual seeking to expand an existing operation or to start a new one. The following are three major contacts.

Virginia Department of Economic Development

This state agency provides professional services and information on such topics as:

Industrial Sites and Buildings
Labor Availability and Costs
Industrial Training Programs
State and Local Taxes
Utilities
Transportation Services
Financing
Laws and Regulations

The Department also provides information assessing the general business climate and living conditions of Virginia.

Virginia Department of Economic Development
P.O. Box 798
Richmond, VA 23206
(804) 371-8100

Virginia Department of Forestry

This state agency provides professional information and assistance on the timber resources of Virginia and forest products utilization and marketing.

Virginia Department of Forestry
P.O. Box 3758
Charlottesville, VA 22903
(804) 977-6555

Virginia Business Resource Directory

A comprehensive listing of assistance is available in a publication entitled "Virginia Business Resource Directory", published by the Virginia Employment Commission in cooperation with the Virginia Chamber of Commerce and the Virginia Department of Economic Development. The following is a listing of the topics in this publication:

- Getting Started
- Business Planning Process
  - Suggested Outline for a Business Plan
  - Business Plan Development Resources
- Management — Legal Aspects, Taxes, and Insurance
  - Forms of Organization
  - Taxation
  - Federal Regulations
  - Insurance
  - Resources on Legal Aspects, Taxes, and Insurance
- Management — Employees and Other Personnel Issues
  - Job Descriptions
  - Recruiting and Training
  - Hiring
  - Immigration Reform and Control Act
  - Incubators
  - Leasing Employees
  - Crime Prevention
- Money
  - Loans
  - Federal Lending Programs
  - State Financing Programs
- Marketing
  - Research
  - Pricing products and Services
  - Trade Shows
  - Doing Business with the State and Federal Government
  - Export Sales
- Regulations, Registrations, and Licenses

Copies of the *Virginia Business Resource Directory* are available from:

Virginia Employment Commission
Economic Information Services Division
703 East Main Street
P.O. Box 1358
Richmond, VA 23211
(804) 786-7496

The School of Forestry and Wildlife Resources
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061