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United States  
Department of  
Agriculture  
Forest Service  
Miscellaneous  
Publication 1473

# Impacts of Forest Industries on Forest Resources in the South





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**This publication is a supplement to Forest Resource Report 24, "The South's Fourth Forest: Alternatives for the Future," a comprehensive analysis of the timber situation in the 12 Southern States prepared by the Forest Service in collaboration with State forestry agencies, forestry schools, and other forestry interests.**

**"The South's Fourth Forest" is available for purchase from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, in both paperbound and microfiche.**

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Washington, DC

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December 1989

# **Impacts of Forest Industries on Forest Resources in the South**

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# Forest Management of Industrial Lands

## The Development of the Forest Industry in the South

Forest industry in the South began with handsawn lumber, pit saws, and water-powered mills. The use of wood for home heating, the development of spar timbers for ships' masts, and early turpentine activities must be considered the forerunners of the industry. However, any study of the timber industry must date its inception to the appearance of large sawmills with their lumbering camps and logging railroads.

In the early years, nobody thought much about regenerating the forests. Most mills followed a "clearcut-and-get-out" philosophy and method of operation.

It might be surprising to today's industrial foresters--whose chief association, the National Forest Products Association, strongly believes the private landowner is well suited to manage his timberlands with minimum government

regulation--that it was not always thus. In Chicago on July 10, 1920, the directors of the National Lumber Manufacturers Association (predecessor of the National Forest Products Association) adopted the following resolutions:

Growing timber crops must be largely, though by no means wholly, a Government and State function. Hence, both should acquire, by purchase and by exchange of stumpage for land, much larger areas of permanent forest land than they now possess. Such acquirement should be largely cut-over land, to assure proper care thereof as well as economy in public expenditure.

If private owners refuse to either sell for such purpose, or to take reasonable steps themselves to keep in timber crops, any deforested land competently classified as suitable chiefly for forest growing and not suitable for agriculture,

Government and States should be permitted to condemn and pay for it at prices comparable to those paid in voluntary transactions (National Lumber Manufacturers Association 1920).

This resolution reflects the attitude of most sawmillers of the early 1900's throughout the South. It was reinforced by tax procedures of the day, which encouraged clearcutting by taxing lands with merchantable timber at a higher level than completely cut-over lands. The constant struggle to remove standing timber from ad valorem taxes had its genesis in this anticonservation policy of taxing authorities.

Favorable tax treatment for timber-growing is without doubt in the minds of many the Federal Government's strongest conservation tool. The capital gains treatment of timber income, as stated by a former United States Senator in private conversation, should always be justified, not on tax grounds but because of the favorable effect the 1944 passage of timber capital gains legislation had on private timber-growing efforts.

In contrast to the 1920 resolutions of the National Lumber Manufacturers Association, and more in line with current industrial thinking, was a recommendation by D.C. Everest, president of the American Pulp and Paper Association, at a national conference on commercial forestry sponsored by the U.S. Chamber of Commerce in Chicago on November 16-17, 1927. Everest made a point of the need to educate the public so that larger governmental appropriations for research would be forthcoming. He felt that research was the panacea for all the problems of management and utilization, and it was the obligation of the Government--in the interest of perpetuating timber supplies for the general welfare--to carry out research because it was best suited for such a continuing effort (Clepper 1971, p. 201).

In the early 1900's, the thriving naval stores industry was important in itself, but by far the greatest impact on the resource was caused by the large sawmills cutting virgin stands of yellow pine, primarily longleaf (*Pinus palustris* Mill.) and loblolly pine (*Pinus taeda* L.) in the coastal and lower Piedmont

areas. Somewhat smaller mills cut shortleaf (*Pinus echinata* Mill.) and other pine species in the Piedmont.

The southern industry today little resembles the mills or philosophies of these early sawmill forebears. Today's southern timber industry consists primarily of sawmills, plywood plants, pole-treating plants, and pulpmills, all utilizing timber diameters previously considered uneconomical or marginal at best.

Pulpmills now use pine timbers at the small end of the spectrum, primarily from trees 4-8 inches in diameter. Small-log sawmills utilize stems from 8- to 14-inch trees, and plywood plants use timber from trees greater than 14 inches in diameter.

To varying degrees, many plants use the residual fiber left from commercial logging jobs, including bark, limbs, branches, and leaves, as fuel in their boilers. The Organization of Petroleum Exporting Countries (OPEC), with its attempts to control oil prices and quantities, is providing the economic impetus for this utilization.

Where a market for this residual fiber for fuel is available, it is strikingly reducing the cost of forest management by eliminating or greatly lowering site-preparation costs before planting.

Perhaps one of the greatest facts of economic portent, not fully recognized by traditional thinkers, is that each of these three major facility types (pulpmills, sawmills, and plywood mills) can within reasonable physical and economic ranges utilize material of the same size. Pulpmills typically have chippers to handle material 24 inches in diameter. Small-log sawmills will frequently cut 6-inch to 24-inch material. And plywood plants are being automated to peel 7-inch veneer bolts, although management prefers larger sizes.

Competition for and utilization of timber sizes in the future may well be decided on a week-to-week basis by prices obtainable for end products and their manufacturing costs. This will mark a significant departure from the time-honored classification of trees by sizes into pulpwood, small logs, large logs, poles, and veneer logs.

The decisions of industrial foresters and other landowners on the rotation age of the millions of acres of pine plantations currently growing and being planted in the South will have an obvious impact on the material sizes available to industry. People and computers continue to attempt to analyze every facet of genetics, spacing, species, burning, and stand improvement in an effort to optimize return on forest investments while supplying their industrial, recreational, and esthetic needs and wants.

Hardwood forests are a major component of southern timberlands, supporting a thriving, if erratic, sawmill industry that specializes in furniture stock, hardwood flooring, and highly prized and priced veneer for interior residential and commercial uses and facings for furniture.

The management of these hardwood lands is a complex and challenging job that industry undertakes primarily by natural stand management emphasizing the favored species. There are limited but ongoing efforts at plantation management of a relatively small number of species being grown with specific

end products in mind. Crown-Zellerbach has intensively managed cottonwood plantations in the Mississippi Delta, and International Paper Company has established sweetgum plantations on its Mississippi River bottomlands for specific mill needs.

These activities, taken in the face of an ever-decreasing quality of remaining trees, are most difficult to quantify and will not be further dealt with in this study.

Hardwoods are playing an ever-increasing role in the pulp industry, both as a raw material and as boiler fuel, and may yet require much more professional attention than they currently attract.

William Parks established the South's first papermill at Williamsburg, VA, in 1774, primarily using rags as raw material. The first serious attempt to manufacture paper from southern pine was undertaken in 1903 near Pensacola, FL, by the firm of Smith and Thomas. It was a failure (Oden 1973, p. 23).

The really significant beginning of today's

southern pulp and paper industry was the use of the sulfate process in 1909 at Roanoke Rapids, NC, by Roanoke Rapids Paper Manufacturing Company (later Albemarle) (Oden 1973, p. 15).

Today, there are 91 pulpmills and papermills in the South, using millions of cords of wood annually. They are dependent upon the conservation efforts of industry, government, and private landowners for this raw material. Under the management guidance of thousands of foresters trained in the professional forestry curriculums of American universities, this challenge is being met.

### **Early Conservation Efforts by Industry**

The first stirring of forestry practices on industrial lands in the South dealt primarily with fire control in an effort to protect the forests and young growth on cut-over lands from the ravages of wildfires.

On a southwide basis, perhaps no man stands out in all the literature more strongly than Austin Cary, who played the role of roving consultant to the States and industry as an

extension specialist for the USDA Forest Service. Listed among the dozens of companies that utilized his services or teachings are Alger-Sullivan Lumber Company, Allison Lumber Company, Brooks-Scanlon Corporation, Crossett Lumber Company, Great Southern Lumber Company, and W.T. Smith Lumber Company. Most of these lands continue under the management of the foremost pulp and paper companies in the South.

Two of the earliest industrial foresters in the South were Walter J. Damtoft, who was employed by Champion Paper and Fibre Company in 1920, and Inman (Cap) F. Eldredge, who joined Superior Pine Products Company in 1926. William M. Oettmeier succeeded Eldredge 6 years later and ultimately became general manager and president of Superior Pine, while bringing the 170,000 acres it owned in southeastern Georgia from a devastated cut-over forest to one of the prime managed forests in the South. This property was later leased to and placed under the management of St. Regis Paper Company.

Practically every State in the South recognizes an early leader in forest

conservation efforts. Perhaps the first recognized conservationist in the South was Henry E. Hardtner, organizer of the Urania Lumber Company in 1898 at a location north of Alexandria, LA. Widely acclaimed as the father of forestry in the South, he was one of the few early lumbermen who believed that second-growth timber, if given adequate fire protection, might actually provide a continuing supply of raw material for a sawmill, rather than supporting the prevalent practice of moving on when the virgin growth was depleted.

Hardtner's work attracted the attention of the Great Southern Lumber Company of Bogalusa, LA, and ultimately furnished the background for the widely acclaimed reforestation efforts of that company under the direction of William H. Sullivan. Starting with the seeding of 800 acres of cut-over land with loblolly seed in 1920, Great Southern, during the next 9 years, planted over 23,000 acres of cut-over land and created the body of knowledge used by numerous other companies in their early regeneration activities.

In Oklahoma and Arkansas, one of the first families to emerge in forest management was the Dierks. By 1920, they owned about 400,000 acres of land and, in 1924, hired William L. Hall as a consultant in forest management. His recommendations included selective cutting and the hiring of a full-time professional forester. In 1927, Glen R. Durrell, with a B.S.F. out of Iowa State University, was hired, and industrial management was on its way. Today, these lands are a valuable backup for the Weyerhaeuser operations in the two States.

W. Goodrich Jones has been called the father of forestry in Texas. Jones was hired by B.E. Fernow, chief of the USDA Forest Service, to make an extensive exploration of Texas timberlands. His report provided the basis for recommendations that a State Department of Forestry be formed. Jones took the initiative to provide grassroots support by arranging a meeting at which the Texas Forestry Association was formed and Goodrich Jones elected president.

In Alabama around 1901, the Alger Sullivan Lumber

Company, under the guidance of Edward A. Hauss, initiated protection of young growth as a first step in perpetuating its operations. The McGowin family, associated with the W.T. Smith Lumber Company at Chapman, AL, early recognized the need for fire protection and perpetual growth. The lands, continuing under the management of Union Camp Corporation with Greely McGowin in a top management position, still attest to wise early industrial management.

Mississippi's early conservation efforts include the leadership of Posey Howell of the Dantzler Lumber Company in southern Mississippi. Howell demonstrated the value of protecting young regrowth from wildfire and was instrumental in some of the first plantation efforts in the State. These lands continue to make a valuable contribution to the State's economy under the current operations of International Paper Company.

While these early conservation and forest management efforts may seem rather rudimentary by today's sophisticated standards, they must be considered almost

revolutionary when viewed against the unknown investment returns and the accepted cut-out-and-get-out, 20-year span of the average sawmill of the day.

The move toward custodial management and limited regeneration efforts laid the foundation for the employment of professional foresters, which accelerated in the 1930's and especially in the mid-1940's at the conclusion of World War II. The industry had arrived at the conclusion that conservation and management were no longer public relations electives but an absolute must to ensure the validity of the huge capital investments on which they were embarking.

### **Forest Industry Management Programs--Origin and Development**

The reputation of the early industry in the South, as throughout the rest of the Nation, was one of despoiler. It was common practice to clearcut stands, with no provision for reforestation, and make the cut-over lands readily available for purchase by anyone interested in them.

Once denuded, much of the land returned to the individual States for nonpayment of taxes and was put up for tax sale. Some of the prime timberland of today, such as the Bienville National Forest in central Mississippi, was purchased by the Federal Government in an attempt to rehabilitate watersheds and to prevent further deterioration of the soil.

The dramatic change in industrial policy on land ownership and management came with industry's substantial investment in manufacturing facilities. At first, industry took a primarily custodial approach, with fire prevention its main objective. Later industry adopted management practices to increase forest productivity at an ever-increasing pace. William Greeley (1951) summed up the situation succinctly with the statement, "Economic interest in forestry increases in proportion to the plant investment per unit of raw material."

In 1942, J.E. McCaffrey, woodlands manager of International Paper Company's Southern Kraft Division, reported on

information he had obtained from forest industries throughout the South. His survey showed that, in 1925, owners of 82 properties totaling 4.7 million acres had started forestry practices to make their lands more productive. In 1925, the southern pulp and paper industry owned less than 500,000 of those acres; by 1940, it owned 4.5 million acres, almost all under what was then considered intensive management. Other corporations in 1940, lumber companies, naval stores operators, power companies, oil companies, and steel companies, owned 12 million to 15 million acres, "so handled that the growing stock is being materially increased each year." McCaffrey pointed out (Clepper 1971, p. 246) that "The latest figures available show that prior to 1925 less than one-half dozen technically trained men were employed by the industry in strictly forestry work. The picture in 1940 is greatly different; the industry now employs a total of 220 trained foresters."

Within the next 30 years, under the successive leadership of Earl Porter, Oscar Traczewitz, and R.M. Nonnemacher as woodlands managers of



International Paper Company's Southern Kraft Division, this one company would have over 500 foresters directing its forest management policies and practices. The industry had over 2,000 professionally trained foresters at work by 1969 (Clepper 1971, p 254).

In 1958, Walter H. Meyer, professor of forest management on the faculty of the Yale School of Forestry, traveled throughout the South interviewing the personnel of 21 industrial organizations about their forestry operations. These companies controlled 9.5 million acres and employed more than 500 technically trained people. He was impressed with the strides made by the industrial foresters in their current management as well as their efforts to correct past mistakes made in management of these lands (Clepper 1971, p. 253).

Perhaps it is well to note here the old cliché that doctors bury their mistakes while architects cover theirs with vines and shrubbery, and add that foresters have their mistakes noted by

forest historians 40 or 50 years after the mistake was perpetrated--many times with little appreciation for the economics of the day that motivated the practices employed. So long as we live in a free enterprise atmosphere, it will be thus with the conflicts between current profits and long-range good being solved by the statesmanship of industry leaders. Their ability to cope with Wall Street financial analysts, fund investors, stockholders, and environmentalists and the ability of their professionally trained foresters to recognize and accept the legitimacy of those conflicting claims in their forest management advice are the keys to the future productivity of these lands.

Before industry's first efforts at management of their properties for continuing crops came a recognition in the very early 1900's that rampant wildfire in the pine forests of the South had to be dealt with before significant investment in other forest practices would be effective. It was imperative to confront both the naval stores industry, which traditionally burned

the woods to protect its collection systems, and the open-grazing stockmen. Who, in 1900, would have dreamed that professionally trained foresters 75 years later would espouse burning as a cherished and necessary silvicultural tool in managing the pine forests of the South?

Early lobbying efforts by woodland owners in several Southern States helped secure passage of the Weeks Law in 1911. This authorization for the Secretary of Agriculture through the Forest Service to enter into cooperative forest-fire protection arrangements with the States and individuals must be recognized as the cornerstone and continuing key to increasing the productivity of the vast pine forests of the South. Without it, forest investments contributing to the profitability of the landowner and the general welfare of the public would not be attractive.

Prevention and suppression of forest fires was so ingrained in foresters that, in the late 1950's, long after Chapman espoused the virtues of prescribed burning, a well-known industrial forest manager, who had endorsed the

practice of prescribed burning for his company's land, turned red faced with embarrassment and drove back to his office, refusing the honor of lighting the match to institute one of their early "controlled" burns. He just couldn't do it!

Very little real progress in professional management of either industrial or nonindustrial forests was possible until State forestry departments were formed and made effective. In 1916, only 5 of the 12 Southern States had forestry departments or commissions established by law.

Many of the industrial companies made beginning attempts to stop their cut-out-and-get-out practices during the first half of the 20th century with Henry Hardtner, of Urania Lumber Company in Louisiana, leading the way. Hardtner had Urania begin investing in cut-over lands in the early 1900's and put them under management for continuous crops. Gifford Pinchot supplied W.W. Ashe, a forester with the USDA Forest Service, to inspect and advise on the management of Urania holdings, 100,000 acres of pine and hardwood lands in central Louisiana.

Hardtner's plan of management was simple, but effective: protect young timber during logging and cut-over land from fire, and natural regeneration will follow. In 1932, he summed up the results of some two decades of forest husbandry at Urania:

I have been operating my sawmill on the same site since 1896 (two decades was about average for large southern mills) and there is now more timber tributary to it than ever. The mill is on a perpetual basis. . . its present size is just right to cut the same amount each year forever--the amount the land is capable of producing, or about 20 million board feet per year (Henry Hardtner 1932).

In recognition of the part wildfire plays in negating forest management, Urania management built one of the first lookout towers and organized fire crews for the early detection and suppression of fires. Another of the very early forest management efforts was the program of the Great Southern Lumber Company at Bogalusa, LA. The lumber company was incorporated in 1902, and Bogalusa

Paper Company was added in 1920. In 1937, Gaylord Container Corporation acquired the properties, and they continue today under the banner of Crown-Zellerbach Corporation.

In 1920, a group of Great Southern Lumber Company directors visited Urania for an inspection of Henry Hardtner's forestry work. They were so impressed by what they saw that they decided to put their cut-over lands under forestry management. Austin Cary was brought in for consultation. "More than any other man, Austin Cary was responsible for the spread of the gospel of reforestation in the yellow pine lands" (Clepper 1971, p. 237).

Lacking a forestry staff and a supply of seedlings, the company nevertheless immediately fenced 800 acres of denuded land, plowed furrows 8 feet apart, and planted pine seeds in them. The next year, seedlings were obtained from the woods and hand-planted on 380 acres. In 1922, a company nursery was started at Bogalusa; 1.2 million seedlings were grown and set out on 1,200 acres. By the end of 1929, 23,000 acres had been

reforested, and plantation management had come to the South (Clepper 1971, p. 238).

During the same period, the Chesapeake Corporation of West Point, VA, began acquiring timberlands and practicing forest management. In 1922, the company, owning only 4,500 acres, started its forest management by leaving seed trees to provide natural regeneration after cutting. By 1929, the company owned 24,000 acres and began planting pine seedlings on abandoned farmland. In 1930, Chesapeake cooperated with the Virginia State Forest Service in financing and erecting four steel fire towers. Between 1932 and 1944, the company cruised and mapped its lands, developed a management plan, established a nursery for seedlings, and set up roadside demonstration plots to display forestry techniques to the general public (Dill 1968).

One other example of early forest management efforts in the South was taking place during the early 1900's, on the Crossett Lumber Company properties in Arkansas.

Typical of the early sawmill companies, the mill at Crossett, built in 1899, was cutting all yellow pine 12 inches in diameter at the stump and disregarding any future growth with the intention of selling off the cut-over land for agricultural purposes. The company did seek forestry advice, and the 1912 class of the Yale Forestry School prepared a report on a portion of the Crossett holdings.

Yale and Crossett continued a close relationship, with H.H. Chapman and Walter H. Meyer advising the Crossett people on fire control and other technical forestry matters over the years. A.E. Wackerman, Crossett forester from 1927 to 1932, brought fires under control. During his tenure, acreage burned decreased sharply, from 25,000 acres in 1928 to 18,000 acres in 1929 to 12,000 acres in 1930 to only 4,800 acres in 1931 (Wackerman 1932).

In 1933, Charles A. Gillett was appointed the first State forester in Arkansas. During the next four decades, fires were brought under control to the extent they were no longer a major hindrance to the practice of silviculture in Arkansas.

Forestry paid off at Crossett. A half-century after Chapman had predicted the company would lose its woodlands unless it changed its policy, Crossett was still producing forest products from the holdings, now increased to 565,000 acres. For these assets, together with the company's manufacturing plants, Georgia Pacific Corporation paid \$127 million in 1962 and continues to manage them today (Clepper 1971, p. 244).

Today's industrial forest land management had its roots in these cited early examples of the awakening need for wildfire control and early reforestation efforts. In fact, with a few exceptions, as late as the early 1900's, industrial forestry efforts were mainly involved in prevention and suppression of wildfires and custodial care of areas logged over by their own or predecessor operations.

International Paper Company, one of the largest industrial landowners in the South with approximately 5 million acres under management, is typical of the industry in its forest management development. Early on, the company decided that investing millions of dollars in a pulp

and paper mill without ensuring a continuous timber supply by investing in and managing timbered lands was imprudent. Bankers the company approached for loans to purchase their early mills insisted on land ownership as part of the package before approving loans. International entered the southern scene in 1925 with the purchase of the kraft mill in Bastrop, LA. It added five additional mills, two by purchase and three by construction, in rapid order. Today, it operates 12 wood-products plants and 11 pulp and paper mills in the South.

During the years 1974 through 1985, this one company has spent, on average, \$800 million annually in capital investment, primarily in plants in the South (Gee 1982). These investments are backed up by over 5 million acres of prime timberland under the management of a cadre of professionally trained foresters and woodwise technicians located in areas strategic to the manufacturing plants.

Their management activities include every modern technology utilized by the forest community. Final

harvest cuts are primarily clearcuts with scheduled site preparations of various forms, followed by planting with genetically improved seedlings. By 1971, International noted its millionth acre in pine plantations by symbolically planting an acre at its research forest located near Bainbridge, GA. The two millionth acre was planted just 11 years later, in 1982.

While some of these plantations were disposed of in various land transactions over the years, the company's 1984 annual report indicates 1.8 million acres in plantation ownership, with 1 million of it in genetically improved seedlings. The report shows 153,000 acres planted to superior pine seedlings in that 1 year--a typical amount of annual planting on these lands. Ten years ago, all seedlings were purchased, primarily from State-owned nurseries. Today, all seedlings are generated from genetically improved seed grown in company-owned-and-operated nurseries.

The backbone of forest management has not been forgotten, as evidenced by the company's southwide fire-control efforts. While

still working cooperatively with State and Federal Governments and other industries in wildfire control, International uses much of its fire equipment in prescribed burning for fuel reduction, hardwood control, and site-preparation activities. Company-owned helicopters are used for aerial ignition of prescribed burns.

The company relies on the results of Bainbridge research in arriving at initial spacing and later thinning activities. Like other companies, International continues to investigate the advantages of various spacings and thinnings. Champions of wide spacing and no thinning oppose supporters of close spacing and thinning at various ages while these investigations continue.

The industry is utilizing the results of cooperative studies in genetics, fertilization, insect and disease control, nursery management, smoke management for prescribed burns, and other areas of silvicultural investigation in day-to-day management of timbered lands. The current crop of foresters must be well versed in all aspects of computer use because all management regimens and

cutting schedules are subject to the scrutiny of computer manipulations in optimizing returns from this vast asset.

While International's timber assets are a vital part of the integrated activities and profitability of the overall corporation, its management has historically searched for ways to measure performance of this individual segment of its business. A recent development is the company's decision to set up its timberland assets and organization in a limited partnership as a subsidiary of the parent company. Stock in this timber subsidiary is listed on the New York Stock Exchange separately from International's common stock, and its performance may at a future date indicate the profitability of a stand-alone forestry enterprise.

### **Trends in the Ownership of Commercial**

**Timberland**--Until recent years, the philosophy of owning substantial amounts of land to back up major forest-product facilities was accepted and unchallenged. Forest industry ownership of commercial timberland in

the South rose from 32,939,000 acres in 1952 to 38,415,000 acres in 1970 to 43,310,000 acres in 1985. Current Forest Service projections have this figure up to 46,786,000 acres in 2010 and 48,912,000 by 2030.

It remains to be seen whether these projections will require modification. The tremendous capital requirements for building a new pulpmill or modifying an old one now approach \$500 million to \$1 billion. This capital requirement leads to a great deal of soul searching by members of the industry. With about three-fourths of all the timberland in the South owned by individuals, the industry recognizes that greater dependence on wood from private owners would free capital now tied up in maintaining a land base.

In the past 10 years, several major companies have built substantial manufacturing facilities in the South with little or no corporate timberland base on the premise that they can compete successfully for the "outside" stumpage. This trend has caused some rethinking within companies who carry heavy financial investments in

timberland. As a direct result, large tracts owned by forest-product companies are now on the open market. Most have been available for some time without attracting a buyer. Some of the original "no land" companies have actively, if quietly, changed their status by acquiring lands adjacent to or within economical transportation range of their plants.

The final outcome of the land ownership dilemma will probably remain unclear for the near future except for one aspect. There is a growing trend toward limited partnerships and other investment groups, including foreign interests looking for relatively short-to medium-range investment opportunities. Only an alert and informed public can prevent a return to the short-term clearcut-and-get-out practices of 60 years ago.

**Leasing and Management of Leased Lands**--One of the methods employed by the industry in relatively recent times to modify the capital investment requirements in land ownership involves leasing privately owned lands and placing them under the professional management of company foresters. The

USDA Forest Service has accumulated some data over the years that indicate that the forest industry has to some degree turned to leasing as an alternative to outright ownership. The 2.9 million acres under long-term leases by 1970 increased to approximately 4.2 million acres by 1985. Georgia leads all States in the South with almost 1 million acres under lease. Louisiana, Alabama, Florida, and Mississippi account for an additional 2.7 million acres, leaving relatively minor amounts to the other Southern States.

The terms of many of these leases are proprietary, but they usually involve a payment for the merchantable timber growing on the leasehold when the lease originated, plus an annual payment for a stated number of years ranging from a low of about 30 years to a high of 99 years. The annual payments are determined by a soil productivity factor, and lessees have the right to manage the timber assets, including harvesting, as they see fit. Many leases require regeneration and return of the property in a prescribed growing condition. Guarantee of the title and payment of annual ad valorem taxes are



normally the responsibility of the lessor.

In another form of lease, the lessee pays all management costs over the years, and these are deducted from stumpage values paid to the lessor as timber is harvested. An additional feature sometimes found in this type of lease is a modest annual payment to the lessor, which is also recaptured out of stumpage values at removal.

Long-term leases require a great deal of wisdom in both parties, including knowing what effect inflation and deflation will have over the period of the lease, what "merchantable" means now and in the future, and other factors very difficult to anticipate and define. As a result of these problems, as in most long-term contracts, a relationship started on the best of terms and mutually satisfactory to both parties frequently turns sour to one or both parties, resulting in unpleasant situations and lawsuits. Substantial numbers of the industry avoid leases, viewing them as employment acts for trial lawyers and consulting foresters who are used as expert witnesses.

## **Trends in**

**Planting**--Plantation management, a vital part of timber management, elicits from some environmentalists and wildlife managers cries of "biological deserts" and worse. Yet years of research have disclosed satisfactory regimens of burning and thinning that enhance wildlife habitat if properly administered. The industry is proceeding with a systematic program of planting that has almost achieved 100-percent use of genetically improved seedlings. These seedlings have been developed for individual characteristics such as specific gravity, straightness, resistance to fusiform rust, and other specialized requirements.

For many years, the media have reported favorably on the industry's genetics programs while decrying unsightly clearcutting and site-preparation activities. Only since the industry turned to less destructive site-preparation techniques and the media recognized the necessity of clearcutting and site preparation to utilize the benefits of genetic improvement has large-scale planting met with reasonable public acceptance.

In 1952, only 660,000 acres of pine plantations existed on the 32,935,000 acres of industry land--an insignificant 2 percent. By 1970, however, 5,714,000 acres were in plantations. As of 1985, fully 33 percent of industrial holdings (14,405,000 acres) in the South were in planted stands. It is estimated that in the next 15 years, 21,046,000 acres, or 48 percent of industry lands, will have been planted. Optimal spacing, thinning, and use of second-generation genetically improved seedlings will affect growth projections on this significant acreage as well as on nonindustrial private lands receiving similar treatment.

Today 4,000,000 acres of pine plantations are owned by private individuals and concerns other than forest-products companies, with projections that this will increase by 100,000 acres per year for the next 15 years.

### **Trends in Timber-Stand Improvement**

**Practices**--For many years, opinion has vacillated on the appropriateness of calling timber an agricultural crop like the row crops (e.g., corn or cotton). While

the length of the maturation period is dissimilar to that of other agricultural crops, the intensive practices associated with planting, growing, and harvesting trees make timber more closely resemble other row crops as time passes.

The most obvious similarity between trees and other agricultural crops is management's search for a superior strain. The forest industry is now planting almost exclusively with superior first-generation seedlings and rapidly positioning itself to use second-generation stock in its tree-improvement efforts.

In addition to this establishment effort, a multifaceted program of intermediate improvement is in progress. According to information reported to the USDA Forest Service, the industry is engaged in intermediate stand treatments on 250,000 to 750,000 acres of land annually, including release and weeding, precommercial thinning, pruning, fertilizing, and prescribed burning for control of understory species. In the past 10 years, intermediate stand treatments have been carried out on over 4.5

million acres of industrial  
land.

## Forest Industry Assistance Programs on Nonindustrial Lands

It is to the credit of the industry that it recognized both the need for and the desirability of engaging in various programs and degrees of assistance to nonindustrial owners of timberlands in order to raise the level of management of these lands.

For almost all of our Nation's history, either the public or private sector has pressed for regulating the management, particularly the harvest, of timber on privately owned timberlands. Henry Clepper's 1971 book, "Professional Forestry in the United States," recalls many early efforts to promote public regulation of cutting practices on private lands. One of these was a report by the Committee for the Application of Forestry, appointed by Frederick E. Olmstead, president of the Society of American Foresters, in 1919. This committee, chaired by Gifford Pinchot, produced a report that declared: "Within less than fifty years, our present timber shortage will have become a blighting

timber famine." One of the report's recommendations was that the Federal Government be authorized "to fix standards and promulgate rules to prevent the devastation and to provide for the perpetuation of forest growth and the production of forest crops on privately owned timberlands for commercial purposes" (Clepper 1971, p. 138).

Both Olmstead and Pinchot had Forest Service backgrounds and were generally acknowledged as leaders in the field of forestry. There was, however, a group of Society members who opposed the proposal for mandatory regulation to be enforced by the Federal Government. It appears that then, as today, within the profession, there were sincere proponents of strict Federal regulation, advocates of strict hands-off free enterprise, and people who favored all levels of intermediate controls, including State Government control, voluntary best management practices, and variations of all of these.

One of the better known attempts at State-level control of cutting practices on privately owned lands was the passage of the Forest Harvesting act by the Mississippi Legislature on March 24, 1944, an act that became known as "the seed tree law." It was passed because of a serious concern over what was considered the devastating clearcutting of privately owned timberlands within the State, with no regard for the future productivity of the land. The basic requirement of the law was the leaving of four well-spaced seed-bearing trees at least 10 inches in diameter, or alternately 100 trees 4 inches in diameter, well distributed over every acre of harvested land unless there was clear evidence that the land was being converted to pasture, row crops, or other uses.

Sporadic attempts at enforcing the seed tree law were, in the main, failures. Well-meaning attempts by timber buyers to include seed-tree provisions in their purchase contracts were frequently negated immediately after the conclusion of the sale by a further sale of the merchantable seed trees by the landowner to a third party. The State forestry

personnel were so limited in numbers and available time to monitor the cutting that they could issue only token numbers of citations. These were easily handled by the landowner in front of a local judge, usually a fellow landowner, by placing a strand of barbed wire around the harvested area and pronouncing it a pasture.

The Mississippi Forestry Commission is still responsible for enforcing the Forest Harvesting Act, but actual violations are seldom discovered. The law, in its present form, is essentially obsolete and ineffective. Modern forest management practices have rendered it archaic.

Despite industry resistance to mandated harvesting laws enforced by either Federal or State authorities, there was general recognition throughout the southern industrial community that unrestricted cutting of private timberlands, without strong, good-faith efforts at providing for regeneration and the growing of professionally managed timber stands on the privately owned lands of the South was detrimental to the economic well-being of the industry in the long

run. Industry, therefore, turned its thoughts to improving the gloomy predictions of the groups considered its adversaries.

It is difficult to pinpoint the beginning of landowner assistance programs because various lumber and pulp companies throughout the South informally assisted neighboring landowners with advice on improving management of their timber stands for many years. According to Southern Forest Institute sources, International Paper Company started a program as early as 1939, when it appointed four field people to work solely with private landowners, giving them timber management and marketing advice in the capacity of "conservation engineers."

In September of that same year, West Virginia Pulp and Paper Company held a meeting and demonstration for 450 landowners in Virginia.

Manpower demands of World War II temporarily halted International Paper Company's conservation engineer program, but it resumed in 1947 with the naming of a professional forester to head the program

in each State where the company had operations in the South.

In January, 1947, the board of directors of the Southern Pulpwood Conservation Association (the predecessor to the current Southern Forest Institute) recommended that each of its member companies, representing approximately 80 percent of pulpwood consumption in the South, employ at least one conservation engineer for each mill location to work with landowners.

In 1948, the name "conservation engineer" was changed to "conservation forester" to more closely reflect the professional affiliations of these individuals. By 1960, approximately 150 industry foresters carried this title.

Other landowner assistance programs started in the 1950's include the DeWeese Tree Farm Family in 1949 (now part of the Weyerhaeuser Tree Farm Family) and programs sponsored by Brunswick Pulp and Paper (1950), West Lumber Company (1953), S.D. Warren-Scott (1954), West Virginia Pulp and Paper, later called Westvaco (1956), and Cape Fear Wood Corporation

(1957). The Westvaco program, called C.F.M.®, and the International Paper Company program, called L.A.P.®, each encompass about 1 million acres.

Today, according to the Southern Forest Institute, there are at least 75 companies in 32 States with some type of landowner assistance program. As no two companies are the same, neither are the landowner assistance philosophies or programs the same. The type, amount, and conditions of assistance vary from company to company and within the same company in different locations.

Minimal programs may involve oral advice to a landowner from a company representative at the time he or she purchases timber. More substantial ongoing programs by some of the major companies involve foresters working full time solely on private landowner management efforts. After consultation with the landowner to determine his or her goals for the use of the land, the company inventories and maps the forest lands and presents a professionally approved management plan. When agreement is reached on

the plan, both parties sign a formal agreement.

Typically, many of these agreements provide the management plan, timber-marking services, and a general overview of silvicultural treatments, such as prescribed burning, timber stand improvement, harvesting, and regeneration at company expense. Most of the agreements provide company assistance at cost for tree planting with variations calling for the landowner to pay an independent vendor for such services. Limited free seedlings, matching seedlings, and genetically improved seedlings at near cost are all variations of the same thrust to encourage regeneration.

Some company programs require in return nothing more than a gentleman's understanding that the landowner will give the company an opportunity to compete in the marketplace when harvesting operations occur. Other programs spell out that the company is to get first opportunity, first refusal, or last refusal of the products at harvest time. A few programs attempt to set firm sale of the timber to the assisting company, and a few

programs spell out first refusal on the purchase of the land itself should the owner decide to sell.

One of the more thorough programs, which requires first refusal of harvested timber, also incorporates a 30-day cancellation clause by either party. Effectively, it says we hope to prove to be a good neighbor over the years and to earn your respect; if we do not, you are free to act on your conscience at any point.

Realistically, most administrators close to these programs acknowledge they would be unpopular and unsuccessful in attempting to enforce required sales before any local judge or jury. The companies carry on the programs as a recognized good-faith effort to encourage good forest management on millions of acres of privately owned forest land without the need for regulation by law.

One of the early, and to some degree continuing, concerns of consulting foresters is the possible conflict, or appearance of conflict, of interest of a company forester recommending management and particularly harvesting of

these private lands. To minimize this possibility, some companies have placed these programs under the direction of their timberland foresters, as opposed to their procurement personnel. Others depend on strict adherence to the originally approved management plan and the ethics of their people to avoid the problem. The concern of the consultants appears to be abating somewhat as these programs popularize the idea among landowners that they need professional help. To control costs of the expanding assistance being requested, company personnel tend to refer landowners to independent consultants.

The American Forest Institute has published a directory of forest industries providing forest management services for private landowners throughout the United States. It identifies the assisting companies, the geographic area involved, and the address of personnel to be contacted.

Perhaps the most widely recognized national effort at assuring the citizens of this country of industry's intent to practice responsible forest



management on its lands and to influence nonindustrial owners to do the same is the nationwide American Tree Farm System®. A tree farm is defined as an area of privately owned forest land dedicated voluntarily by its owner to the growing and harvesting of repeated forest crops. The emphasis is on timber as a crop. (The State of Alabama has carried this a step further in recognizing the importance of other forest amenities, such as wildlife, water, etc., by certifying properties as Treasure Forests if they meet specified standards in these expanded aspects.)

Tree Farm No. 1, 120,000 acres owned by the Weyerhaeuser Timber Company in Washington State's Grays Harbor County, was dedicated on June 12, 1941. Chapin Collins, editor of the local *Montaesano Vidette*, suggested naming the forest the "Clemons Tree Farm" in honor of the well-respected pioneer logger Charles H. Clemons.

The idea of an industry-sponsored nationwide tree farm system grew rapidly, if somewhat erratically, in the ensuing years. The National Lumber Manufacturers Association,

at the urging of western members, officially resolved in November 1941 that a nationwide tree farm system be established. In the following year, the American Forest Products Industries, then a subsidiary of the National Lumber Manufacturers Association and now known as the American Forest Institute, accepted responsibility for the American Tree Farm System. Under its sponsorship, the program spread in 5 years to about half the States, each developing its own organization and criteria for certification.

The tree farm movement came to the South with the dedication of a tree farm near Brewton, AL, on April 4, 1942, under the sponsorship of the State Chamber of Commerce. It was followed on June 6, 1942, by the first tree farm in Arkansas. Before long, the Southern Pine Association, now the Southern Forest Products Association, assumed sponsorship of the program throughout the South. During the first 10 or 12 years, each sponsoring organization had its own criteria for certification.

In 1954, in order to provide a truly national system with

recognized standards, the trustees of the American Forest Products Industries approved the "Principles of the American Tree Farm System." Although revised periodically, the major criteria for their tree farm certification remain essentially the same: the property must be privately owned, managed for the growth and harvest of forest crops, and protected adequately from fire, insects, disease, and destructive grazing. Significantly, harvesting practices must ensure prompt restocking with desirable trees.

Reorganization of the American Forest Products Industries in 1964 into the American Forest Institute, dissolution of State forest industry committees, and reorganization of independent State associations to sponsor and administer the tree farm program had the program and its recordkeeping system in a condition close to collapse. The early 1970's saw a rejuvenation, with the American Forest Institute computerized and updating its records and initiating a program to reinspect every tree farm in the Nation. By the middle of the decade,

with thousands of foresters from industry, government, and consulting firms volunteering their time, the massive effort brought the tree farm system back to a well-run and well-documented program. Today, the American Tree Farm System is a program of the American Forest Foundation, administered by the American Forest Institute and supported by membership dues from forest industry and voluntary contributions from tree farmers and others.

The number of tree farms in the 12 Southern States and the acreage involved are illustrated in the following tabulation, extracted from American Forest Institute data.

Perhaps industry's continuing interest in the productivity of the Nation's forest lands is best exemplified by the vast forest productivity project initiated in 1974 by the Forest Industries Advisory Council (then known as the Economic Council of the Forest Industries). The objective of the study was to analyze and make recommendations for improving forest productivity in the United States

Tree Farm System  
By AFI Region

State	1/1/84 Tree farms	1/1/84 Total acreage
Alabama	2,204	7,178,832
Arkansas	3,551	4,461,162
Florida	2,274	6,081,315
Georgia	2,852	7,602,942
Louisiana	2,677	5,605,610
Mississippi	5,633	4,194,409
North Carolina	2,554	2,537,978
Oklahoma	239	1,234,778
South Carolina	1,150	3,037,646
Tennessee	1,437	1,590,754
Texas	2,510	4,162,127
Virginia	1,699	1,953,576
<b>Total</b>	<u>28,780</u>	<u>46,641,129</u>

## Forest Industry Research Programs

### Timber Management

Many forest-products companies carry out significant individual research efforts on a continuing basis. The nature of this research reflects the concerns and interests of the individual companies both in the matter of environmental impact of various silvicultural practices and timber productivity.

For many years, the important segments of the industry have been like-minded in their cooperative efforts in pursuing both basic and applied research in genetics, fertilization, nursery practices, plantation spacing and thinning, smoke management, harvesting, site preparation, insect and disease control, and other silvicultural practices. Industry has underwritten its commitment through funding as well as active field and laboratory participation with academic institutions and the USDA Forest Service's forest experiment stations.

A prime concern of the industry is the constant

and complex, changing nature of the timber inventory in the South. An accurate data base of timber growth and removals within relatively small geographic areas is a must for industrial planning. As a result, the industry contributes both money and manpower to the Forest Service's survey efforts and maintains a constant demand for decreasing the time cycle and increasing the information included in these periodic surveys. Present surveys, taken at 10-year intervals, are still producing surprises, which are anathema to corporate planners. The Forest Service and individual companies employ projection techniques that attempt to annually update the most recent surveys with reasonably good results, but they are not satisfactory substitutes for good on-the-ground survey data.

Perhaps one of the greatest research efforts undertaken by the industry is in the field of tree improvement. For 29 years, the North Carolina State University-Industry Cooperative Tree

Improvement Program has sought the answers to increasing productivity of forest lands through genetic manipulation of several species of trees. The main emphasis, since the start of the project in 1956, has been on loblolly pine.

The Cooperative Forest Genetics Research Program, University of Florida, has emphasized work with slash pine while the Western Gulf Tree Improvement Program, Texas A&M University, has worked with both loblolly and slash pine west of the Mississippi River.

Illustrative of the impact of the North Carolina State University project is the production of cones, seeds, and seedlings from loblolly pine seed in cooperators' orchards during the last 8 years, shown in table 1. The cone and seed yield shown includes 5,122 bushels and 6,321 pounds of second-generation material. In the 3 years 1982, 1983, and 1984, second-generation orchards produced enough seed to grow 72 million seedlings and regenerate slightly over 100,000 acres of land. These second-generation orchards will experience rapid increases in

production in the next few years. This should permit first-generation orchards to be heavily rogued, thereby concentrating efforts on the better performers, particularly since first-generation breeding efforts were complete as of 1983 and progeny test information is well enough along to allow orchards to be brought to their final genetic composition.

Some organizations now have enough seed in storage to meet their planting needs for several years. With minimal efforts, industry and State forestry commissions should now be approaching the ability to provide all customers' planting needs with genetically improved stock.

Final crop gains on 25-year rotations from one generation of loblolly pine tree improvement are estimated to be as high as 7 percent in height, 12 percent in cubic volume, and 32 percent in harvest value (Talbert and other 1984).

There were 11 charter members when this cooperative effort started. Today, there are 29 members, including 24 industry members, 4 State forestry organizations, and

1 commercial seed company. The staff budget runs several hundred thousand dollars per year, and it is roughly estimated the industry spends 20 to 30 times as much in individual efforts. This is one of the outstanding examples of consistent, long-term commitment to a forest research program.

Work on nursery practices is being carried out by the Auburn University-Southern Forest Nursery Management Cooperative. Formed in 1970, it operates on an annual budget of approximately \$250,000 and is composed of 19 industry members and 13 others, including State forestry commissions and chemical companies.

Cooperators are producing almost 1.5 billion seedlings annually. Its mission is threefold: (1) to gather data on relationships among selected pesticides, pests, soil characteristics, and seedling production in forest nurseries; (2) to obtain registration of pesticides; and (3) to develop techniques for increasing the quantity and quality of tree seedlings. In addition to performing research, the cooperative will continue to keep the nursery industry informed of practices already found to improve

seedling production such as those put forth by Wakeley in 1954.

Work of this cooperative has been instrumental in replacing hand weeding, the use of mineral spirits, and methyl bromide fumigation with herbicides for control of weeds in nursery beds. The cooperators' nurseries are saving more than \$2 million per year below 1975 costs in reduced use of these practices. More important, they are producing better planting stock at these reduced costs. Most herbicides currently used in southern forest nurseries have been registered with data collected by this cooperative.

One of the areas of investigation contributing to potential productivity increases is the research in forest fertilization being carried out by members of the forest industry and agricultural chemical companies in cooperation with the School of Forestry Resources and Conservation and the Soil Science Department of the University of Florida. This effort to promote research in forest soil management with emphasis on forest fertilization and tree nutrition has been ongoing since

1967. Six of the 12 land-owning members of the cooperative collectively treat an estimated 100,000 acres per year in Florida and Georgia, with others treating an undetermined acreage of coastal lands in North and South Carolina, Alabama, Mississippi, Louisiana, and Texas.

Fundamental research on tree nutrition, forest soils, and fertilizer reactions in soils are conducted in greenhouses and other facilities of the University of Florida. Cooperators' annual grants of approximately \$100,000 are combined with supporting agency funds and university funds to finance graduate students, visiting scientists, and university support personnel to promote this basic phase of the program.

Over 300 field experiments (160 ongoing) have been installed on cooperators' lands throughout the lower coastal plain and are yielding valuable observations on the interactions between fertilization and other silvicultural treatments, such as site preparation, burning, thinning, and herbicide use.

Observations show that fertilization at planting time

may increase volume growth on many sites by an average of about 20 percent during a rotation.

Midrotation fertilization may increase volume growth by about 40 percent for up to 10 years on many wetter sites.

One truism emerging from this work is that fertilization is not a general treatment or panacea to increase forest productivity. It is site and time specific and can be unproductive or even have a negative impact unless done under the correct circumstances.

Insect and disease research has included both cooperative and individual projects involving root rot, brownspot affecting longleaf pine seedlings, and extensive work on the southern pine beetles. Work on the root rot program was pioneered by International Paper Company at its Bainbridge, GA, research center. Working in cooperation with the USDA Forest Service and other agencies, investigators in a crash program discovered that applying borax to a stump, immediately after the tree had been felled, prevents the spread of the fungus *Heterobasidion annosum*.

The forest industry established the Southern Forest Disease and Insect Research Council. Administered by a committee, working under the Southern Pulpwood Conservation Association, the Council grants awards generated by industry contributions to southern universities for research aimed at developing methods of combating the diseases and insects that attack southern forests. In the typical year of 1968, grants for disease projects went to Duke University, the University of Georgia, and North Carolina State University. Duke, Mississippi State University, and Texas A&M University received 1968 grants for forest insect studies (Oden 1973).

Another example of industry involvement in providing input and support for publicly funded forest research programs is the Southern Industrial Forestry Research Council. It was established in 1978 by the joint actions of the two southern divisions of the American Pulpwood Association. In 1981 the Southern Forest Products Association joined in the effort.

The council serves as a vehicle for determining its

member companies' most pressing research needs and evaluating the ongoing research being conducted at the 16 universities with forestry schools and the 20 Forest Service laboratories in the South.

The council maintains an active liaison with the Hardwood Research Council. It also participates with the Forest Service and the National Association of Professional Forestry Schools and Colleges in their southern region forest research planning groups' planning process as part of the Renewable Resources Planning Act.

In 1983 the council agreed to serve as representatives of the southern region on the newly formed National Forest Products Association's forest resource research committee.

In recent years, vegetative propagation has been an active area of investigation by several companies working independently. Reports of results are not being widely dispersed, but this is an area of significant importance in its possible impact on future pine growing. Mass production of selected material through vegetative propagation



would allow production orchards to be bypassed entirely and would hasten the deployment of superior stock. Mass vegetative propagation of loblolly pines by any means is not now feasible, either biologically or economically, but it is likely to become a reality in the next decade (Talbert and others 1984).

Harvesting and logging research has included building prototypes and field testing many pieces of equipment in cooperation with various equipment companies. One cooperative project between industry and the Forest Service is the attempt to develop a whole-tree chip harvester to produce fuel chips from the forest biomass residual left after commercial harvest of merchantable stands. In addition to this cooperative effort, Georgia-Pacific has been working individually on a similar concept.

To accomplish one of the South's major silvicultural jobs--pine stand thinnings--International Paper Company has been working with Timberline Equipment Company to develop a thinner-harvester. The machine has successfully thinned thousands of acres of

southern pine stands but has not been accepted in the trade. Limiting factors include its price, interference in operation caused by topography, and the complexity of training operators.

The American Pulpwood Association's Harvesting Research Program, started in 1968, is an outstanding example of an industry cooperative. The program was originally funded by six companies, pledging \$50,000 each per year for 5 years. The project continued from July 1967 until November 1973, attracting eight additional companies as sponsors.

Research was undertaken in four major areas: equipment development, harvesting systems evaluation, forest-stand simulations, and nonphysical factors affecting harvesting efficiency. This last subject seems to have caused divisiveness in the project because it centered on the difficult areas of human behavior and motivation. It pointed out the value of operator training and safety and led to training programs by equipment manufacturers and a Forest Harvesting Training Center at Long Beach, MS,

supported by the industry and run for several years under the joint direction of Louisiana State and Mississippi State Universities. Other work of a similar nature was carried on by Clemson University.

Of lasting impact is the Harvesting Research Program's work on equipment development, including research on a feller-buncher head for small tree-to-tree machines, a hydraulic grapple for farm tractors, and a prime mover (research base machine) for a variety of forest operations.

The harvesting systems evaluation, which included studies and reports of systems used by cooperating companies, led to a harvesting analysis technique. This technique involves a computer simulation program for the comparison of a variety of machines and systems on one stand of timber, or the comparison of one machine or system on a variety of stands. The harvesting analysis technique is currently being used by a number of pulp and paper companies for machine and systems analysis.

Simulation of stands, the fourth area of investigation,

resulted in generation of forest models of over fifty 1-acre, mapped stands. Today, biometricians can seek the best combinations of pieces of equipment to fit into a logging system by using over 110 forest models available from Virginia Polytechnic Institute and State University while working in the comfort of their laboratories.

The Harvesting Research Program was terminated due to economic conditions within the industry, a not-unusual cause for interruption of research projects. Also, there was some feeling among cooperators that the project was getting ahead of the industry's perceived needs, particularly in the area of nonphysical factor studies. But cooperators remain unified in supporting thorough training in operations and safety.

At least one major research problem remains: design of a thinning system that is acceptable to a major portion of the industry, efficient for both natural and plantation pine stands, and priced within the economic range of the small pulpwood contractor in the South.

## Utilization Research

Paper has been manufactured in the South, at rag papermills, since before the Civil War. Near Atlanta, a groundwood process mill used shortleaf and loblolly pine in combination with rags to produce currency for the Confederacy until General Sherman's army destroyed it in 1864.

In 1888, a small sulfite mill, the Piedmont Pulp and Paper Company, was built near Luke, MD, by the Luke family. The mill later became part of the West Virginia Pulp and Paper Company, which is now known as Westvaco.

But the real key to papermaking in the South turned with the introduction of the sulfate process.

Sulfate processing dates back to 1879, when C.F. Dahl, a German chemist, successfully substituted sodium sulfate for the soda ash used in the old sulfite process. In 1884, Dahl received a patent for this process, which led to a faster rate of cooking and "kraft" (German and Swedish word for "strong") pulp.

USDA Forest Service investigations at the Forest Products Laboratory into

manufacturing and chemical variables resulted in the technology needed to successfully utilize the southern pines in the sulfate process (Wells and Rue 1927, Surface 1914). The South's abundance of wood, power, labor, and water and its proximity to markets were attractive to papermakers. A general expansion in southern pulp and paper occurred in the 1920's with International Paper Company contributing a major effort.

By 1930, there were 15 major southern kraft mills, accounting for 50 percent of the Nation's sulfate pulp production (U.S. Bureau of the Census 1931). International Paper Company owned 5 of the 15 mills and produced 800 tons of pulp per day.

Research during the 1920's paid off in two breakthroughs. First was the introduction of synchronized electric drivers, replacing the gear-driven series of machines used to operate the paper machine. These electric drivers dramatically increased production capacity. Second, in 1925 researchers discovered that kraft made excellent board and that the Fourdrinier, with little change, could

make not only bag and wrapped paper, but also board paper. Today, linerboard is one of the mainstays in the southern paper industry.

Introduction of continuous digesters and high-capacity chemical recovery boilers, plus constant research into refinement of pulping techniques, bleaching processes, and blending of hardwood pulps with various pine pulps, has developed a highly diverse industry. Using southern tree species, the industry today manufactures newsprint, linerboard, fine writing papers, label papers, magazine stock, coated and uncoated bleached board, and other items to package anything you can find at a fast food restaurant, in your refrigerator, or in your microwave oven.

While the industry has grown tremendously in its use of southern pines, it has continued to search for uses for the plentiful and underutilized low-grade hardwoods found throughout the South. Typical of the results of this effort is the development of Chemfibre, a corrugating material, patented by International Paper Company and used in the manufacture of shipping

containers. The middle layer of this shipping container is made from hardwood pulp.

The St. Francisville Paper Company in Louisiana was built as a joint venture of Crown-Zellerbach Corporation and Time, Inc. This 225-ton-per-day mill has the distinction of being the first southern mill to use only hardwoods in the manufacture of coated printing papers.

Nearby at Natchez, MS, in 1950, International Paper Company built the first mill of its kind in the world, manufacturing rayon pulp, using the sulfate process and utilizing hardwood pulpwood.

Constant research, largely proprietary and well guarded by various industry members, has dramatically increased hardwood usage, frequently blending hardwood pulp with pine in various combinations to reduce product cost, while in many cases improving such aspects of the product as smoothness and printability.

While much research effort has been devoted to pine and hardwood pulpwood and their usage in the pulp and paper industry, one of

the most challenging and successful research efforts has involved the use of southern pines in the manufacture of plywood. Experiments begun in 1952 at Yale University and the Forest Products Laboratory at Madison, WI, led to the conclusion that the manufacture of southern pine plywood was not feasible. Georgia-Pacific Corporation, which had hardwood plywood manufacturing experience at its Savannah, GA, plant, felt the manufacture of southern pine plywood was not the question: making a commercially acceptable product was the question. The development of an automatic lathe charger and retractable chucks made the use of the small (by west coast standards) southern logs practical. Georgia-Pacific worked on glue formulas, drying time, and steaming of logs until personnel felt confident they had the necessary knowledge to successfully manufacture southern pine plywood. In February 1964, the company shipped the first load of plywood from its new \$2.25 million plant at Fordyce, AR, and the race was on (Ross 1978).

Today, there are plywood plants throughout the South, manufacturing annually

about 10 billion square feet of rough plywood expressed in the commonly used 3/8-inch basis and consuming about 4 billion board feet of logs, Doyle Scale. The impact of this new industry has been significant both on the labor market and the timber resource of the South.

The other major development in industrial forestry in the South was taking place during the years 1963 to 1966. Several machines had been developed, some in local machine shops, in an attempt to recover slabs for the paper industry from sawmill bandsaws or circular saws. These devices met with limited success. The economics of transporting the slabs to a centralized chipping center and the lack of chip uniformity (and sometimes the presence of bark) made the chips unacceptable to most pulpmills.

Starting about 1963, the advent of the chipping headrig made it possible to convert small logs into cants with immediate downstream sawing of the cants into lumber. This direct conversion of what used to be slabs into pulp chips of relatively uniform size rounds out the story of

tree utilization in the South. Burning slab piles disappeared.

With modern, environmentally sound treating plants to convert the straightest trees into poles and piling; plywood plants to manufacture veneer-quality logs into widely used commercial plywood; small-log chipping sawmills and pulpmills for the smaller logs; and industrial boilers to use the bark and biomass from the forest, every imaginable

part of the tree is being utilized. Obviously, new products, such as the various oriented fiberboards and waferboards, will play a continuing role in the southern industrial forestry scene. But a major, if not the major, challenge of the future will be to keep in sight the need for intensive forest management and stewardship of the land, its timber, wildlife, water, and other associated benefits so important to Americans' enjoyment of a quality life.

**Table 1—Production of cones, seed, and seedlings from cooperative members' loblolly pine seed orchards over the last 8 years, including an estimate of acres that could be regenerated with improved seedlings if all the seed were used**

Harvest year	Bushels of cones	Tons of seeds	Millions of seedlings	Millions of acres regenerated
1977	32,152	24.8	396	0.66
1978	37,977	23.5	376	.63
1979	38,693	27.7	443	.74
1980	15,296	7.9	127	.22
1981	64,811	50.5	808	1.35
1982	44,761	30.5	488	.81
1983	68,447	49.0	784	1.31
1984	105,239	80.1	1,281	2.14
Total	407,376	294.0	4,703	7.86

Source: North Carolina State University (1985)

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