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FORESTS AND THE TEXAS ECONOMY

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FORESTS AND THE TEXAS ECONOMY

by

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Department of
FOREST SCIENCE



FOREWORD

This publication provides a comprehensive summary of the contribution of Texas forest resources to the economy of the state. It identifies the potential for expanding the timber raw material base, and the challenges that must be addressed to reach that potential.

Without expansion, the forest products industry of the future may provide fewer jobs, according to recent projections by the U.S. Forest Service. Without additional timber supplies, the industry cannot expand, and the state will become even less self-sufficient in meeting its forest products needs than it is today.

Our forests produce exceptional benefits in addition to an industrial base for East Texas. Forests are an important source of recreation, wildlife habitat, soil and water conservation, and aesthetic values. Providing increased economic benefits, while maintaining a healthy forest environment, requires the cooperation and understanding of many individuals, groups, and organizations.

This document provides a unique statistical base for understanding the current status of forestry in Texas and projecting its future contributions. Its objective is to stimulate further discussion and action that results in a full realization of the economic and social benefits that accrue from healthy, well-managed forest resources.

A handwritten signature in cursive script that reads "J. Charles Lee".

J. Charles Lee, Ph.D.
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Department of Forest Science
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1. Introduction and Highlights

An overview of the forest resources of East Texas and their economic importance to the state is presented in this report. Because of the extensive area covered by forests in Texas—14 percent or an area equivalent in size to the state of Indiana—everything about the Texas forest resource cannot be addressed in one publication. However, an attempt has been made to describe the comprehensive range of benefits provided to Texans from forests and forest lands.

This report is timely, in that it highlights and expands upon Texas forest resource information recently published by the U.S. Forest Service. Chief among these publications is the culmination of a study that has been underway for more than three years—*The South's Fourth Forest: Alternatives for the Future* (USDA Forest Service 1987a).

Importance of Forests to People

Forest products include paper for packaging materials, newspapers, magazines, and paper bags; as well as solid wood products such as lumber, plywood, and wood panels contained in our homes and their furnishings. Forests provide not only wood products and employment, but also investment opportunities, recreation, and a vast array of other benefits to people.

The economy of East Texas is based on its natural resources—wood, petroleum, and coal. This area of dense forests has long been recognized as a significant source of lumber, wood products, and recreational opportunities (*Texas Almanac* 1986).

Forest-based employment is a direct benefit to thousands of Texans, as the following indicates:

- The wood-based industry employs almost 60,000 Texans. Approximately 18,000 people are directly involved in the growing, harvesting, and converting of timber into primary wood-based products such as lumber, plywood, and paper. The remaining 42,000 jobs are in manufacturing secondary wood-based products such as doors, cabinets, furniture, treated poles, and consumer paper products and paper packaging (Figures 5-7 and 5-10).
- An additional 228,000 Texans transport, sell, or use wood-based products in construction activities and in printing and publishing (Figure 5-7).

Forest Resources of Texas

More than 23 million acres of the land in Texas is forested. About half of this area, roughly 11.6 million acres, lies in East Texas and is considered to be timberland—land capable of growing timber crops (Lang and Bertelson 1987). East Texas' timberlands are located near the borders of the neighboring states of Oklahoma, Arkansas, and Louisiana, and are often referred to collectively as the "Piney Woods." Almost all of the rest of Texas' 11.4 million acres of forest is classified as woodlands, and consists, for the most part, of sparsely distributed hardwoods.

This report, with its focus on economics, concentrates on the timberlands of the Piney Woods region. In this region of East Texas—representing 12.6 percent of the state, which is an area larger than the state of South Carolina or Maine—55 percent of the land is timberland (Figure 2-3). The major timber types present in the Piney Woods are pine, oak-pine, upland hardwood, and bottomland hardwood. Pine is the principal tree on 36 percent of the timberland acres. Oak and other hardwoods in association with pine (oak-pine) are the principal forest types on 26 percent of the timberlands. So pine trees are present to a substantial degree on well over half of the East Texas Piney Woods timberlands. Upland hardwood forest covers 29 percent of the timberland acres, and bottomland hardwoods cover the remaining 14 percent.

Public Opinion and Forestry

A public opinion survey by Shipley & Associates, commissioned in 1984 by the Texas Forestry Association, revealed that people are not knowledgeable about the forest resource, forestry practices, or the forest products industry. More than half of the citizens of East Texas who were surveyed indicated that they had heard little or nothing about the industry. Surprisingly, only 6 percent of the East Texans surveyed realized that timber supports an industry of major importance in the region (AFI 1985).

Given that forestry in East Texas has such a low level of public awareness, it is no surprise that 55 percent of the respondents to the survey believed that companies could not be trusted to preserve forest lands, and that legislation should be passed to protect forests (AFI 1985). But excessive environmental and regulatory restrictions can create timber availability problems and potentially stifle industrial growth. And, as Figures 10-8 and 10-10 illustrate, companies in the Texas forest products industry have planted a substantial amount of their harvested timberlands with trees, which is an indicator of good timber resource stewardship.

The general public may know little about forestry, but in the past decade, active groups of concerned citizens from many areas of the state have become increasingly aware of the forests of East Texas, and interested in the actions taken to manage these resources. Areas of concern have included timber harvesting methods (particularly clearcutting), site preparation methods, and air quality (more specifically, the management of smoke from prescribed fire or controlled burning of the forest).

More Texans are using the forests for recreation purposes and are thus able to observe forest management activities firsthand. The influence exerted on the management of forest lands by citizens who are concerned about the forest may or may not be disproportionate to their numbers. But one thing is certain: Citizen concern regarding forestry matters will continue to be a crucial element for planning and implementing management activities on all timberlands, regardless of who owns them.

Texas' Forest Products Industry

The forest products industry in Texas manufactures wood-based products such as lumber, plywood, poles, furniture, pulp, paper, and a host of other products from the timber grown in Texas forests. The economic activity in the forest products or wood-based industry is a part of the manufacturing industry that is a vital component of Texas' diverse economy (Figures 5-1 to 5-3). As indicated below, Texas is one of the top producers of forest products in the country:

- Texas is one of the top ten states in the U.S in primary wood-based manufacturing. Texas ranks third in plywood production, seventh in pulpwood consumption, and twelfth in lumber production (Figure 5-13).
- The Texas wood-based industry is the ninth largest in the nation (Figure 5-11) and the fourth largest in the South (Figures 5-6 and 5-12), with sales of \$5.6 billion and a value added contribution of \$2.3 billion in 1984.

Economic Impact of Texas' Forest Products Industry

The wood-based industry has a substantial impact on the Texas economy. The industry provides jobs and income for thousands. Timber is a major cash crop for landowners. Examples of the industry's economic impact include the following:

- Timber is the most valuable agricultural crop in the South. In Texas, timber consistently ranks among the top four cash crops, with an annual delivered value of approximately \$500 million (Figure 6-4).
- Timber grown in East Texas is processed into primary wood-based products that had a sales value of \$1.6 billion and a value added contribution of \$550 million in 1984 (Table 6-3 and Figure 6-6).
- The wood-based industry provides more than one-fourth of the manufacturing employment opportunities in rural East Texas (Table 5-1).
- A 1 percent increase in the output of the primary manufacturing sector of the industry—lumber and plywood, and pulp and paper—will produce a statewide impact of almost \$50 million (Table 6-2).
- If processed in new manufacturing facilities, a 12 percent increase in Texas timber harvests could have a statewide economic impact of \$187 million, of which \$63 million is value added. This new manufacturing capacity could result in 1,300 new jobs (Table 10-1).

Future of Texas' Forest Resources and Forest Industry

Short-term: The present situation and short-term outlook for Texas' forest resources appear favorable, based on the recent forest inventory conducted by the U.S. Forest Service with assistance and cooperation from other members of the Texas forestry community. The major portion of the Texas timber inventory is in the larger and more valuable classification of sawtimber (Figure 2-5), indicating an adequate supply of raw material for Texas' diverse wood-based manufacturing

facilities. The short-term outlook for the forest products industry is based on the following:

- Historically, Texas wood-based industry growth in the primary manufacturing industries (Figure 5-10) was fueled in the 1960s and 1970s by an abundance of softwood timber supplies (Figures 9-4 and 10-3).
- Annual harvests of Texas timber for the past decade have been approximately equal to annual timber growth (Figure 9-4). Any additional harvests would reduce the timber growing stock inventory. This is illustrated by U.S. Forest Service projections of declining future softwood inventories in Texas (Figure 10-3).
- Future expansion of the primary wood-based manufacturing industry will require additional sawtimber and pulpwood as raw materials. Because these timber products have a low value-to-volume ratio, as a rule of thumb, the economic transportation distance for timber is 50 miles. Texas mills will therefore depend upon the supply and proximity of Texas timber. This notion is reinforced by Texas' position as a net exporter of timber (Figure 9-5).

Long-term: The long-term outlook for Texas' forest resources relative to projected future demand may not be as favorable as the short-term, based on the findings of a U.S. Forest Service study (USDA Forest Service 1987a):

- Annual increases to the pine growing stock throughout the South, including Texas, are beginning to decline (Figure 10-3). Several factors are cited as being responsible for this trend. Principal among them is the lack of adequate regeneration after harvest on non-industrial private forest lands. Other factors contributing to projected declines in softwood timber growth are increases in tree mortality caused by pine bark beetles and the conversion of timberland to other uses. The effects of projected land use changes are illustrated in Figure 10-1.

The future of the forest industry sector depends on the solution to timber growth and timber supply problems. Without a change in landowners' management activities, the U.S. Forest Service foresees a decline in the future timber inventory. Reductions in timber inventories mean decreased timber supplies and increased raw material costs for the wood-based industry. Together with improvements in manufacturing technology, reduced timber supplies could result in fewer jobs in the industry than currently exist. The most rational solution is to plant more trees today to provide a sustained timber supply in the future. Timber supplies can be increased as explained below:

- There are opportunities to increase future timber supply inventories in Texas that would also provide landowners with attractive rates of return on their investments (Figures 10-12 and 10-13).
- Investment opportunities on 1.9 million acres of private timberlands exist that could potentially provide greater than a 10 percent real rate of return, pre-tax. These investments, at an estimated cost of \$145 million, would increase annual timber growth in Texas by 25 percent (USDA Forest Service 1987a).

2. Texas' Changing Forest Resource

Forests cover almost 14 percent of the land area in Texas. These forests provide income for their owners, raw material for wood product facilities, recreation opportunities, wildlife habitat, soil and water protection, aesthetic values, and employment for thousands of Texans.

Half of Texas' forests are in the Piney Woods region of East Texas. The Post Oak region, just west of the Piney Woods, has 3.6 million acres of trees. The Cross Timbers region in North Central Texas has almost 2.4 million acres of trees. The Cedar Brakes region, in the East Central hill country, has 4.5 million acres of mountain cedar mixed with oak, elm, and other hardwoods. Another 1.5 million acres of forests are in the mountains of West Texas, the coastal regions, and in flood plains in South Central Texas. Extensive areas of rangeland that grow mesquite are not included as forested acreage (TFS 1970).

Of the total forest area in Texas, 12.118 million acres are considered to be productive timberland (USDA Forest Service 1987a).

Of the twelve southern states, Texas ranks eleventh in timberland acreage (Figure 2.1). Ninety-five percent of the timberland in Texas, or 11.565 million acres, is in the Piney Woods region. Timberland is forest land that is producing, or is capable of producing, crops of industrial wood. Land that is otherwise withdrawn from timber utilization, such as legally designated wilderness and preserve areas, are not classified as timberland, regardless of their productive capability. The minimum productivity standard for timberland is annual growth of 20 cubic feet of wood per acre, which is only about one-fourth of a cord. According to the U.S. Forest Service (Lang and Bertelson 1987), the "average" acre of Texas timberland can produce 76 cubic feet per year—almost one cord of wood.

Forest Survey Regions

Texas is divided into three forest survey regions: The Post Oak region, and the more productive Northeast and South-

TWELVE SOUTHERN STATES TIMBERLAND ACREAGE BY OWNERSHIP 1985

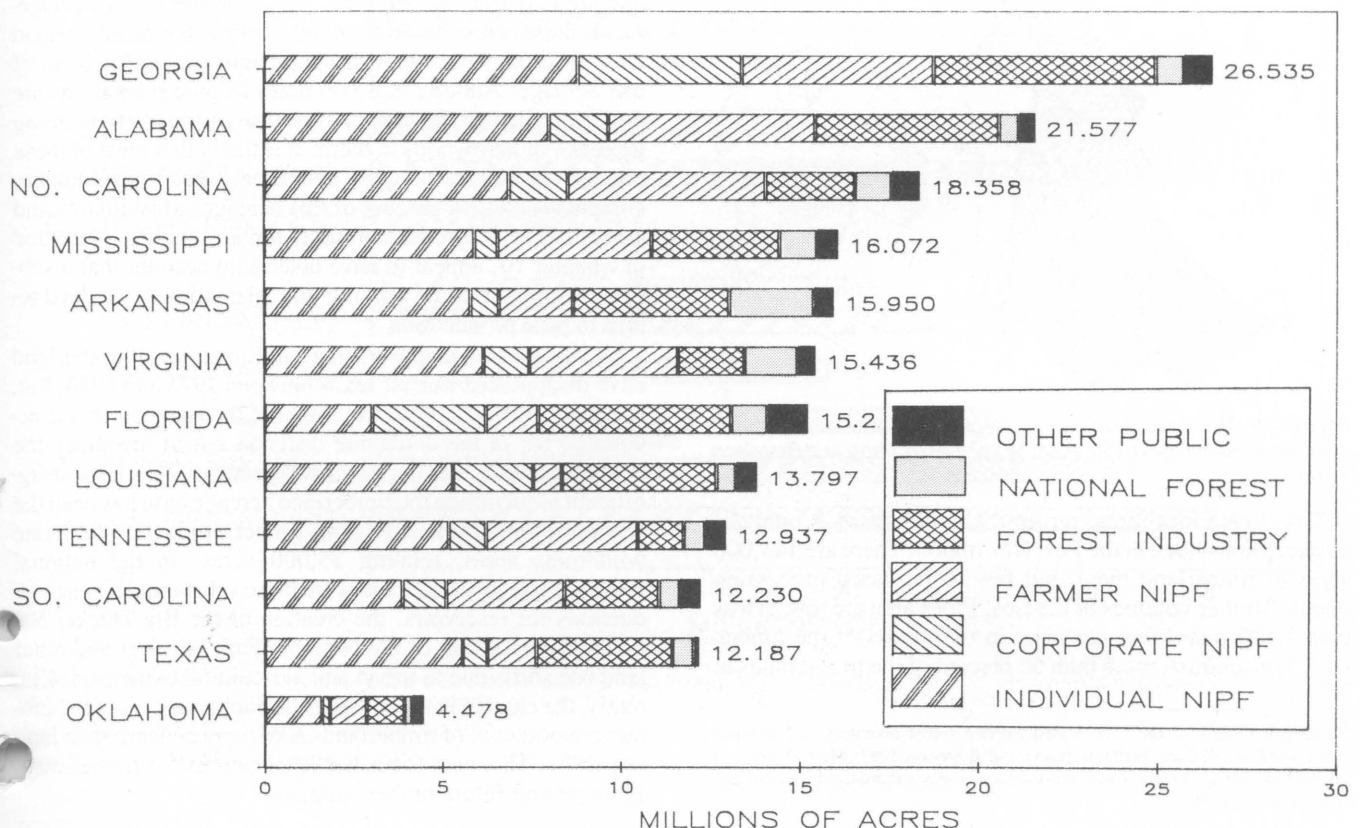


Figure 2-1. Twelve southern states ranked by timberland acreage ownership. (Source: USDA Forest Service 1987a).

east regions (Figure 2-2). An inventory of the forest, using sampling methods, is conducted approximately every 10 years by the U.S. Forest Service. The most recent survey inventory was completed in 1986. These findings as reported by McWilliams, Rudis, and Lord (1987)¹ reveal trends when compared to the 1975 survey. A brief but comprehensive and highly readable report of these findings and their implications for the future is available from the Texas Forest Service (TFS 1987b). Some of these findings are addressed in this chapter.

The Post Oak region consists mainly of lands with a low productivity rating that grow low-valued hardwood trees. Although almost one million acres of timberlands are in the Post Oak region, this region was not included in the 1986 survey inventory for efficiency reasons because these lands are used little for timber production. The vast majority of forest land in the Post Oak region is classified as woodland. Because of adverse site conditions, woodlands will not grow the requisite 20 cubic feet of wood per acre per year needed to qualify as timberland.

FOREST RESOURCE REGIONS OF EAST TEXAS

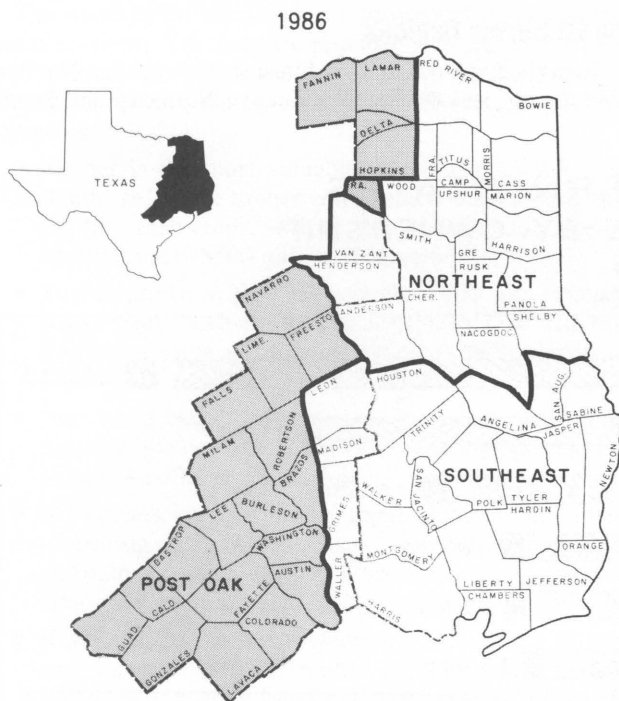


Figure 2-2. The three forest survey regions of East Texas and the counties in each region. (Sources: Murphy 1976; Lang and Bertelson 1987).

The "Lost Pines" area, centered around Bastrop County, is an exceptional area in the Post Oak region. There are 143,000 acres of timberland there, but few wood-based processing plants. Timber volumes in the Lost Pines area are low, at less than 1,500 board feet per acre on two-thirds of the timberland. By contrast, more than 60 percent of the timberlands in

¹ Statistical reports of the U.S. Forest Service forest inventory and analysis completed in 1986 are available (Lang and Bertelson 1987; McWilliams and Bertelson 1986a, 1986b). These statistics are briefly summarized by Lord and McWilliams (1986).

the Piney Woods have more than 1,500 board feet per acre (McWilliams and others 1987).

The Northeast region consists of pine and higher-value hardwood trees and accounts for 4.9 million acres of timberland. The forest type on these acres is determined by the predominant type of tree that occupies a given area of land. In 1986, pine forests comprised 25 percent of the total timberland acreage, mixed oak-pine forests covered 22 percent, upland hardwood forests accounted for 38 percent, and bottomland hardwood forests made up the remaining 15 percent (Lang and Bertelson 1987). When compared with the previous survey conducted in 1975 (Murphy 1976), the 1986 figures revealed a 15 percent decrease in pine forest acreage and a corresponding 16 percent increase in upland hardwood acreage.

The Southeast region has more than 6.6 million acres of timberland. More than 45 percent of this area is classified as pine forest. The oak-pine forest type is 20 percent, upland hardwood forest acres comprise 22 percent, and bottomland hardwood forest covers 12 percent of the acreage. Since 1975, the Southeast region has experienced a 9 percent decrease in pine forest acreage and an 11 percent decrease in oak-pine forest. Upland hardwood acreage has increased by 46 percent.

Pine forest type acreage decreased by 159,200 acres in the Northeast region and 453,000 acres in the Southeast region. It would appear from U.S. Forest Service inventories in 1975 and 1986 that 612,700 acres of pine timberland has been lost from the pine forest type, and thus from pine production. However, 344,000 acres of this apparent loss is accounted for by plantations that have a high proportion of hardwood trees, and are classified as oak-pine. Under proper forest management, these acres should eventually return to pine timberland classification. Forest industry companies own 83 percent of this acreage. Another 228,000 acres of pine plantations are now classified as oak-hickory because of the overwhelming presence of hardwoods in them. It is likely that most of these plantations will shift to pine over time, since forest industry companies own 70 percent of this acreage (McWilliams and others 1987). Projections of future timber supplies, presented in Chapter 10, appear to have taken into account that a substantial amount of the missing pine plantations do indeed return to pine production.

At first glance, it appears that a million acres of timberland have disappeared in East Texas between 1975 and 1986, but, in reality, this is not the case. Most of the apparent loss is accounted for in the deliberate decision not to inventory the Post Oak region. During the last 10 years, the single most significant reduction in the timberland acreage base has been the withdrawal of forest land from timber production to create wilderness areas, totaling 35,000 acres, in the national forests. Prior to 1975, there were more substantial acreage reductions for reservoirs, the creation of the Big Thicket National Preserve unit of the National Park Service, and other land use shifts due to urban and agricultural expansion. Currently, the change in timber types and achievement of the productive potential of timberlands is of more concern than land use shifts. This new focus has implications for timber management and future timber supplies.

East Texas Piney Woods

There are 43 Texas counties in the Piney Woods region. This coincides with the forest survey regions designated as Northeast and Southeast Texas (Figure 2-2). Considering all land uses, the Piney Woods region consists of almost 22 million acres.

Timberland comprises almost 55 percent of the land in East Texas. Of the six other states in the South Central region², only Alabama has a higher percentage of timberland. There is more pasture land in East Texas than in any other southern state. Of the eleven other states in the South, only Eastern Oklahoma has fewer acres of cropland than exists in East Texas (Figure 2-3).

Forest Land Productivity

Texas timberlands have a high productive potential, averaging almost one cord per acre per year. More than three-

fourths of the timberland acreage consists of land with good to excellent site productivity (Figure 2-4). Natural stands on good sites are capable of producing greater than 85 cubic feet of wood per acre per year, which is at least one cord per acre annually. By applying current plantation forestry practices, these yields can be increased by up to 40 percent. New technologies such as genetic improvement with biotechnology, coupled with fertilization and herbicide application, offer the promise of doubling and perhaps tripling the productivity of a natural stand (Farnum and others 1983).

The overall average productive potential of Texas timberlands is estimated at 76 cubic feet per acre per year. Currently, Texas timberlands are producing an average of 54 cubic feet of wood per acre per year. With increased management efforts toward achieving the 76 cubic feet of wood growth potential, the average annual growth of timber could be increased by 40 percent, and Texas landowners could receive substantial and highly competitive rates of return on their in-

SOUTHERN LAND AREA CLASSIFICATIONS BY STATE

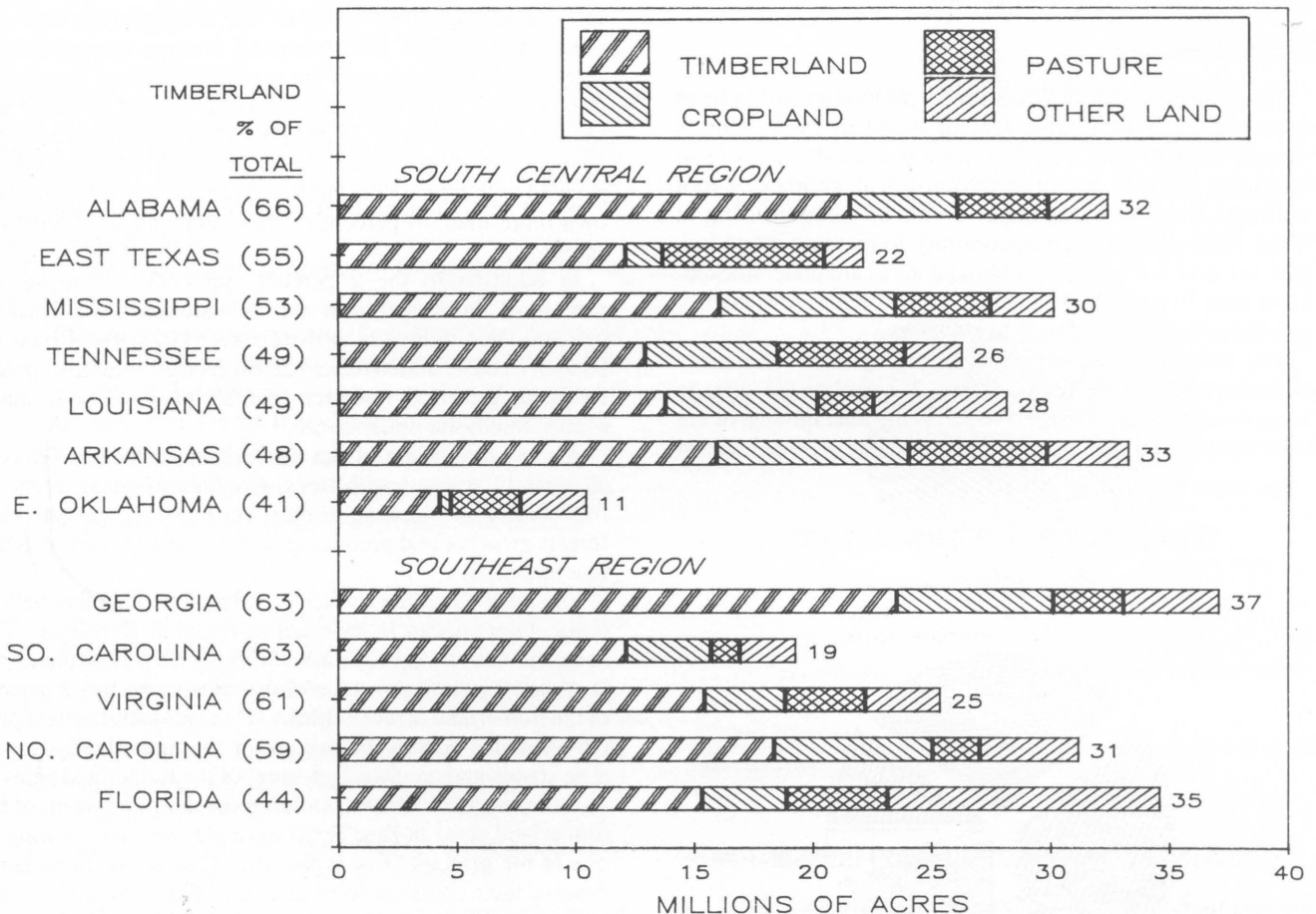


Figure 2-3. Southern land area classifications by state, including East Texas and East Oklahoma. Ranked within region by timberland percentage of total land. (Source: USDA Forest Service 1987a).

²The South Central region consists of Alabama, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas (USDA Forest Service 1987a).

vestments. The opportunities for achieving this goal are summarized in Chapter 10 (Figures 10-12 and 10-13).

There are 965,000 acres of marginal crop and pasture land in East Texas that could produce net annual growth of 40 to 100 million cubic feet of wood per year if converted to pine. For comparison purposes, the 1985 timber harvest in Texas totaled 551.5 million cubic feet. Another 145,000 acres of highly erodible lands in Texas could be converted to pine forests and produce net annual growth of 10 to 16 million cubic feet of wood (USDA Forest Service 1987a). The Conservation Reserve Program, a new feature of the 1985 Farm Bill, is targeting these acres for planting of pine or other cover crops to protect these lands from soil erosion.

In summary, the growth potential of Texas forest lands is not being met. The difference between actual growth and potential growth provides a challenge for all landowners and others who guide timberland decisions to better utilize the Texas forest resource. The rates of return on investments made by landowners to improve their timberlands is very competitive with other investment alternatives. Increased timber inventories could provide an opportunity for growth in the wood-based industry. Further discussion of this important topic is included in Chapter 10.

Timber Inventory

The growing stock of Texas timber was estimated to be in excess of 12 billion cubic feet of wood in 1986. This is enough wood to pave a 24-foot-wide boardwalk of 2 x 4s to the moon, circle it, and return to earth with another 24-foot walkway. Even with this huge volume of wood growing in Texas forests, there is an opportunity to increase wood volume because 3.8 million timberland acres are understocked. More than 70 percent of the understocked acres are owned by non-industrial private forest landowners.

The 1986 Forest Survey inventoried the 11,565,190 acres of timberland in East Texas. Figure 2-5 depicts the acreage breakdown by size of timber, which is the average size of the trees growing on that acreage. Approximately 50 percent of

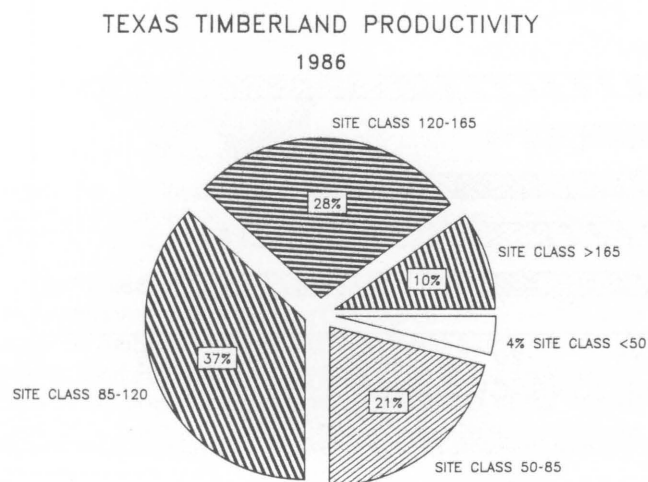


Figure 2-4. Texas timberland productivity by site class (cubic feet/acre/year). Expressed as a percent of the total acreage in Texas, which is 11,565,190 acres. (Source: Lang and Bertelson 1987).

TEXAS TIMBERLAND ACREAGE
1986

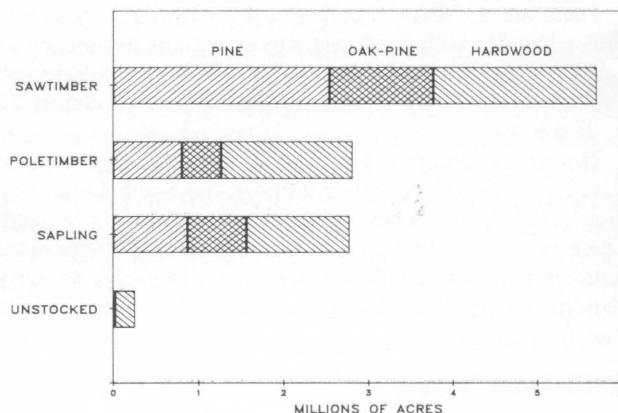


Figure 2-5. Texas timberland acreage classified by timber size class and forest type. (Source: Lang and Bertelson 1987).

the total acreage has sawtimber size trees growing on it. Almost one-fourth of the timberland acreage has poletimber size trees. Poletimber trees are merchantable trees that are not large enough to be sawn into lumber products. Seedling and sapling stands occupy 24 percent of the timberland acreage. Two percent of the timberland acreage (258,000 acres) is not stocked with trees. Non-industrial private forest landowners own more than 70 percent of these unmanaged timberland acres.

In addition to the 2 percent non-stocked acreage, 33 percent of the timberlands are understocked by at least 40 percent. Non-industrial private forest landowners own 69 percent of these understocked acres. A large volume of potential wood growth is lost each year, simply because so many timber stands are understocked.

Almost two-thirds of the timberland acreage in Texas is adequately stocked with trees. Continued management efforts aimed at stocking control on this acreage can keep forests growing and producing wood at or near their productive potential.

The most abundant trees in East Texas are southern yellow pines. Four species of pine can be found in East Texas. The beautiful native longleaf pine (*Pinus palustris*) and the exotic fast-growing slash pine (*P. elliotti*) together occupy 2 percent of the timberland acres. Loblolly (*P. taeda*) and shortleaf pine (*P. echinata*) occupy 34 percent of the timberland acres as pine stands and another 21 percent of the timberland acres in an oak-pine association. In total, more than 57 percent of the timberland acres in East Texas have pine species growing as one of the principal tree types, thus East Texas timberlands deserve their common sobriquet, the "Piney Woods."

Hardwood forest types are predominant on 43 percent of the timberlands. Bottomland hardwoods—so called because they grow in the flood plains of rivers, streams, or creeks—comprise 14 percent of the total timberland acreage. These forests contain valuable timber resources, and are prime areas for recreation and wildlife habitat. Lower-valued upland hardwood tree species cover the remaining 29 percent of the timberlands in the Piney Woods.

Summary

A Texas Forest Service summary (TFS 1987b) of the 1986 forest survey conducted by the U.S. Forest Service addresses these main points regarding the status of timber resources in East Texas:

- Acreage of pine timber is declining.
- Timber growth has declined.
- Timber mortality has more than doubled in the past decade.
- Annual pine timber removals exceed annual growth.
- Pine timber inventory is declining.

- Tree planting has not kept pace with harvesting.
- There are many opportunities to increase timber growth.

The future of the Texas forest economy as described in *The South's Fourth Forest* report (USDA Forest Service 1987a) is not a favorable one. The U.S. Forest Service projects that future demand for timber will increase at a more rapid rate than future timber supplies. If problems—such as higher timber and wood product prices and reduced opportunities for industrial growth—caused by this situation are to be resolved, it is important to understand the objectives of various timberland owners.

3. Ownership of Timber Resources

Ownership is a critical factor in determining how timberlands are managed; its importance as a management consideration cannot be overstated. The landowner—within legal, environmental, economic, social, and political constraints—decides what happens to the land, including the timber resource attached to it.

There are three major categories of timberland owners in Texas:

- 1) Private landowners not involved in the manufacturing of wood-based products—Non-Industrial Private Forest (NIPF) landowners—own more than 60 percent of the timberland in the Piney Woods region (Figure 3-1).
 - In the Northeast forest survey region, this group holds more than 80 percent of the timberland (Figure 3-2).
 - Ownership objectives are diverse and difficult to generalize.
- 2) Companies involved in the manufacturing of wood-based products own 33 percent of the timberland in the Piney Woods region (Figure 3-1).
 - Industrial ownership is concentrated in the Southeast forest survey region (Figure 3-2).
 - The primary ownership objective is to provide supplies of wood for the companies' manufacturing facilities.
- 3) Public ownership of timberland in Texas amounts to less than 7 percent of the total (Figure 3-1).
 - Most timberland in this category is managed by the U.S. Forest Service as national forests, concentrated in the Southeast region (Figure 3-2).
 - Public forests are managed to provide many different uses.

Further discussion of ownership objectives is provided in the sections that follow.

TEXAS TIMBERLAND OWNERSHIP

1986

EAST TEXAS PINEY WOODS TOTAL: 11,565,190 ACRES

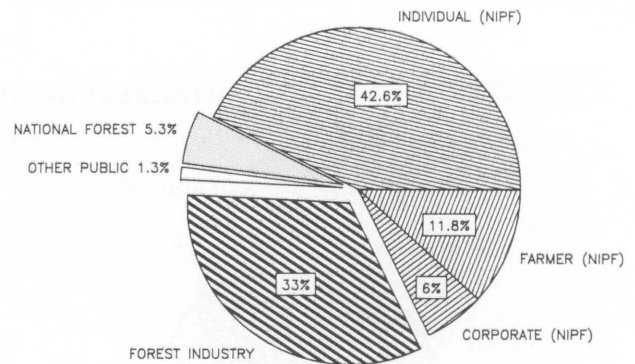


Figure 3-1. Percent of total East Texas timberland acreage by ownership category. (Source: Lang and Bertelson 1987).

Non-Industrial Private Forest (NIPF) Ownership

NIPF ownership is the largest segment of Texas' timberland acres. More than 7 million acres of timberland is in non-industrial private ownership. By definition, these owners do not process their timber into lumber or other wood-based products.

The management objectives of the NIPF owners are as diverse as the owners themselves. Even categorization of these estimated 150,000 owners is difficult. The forest inventory

conducted by the U.S. Forest Service now recognizes three sub-groups of NIPFs: farmers, corporate, and individuals (Figure 3-2). However, ownership objectives are likely to be quite independent of any generalization based on these three categories. Some NIPF landowners are timber culturists, practicing forest management and making investments to improve the value of their timberland. Some landowners are willing to let Mother Nature manage their timber stands for them, and harvest when they need income, with varying degrees of concern about future timber inventory. Others own timberland for a variety of non-timber production reasons, including recreation, aesthetics, and a place to get away from urban pressures. Wildlife, grazing opportunities, and watershed enhancement may be key objectives in timberland ownership, whether timber value is the primary goal or not. A part of the forest industry's future will be determined by the decisions made regarding understocked NIPF timberlands.

Forest Industry

Companies in the forest products industry own 33 percent of the total timberland acreage in Texas. This percentage is higher than in the U.S., the South, or the West Gulf region (Figure 3-3). The West Gulf region includes Texas, Arkansas, Oklahoma, and Louisiana. Only two other states—Maine and Florida—have a higher percentage of industrial timberland ownership than Texas (Figure 3-4). The largest portion of industry ownership in Texas, totaling more than 3 million acres, is in the Southeast forest survey region (Figure 3-2).

Forest industry companies manage their lands for timber production to ensure a supply of raw material for their lumber, plywood, and pulp and paper production facilities.

Ownership objectives are often stated as ensuring low-cost wood supplies for company mills. These wood-based companies provide employment for many Texans (See Chapter 5.), as well as recreation opportunities, watershed protection, tax revenues, and the manufacture of a wide variety of useful and versatile wood-based products.

Public Forests

The national forests of Texas contain 5.3 percent of the 11.6 million timberland acres. There are four national forests in Texas: Sam Houston, Davy Crockett, Sabine, and Angelina. These areas include 610,000 acres classified as timberland. Almost all of these federally owned timberlands are managed by legal mandate for multiple uses, which include timber management, recreation, wildlife, grazing, watershed protection, and other environmental concerns. National forests have 35,000 acres that are classified as legal wilderness areas from which timber may not be harvested.

Other public agencies with timberland include state parks, Texas Forest Service forests, and state wildlife management areas. Collectively, these state agencies, county and municipal agencies, and other federal agencies hold 1.3 percent of the timberland acreage.

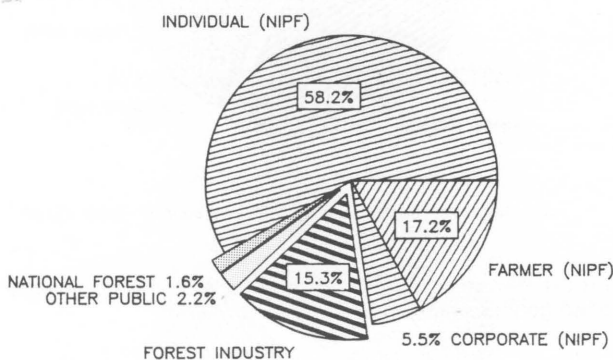
The Texas Forest Service (TFS) owns and manages 7,200 acres of timberlands in five state forests. TFS also manages timberlands owned by the General Land Office and the Texas Department of Corrections. Timber and seedling sales provide revenues for the state. These forests also provide demonstration areas for landowners to see good forestry at work and sites for applied research.

EAST TEXAS TIMBERLAND OWNERSHIP BY REGION

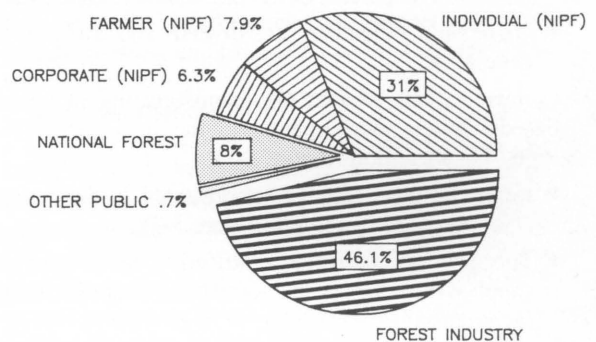
1986

NORTHEAST TOTAL: 4,898,690 ACRES

SOUTHEAST TOTAL: 6,666,500 ACRES



Northeast Texas NIPF Percent of Total : 80.9%

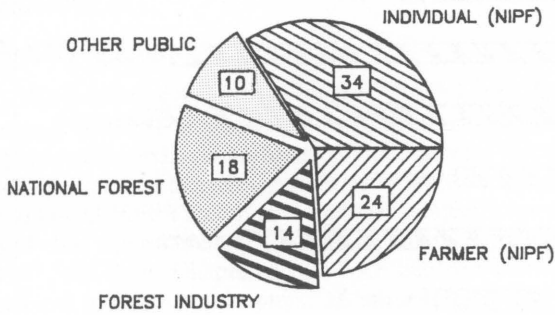


Southeast Texas NIPF Percent of Total : 45.2%

Figure 3-2. Texas timberland ownership by region and ownership category. Expressed as a percentage of total acreage for both the Northeast and Southeast. (Source: Lang and Bertelson 1987).

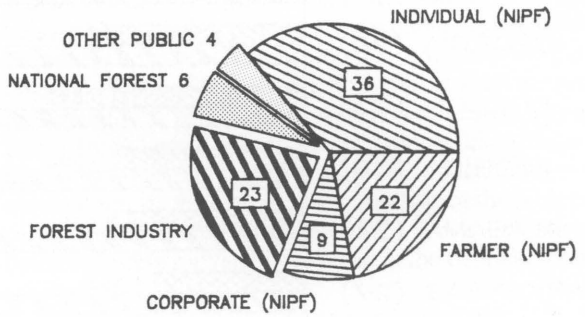
TIMBERLAND OWNERSHIP

U.S. TOTAL: 482.5 MILLION ACRES (1977)



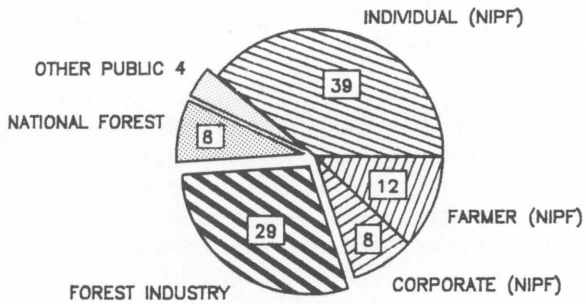
NIPF Percent of Total: 58%

SOUTHERN U.S. TOTAL: 182.2 MILLION ACRES



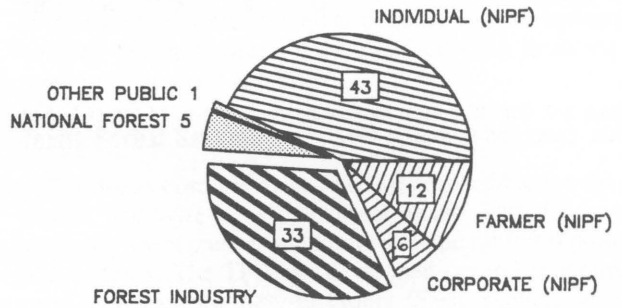
NIPF Percent of Total: 67%

WEST GULF TOTAL: 46.7 MILLION ACRES



NIPF Percent of Total: 59%

EAST TEXAS TOTAL: 11.6 MILLION ACRES



NIPF Percent of Total: 61%

Figure 3-3. Total timberland acreage in the U.S., the South, the West Gulf, and Texas shown by ownership category. The West Gulf Region includes the states of Arkansas, Louisiana, Texas, and Oklahoma. (Sources: USDA Forest Service 1987a; USDA Forest Service 1982).

TOP 10 STATES RANKED BY FOREST INDUSTRY TIMBERLAND

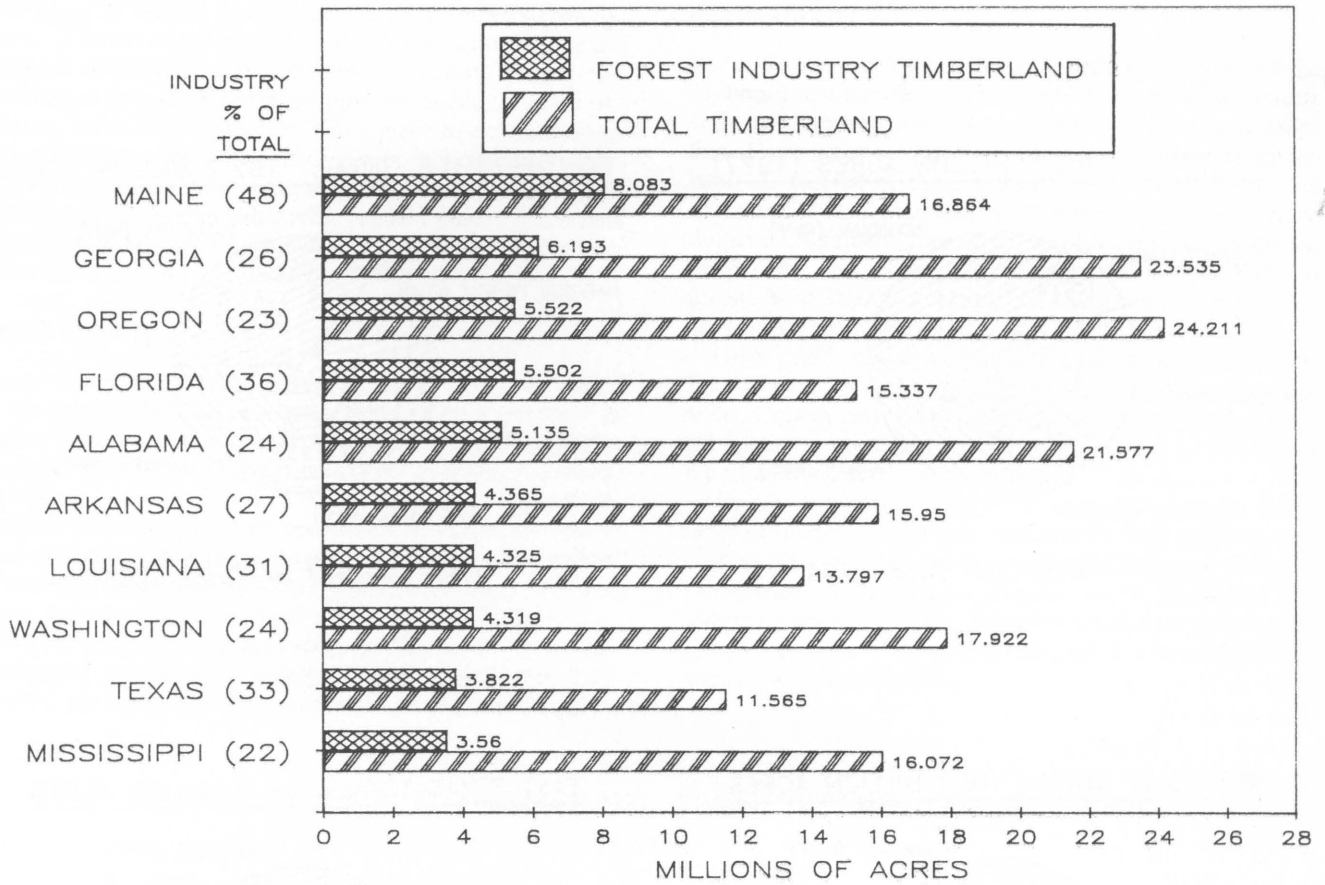


Figure 3-4. Top 10 states ranked by percentage of forest industry timberland. (Sources: USDA Forest Service 1982; USDA Forest Service 1987a; Lang and Bertelson 1987).

4. Texas' Forestry Organizations

The following sections describe organizations interested in forestry in Texas. As an indication of the economic and social importance of forests, both the public and private sectors are well represented. The forest products industry, an important component of the forestry sector, is described and analyzed in Chapter 5.

Society of American Foresters

The Society of American Foresters (SAF) is a professional natural resource management organization. Members include public and private forestry practitioners, researchers, administrators, educators, and forestry students. Founded in 1900 by Gifford Pinchot and six other pioneer foresters, the SAF has approximately 20,000 members nationwide. In 1987, the Texas Chapter of the SAF had 435 members organized in five local chapters. Membership is down from a peak of nearly 600 in the early 1980s, in part because of generally hard times in the forest industry.

SAF objectives are to advance the science, technology, education, and practice of professional forestry and to use the knowledge and skills of the profession to benefit society. To meet its objectives, the SAF strives to enhance public understanding of forestry, publish peer-reviewed results of current forest research, sponsor conferences and workshops on forestry and related topics, and accredit university programs in professional forestry.

U.S. Forest Service

The U.S. Forest Service, in the U.S. Department of Agriculture, is the federal government agency responsible for management of the National Forest System. Nationwide, this amounts to 191 million acres, most of which is in the western states. In Texas, there are 635,000 acres in the Sam Houston, Davy Crockett, Angelina, and Sabine National Forests. The Forest Service also manages 38,000 acres of national grasslands north of Dallas and Fort Worth.

Management of national forests is by multiple use on all but wilderness lands. The multiple use concept means that all aspects of the forest environment are considered in a long-range comprehensive planning process. The plan includes timber management, wildlife, recreation, watershed protection, grazing, and aesthetic values. The Land and Resource Management Plan adopted by the agency in 1987 (USDA Forest Service 1987b) reflects the concerns expressed by almost one thousand comments received from interested and concerned citizens in response to a draft plan circulated for public comment in 1985 (USDA Forest Service 1987c). Of the 610,000 acres classified as timberland (Lang and Bertelson 1987), the Plan identifies 521,000 as suitable for timber production purposes.

The benefits of the national forests in Texas include, but are not limited to, a supply of raw material for Texas' forest products industry. Habitat for game and non-game wildlife is

an important consideration. Many Texans use their national forests for hunting, fishing, hiking, camping, and many other outdoor recreation activities. Non-cash benefits to users are estimated at \$85 million per year (USDA Forest Service 1987c).

Timber sales from the national forests in Texas are substantial, and have an important local economic impact. Total receipts will be almost \$30 million per year under the Plan. By law, one-fourth of the receipts from timber sales are returned to the counties in which the timber was grown. These payments are in lieu of property taxes, and are used in the counties for schools and county roads. The annual budget of the national forests in Texas is about one-half of the projected receipts (USDA Forest Service 1987c). There are, then, two dollars of timber revenue produced in the national forests for every dollar spent.

Besides its land management mission, the U.S. Forest Service cooperates with state and private forestry organizations to help them accomplish their goals. The Forest Service also conducts research to increase knowledge of the management of all forest resources. In addition to its own research, the Forest Service provides cooperative aid to universities conducting research in forestry and related areas.

Periodic forest surveys of the forest resource are conducted by the U.S. Forest Service in cooperation with forest industry companies and other agencies, including the Texas Forest Service. These surveys are necessary for determining trends in the forest resource, as well as documenting the existing inventory. Recent findings of the 1986 survey in Texas are featured in Chapters 2 and 3.

Texas Forest Service

The Texas Forest Service (TFS) is responsible for the protection and wise development of Texas' varied forest resources to meet present and future demand for forest products and benefits. The TFS has developed several programs to meet its responsibilities, including forest resource development, reforestation, tree improvement, fire control, rural fire defense, forest insect and disease control, information and education, urban forestry, forest products, West Texas windbreaks, and administration. The TFS was established by the state legislature in 1915 as a part of the Texas A&M University System (TFS 1983).

The Texas Forest Service provides technical forestry assistance to non-industrial private forest (NIPF) landowners, who own 60 percent of the timberlands in Texas. The TFS is the key agency for two reforestation cost-sharing programs for NIPF owners. First, is the federally funded Forestry Incentives Program (FIP). Second, the unique TRe ("Tree" is an acronym for Texas Reforestation.) Foundation that is funded by voluntary donations from Texas forest products industry companies. The TFS operates two nurseries that provide low-cost conifer and hardwood seedlings for reforest-

ation on Texas NIPF timberlands and establishment of windbreaks throughout the state.

The TFS Fire Control program is a cooperative effort in fire prevention, detection, and suppression with the U.S. Forest Service, private forest industry companies, and rural community fire departments. The TFS Fire Control program directly protects more than 22 million acres of forest land.

Applied research on forest products, tree improvement, insect and disease control, and urban forestry are other important activities of the Texas Forest Service that benefit many Texans. Research conducted at the TFS' Forest Products Laboratory in Lufkin is responsible for new and innovative uses of wood products, such as pine roofing shingles. The wide range of wood-based products manufactured in Texas is documented in a directory of products and companies compiled by the TFS (1987a). Currently, TFS researchers are working on the development of a low-cost fire retardant to be applied on wood roofs. The TFS conducts genetic research to develop superior strains of trees for commercial pine timber production, hardwood forest areas, and Christmas tree plantations. Seedlings produced from research efforts are made available for reforestation efforts through a cooperative organization in which the TFS is the lead agency. In the areas of insect and disease control, the TFS provides technical assistance to field foresters and landowners to prevent or reduce losses from these pests. Much of the knowledge needed for this important task is gained through applied research efforts by the TFS. The TFS Urban Forestry program was initiated in 1972 to assist local communities with the management of their urban trees and forests (TFS 1983 and 1985b).

Unique among all southern states is the annual report published by the TFS that documents how Texas timber is being utilized (TFS *Texas Forest Resource Harvest Trends*; Skove and Lord 1986). This county-level information is used by those considering growth opportunities in the wood-based industry. Chapters 5, 9, and 10 summarize some of this information.

Forestry Education

Texas A&M University, located in College Station, and Stephen F. Austin State University, in Nacogdoches, offer programs in professional forestry education that are accredited by the Society of American Foresters.

Texas A&M University, the state's first public institution of higher learning, was founded in 1876. The Department of Forest Science, established in 1968 in the College of Agriculture, offers undergraduate options in Forest Management and Urban Forestry leading to a Bachelor of Science degree. Strong support of undergraduate and graduate forestry education at Texas A&M is provided by the Departments of Range Science, Recreation and Parks, and Wildlife and Fisheries Sciences.

Graduate forestry education at Texas A&M, leading to Master of Agriculture, Master of Science, and Doctor of Philosophy degrees in forestry, is offered in the faculty's specialty areas of biometrics, ecology, economics and policy, forest management, genetics and tree improvement, harvesting, operations research, pathology, physiology, tissue culture, molecular biology, remote sensing, geographic information systems, silviculture, soils and nutrient cycling, urban forestry, and wood chemistry.

Stephen F. Austin State University was established in 1921. Forestry began as a department in 1947 and advanced to school status in 1965. The School of Forestry offers the Bachelor of Science in Forestry (B.S.F.) degree with options in Forestry, Forest Management, Forest Game Management, Forest Recreation Management, and Forest Range Management. A Bachelor of Science degree in Environmental Science is also offered.

Graduate forestry education at Stephen F. Austin State University leading to the degrees of Master of Science in Forestry, Master of Forestry, Doctor of Forestry and a cooperative Ph.D. program with Texas A&M is available within the School of Forestry. Graduate degrees are offered within the faculty's specialty areas of plant physiology, hydrology and watershed management, forest management, forest wildlife management, forest entomology, forest recreation, biometrics, silviculture, wood products, forest pathology, remote sensing, forest fire management, forest policy, forest soils, and conservation education. In addition, a non-thesis Master of Science in Forestry is available in cooperation with the School of Business.

Forestry Research

Research in forestry is conducted in The Texas A&M University System through both the Texas Agricultural Experiment Station and the Texas Forest Service. The School of Forestry at Stephen F. Austin State University also conducts forestry research and works closely with a research station on campus maintained by the U.S. Forest Service. Research provides educational benefits for undergraduate and graduate students by ensuring that researchers are at the forefront of knowledge in their fields. Research specialties of the two universities match faculty specialties, as detailed in the previous section.

Research projects at both universities are conducted to improve the quality of the trees being planted and to determine the best methods of protecting and managing timberlands. Several of the companies in the forest products industry conduct research and make some of their findings available to the forestry community. Forestry research provides the public with new and innovative products and keeps managers and landowners abreast of management practices that will ultimately provide affordable timber products. Research has proven to be a valuable tool for education, and it is put into practice through the continuing education efforts of the Texas Agricultural Extension Service.

Texas Agricultural Extension Service

The Texas Agricultural Extension Service (TAEX) is responsible for extending the research and educational bases of the universities to landowners and forest resource managers, enabling them to make prudent decisions regarding the use and management of forest resources.

TAEX, a part of the Texas A&M University System, maintains offices in each Texas county. Forestry extension specialists carry the latest knowledge gained through forestry research to the county level to apprise landowners of current forest practices. Educational programs are conducted for forest landowners on such topics as regeneration and timber stand management methods, and the economics of forest

management. Specialists from all natural resource fields come together to acquaint forest landowners with the wide range of forest resource management opportunities through seminars and workshops, some of which are conducted for absentee landowners in Dallas and Houston.

Forest management demonstrations have been established in many East Texas counties to support other educational programs. In these demonstrations, landowners are able to observe forest management techniques and select those that are needed and will work well on their land. Other Extension Service programs include the proper selection, use, and care of wood for homeowners in Texas. Special seminars on wood products for professionals such as architects and builders help increase awareness of potential uses of forest products. Periodic publications, news releases, magazine articles, and radio and television programs by the Extension Service keep the public aware of the importance of forestry in Texas.

Texas Forestry Association

The mission of the Texas Forestry Association (TFA) is to promote the public interest of forestry within the state while serving the needs of wood growers, suppliers, and consumers in the economical, efficient, and widespread stewardship of timber and related resources through the operation of the free enterprise system.

The TFA is a non-profit organization founded in 1914 by W. Goodrich Jones, who is widely recognized as the "Father of Texas Forestry." The TFA is one of the oldest privately supported conservation organizations in the nation. The 2,500 members of the TFA, who represent a cross-section of the Texas forestry community, recognize the need to use the forest resources of Texas wisely and to their full economic extent. *Texas Forestry*, a monthly periodical, keeps members current on national, regional, and local issues that are important to the forestry community. TFA programs, described briefly below, include the TRe Foundation, American Tree Farm system, and Texas Forestry Museum. The TFA also administers a forestry political action committee (FORPAC) and sponsors a reward program to deter land abuse crimes such as dumping and arson, and property theft on forest lands.

The TRe ("Tree" is an acronym for Texas Reforestation.) Foundation, Inc., is a cost-sharing program for non-industrial private forest (NIPF) landowners to aid in the cost of regeneration and stand improvement. TRe was initiated in 1981 and is administered by the Texas Forestry Association. The funds for the TRe program are voluntary contributions from

the companies in the Texas wood-based industries. As of 1987, more than \$2 million had been distributed to NIPFs from TRe funds. Because it is funded from private sources, TRe is the only program of its kind in the nation. In recognition of this innovative private sector initiative that is helping the nation achieve its goals, President Ronald Reagan in 1984 awarded the TRe Foundation the Presidential "C" Flag. An additional discussion of TRe Foundation accomplishments is presented in Chapter 10.

The first tree farm in Texas was established in 1944, even before Texas officially joined the American Tree Farm program in 1954. TFA has served as the official state sponsor and administrator for the American Tree Farm program in Texas since 1954. Landowners in the Tree Farm system have their land inspected periodically. These tree farmers maintain timber management plans, which help them realize the full benefits of their timberland investments. Many professional foresters volunteer their time and effort to make this program work for landowners.

The Texas Forestry Museum is a joint effort of the Texas Forestry Association and the Lufkin Kiwanis Club. Dedicated in 1976, the museum is located on Highway 103 on the east side of Lufkin, adjacent to TFA headquarters. The museum is open free-of-charge to the public every day from 1:00 to 4:30 p.m. Many exhibits, including a scale model paper mill, historic logging paraphernalia, and railroad cars, are on display. The museum, supported by private donations, publishes *Crosscut*, a quarterly newsletter highlighting museum displays and current events. Memberships in the Museum Society are available to interested citizens.

Consulting Foresters of Texas

The Consulting Foresters of Texas (CFT) is a non-profit organization of professional consulting foresters who practice in Texas. The CFT was established in 1980 to promote sound forest management and encourage high ethical standards and professional skills among consultants. Working toward these goals, the CFT has sponsored numerous educational seminars and promoted better communication among consultants and between consultants and other forestry-related organizations.

Membership is limited to full-time, independent forestry consultants who hold professional degrees in forestry, have proper experience in forest management, and are in good standing in the forestry profession and the communities in which they live.

5. Texas' Forest Products Industry

Overview

The manufacturing of products from the timber grown in Texas forests is a vital part of the Texas economy, as well as the regional and national economy. Together, the companies that manufacture products from timber may be called the forest products or wood-based industry. The U.S. Department of Commerce divides the industry into three industries: Lumber, plywood, and other solid wood products; wood furniture; and pulp, paper, and paper products.

The manufacturing industry is an important component of the Texas economy. In the U.S., Texas ranked fourth—behind California, New York, and Ohio—in value added by all manufacturing activity in 1984 (Figure 5-1). In 1982, Texas had

TOP 10 STATES
VALUE ADDED BY MANUFACTURING
1984

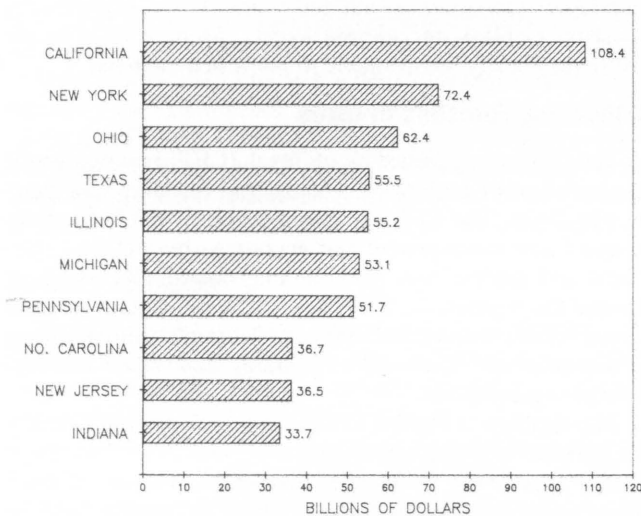


Figure 5-1. Top 10 states in value added by all manufacturing activity in 1984. (Source: USDC Bureau of the Census 1986a).

ranked third, ahead of Ohio. Almost one in five Texans depend on the manufacturing industry as their source of income (Figure 5-2). Within the wide diversity of Texas' manufacturing industries, the wood-based industry ranks eighth in employment, ninth in payroll, and ninth in value added (Figure 5-3). Because Texas is a large and economically diverse state, it is meaningful to isolate the importance of the forest products industry in East Texas. There, the industry represents more than one-fourth of all the manufacturing jobs outside of the four metropolitan areas of Houston, Beaumont-

TEXAS PERSONAL INCOME BY INDUSTRY
1984

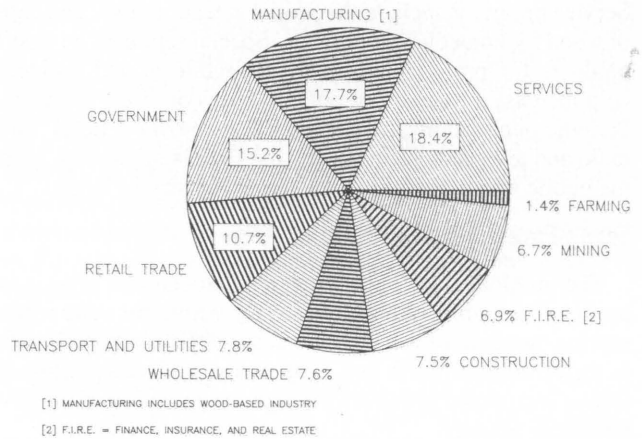


Figure 5-2. Personal income by industry in the state of Texas. Industry percentages equal \$151.3 billion in total personal income. (Source: USDC Bureau of the Census 1986b).

Port Arthur-Orange, Longview-Marshall, and Tyler (Table 5-1). In 17 of the 43 East Texas counties, wood-based manufacturing is the largest manufacturing industry (Figure 5-4). The primary forest products plants are concentrated in these 17 counties (Figure 5-5) and 14 others where wood-based manufacturing ranked second (Figure 5-4).

The diversity in the Texas economy also makes it meaningful to compare the Texas forest products industry to those in other southern states. Texas is a prominent front-runner in many aspects of the South's forest industry, and is a significant factor nationally.

Earlier, it was noted that Texas ranked eleventh in timberland acreage among the twelve southern states (Figure 2-1). But because three of the ten largest cities in the U.S. are in Texas, there are major markets for wood-based products in the state. These markets help Texas stay near the top of state rankings in value added and employment in wood-based manufacturing (Figure 5-6).

Nationwide, the total value of wood-based product shipments exceeded \$176 billion in 1984, of which more than \$76 billion was value added by manufacturing (USDC Bureau of the Census 1986a). When transportation, construction, marketing, and other activities are included, wood-based economic activity accounts for 4 percent of the total U.S. gross national product and employment (Phelps 1980). Including the paper-dependent printing and publishing industry, roughly 5 percent of all economic activity is related to wood products. In other words, there is a wooden nickel in every dollar. This holds true in the U.S. as a whole, and also in Texas.

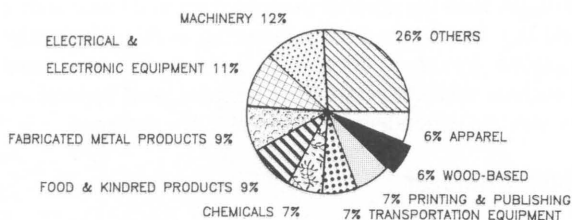
In Texas, more than 280,000 Texans have jobs that depend on wood-based products (Figure 5-7). This group comprises approximately 5 percent of the entire Texas work force.

Almost 60,000 Texans are employed directly in the manufacturing of wood-based products. Wood-based manufacturing was a \$5.6 billion industry in Texas when measured by value of shipments in 1984 (Figure 5-7). Of this, \$2.3 billion was value added directly by the manufacture of wood-based products. Since Texas is a net exporter of timber (Skove and Lord 1986) on balance, all of the timber raw material used by the primary wood-based industry manufacturing segments comes from the forests of East Texas.

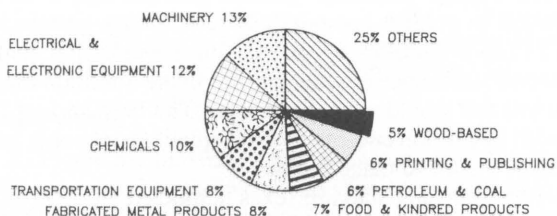
TEXAS MANUFACTURING INDUSTRIES

1984

-- EMPLOYMENT --
TOTAL: 975,100 WORKERS



-- PAYROLL --
TOTAL: \$22.0 BILLION



-- VALUE ADDED --
TOTAL: \$55.5 BILLION

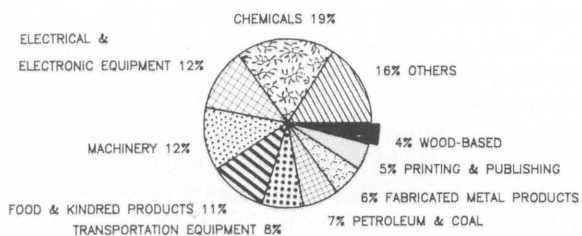


Figure 5-3. Employment, payroll, and value added in Texas manufacturing industries. Industry percentages are proportions of total manufacturing activity. (Source: USDC Bureau of the Census 1986a).

Table 5-1. Texas wood-based industry employment as a percentage of all Texas manufacturing industry, 1982.

Area	Employment	Salaries and Wages
State of Texas	5%	4%
East Texas ● 43-County Piney Woods region	6%	4%
East Texas ● Excluding Houston	14%	11%
East Texas ● Excluding Houston, Beaumont-Port Arthur-Orange, Longview-Marshall, and Tyler	28%	27%

Source: USDA Forest Service 1987a

Almost \$500 million of the \$5.6 billion value of shipments by the wood-based industry in 1984 represents the value of timber delivered to mills. Landowners received approximately \$300 million of this amount as timber stumpage receipts, and the remaining \$200 million was value added by timber harvesting, which includes delivery to a primary manufacturing mill or woodyard.

WOOD-BASED INDUSTRY EMPLOYMENT

1984

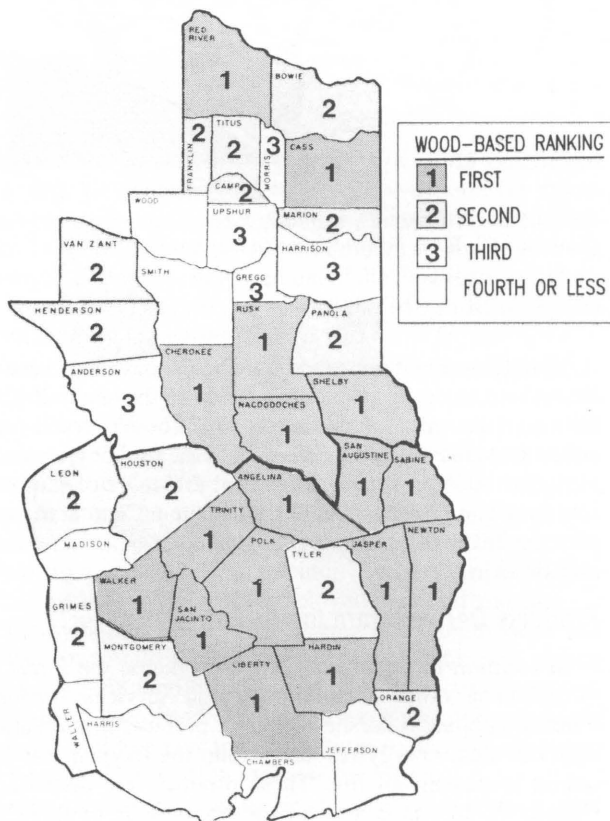


Figure 5-4. Wood-based industry employment in the 43 counties of East Texas. Various degrees of shading represent the ranking of wood-based manufacturing employment as compared to other manufacturing industries. (Source: USDC Bureau of the Census 1986c).

EAST TEXAS WOOD-BASED MANUFACTURING FACILITIES

1986



Figure 5-5. Locations of the primary forest products plants in Texas (Source: TFS, Texas Forest Resource Harvest Trends).

Manufacturing inputs purchased by the industry to convert timber into wood-based products made up the remaining \$2.8 billion in the value of shipments total not accounted for by either the value of timber delivered to the mill or manufacturing value added. This breakdown of the value of shipments into three components will be used again in Chapter 6 to compare the Texas forest products industry to other agricultural industries in the state.

Products Derived from the Forest

In addition to timber and wood products, the forest produces many other useful goods and services, including wildlife habitat, watershed and soil protection, recreational opportunities, energy resources, and the oxygen that is required to sustain all life. These products are discussed in Chapter 8. In recognition of the importance of these non-timber products, which may be rightfully termed forest products, the term "wood-based" industry is used specifically to refer to the various stages in the manufacturing of wood-based products.

Many useful products are based on the wood harvested from Texas timberlands. Products familiar to most people include lumber, plywood, and other panel boards used in the construction of homes, apartments, and offices. Paper products that are used every day include writing paper, newsprint, bathroom tissue, and packaging products such as bags and cardboard boxes. All of these are wood-based products. In addition, most household furniture is made of wood.

Not all products derived from wood are easily recognized; for instance, printing inks, plastics, and a wide variety of chemicals use wood as a base raw material. Wood pulp is used not only to make paper, but also rayon, from which apparel and tire cords, among other items, are made. The economic value of these wood chemical products, textiles, and plastics is not included as part of the wood-based industry or other wood-based activity in this report. It should be noted, however, that Phelps (1980) determined that these industries represented more than one-fourth of the economic activity in his definition of secondary wood-based manufacturing. If the same relationship between industries exists now as in 1972, and if Texas parallels the national inter-industry relationships, then the number of employees and value added by secondary wood-based manufacturing in this report may be increased by approximately one-third. This increase would include miscellaneous fiber, textiles, and apparel industries that are dependent on wood as a raw material.

The Timber Harvest

Texas forests furnished 551.5 million cubic feet of wood in 1985, most of which went to primary manufacturing facilities (Skove and Lord 1986). This annual harvest included enough softwood sawtimber to build frames for 165,000 average-sized new homes, plus enough softwood pulpwood to publish enough daily and Sunday newspapers for 13 million families for a year, and enough high quality hardwood sawtimber (mostly oak) to make 6 million dining room sets that would seat eight people. The 1985 harvest also included 81 million cubic feet of low quality hardwood, most of which is used to make paper.

In 1984, housing starts in Texas numbered 195,500 units. Almost 85,000 of these were single-family dwellings. The rest were multiple dwellings, such as apartments (USDC Bureau of the Census 1985a). This level of construction activity and the consumption of other wood-based products represent enough demand to consume the annual Texas timber harvest. On balance, then, Texas is not self-sufficient in forest products. Further discussion of this important topic is included in Chapter 9.

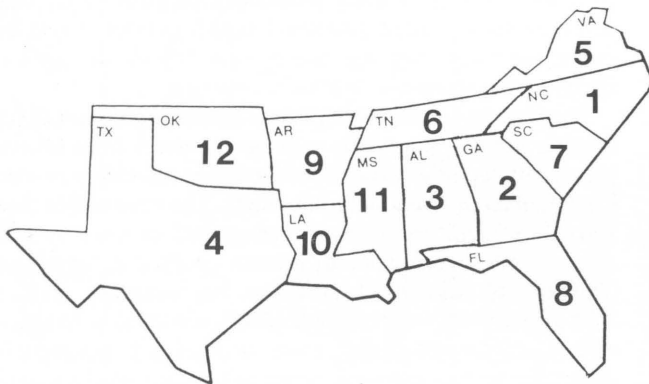
Softwoods, almost all of which are southern yellow pine, accounted for 79 percent of the total volume of wood harvested in 1985 (Figure 5-8) and an even higher proportion of the value of the harvest. Sawtimber, veneer logs for plywood, and pulpwood were the most important softwood products harvested. A fairly even distribution of harvested timber volume was attributed to each of these three timber products. Almost half of the hardwood volume harvested was delivered as pulpwood. Hardwood sawtimber and crossties comprised most of the rest of the harvest.

As Figure 5-9 illustrates, from 1964 to 1978, softwood timber harvests more than doubled as the industry grew, but since 1978, harvest levels have fluctuated with general

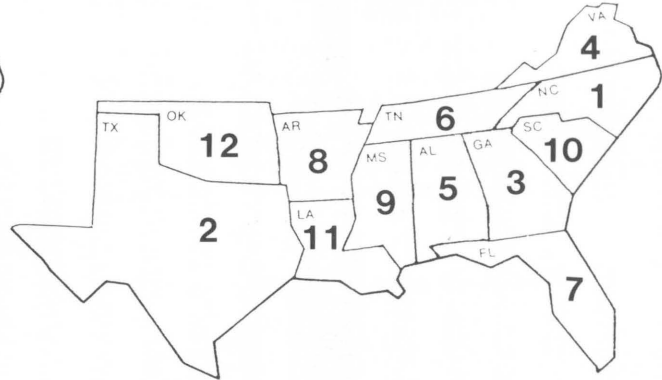
TWELVE SOUTHERN STATES

1984

VALUE ADDED



EMPLOYMENT



SOFTWOOD INVENTORY



TIMBERLAND ACREAGE



HARDWOOD INVENTORY

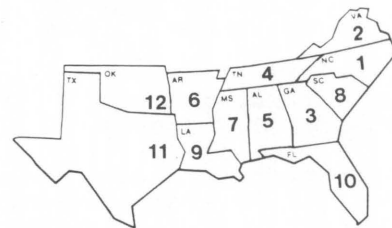


Figure 5-6. The 12 southern states of the U.S. ranked by value added and employment in wood-based manufacturing. States are also ranked by amount of hardwood and softwood inventory, and timberland acreage. (Source: USDA Forest Service 1987a; USDC Bureau of the Census 1986b).

economic conditions. The effect of the economic recession in the early 1980s is clearly evident in Figure 5-9.

Employment

As Figure 5-7 illustrates, in 1984, there were 288,475 jobs in Texas related to the wood-based industry. Of these jobs, 18,000 were directly tied to the forest resource: Managing the growing of trees, the harvesting of timber, and the primary processing of raw timber in sawmills, veneer mills, and pulp mills. Manufacturing of secondary wood-based products employed 41,800. The transportation and trade of wood-based products, and the construction of wooden structures and buildings accounted for 163,575 additional jobs (USDC Bureau of the Census 1985c,d,e). Phelps (1980) suggested that these industries were dependent on the manufacturing of wood-based products. The printing and publishing industry employed 65,100 Texans (USDC Bureau of the Census 1986a). All of the employees in the wood-based industry and the other wood-based activities represented in Figure 5-7 represent approximately 5 percent of the Texas labor force.

As Figure 5-2 indicates, 18 percent of the income received by all Texans in 1984 derived from manufacturing industries.

Texas, the wood-based industry is the eighth largest employer among manufacturing industries (Figure 5-3). By itself, the wood-based industry represents approximately 1 percent of all Texas workers. But the industry has a special significance in the East Texas Piney Woods region.

Importance of the Industry in East Texas: In East Texas, 17 of the 43 counties—or 40 percent—depend on wood-based industries as their number one manufacturing employer. In 14 more counties, it is the number two manufacturing employer. Therefore, in 72 percent of the East Texas counties, the wood-based industry is one of the two most important manufacturing industries (Figure 5-4).

The importance of the wood-based industry in East Texas depends largely upon how East Texas is defined. The 43-county Piney Woods region encompasses the two forest survey regions. As Table 5-1 indicates, when metropolitan Houston is included, the wood-based industry is only slightly more important than it is in relation to the rest of the state. However, if the four metropolitan areas in East Texas are removed from consideration, the industry accounts for 28 percent of the rural work force employed in manufacturing.

Employment in forest products and related industries is not limited to wood-based manufacturing. Other job opportunities exist in land management; timber harvesting; transportation of raw, primary, and secondary or converted timber products; building construction activities; and the wholesale and retail marketing of wood-based products.

Forest management is the first category of employment upon which the wood-based industry depends. Forest management involves not only the direct management of timberlands, but also education, research, and extension to improve landowners' knowledge of their forest resources. The care

TEXAS WOOD-BASED EMPLOYMENT

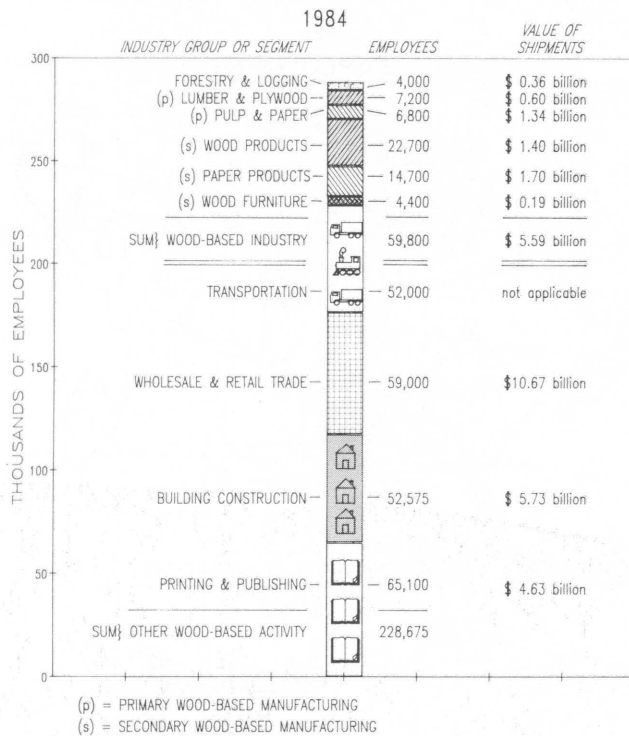


Figure 5-7. Texas employment in wood-based industry and other wood-based activities. Depicts number of employees and value of shipments for each industry group or segment. (Sources: USDC Bureau of the Census, various reports).

and management of pine tree seed orchards and the management of nurseries are activities designed to provide landowners with quality seedlings that can be planted to reforest harvested acres. Approximately 1,700 Texans were employed in forest management activities in 1984 (TFA and TSAF 1986).

Harvesting, often referred to as logging, is the process of removing the raw material from the land so that it may be processed by wood-based manufacturing facilities. In 1984, 2,300 Texans were employed in timber harvesting activities (USDC Bureau of the Census 1985b).

Wood-based manufacturing employment, in general, has steadily increased since 1967 (Figure 5-10). In 1984, the lumber and wood products segment of the manufacturing industry employed 31,300—almost double the 1967 level. The largest increase occurred by 1972, which can be explained in part by the rapid growth of the plywood industry in the South. After 1977, the increase continued, but at a slower rate. The furniture manufacturing segment employed 4,400 in 1984, and has increased only slightly since 1967. But peak employment occurred in 1977 at 4,700. The paper and allied products sector of the manufacturing industry employed 21,500 in 1984. Since 1977, growth in paper products employment has leveled off to the same growth rate as lumber and wood products (Figure 5-10).

Transportation is an important part of wood-based economic activity because timber and wood products have a fairly low value-to-volume ratio in comparison with other raw materials or manufactured products. In 1982, 52,000 trucks were hauling forest products in Texas (USDC Bureau of the Census 1985c). The number of employees in transpor-

tation was assumed to be 52,000 by attributing one person per vehicle.

There are at least three phases in the transportation of wood-based products. First, harvested timber is transferred from the forest to primary processing facilities. This phase involves trucks loaded with tree-length logs ("longwood") or pulpwood trucks hauling "shortwood." Both are common sights on the highways of East Texas.

The second phase of the transportation process involves moving lumber, plywood, or paper products from primary processing facilities to areas referred to as secondary processing facilities or manufacturing plants. The products of these secondary facilities are those recognized or used by most people. They include not only primary products of lumber and plywood for building construction, but secondary products such as millwork—for example, doors and window frames—pallets, and treated lumber, posts, and poles. In the paper industry, secondary products, often called converted products, include cardboard boxes and cartons for packaging a myriad of items, paper for writing and printing, bathroom and facial tissues, and many other useful products. Wood furniture is also a secondary wood-based manufacturing industry.

The third phase of transportation is the moving of secondary products to their consumer markets: The building supply store or lumber yard, the printing plant, and factories or warehouses that package their products in cardboard containers for further distribution to retail stores. Dimension lumber and plywood may be transferred to marketing centers during phase two, but also involve a third transportation step when moved to a construction site.

TEXAS TIMBER HARVEST 1985

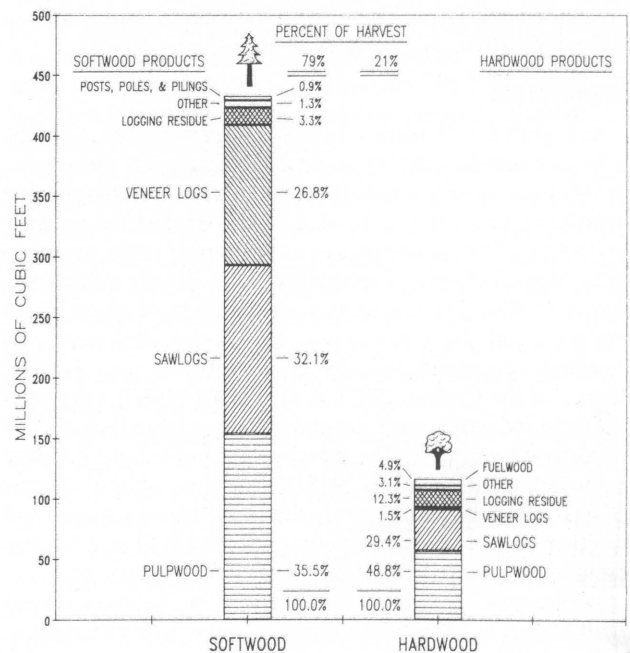


Figure 5-8. Total volume of 1985 Texas timber harvest by softwood and hardwood products. Shows percent of harvest for each product. (Source: TFS, Texas Forest Resource Harvest Trends).

TEXAS TIMBER HARVEST TRENDS 1964-1986

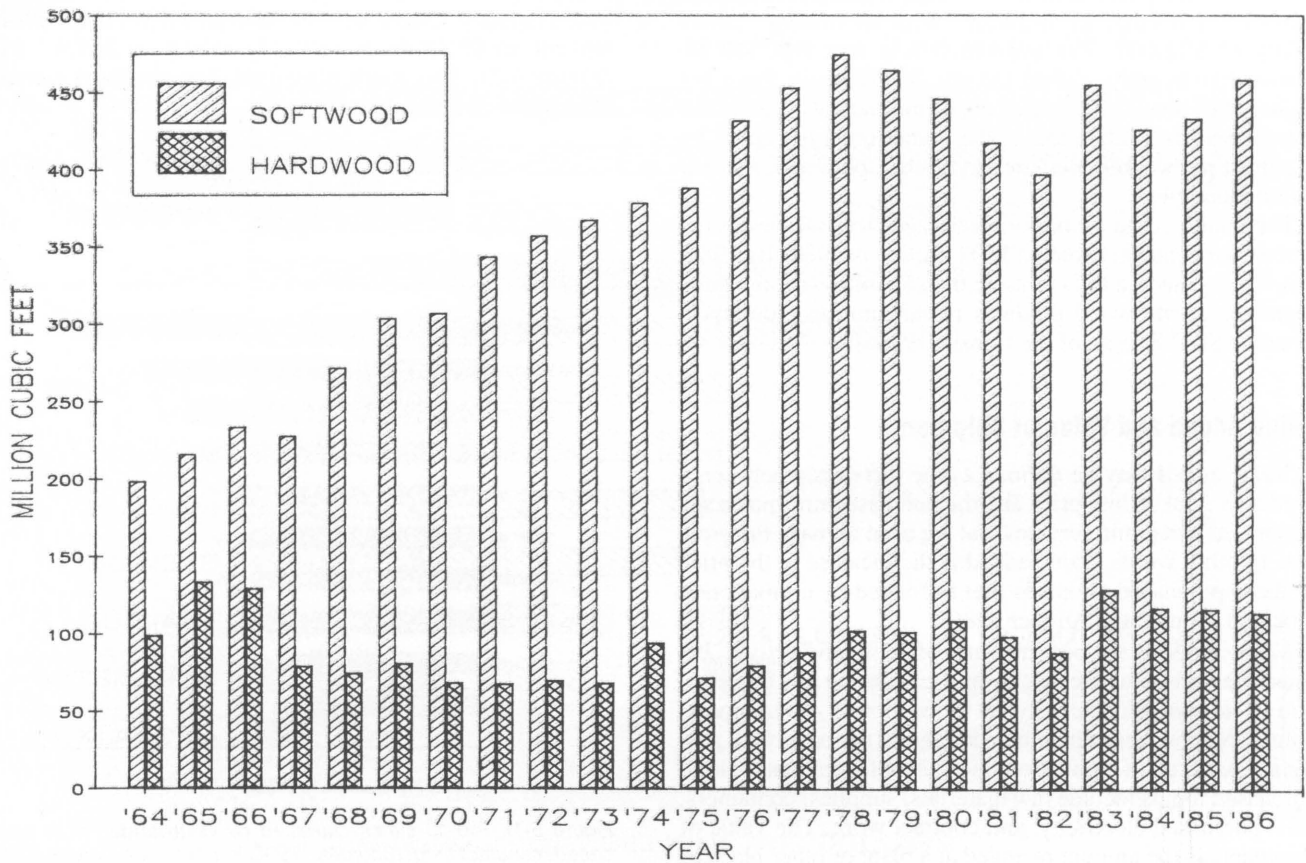


Figure 5-9. Texas timber harvest trends for softwood and hardwood volume for 1964-1986. (Source: TFS, Texas Forest Resource Harvest Trends).

TEXAS WOOD-BASED INDUSTRY TRENDS MANUFACTURING EMPLOYMENT 1967-1984

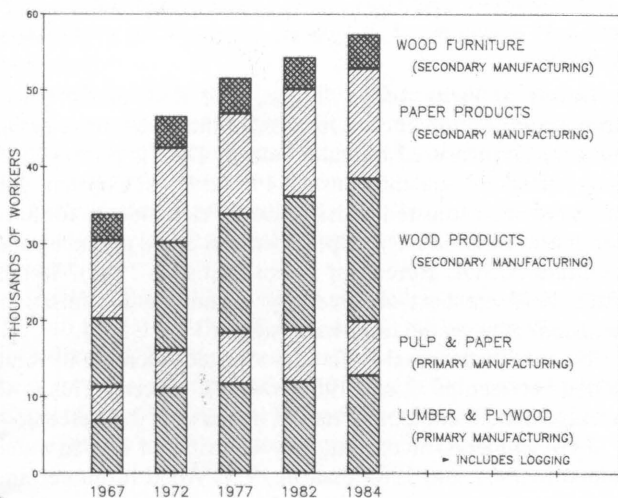


Figure 5-10. Wood-based manufacturing employment trends for 1967-1984. (Sources: USDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a).

There were 59,000 employees in retail and wholesale trade related to wood products in 1984. These activities involve the sale of lumber and paper products to consumers. Also included is customer service to construction contractors and individuals who build their own projects and remodel their own homes (USDC Bureau of the Census 1985d).

In 1984, 52,575 Texans were employed in construction industries that used lumber, plywood, millwork, or other wood products. These were mainly carpenters building houses, apartments, and wood storage buildings such as barns and garages (USDC Bureau of the Census 1985e).

Income and Income Per Worker

The most complete data available on personal income from forest products is in the manufacturing sector, or wood-based industry. In 1984, personal income from timber harvesting was \$34 million, an average of more than \$17,000 per employee.

In 1984, the Texas lumber, plywood, and other wood products manufacturing industries provided \$448 million in personal income for their employees, who earned an average of \$6.17 per hour. The average annual salary for a wood products worker involved in manufacturing was more than \$14,000.

Personal income in the furniture industry exceeded \$57 million in 1984. The average wage for employees was \$5.60

per hour, providing an average annual income of more than \$12,000.

In 1984, the paper industry provided higher incomes than lumber, harvesting, or furniture, with an average annual salary of \$22,000. The average hourly rate was \$10.24. These significantly higher income levels result from the higher skill levels required of paper products workers. This requirement is a reflection of the higher level of capital investment per worker compared to lumber, plywood, and furniture industries.

Personal income in the form of wages and salaries in the wood-based industry totaled \$802 million in 1980. By 1984, this figure rose to a total of more than \$1 billion for the three segments of the wood products manufacturing industry in Texas (USDC Bureau of the Census 1986a).

Value Added and Value of Shipments

Value added may be defined as the difference between a product's final selling price and the purchased raw materials, purchased parts, and services that are used to make the product. In other words, value added is the increase in the price of these purchased elements that is created by a production process (Ammer and Ammer 1986).

Value added is the best measure of economic activity because it avoids double counting and reflects the true contribution of a particular activity in its economic environment. Value added is determined by subtracting the cost of all purchased production inputs from the value of shipments. These purchased inputs include raw materials, supplies, containers, fuel, purchased electricity, and contract work. The value of shipments is the amount received at a plant or other place of business for the goods produced or services provided there. Value added avoids duplication, which is important because the goods and services provided by some business establishments are purchased and used by other establishments in the course of their business, and are therefore reflected in their prices. Consequently, value added should be used to avoid counting one particular activity repeatedly. Thus, value added reflects the relative economic importance of different industries in the most meaningful and undistorted manner. The sum of value added by each sector of an economy is the gross economic production in that economy.

In value added by wood-based manufacturing, Texas ranks ninth in the U.S. (Figure 5-11) and fourth among the twelve southern states (Figures 5-6 and 5-12). As can be seen by examining the industry segments on Figure 5-12, Texas leads all other southern states in value added in the lumber and wood products industry.

However, Texas is not the number one producer of lumber in the South. In fact, Texas is seventh among the southern states in lumber production, a position that places Texas twelfth in the nation (Figure 5-13). Texas is the third leading producer of wood structural panels in the nation, which includes softwood plywood (Figure 5-13). But Texas' leadership in lumber and wood products value added in the South comes from secondary manufacturing of lumber products (Figures 5-7 and 5-10).

The paper industry in Texas exhibits a fairly even balance between primary and secondary manufacture (Figures 5-7 and 5-10). As indicated by the amount of pulpwood con-

sumed, Texas is among the top ten paper-producing states (Figure 5-13).

Among the manufacturing industries of Texas, the wood-based industry ranked ninth in value added in 1984, with 4.1 percent, or \$2.3 billion, of the Texas total of \$55.5 billion (Figure 5-3). This ninth place rank has remained constant throughout the past decade.

TOP 10 STATES
VALUE ADDED BY WOOD-BASED MANUFACTURING
1984

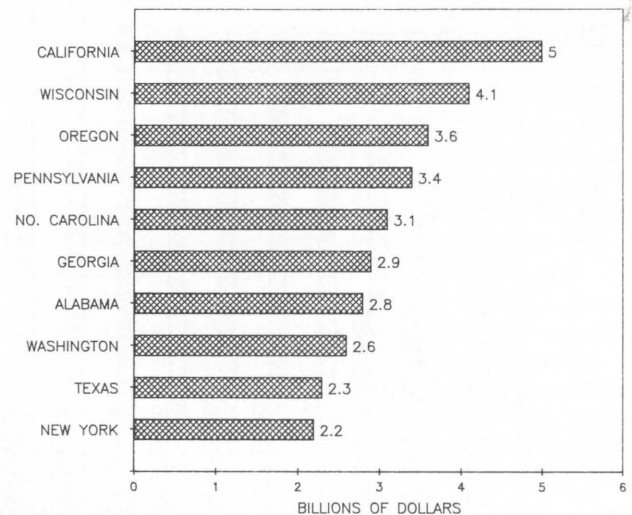


Figure 5-11. Top 10 states classified by value added from wood-based manufacturing. (Sources: USDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a).

Trends in Value Added and Value of Shipments

Trends in value added and value of shipments in the Texas wood-based industry are presented in Table 5-2. Also included is value added as a percentage of the value of shipments. Graphic portrayals of these data in Figures 5-14, 5-15, and 5-16 reveal some interesting trends in the wood-based industry.

Trends in Value Added: Figure 5-14 illustrates the economic contribution of each segment of the Texas wood-based industry as measured by value added. Data is portrayed in both current dollars and constant 1984 dollars. Constant dollars have been adjusted with Producer Price Indexes for lumber and wood products; pulp, paper, and allied products; and furniture (USDL Bureau of Labor Statistics 1986). Trends since 1972 are best observed by examining the inflation-adjusted trend on the right-hand side of Figure 5-14.

The constant or real (inflation-adjusted) increase in value added between 1972 and 1984 was 38.1 percent. This is an average annual compound rate of increase of 2.7 percent.

Two segments of the industry contributed less in value added in 1982 and 1984 than in 1977: Wood furniture, and lumber and plywood or primary lumber and wood products. This is significant, because payrolls and corporate profits are components of value added.

Lumber and plywood manufacturing is a different industry in the 1980s than it was in the 1970s, as can be seen from

TWELVE SOUTHERN STATES VALUE ADDED BY WOOD-BASED MANUFACTURING 1984

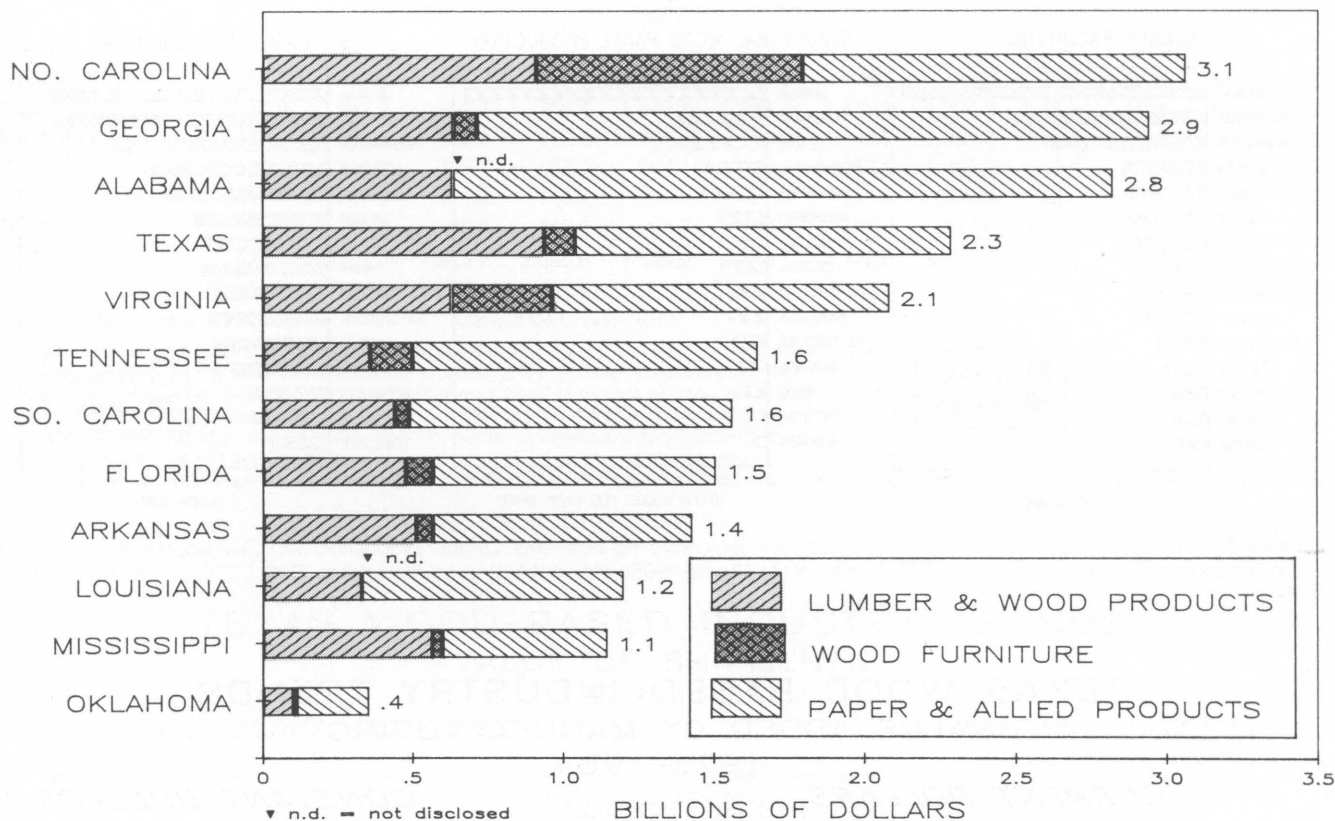


Figure 5-12. Twelve southern states classified by value added from wood-based manufacturing. (Sources: USDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a).

these trends in inflation-adjusted value. Between 1972 and 1984, this industry segment lost 38.2 percent in real value added, an average rate of decrease of 2.8 percent per year. The decline was even steeper from 1977 to 1984, with a total decrease of 52.8 percent, an average decline of 4.9 percent per year.

Trends in Value of Shipments: Value added (Figure 5-14) is one component of the value of shipments. The recent trend in the value of shipments by segments of the Texas wood-based industry is presented in similar fashion in Figure 5-15.

The constant or real (inflation-adjusted) increase was 47.4 percent, an average annual compound rate of increase of 3.3 percent.

Unlike value added, which showed a real decline from 1977 to 1982, the value of shipments in the industry has steadily increased. But the lumber and plywood segment shows a peak in value of shipments in 1977, as it did in value added. Except for a slight decline in wood furniture, the other industry segments exhibited steady growth from 1972 to 1984.

Trends in Value Added as a Percentage of Value of Shipments: This measure, presented in Table 5-2 and portrayed in Figure 5-16, gauges the performance of the industry in a general way because wages and profits are major components of value added. As value added as a percentage of the value of shipments declines, there is relatively less to provide wages and salaries to employees and profits to owners. Overall, the industry total indicates that value added has remained at a steady 40 to 44 percent of the value of shipments. For the industry as a whole and for each segment of the industry, 1984 was a better year than the doldrums of 1982.

For the primary lumber and plywood, and pulp and paper segments of the industry, the 1980s have not been kind. Secondary wood and paper products manufacturing has fared better during the economic turmoil of the 1980s.

Whereas wood furniture lost sales in constant, inflation-adjusted dollars from its peak in 1977 (Figure 5-15), it has maintained a high proportion of value added.

TOP 15 STATES WOOD-BASED INDUSTRY PRIMARY MANUFACTURING SEGMENTS 1985

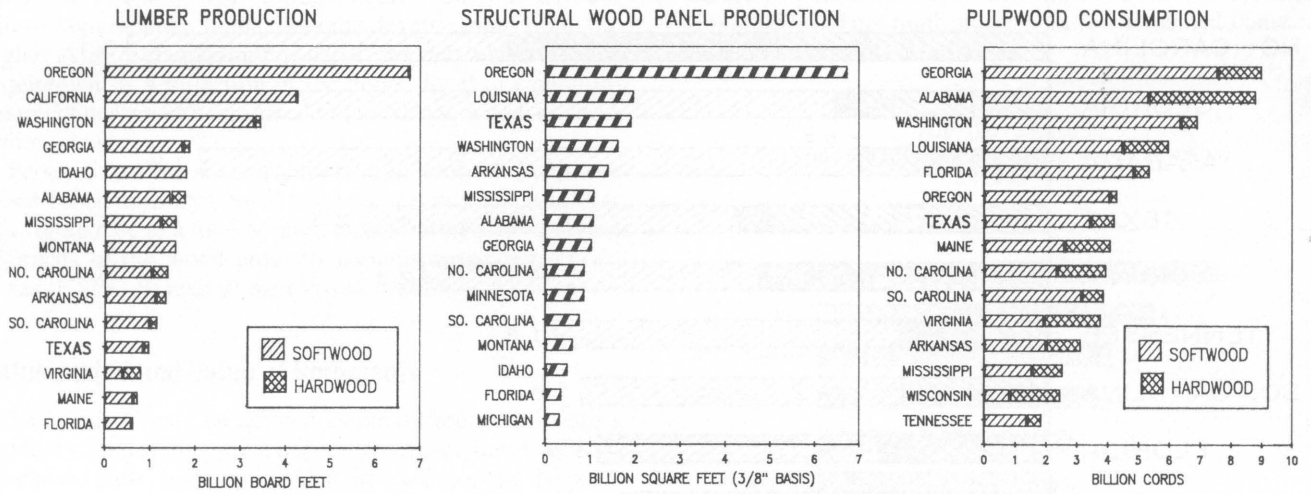


Figure 5-13. Top 15 states by wood-based industry primary manufacturing segments: Lumber production, structural wood panel production, and pulpwood consumption. (Sources: USDC Bureau of the Census 1986d; American Plywood Association 1986; USDC Bureau of the Census 1986e).

TEXAS WOOD-BASED INDUSTRY TRENDS VALUE ADDED BY MANUFACTURING 1972-1984

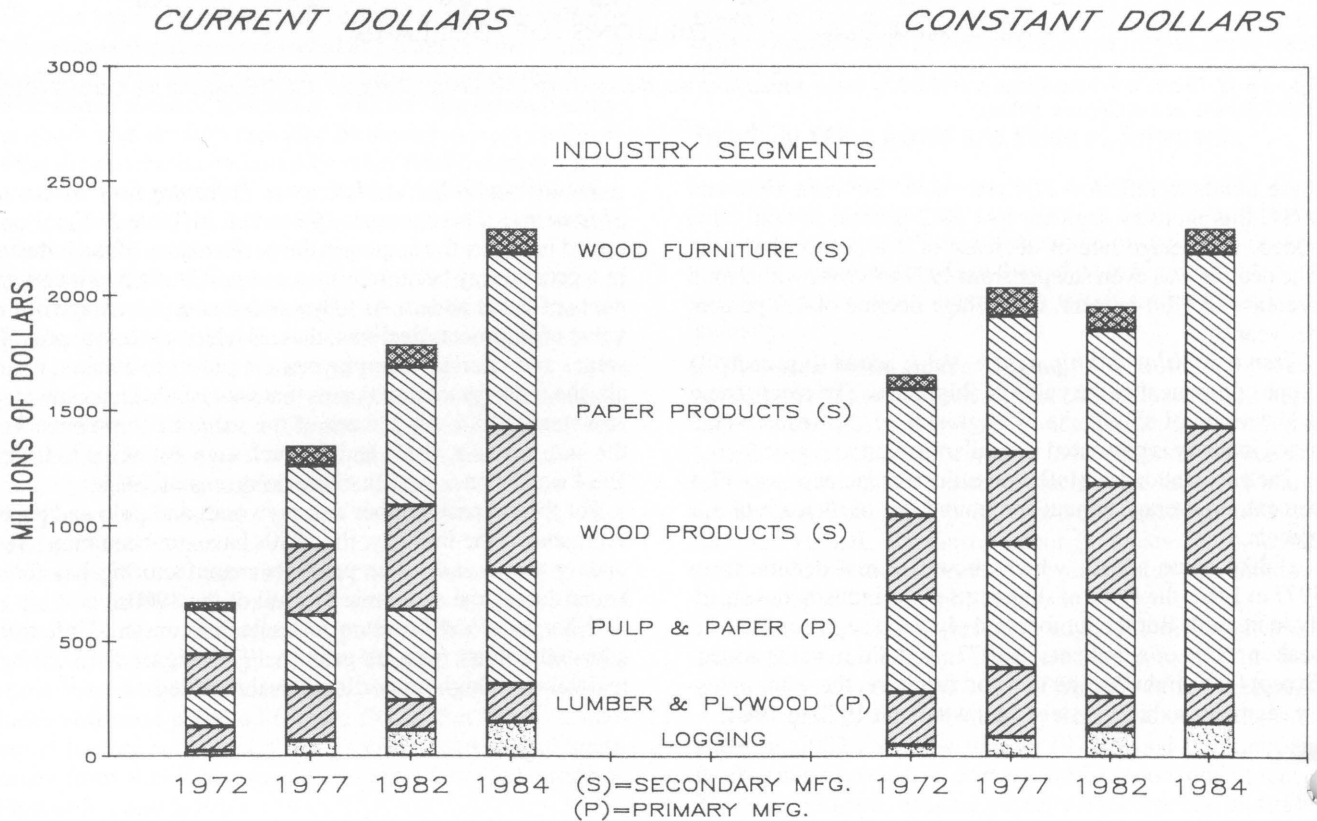


Figure 5-14. Economic contribution of Texas wood-based industry segments by value added. Data portrayed in both current dollars and constant 1984 dollars. (Sources: USDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a).

Table 5-2. Texas wood-based industry trends in value added and value of shipments, 1972-1984.

	Value Added				Value of Shipments				Value Added as a Percentage of Value of Shipments			
	1972	1977	1982	1984 ⁷	1972	1977	1982	1984 ⁷	1972	1977	1982	1984 ⁷
	Millions of Dollars								Percent			
Wood Furniture ¹	33.8	87.8	99.8	109.7	97.5	154.6	178.9	188.2	34.7	56.8	55.8	58.3
Paper Products ²	194.9	347.2	602.4	756.1	448.1	884.4	1,473.3	1,704.3	43.5	39.3	40.9	44.4
Wood Products ³	167.6	304.0	453.8	622.8	407.9	771.9	1,148.9	1,395.3	41.1	39.4	39.5	44.6
Pulp & Paper ⁴	147.1	315.8	393.7	494.2	294.1	696.5	1,158.3	1,339.9	50.0	45.3	34.0	36.9
Lumber & Plywood ⁵	107.5	230.9	131.2	163.7	237.6	496.4	517.8	600.8	45.2	46.5	25.3	27.2
Logging ⁶	22.8	65.6	110.9	149.1	64.7	155.3	298.8	357.8	35.2	42.2	37.1	41.7
Total	673.7	1,351.2	1,902.7	2,295.6	1,549.9	3,159.1	4,776.0	5,586.3	43.5	42.8	39.8	41.1

Sources: USDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a.

¹ Includes SIC 2511, 2517, 2521, and 2541; wood household furniture, wood TV cabinets, wood office furniture, and wood partitions.

² Includes SIC 264 and 265; misc. converted paper products, and paperboard containers and boxes.

³ Includes SIC 243 (except 2435 and 2436), 244, 245 (except 2451, mobile homes), and 249; millwork, wood containers, wood buildings, and misc.

⁴ Includes SIC 261, 262, 263, and 266; pulp mills, paper mills, paperboard mills, and building paper mills.

⁵ Includes SIC 242, SIC 2435, and SIC 2436; sawmills, hardwood veneer, and softwood veneer.

⁶ Includes SIC 2411; logging and harvesting.

⁷ Total for 1984 from Annual Survey of Manufactures (USDC Bureau of the Census 1986a). Certain industry segments for 1984 have been estimated from 1982 relationships.

TEXAS WOOD-BASED INDUSTRY TRENDS VALUE OF SHIPMENTS 1972-1984

CURRENT DOLLARS

CONSTANT DOLLARS

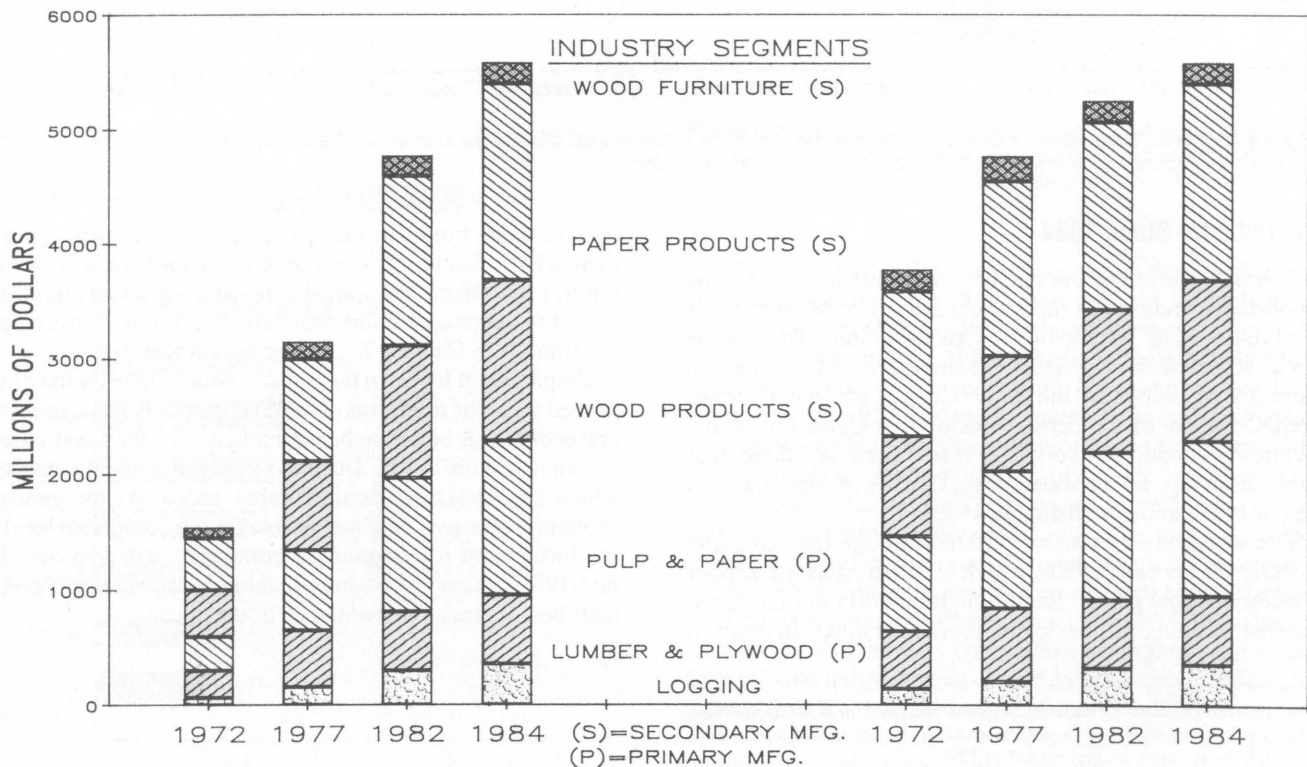


Figure 5-15. Economic contribution of Texas wood-based industry segments by value of shipments. Data portrayed in both current dollars and constant 1984 dollars. (Sources: USDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a).

TEXAS WOOD-BASED INDUSTRY TRENDS BY INDUSTRY SEGMENTS

VALUE ADDED AS A PERCENTAGE OF VALUE OF SHIPMENTS

1972-1984

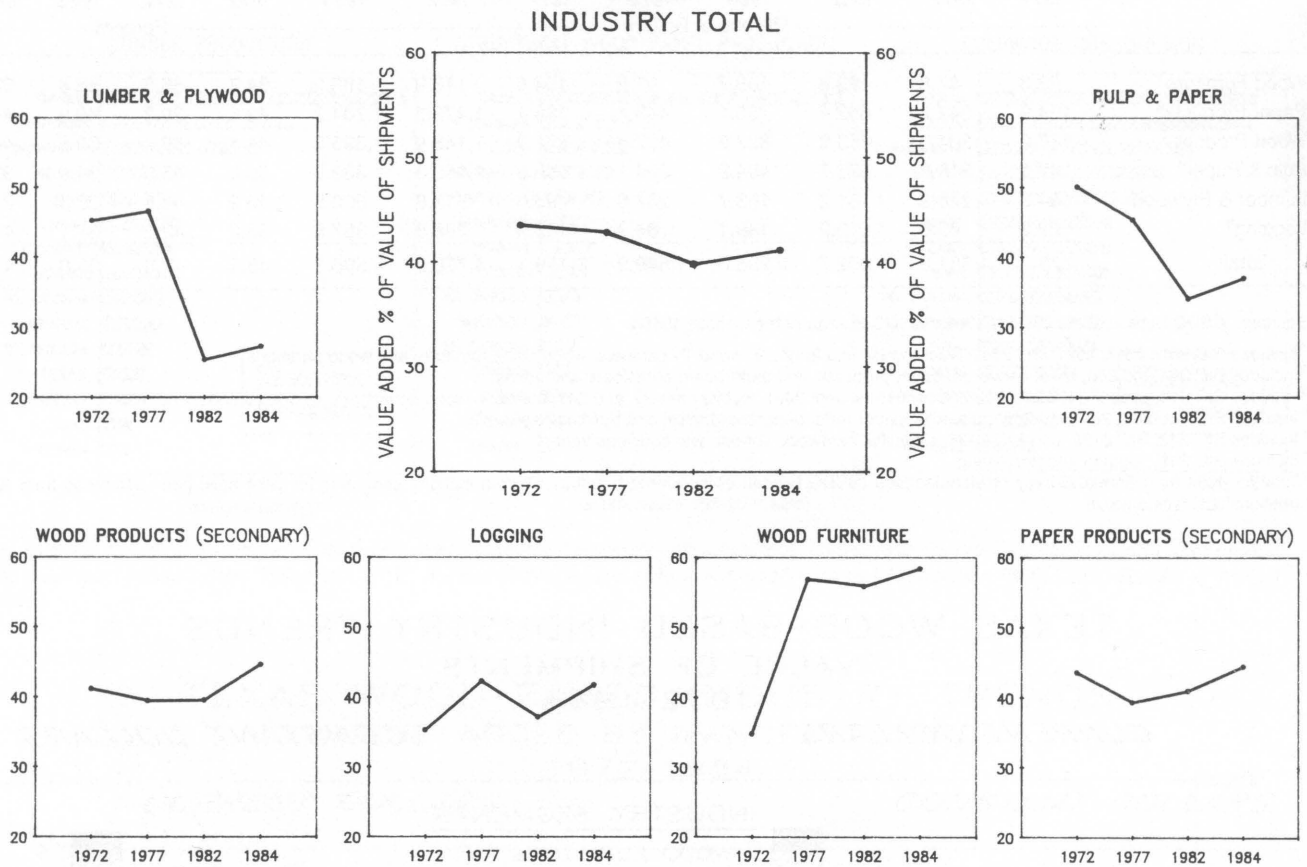


Figure 5-16. Texas wood-based industry trends in value added as a percentage of value of shipments. Data presented by industry segments as well as by industry total. (Source: USDC Bureau of the Census 1986a).

The Industry Since 1984

The most current economic data available in 1987 for the wood-based industry is the Annual Survey of Manufactures for 1984 (USDC Bureau of the Census 1986a). This data is not as complete or reliable³ as the more detailed information currently available in the 1982 Census of Manufactures (USDC Bureau of the Census 1985b). The Census of Manufactures is conducted every five years. There is a three-year publication lag, so the most recent Census of Manufactures was in 1987, to be published in 1990.

The wood-based industry suffered through the economic recession in the early 1980s, which was characterized by poor markets and low prices. Record high interest rates increased the cost of doing business, and profits declined. In order to

survive these troubled times, many companies restructured themselves. Some left the industry, creating growth opportunities for others. But all had to become leaner and more efficient to survive. A more complete discussion of restructuring follows in Chapter 7.

Employment levels in the forest products industry have improved since the doldrums of 1982 (Figure 5-10), and the general economy is better, so better markets exist for wood-based products (Figure 5-15). This has improved corporate profits, which are one component of value added. As the general economy improves and interest rates reach acceptable levels, the fortunes of forest products companies will improve. In mid-1987, many wood-based companies were achieving their best financial performance of the decade.

³The 1984 breakdowns by industry segment presented in this chapter were estimated by using 1984 totals in the major industry groups and the relationships among industry segments that existed in 1982.

6. Economic Impact of Texas' Forest Products Industry

The influence or impact of the forest products industry on the Texas economy can be expressed or measured in many different ways. Chapter 5 described the \$5.6 billion wood-based manufacturing industry as a direct employer of 59,800 jobs and more than \$2.3 billion in value added by manufacturing. Another 288,475 Texans had jobs that indirectly involved the use of wood products. These facts alone indicate a significant impact on the Texas economy (Figure 5-7).

In Chapter 5, Texas' wood-based industry was compared to that of other states in the nation and in the South. By any of those various measures, the industry is a significant one. Texas ranks among the southern states as the second largest employer in the wood-based industry. Texas is the fourth leading state in the South in terms of value added by wood-based manufacturing, and ninth in the nation.

There are several other ways to consider the impact of Texas' forest products industries. One is to compare timber to other agricultural products. Another is with economic impact multipliers.

Economic Impact of Texas' Agricultural Products

In 1985, Texas was the second leading agricultural state in the nation (Figure 6-1). The leading agricultural product in

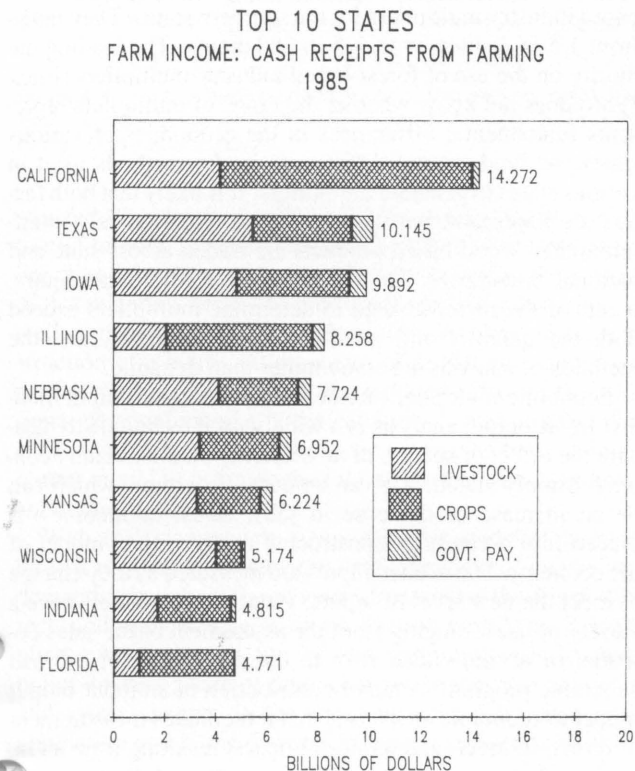


Figure 6-1. Top 10 agricultural states in the U.S., categorized by farm income from livestock, crops, and government subsidies. (Source: USDA 1986).

Texas is beef cattle, representing 42 percent of the total value in 1986 (Figure 6-2). Other livestock represent another 16 percent of the value. According to the Texas Agricultural Extension Service, recreation (\$147 million) and hunting (\$136 million) together account for almost 3 percent of the total \$10.6 billion in value received by agricultural producers in 1986 (Anderson 1987). The remaining 39 percent of the total agricultural value was cash crops, including timber (Figure 6-2).

TEXAS AGRICULTURAL PRODUCTS
ESTIMATED VALUE BY COMMODITY GROUP
AS PERCENT OF TOTAL VALUE
1986

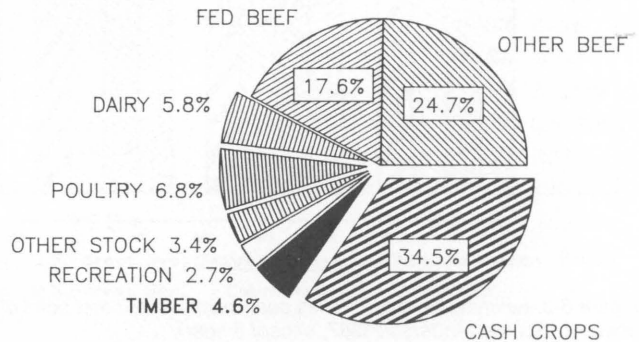


Figure 6-2. Estimated value of Texas agricultural products by commodity group. Data presented as a percentage of the total \$10.6 billion in value received by agricultural producers in 1986. (Source: Anderson 1987).

When the value of Texas cash crops were estimated at their first point of delivery in 1986, cotton was the leader in value at \$680 million, followed by sorghum⁴ and then timber, at an estimated \$490 million (Figure 6-3). Approximately three-fifths of the timber value represents timber stumpage sold by landowners (TAEX 1985). The remainder is the value of harvesting or logging, and transportation to the first point of delivery, which is usually a lumber, plywood, or pulp mill, or a wood concentration yard. It is necessary to add harvesting and hauling to the landowners' stumpage receipts so that timber may be compared equally to other agricultural crops.

Figure 6-4 illustrates that timber has ranked consistently with the leading agricultural crops in Texas, with values at the first point of delivery comparable to sorghum and wheat. Cotton is the only crop that consistently has produced a value greater than the delivered value of timber in Texas.

According to the U.S. Forest Service, timber ranks as the number one agricultural crop in the southern U.S. Soybeans, cotton, tobacco, wheat, and corn follow timber in value at

⁴Texas led the nation in the production of cotton and sorghum in 1985 (Texas Almanac).

the first point of delivery.⁵ In 1984, timber was the number one agricultural crop in 6 of the 12 southern states. Timber ranked second in three other states, and third in the remaining three (USDA Forest Service 1987a).

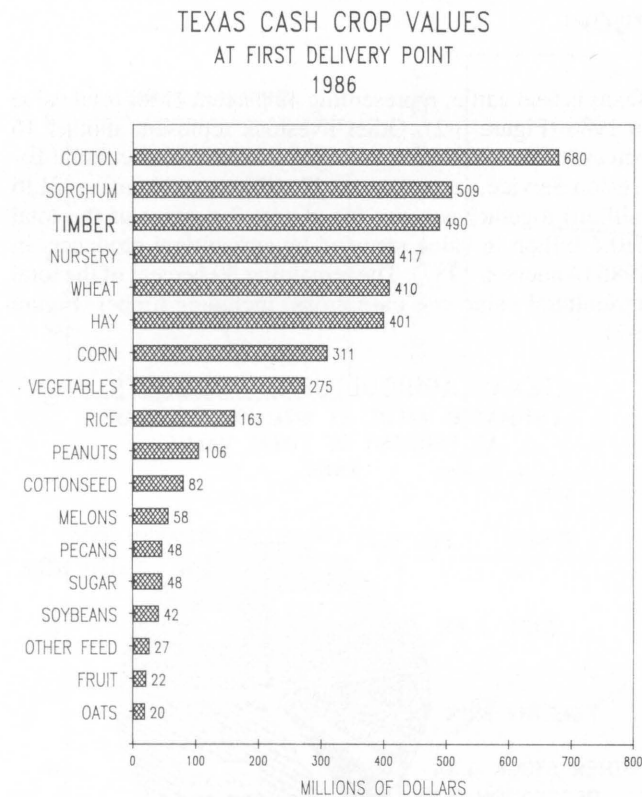


Figure 6-3. Estimated value of Texas cash crops at their first point of delivery. (Source: Anderson 1987, except timber).

As Figure 6-5 illustrates, when economic impact—measured by the value of manufactured products based on agricultural commodities—is considered, the timber harvested and processed in East Texas has an impact on the state economy that is comparable to other major cash crops and agricultural products. In 1982, each dollar's worth of Texas timber delivered to a primary wood-based manufacturing plant in Texas ultimately provided 1.4 times the value of timber in value added by primary wood-based manufacturing⁵. Wheat also had a ratio of 1.4 in value added to the commodity value. Cotton is the only other agricultural product in Figure 6-5 with a ratio of value added to delivered commodity value that exceeds 1.0, and at 1.1, it barely does so. Beef, dairy, and feed grains did not provide a manufacturing value added equal to the value of the commodity; timber, wheat, and cot-

⁵ The year 1982 was used because Census of Manufactures data for later years is unavailable. This unconventional "value added multiplier" of 1.4 was determined in the following manner: The delivered value of timber at Texas mills in 1982 was \$371 million (Figure 6-4). Along with other purchased inputs, this timber produced a value added in the primary lumber, plywood, and paper manufacturing industries of \$525 million (Table 5-2), and a value of shipments of primary lumber, plywood, and paper products totaling \$1.7 billion in 1982 (Table 5-2). Timber imported to Texas accounted for 10.6 percent of processed timber in Texas (TFS Texas Forest Resource Harvest Trends), so an appropriate downward adjustment was made in timber value, value added, and value of shipments in Figure 6-5.

ton did. Figure 6-5 also indicates that manufacturing timber into primary wood-based products requires the purchase of many more inputs than do other agricultural industries, due to the amount of manufacturing and purchased inputs needed to convert timber into useful wood-based products.

Economic Impact Multipliers

An economic impact multiplier can be likened to a rock tossed into water, in that multipliers are designed to measure the ripple effect upon the rest of the economy created by changes in economic sectors or industries. Multipliers are developed for gauging the effect of changes in employment, personal income, and output, or sales revenues.

Multipliers may be interpreted in the following way: An additional dollar of sales revenue by the solid wood manufacturing sector of wood-based industry would generate a total of \$2.58 of sales revenue throughout the entire state economy. In other words, for each additional dollar of lumber sales revenue, there would be an additional \$1.58 in sales revenue generated in all other industries. Similarly, one additional job in the lumber manufacturing industry would generate or require approximately 1.29 jobs in other industries, for a total effect of 2.29 jobs.

The Texas wood-based industry multipliers cited above are those reported by the U.S. Forest Service for Texas in Table 6-1 (USDA Forest Service 1987a). The various wood-based industry Type II multipliers (See the Glossary.) in Texas are quite similar to the average multipliers in the South Central states (Table 6-1).

The use of multipliers to gauge economic impact must be approached with caution. There is a wide range of wood-based industry multipliers for the southern states. They range from 1.5 in Tennessee to 3.5 in Oklahoma. The leading authority on the use of forest-based industry multipliers (Flick 1986) does not know whether the range of multipliers represents fundamental differences in the economies of various states, or fundamental differences in the methods used in various states to generate multipliers. It is likely that both factors are important, but wood is wood, and relatively undifferentiated wood-based products are traded across state and national boundaries. On the other hand, the data requirements of the methods used to determine multipliers exceed both the quantity and quality of data available, and the methods of analysis are static rather than dynamic.

Economic multipliers are derived from input-output models. Input-output analysis is a widely used technique to measure the effect of sectors of an economy on the overall economy. Simply stated, a given amount of output—which can be an increase or decrease in jobs, sales, or income—is placed into a carefully constructed mathematical model of the economy. The needed inputs are measured as they change to meet the new level of inputs. Input-output models have a variety of uses, ranging from the assessment of the sales potential of an individual firm to the assessment of a broad economic program. A major contribution of an input-output model to economic analysis is that it facilitates measurement of direct, indirect, and induced impacts resulting from an incremental change in demand in one sector of the economy. An example of input-output analysis could be demand for houses. An increase in consumer demand for houses will lead to a direct increase in the number of houses being con-

TEXAS TOP FOUR CASH CROPS AT FIRST DELIVERY POINT 1981-1986

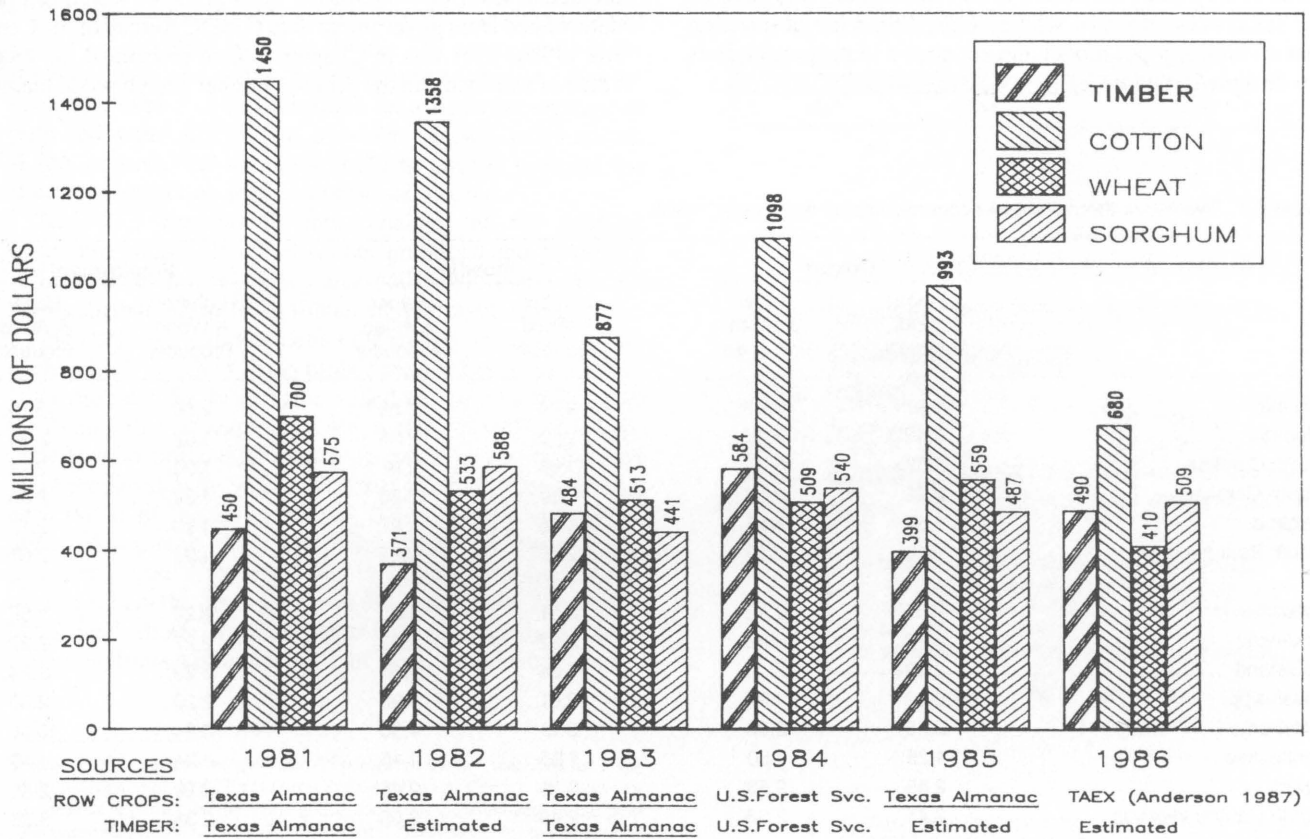
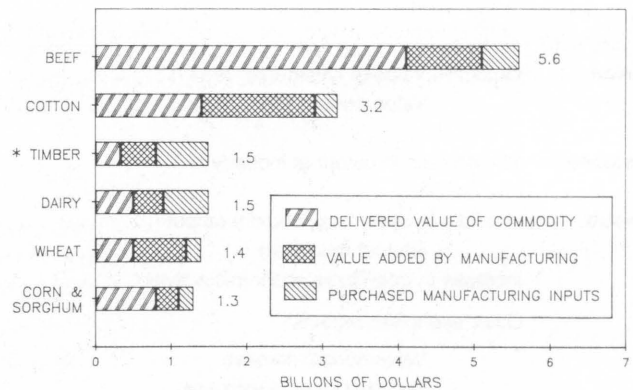


Figure 6-4. Top four cash crops in Texas at first delivery point. (Sources: Row crops—Texas Almanac; USDA Forest Service 1987a; Anderson 1987. Timber—Texas Almanac; USDA Forest Service 1987a; other years estimated from TFS, Texas Forest Resource Harvest Trends; and Timber Mart—South 1984).

structured. This increase will lead to an increase in the production of lumber, gypsum wallboard, roofing, and other building materials. This, in turn, indirectly increases the amount of raw materials needed to produce the building materials, as well as many other goods and services involved in the construction of a house. At all stages of production, additional employment is created, and the induced effect of the additional personal income in the economy is measurable. Type II economic impact multipliers can be derived from an input-output model to estimate the total impact of direct, indirect, and induced effects.

With analysis based on an input-output model of the economy, it is possible to trace this intricate chain of interrelated demands throughout the economy, measuring the direct, indirect, and induced effects on production with Type II multipliers. An important use of this information is to make policy-makers aware of these changes so they can anticipate and assess changes in the economy caused by changes in population and in the demand for goods and services.

TEXAS TOP AGRICULTURAL PRODUCTS VALUE OF MANUFACTURED PRODUCT SHIPMENTS BY AGRICULTURAL COMMODITY 1982



* VALUE ADDED AND PURCHASED INPUTS FOR TIMBER ARE ONLY FOR PRIMARY WOOD-BASED MANUFACTURING SEGMENTS (LUMBER & PLYWOOD, PULP & PAPER) THAT PROCESS TEXAS TIMBER (SICs 2421, 2436, 262, 263).

Figure 6-5. Leading agricultural products in Texas measured by the value of manufactured product shipments by agricultural commodity. (Sources: Texas Almanac 1982; USDC Bureau of the Census 1985b).

Economic Impact of the Primary Wood-Based Industry

If the primary segments of the Texas wood-based industry were to expand their levels of output by a certain amount as measured by sales revenues, what effect would this have on the Texas economy as a whole? This is the kind of question that an input-output model and economic impact multipliers are designed to address.

What if demand for primary wood-based products caused sales revenues to increase by, say, 1 percent? Replies to this question are provided in Table 6-2. The starting point is with the actual level of wood-based sales in 1984, which can be determined from government data (USDC Bureau of the Census 1986a) as it was in Chapter 5. One percent of the total value of shipments in the primary lumber and plywood manu-

Table 6-1. Twelve southern states—economic impact multipliers,* 1984.

	Output		Income		Employment	
	Lumber & Wood Products	Paper & Allied Products	Lumber & Wood Products	Paper & Allied Products	Lumber & Wood Products	Paper & Allied Products
Florida	2.97	3.03	2.70	2.56	2.50	3.10
Georgia	2.43	2.36	2.10	2.35	1.82	2.80
North Carolina	1.57	1.53	1.94	1.91	1.90	2.17
South Carolina	2.43	2.36	2.10	2.35	1.82	2.80
Virginia	1.57	1.53	1.94	1.91	1.90	2.17
South East average	2.19	2.16	2.16	2.22	1.99	2.61
Alabama	2.66	2.42	2.51	2.85	2.29	3.58
Arkansas	2.42	2.36	2.32	2.32	2.27	2.27
Louisiana	2.62	2.48	2.86	2.65	2.29	3.24
Mississippi	2.02	1.97	2.01	1.96	2.23	2.60
Oklahoma	3.58	3.38	3.19	4.88	3.94	10.14
Tennessee	1.25	1.50	1.35	1.45	1.24	1.48
Texas	2.58	2.53	3.21	2.45	2.29	2.91
South Central average	2.45	2.38	2.49	2.65	2.36	3.75

*Type II multipliers, reflecting industry interactions and induced effects due to increased personal income.

Source: USDA Forest Service 1987a

Table 6-2. Estimated economic impact of an increase in the primary wood-based manufacturing industry on the Texas economy, 1984.

		Lumber & plywood mills	Pulp & paper mills
		—millions of dollars—	
Given:	Output — Value of shipments, 1984	600.8	1339.9
	Value added, 1984	163.7	494.2
Assume:	1% increase in output of industry		
Result:	Increase in direct total industry output	6.0	13.4
	[Output multiplier]	[2.58]	[2.53]
	Increase in total Texas economic activity	15.5	33.9
	Other economic impacts:		
	Value added increase	7.3	13.4
	Personal income increase	4.4	7.1
	Federal tax increase	.930	.271
	State tax increase	.047	.136
	Local tax increase	.078	.373

Sources: Adapted from Jones 1986. Value of shipments and value added adapted from USDC Bureau of the Census 1985b (Table 5-2). Multipliers from USDA Forest Service 1987a (Table 6-1).

facturing industries was \$6.0 million in 1984. Applying the revenue output multiplier to it estimates total impact in the state of \$15.5 million. The increase in total value added, personal income, and taxes in Table 6-2 are based on the \$15.5 million figure and the relationships in the state input-output model (as modified by Jones 1986). The same analysis for primary pulp and paper manufacturing indicates a total economic impact of \$33.9 million for a 1 percent increase in pulp and paper mill output, of which \$13.4 is value added. A similar analytical approach could be used to estimate the statewide impact on jobs and personal income.

Table 6-3 presents a static analysis of the induced economic impact effects of timber produced and processed in East Texas in 1984. The value added and value of shipments attributable to Texas timber are portrayed in Figure 6-6 by industry segment, and depict the finding in Table 6-3 that each dollar's worth of Texas timber received at Texas mills in 1984 provided \$1.44 in value added by manufacturing and \$4.29 in value of shipments. Even after adjusting for integrated wood utilization⁶, the pulp and paper industry segment produced more value added and value of shipments per each dollar of timber input than did either the sawmill or plywood segments. Pulp and paper manufacturing also had a greater timber value per dollar in employment and payroll measures than the other segments did (Table 6-3). The results of this analysis are used in Chapter 10 to estimate the possible economic impact of an increase in Texas timber supplies.

⁶ Because chips and sawdust provided 45 percent of the raw materials for Texas pulp and paper mills (TFS Texas Forest Resource Harvest Trends), it is necessary to attribute a portion of the value added and value of shipments in the pulp and paper segment to sawlogs and veneer logs. Adjustments for this integrated utilization of wood, or process integration (Cleaves and O'Laughlin 1986), have been made in Table 6-3 and are reflected in Figure 6-6.

TEXAS PRIMARY WOOD-BASED INDUSTRY SEGMENTS

1984
(MILLIONS OF DOLLARS)

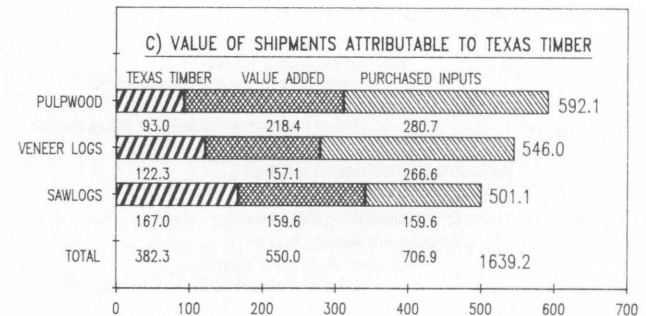
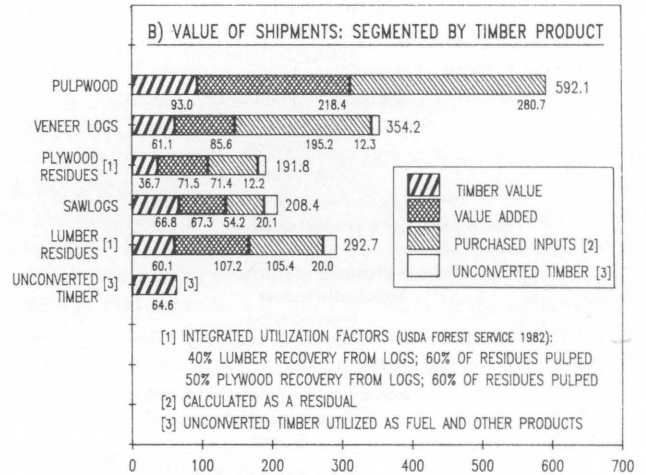
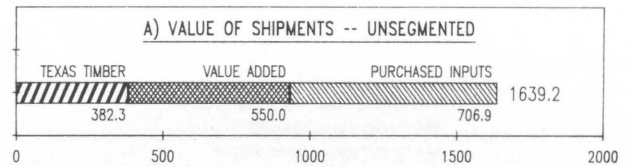


Figure 6-6. Value added and value of shipments attributable to timber produced and processed in East Texas in 1984. Portrayed by industry segment and in total. (Source: Adapted from Table 6-3).

Table 6-3. Measures of induced impacts on the Texas economy from timber produced and processed in Texas, 1984.

	Primary Wood-Based Industry Segments			TOTAL
	Sawmills SIC 2421	Softwood Plywood SIC 2436	Pulp & Paper SIC 262,3	
	millions of dollars			
INDUSTRY DATA, 1984 (Sources footnoted)				
Mill receipt value, all timber ^a	\$183.0	\$126.0	\$105.3	\$416.9
Mill receipt value, Texas timber ^a	\$167.0	\$122.3	\$ 93.0	\$382.3
Ratio, Texas timber/all timber	.913	.951	.883	.917
Value added by manufacturing ^b , all timber	\$ 73.7	\$ 90.0	\$494.2	\$657.9
Adjustment factors				
Imported timber	.913	.951	.883	.917
Wastepaper feedstocks ^c	NA.	NA.	.910	NA.
Value added to Texas timber	\$ 67.3	\$ 85.6	\$397.1	\$550.0
Adjustment for integrated utilization				
Chips & sawdust feedstocks ^d	NA.	NA.	.550	NA.
Subtotal	\$ 67.3	\$ 85.6	\$218.4	NA.
Chips & sawdust residues ^e	\$107.2	\$ 71.5	NA.	NA.
Value added to Texas timber (integrated)	\$174.5	\$157.1	\$218.4	\$550.0
Value added per \$ of Texas timber	1.04	1.28	2.35	1.44
Value of shipments ^b , all timber	\$228.3	\$372.5	\$1,339.9	\$1,940.7
Adjustment factors				
Imported timber	.913	.951	.883	.917
Wastepaper feedstocks ^c	NA.	NA.	.910	NA.
Value of shipments from Texas timber	\$208.4	\$354.2	\$1,076.6	\$1,639.2
Adjustment for integrated utilization				
Chips & sawdust feedstocks ^d	NA.	NA.	.550	NA.
Subtotal	\$208.4	\$354.2	\$592.1	NA.
Chips & sawdust residues ^e	\$292.7	\$191.8	NA.	NA.
Value of shipments, Texas timber (integrated)	\$501.1	\$546.0	\$592.1	\$1,639.2
Value of shipments per \$ of Texas timber	3.00	4.46	6.37	4.29
INDUCED OUTPUT EFFECTS				
Output multiplier (Type II) ^f	2.58	2.58	2.53	NA.
Induced economic impact in				
Value added per \$ of Texas timber	2.68	3.30	5.95	NA.
Induced economic impact in				
Value of shipments per \$ of Texas timber	7.74	11.50	16.12	NA.
INDUCED EMPLOYMENT EFFECTS				
Employees ^b	3,024	3,775	6,900	13,699
Employees/million \$ of timber	16.5	30.0	65.5	32.9
Employee multiplier (Type II) ^f	2.29	2.29	2.91	NA.
Induced economic impact in				
Employment per million \$ of timber ^g	37.78	68.70	190.60	NA.
INDUCED PAYROLL EFFECTS				
millions of dollars				
Payroll ^b	\$44.7	\$67.1	\$197.7	\$309.5
Payroll per \$ of timber	.24	.53	1.88	.74
Income multiplier (Type II) ^f	3.21	3.21	2.45	NA.
Induced economic impact in				
Income per \$ of timber ^g	.77	1.70	4.61	NA.

NA. = Not Applicable

Sources: ^aTFS, Texas Forest Resource Harvest Trends; Timber Mart—South 1984.^bUSDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a.^cMiller Freeman, Inc. 1984.^dTFS, Texas Forest Resource Harvest Trends.^eSawmill residues provided 60 percent of the chips and sawdust used for pulp; plywood residues provided 40 percent (Figure 6-6.).^fUSDA Forest Service 1987a.^gInduced effects per dollar of Texas timber would be exactly the same if similar factors were used to adjust for timber imports, as were used with value added and value of shipments per dollar of Texas timber.

7. Other Effects Of and On the Forest Products Industry

Taxes

The estimated contribution to federal taxes from the Texas forest product industry was \$193.2 million in 1985, paid through corporate and personal income taxes. The wood-based industry provided state tax revenues amounting to \$14.3 million (Jones 1986).

Timberland owners pay substantial amounts of property taxes to support local government activities. In 1985, an estimated \$29.8 million was collected from forest industry companies and non-industrial private forest landowners by local governments. This is an average of \$2.76 per acre per year. Qualifying Texas timberland owners are entitled to special timber use valuation for *ad valorem* taxation purposes.

In summary, the total tax contribution from wood-based activities in 1985 was estimated at \$237.3 million, of which \$193.2 million was federal tax, \$29.8 million was local property tax, and \$14.3 million went to the state of Texas (Jones 1986).

Taxes, of course, are a cost of operating a business. Even though marginal income tax rates for individuals have been reduced, the federal Tax Reform Act of 1986 has created widespread uncertainty regarding investments to maintain forest resources and capital equipment used in wood-based and other industries throughout the nation. The loss of investment tax credits increases the cost of manufacturing productivity improvements in the manufacturing industry. Early indications offered in *Business Week* (Magnusson 1987) are that capital spending is not exactly booming, but seems to be holding its own.

The loss of a differential on capital gains income is of concern to timberland owners and investors. The long-term nature of a tree farm investment—a minimum of 15 years for a new pine plantation to produce marketable timber products—coupled with the new income tax rules on the treatment of annual forestry-related expenses, tend to make a forestry investment somewhat less attractive.

But neither of these new tax complications, resulting from tax reform, should pose a significant hurdle for landowners contemplating investments to improve their timberlands. In addition, the new rules for treatment of annual expenses should pose no problems for owners actively managing their timberlands and keeping a journal of their activities (Siegel 1987; Condrell and others 1987).

Projected rates of return will still be attractive and competitive with alternative investments for landowners willing to tie up their investment funds for at least 15 years. For new forestry investments made today, the capital gains treatment of income, an incentive lost in the 1986 tax reform, does not occur for many years. Therefore, its effect on a projected rate of return is diminished by discounting for the time difference of several decades.

Investment analysis of a pulpwood plantation presented in Table 7-1 reveals that a projected rate of return for a taxpayer

in the maximum tax bracket before the 1986 tax reform would have been a 13.7 percent internal rate of return. With the combined effect of a lower tax rate and the loss of capital gains treatment of income, the rate of return after tax reform is reduced to 13.0 percent. The difference, a loss of 0.7 percentage points on the internal rate of return, should not be significant enough to deter landowners from making forest management investments based on the loss of the timber capital gains incentive.

Suppose a landowner faced an investment of \$200 per acre to prepare and plant the site instead of the \$100 per acre cited in the preceding paragraph and displayed in columns 1 and 2 in Table 7-1. As columns 3 and 4 in the table indicate, the anticipated rate of return before tax reform would have been 8.7 percent, and decreases to 8.2 percent with the effects of tax reform. Again, the difference should not be enough to dissuade landowners from planting pine trees, assuming that they already own the land.

Capital Investment

Capital investments include expenditures for permanent additions and major alterations to manufacturing establishments, and machinery and equipment replacements, or additions to manufacturing plant capacity. Throughout the South, companies in the paper and allied industries made capital investments totaling \$4.6 billion in 1983 (Slatin 1986).

Figure 7-1 indicates the amount of capital investments made by Texas wood-based companies from 1972 through 1984, which totaled more than \$2 billion. A clear pattern reveals that lumber and wood products, furniture, and paper and allied products all had significant reductions in capital spending in 1983. This is no doubt a reflection of capital spending plans made in 1982 at the low point of a severe economic recession. Increased spending in 1984 is an indicator of more confidence in the overall economy on the part of wood-based companies.

A further discussion of these investment opportunities to increase timber supplies in Texas is presented in Chapter 10.

International Trade

Some timber products and manufactured wood-based products are exported from Texas to other states and nations, but on balance, Texas is a net importer of wood-based products. The U.S. as a whole consumes more wood-based products than it produces. In 1983, the U.S. exported \$6 billion in forest products, but imported approximately \$10 billion (Wisdom 1986). That the U.S. is a net importer of wood-based products is somewhat paradoxical for a nation that is endowed with the wealth of forest resources that the U.S. enjoys. Most of the imports to the U.S., and to Texas, are Canadian softwood lumber. Major U.S. forest products exports include wood pulp, linerboard (used to make corrugated cartons), and logs

harvested from private lands in the Pacific Northwest that are processed in Japan.

Exports of southern wood-based products were valued at \$2.1 billion in 1982. Pulp and paper product exports averaged \$1.8 billion during the years 1980-1982 (Wisdom 1986). Three-fourths of the trade is directed to Western Europe and the Caribbean. Texas produces very little high quality hardwood logs, lumber, or veneer demanded by export markets, but does produce a variety of softwood products that can be competitive in international markets. Texas also has excellent port facilities that can handle bulk and containerized products (TFS 1985a).

The international situation for states with capabilities to export forest products is favorable. A recent study commissioned by the U.S. Senate Committee on Appropriations

came to the following conclusion (U.S. Congress Office of Technology Assessment 1983, p.2):

Global demand for a wide range of forest products is growing rapidly, but the best trade opportunities appear to be in the paper markets of other industrialized nations, particularly Western Europe and Japan. In contrast to many basic U.S. industries, the forest products industry has distinct advantages over its foreign competitors. The U.S. forest products industry is the most productive and among the most efficient in the world, and it benefits from a vast and highly productive domestic forest resource.

The question is, can the wood-based industry in Texas supply export markets with forest products if the demand

Table 7-1. Rates of return to a pulpwood plantation before and after tax reform.

ASSUMPTIONS

- Land is already owned, no land acquisition costs included.
- Plantation establishment cost is considered at two different levels:
 - \$100 per acre (*light site preparation*, columns [1] and [2]), and
 - \$200 per acre (*heavy site preparation*, columns [3] and [4]).
- No cost share payments received, no reforestation tax incentives used.
- Annual management costs and property taxes are offset by hunting lease revenues, with no tax implications (a realistic simplifying assumption).
- Pulpwood yield of 23 cords per acre in 15 years.
- Pulpwood stumpage value of \$36 per cord in 15 years, which is:
 - Equivalent to \$20 per cord today with 4% annual inflation rate, or
 - Equivalent to \$15 per cord today with 4% annual inflation rate and 2% per year real price increase.
- **Before tax reform:**
 - Landowner is in maximum marginal tax bracket of 50%.
 - Capital gain exclusion of 60% of timber income.
- **After tax reform:**
 - Landowner is in maximum marginal tax bracket of 28%.
 - No capital gain exclusion on timber income.

INVESTMENT ANALYSIS

	Light Site Preparation		Heavy Site Preparation	
	[1] Before Tax Reform	[2] After Tax Reform	[3] Before Tax Reform	[4] After Tax Reform
	per acre			
Investment in plantation establishment	\$100	\$100	\$200	\$200
Return in 15 years, pre-tax	\$828	\$828	\$828	\$828
Rate of return, pre-tax	15.1%	15.1%	9.9%	9.9%
After-tax calculations:				
Gross return, pre-tax	\$828	\$828	\$828	\$828
less investment	100	100	200	200
Capital gain	728	728	628	628
less 60% exclusion	437	-0-	377	-0-
Taxable gain	291	728	251	628
Income tax payable	146	204	126	176
Net return, after-tax	\$682	\$624	\$702	\$652
Rate of return, after-tax	13.7%	13.0%	8.7%	8.2%

TEXAS WOOD-BASED INDUSTRY CAPITAL EXPENDITURES 1972-1984

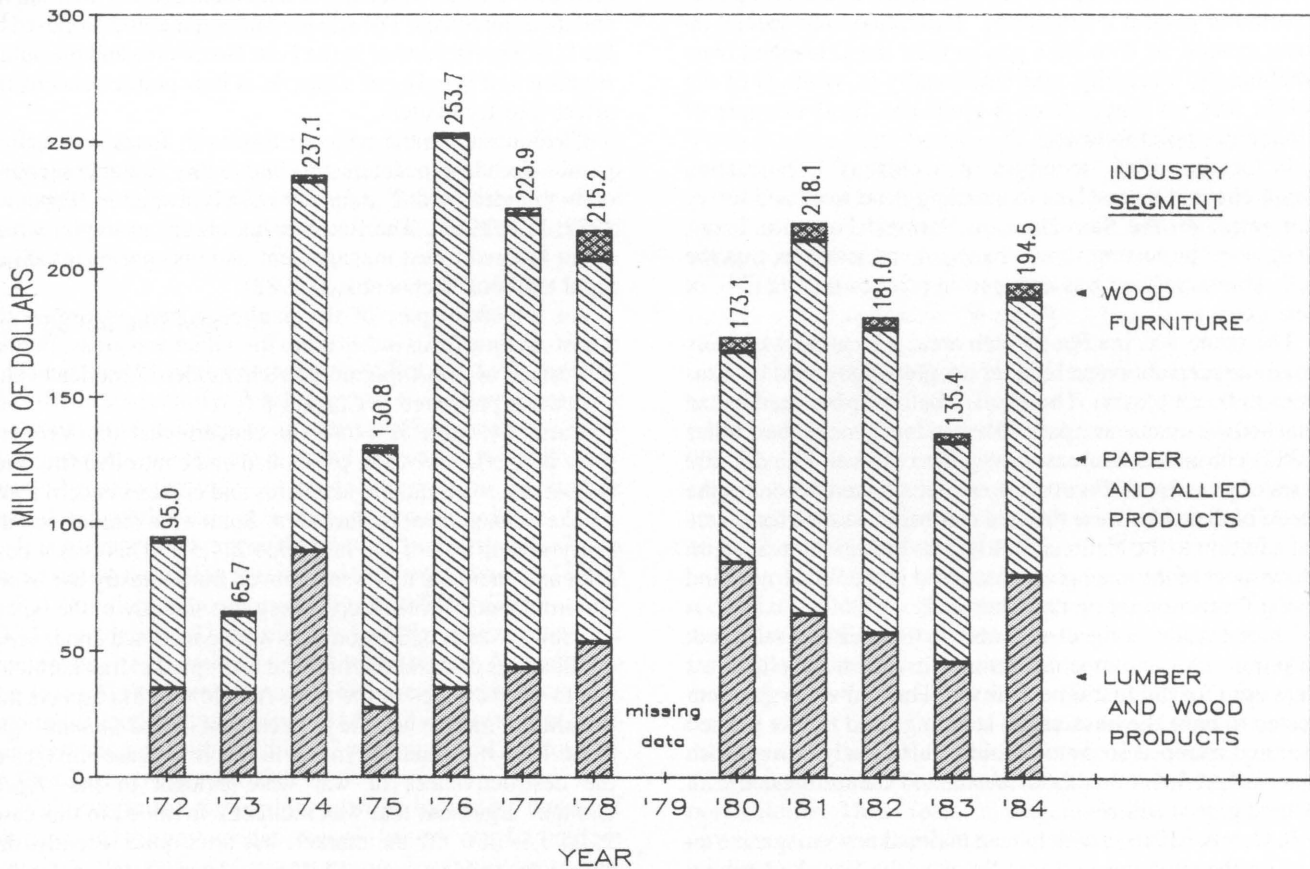


Figure 7-1. Texas wood-based industry capital expenditures by industry segment. Total for 1972-1984 exceeded \$2 billion. (Sources: USDC Bureau of the Census 1985b; USDC Bureau of the Census 1986a; Bureau of Business Research 1987).

existed? As discussed in Chapter 9, it appears that as a whole, Texas cannot supply its own domestic wood-based product needs, because the state is not self-sufficient with respect to wood-based products. Then the question becomes, can Texas' wood-based industry expand to meet anticipated increases in domestic and international demand?

Restructuring to Maintain Competitiveness

Restructuring is a response to change; it is a term for reorganizing an individual firm, or an entire economic system. The pattern of restructuring by individual forest products companies resulted in a more concentrated forest products industry in the mid-1980s than at the beginning of the decade. For example, in 1984, there were seven major forest products companies in Texas. Corporate restructuring has left only four to manage the same system of lands and mills (O'Laughlin and Bell 1986).

Grum (1986), the Chief Executive Officer of Temple-Inland, a large integrated southern U.S. forest products company based in Texas, recently said, "Forest products companies have two choices: they can restructure [themselves] to

become more cost-efficient or they can be restructured [by others] via corporate takeovers."

The change agents leading to restructuring in the forest products industry can be lumped into two major categories: 1) economic factors, and 2) raw material or timber supply characteristics. The severe economic recession of the early 1980s that occurred as policy-makers fought to control inflation (which they were able to do) also produced the highest real interest rates in U.S. history. With unprecedented and staggering federal revenue and international trade deficits, the U.S. has become the largest debtor nation in the world.

Ultimately, restructuring the economy with revamped taxation policies and changed federal spending priorities will have some effect on timber supplies. These effects are decades away and difficult to foretell.

Public Opinion and Forestry

Groups of concerned citizens can exert an influence on land management activities that is, as the Sierra Club proudly points out in recruitment mailings, "out of all proportion to their numbers."

Vocal minorities can affect forest management, and will use legal action and powerful symbols to get their point across. As Lindheim (1985) says, America in the 1980s is in a period of painful restructuring. Individuals and special interest groups, as if to fill a gap in their lives, respond overwhelmingly, viscerally, and emotionally to symbols of the values they no longer live. A vivid and local example of Lindheim's point follows.

In October 1986, members of a citizens' conservation group chained themselves to standing dead trees and heavy equipment on the Sam Houston National Forest in Texas. They were protesting forest management activities that the U.S. Forest Service was engaged in prior to the planting of pine trees.

The scene was the Four Notch area, a location where unusual site preparation techniques not previously used in Texas were to be employed. Three years before, pine beetles had attacked the mature and park-like stands of pine timber. Miles (1987) chronicles the reason why the outbreak killed 3,500 acres of pine forest: Foresters were not allowed to control the beetle outbreak because the area was being studied for potential addition to the National Wilderness Preservation System. This aspect of the example is discussed in the Wilderness and Forest Protection section of Chapter 8.

Three-fourths of the dead timber in the area was salvaged. To minimize environmental damage in the area, helicopters were used for the first time in Texas. The Forest Service contracted to have the unsalvaged standing dead timber pushed over and chopped so that it could be efficiently burned with a prescribed fire ignited from the air, and later reforested with planted pine seedlings.

In October 1986, a widely read national news magazine report on the situation said that Smokey the Bear had done a turnabout and was napalming, or fire-bombing, the forest (Uehling and others 1986). The Forest Service was actually planning to start a controlled burn by dripping a jellied mix of gasoline and diesel fuel from a torch suspended from a helicopter. The objective was to reduce the accumulation of dead trees left in the beetle's wake. Injunctions temporarily halted site preparation activities, but subsequent federal court actions found no violation of law or procedure in the Forest Service's planned timber management activities. In the fall of 1987, the prescribed burn was implemented, and pine trees will be planted as planned on about 60 percent of the ravaged Four Notch area.

The message to the forestry community is that the consequences of land management activities need to be carefully analyzed not only for their technical effectiveness and effi-

ciency, but for public acceptance as well. To maintain professional credibility, foresters should include public opinion in their assessments of technical land management alternatives and their outcomes. The site preparation method proposed by the U.S. Forest Service in the Four Notch area and the public reaction to it is only one example of how public concern can affect forestry matters.

Clearcutting in the national forests in Texas was a focal point a decade ago. Interesting and highly readable accounts of both sides of that story are readily available (Popovich 1977; Fritz 1983). The final verdict on this example, which again favored forest management, is now case material in a legal textbook (Schoenbaum 1982).

An important part of the public concern regarding the forests in East Texas is the desire for wilderness areas. Further discussion of this important ideal in modern American value systems is presented in Chapter 8.

Currently, there is cause for concern that the forester's most cost-effective tool, prescribed and controlled fire, may be lost due to air quality standards and citizen concern about smoke management by foresters. Somewhat similar was the fairly recent loss of the herbicide 2,4,5-T. This was a cost-effective chemical that was removed from forestry use by the Environmental Protection Agency due directly to the outcry of a few citizens in Oregon who were concerned about aerial applications of the herbicide, and attempted to link herbicide use to miscarriages in the area. Arnold (1982) suspects that the ulterior motive was the protection of illegal *Cannabis* gardens. Like the napalm symbol in the Texas case, images of the destructiveness of war were evident in the "Agent Orange" argument that was indirectly involved in this case. 2,4,5-T is now off the market, but until quite recently, this herbicide could be used on highway rights-of-way and in rice paddies, but not for forestry purposes as a result of public opinion. The point is, it was not scientific evidence of the harmful effects of 2,4,5-T on humans that took the herbicide off the market, but public opinion.

This is important in Texas, because public opinion regarding forest management could result in environmental restrictions that might lead to a ban on forest burning due to air quality issues. Public concern could also lead to land management regulations such as forest practices acts that other states have implemented, or local ordinances that inhibit forestry activities (Cubbage and Siegel 1985). These issues could affect the Texas forest economy by making timber production more expensive, and thereby restricting future timber supplies.

8. Non-Timber Uses of the Forest

The forests of Texas provide many more benefits than trees that provide timber and jobs and income in wood-based manufacturing and related industries. These other important forest outputs or products of the forest are briefly described in the following sections.

Recreation and Tourism

The impact of outdoor recreation in Texas or anywhere else is difficult to quantify. What does the recreation experience mean in terms of dollars to an individual? Answers to subjective questions like this are required to measure recreation impacts, because the value of outdoor recreation is not fully priced in a market, as are timber and wood products.

It is estimated that more than \$10 billion is spent in Texas in pursuit of recreation and related tourism activities (TPWD 1983). Another source puts the figure at \$16 billion in 1985 (TTDA undated). These figures include expenditures for equipment, travel, vehicles, food, and licenses. According to the Texas Agricultural Extension Service, farmers, ranchers, and forest landowners received \$147 million from non-hunting recreation in 1986. Of this, 37 percent or \$54 million was in East Texas (Anderson 1987).

With continued population growth, increased levels of tourism, and the projected increase in leisure time for outdoor activities, the demands for recreation in Texas will be increasing. In 1980, more than one billion activity days occurred in Texas. By the year 2000, it is estimated that recreation activity will triple to almost 3 billion activity days (TPWD 1983).

Population growth means increased demand for forest recreation, and provides additional opportunities for forest landowners to obtain non-timber revenues. Camping and hunting are two popular activities that landowners can offer to the public for a fee. Hunting opportunities in the woods of East Texas provide recreation for many Texans. Because of the extensive land areas needed by wildlife, management of land as a hunting recreation resource poses a variety of specialized problems.

Statewide, private landowners' hunting receipts were estimated by the Texas Agricultural Extension Service at \$136 million. Of this total, 16 percent or \$22 million was received by landowners in the Piney Woods region (Anderson 1987).

Wildlife Management and Hunting

In East Texas, public hunting areas are provided by the National Park Service, U.S. Forest Service, Texas Parks and Wildlife Department, Texas Forest Service, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and the Bureau of Reclamation.

A survey of forest industry companies that together owned 3.5 million acres of East Texas timberland in 1983 revealed that 65 percent of their lands was leased to hunting clubs. They received an average of \$1.14 per acre in lease revenue (Massey and Rodgers 1984). Forest land can be leased in East

Texas at somewhere between \$1 and \$5 per acre per year for hunting (TAEX 1986).

Most non-industrial private forest landowners participating in a survey indicated that they would lease their lands for hunting as a source of extra income. However, 35 percent of the NIPF landowners that were surveyed indicated that no incentive would encourage them to allow hunting on their lands (Wright 1985).

The forests of East Texas provide habitat for many species of wild animals and birds. The pine forests of East Texas are home to the red-cockaded woodpecker, an endangered species with special management requirements. It depends on stands of pine trees that are at least 50 years old. These stands now exist almost exclusively on the National Forests of Texas and other southern states.

Many landowners, companies, and government agencies recognize wildlife concerns in their management plans. Good timber management can also be good wildlife management, particularly for white-tailed deer and wild turkey. The majority of wild creatures are "edge" animals. Edges are created where timber of two different age classes intersect, causing a stair step in the forest canopy. These edges provide a good environment for a wide variety of plants that can support wildlife. Thus, forest management that is designed to provide more wood products can also provide more varied wildlife habitats.

Water Supplies

East Texas is blessed with more rainfall than the rest of the state. Many large reservoirs—Toledo Bend, Sam Rayburn, Livingston, and Conroe—have a substantial acreage of productive timberland underwater. So much of Texas' surface is covered with water that only Alaska has more. In East Texas, more than 440,000 surface acres of water are contained in 30 large reservoirs during normal conditions (TPWD 1984).

Between 1965 and 1975, some 561,000 acres of timberland were converted to other land uses, of which water reservoirs was one (TFS 1983). From 1977 to 1985, roughly 239,000 acres of natural pine stands and bottomland hardwoods were converted to other uses (USDA Forest Service 1987a).

There are 311,000 acres of new reservoirs planned for East Texas (TDWR 1984). Of these acres, 164,000 are slated for the Rockland Dam project, which the U.S. Army Corps of Engineers now finds is "no longer economically justified" for flood control or hydroelectric power. However, water supply and recreation use justifies the almost \$700 million cost of the project. But the Corps of Engineers' study did not include the loss of 65,000 acres of timberland that would be flooded. The Corps has set aside indefinitely a reevaluation study of this project (TFA 1987).

But there are still prospects on the books for 147,000 acres of new reservoirs in East Texas. It is not known how much

of this is timberland, but somewhere between 30 percent to 50 percent would be a conservative estimate. Other than Rockland Dam, future reservoirs have the potential to flood 75,000 acres of timberland.

Shifting Agricultural Land Use

In the South, 6 million acres of agricultural croplands and 11 million acres of pasture lands are identified by the U.S. Department of Agriculture as "marginal lands." Almost a million of these acres are in Texas (USDA 1983; USDA Forest Service 1987a). The definition of marginal lands is simple: The landowner would receive higher rates of return if pines were planted there instead of annual crops or pastures (USDA 1984). But many Texans enjoy working their land or cattle, and forestry requires relatively little work. However, forestry investments are characterized by long payoff periods of at least 15 years, which many landowners find unattractive, regardless of the projected rate of return on investment. These potential returns are discussed in further detail in Chapter 10.

Wilderness and Forest Protection

The designation of public land as a legal wilderness reduces the potential acreage of timber supply, as well as the county portion of timber sale receipts that are received from U.S. Forest Service timber sales in lieu of property taxes. Adjacent private landowners can also be impacted if wildfire or pest epidemics that are not managed in wilderness areas escape to their lands.

Wilderness is a new use for Texas forests. Under provisions of the Eastern Wilderness Act of 1975, five areas in the national forests of Texas now totaling 35,176 acres have been designated as legal wilderness by the U.S. Congress in the Texas Wilderness Act of 1984. The selection of areas to be added to the National Wilderness Preservation System was a classic example of political compromise, and yet another example of the importance of public opinion on forest management matters. Special interest groups with the objective of setting aside as much of the public lands in the U.S. as possible wanted to designate 81,000 acres of national forests as wilderness. They settled on a wilderness bill sponsored by a congressman from Dallas that proffered 65,000 acres for wilderness designation. Another bill, sponsored by a congressman from East Texas and supported by the Texas Forestry Association, proposed less than 9,000 acres for legal wilderness designation. The total of 34,346 acres originally set aside for wilderness preservation was a compromise—almost an even split between the two bills. The additional 830 acres have subsequently been added as boundary adjustments, and land trades with private landowners were made.

The forestry community recognizes the important non-economic values of wilderness areas, as shown by its support for a 9,000-acre wilderness set-aside. However, there is significant concern that by allowing wilderness lands to revert to whatever nature provides, forest productivity on adjacent private lands could be jeopardized by lack of adequate protection on these wilderness areas.

The control of the devastating southern pine beetle in wilderness areas was a recent issue. The southern pine beetle is

notorious for its rapid life cycle, producing up to seven generations per year. The only cost-effective control measure requires cutting a 250-foot-wide buffer strip around the infected trees to prevent the population of infectious beetles from spreading. On wilderness areas or public lands being considered as potential wilderness, cutting trees is prohibited. Attacks from pine beetles, incapable as they are of knowing where legal boundaries exist, can be disastrous without prompt treatment. According to the Director of the Texas Forest Service (Miles 1987), private landowners adjacent to the 1984 pine beetle outbreak in the Four Notch area of the Sam Houston National Forest suffered damage as the beetle attack spread to their land.

Other significant losses attributable to the southern pine beetle have occurred on the Beech Creek and the Big Sandy Units of the Big Thicket National Preserve. A total of 8,000 acres of pine stands were killed. These losses affect not only the pine timber, but also the habitat of the endangered red-cockaded woodpecker (Miles 1987).

The Big Thicket National Preserve consists of 84,500 acres that cannot be managed for timber production. Some of the lands were formerly industrial pine plantations. Continuing arguments for increasing wilderness areas in the National Forests of Texas seldom take into account these forests that are managed for one purpose: preservation of biological communities. These are *de facto* wilderness areas.

Under new authorization to act on pine beetle outbreaks in wilderness areas following the Four Notch incident, the U.S. Forest Service has responded quickly to more recent pine beetle infestations. Despite criticism from some citizen groups, they have limited 275 infestations to an average of 5 acres each. By using appropriate control measures, the number of acres lost to beetle attacks in wilderness areas has been minimized. Much more importantly, adjacent owners have been assured better protection for their valuable timber resources (Miles 1987). So the negative impact of one aspect of wilderness has been addressed.

The other impact of wilderness designation is the reduction of timberland acreage. The only way to make up for this loss of Texas timber is to intensify timber management on the remaining acreage.

Environmental Quality

The most recent wave of the environmental movement that began in the late 1960s is still an important concern today, and one that affects all land managers, including those who own and manage forests. Efforts made today to enhance environmental quality will influence the future availability of wood, water, and air. Good forest management practices can enhance the environment by providing for soil conservation and enhanced water quality. At the same time, raw materials can be furnished to the industry that convert timber into the products used every day by consumers. Soil conservation and the quality of water, air, and forests as a visual resource will continue to be an important facet of forest management that must be considered by landowners and foresters.

9. Sufficiency of the Forest Resource

Forest Products Self-Sufficiency

Texas is not self-sufficient with respect to wood-based products. There are three other southern states that are in the same situation: Oklahoma, Florida, and Kentucky. This is a major finding of a recent study by the U.S. Forest Service (Schallau and Maki 1986; Schallau and others 1987).

The excess employment technique was used to determine what each state's economic base industries were. The economic base industries are those that exceed the nationwide norm of employee distribution. For an industry to qualify, the percent of all workers in the state must exceed the percent of all workers in the industry nationwide. This simple measure is important because economic base industries generate new dollars in the state by earning excess exchange with other regions. Economic growth in a state is dependent on the success of its economic base. The core of economic base theory is that the economic growth of a region depends on exogenous demand. Whether a region grows or declines is determined by how it performs as an exporter to the rest of the world (Bendavid-Val 1983).

As Figure 9-1 indicates, in 1980, eight industries made up almost 90 percent of the economic base in Texas. The manufacturing industry, to which the wood-based industry belongs, was not one of them. If an industry is not part of the economic base of the state, the industry is not considered as earning excess exchange and economic advantage for the state. Therefore, the state is not self-sufficient in that particular industry (Schallau and others 1987).

Although this measure and application of "economic base" at first seems simplistic, it is only simple in its logic. If the percentage of total employees in a particular industry in a state is below the national norm for that industry, then by the law of averages, some other region must be producing for that state's needs. Thus, if Texas is not self-sufficient in wood-based products, there might be an opportunity to provide for those demands within the Texas economy, and thus a chance for economic growth in the state. In other words, demand seems to exist for additional wood-based products beyond those which are produced in Texas.

Is not being self-sufficient good or bad? As is true with most questions in economics, the reply depends on many factors. If not being self-sufficient is viewed as a static situation occurring at one point in time, then it very well may be viewed as bad, given that self-sufficiency is an often-stated economic goal and an admirable personal trait. But if viewed dynamically over a period of time extending into the future, it could be good if opportunities existed to change the situation.

Such is the case with manufacturing industries in Texas, of which the wood-based industry is one. In spite of the fact that the manufacturing industry in Texas is the fourth largest in the nation (Figure 5-1), the state needs to find opportunities to expand manufacturing and other industries to provide more jobs and income for Texans. As Figure 9-1 indi-

TEXAS AND U.S. MAJOR INDUSTRIES
COMPARISON OF PERCENT OF TOTAL EMPLOYMENT
1980

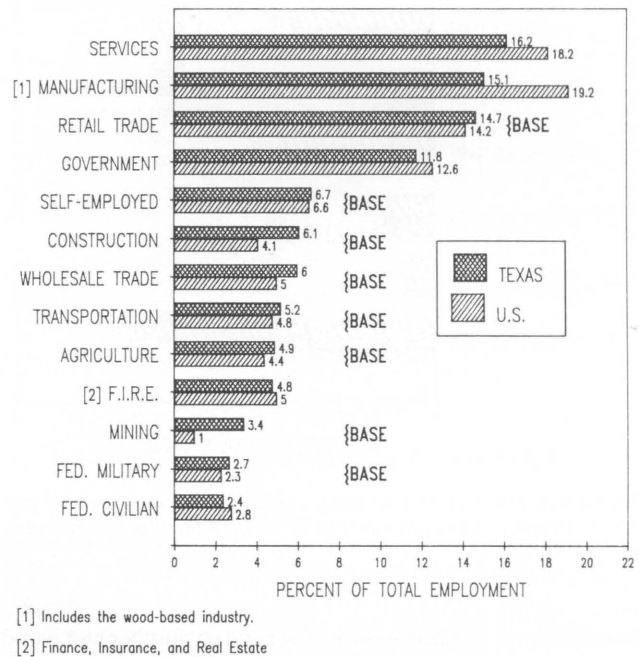


Figure 9-1. Percentage of total employment by major industries in Texas and the U.S. Data depicts the industries that constitute the economic base in Texas. (Source: Schallau and others 1987).

cates, the manufacturing industries in the state employed 15 percent of all working Texans in 1980. Nationwide, 19 percent of all workers were in manufacturing. During the 1970s, the economic base industries that Texas depends on became less diversified and more dependent on oil and gas production (Figure 9-2). Some opportunities to catch up with the U.S. manufacturing employment norm in Texas must exist, given the natural and human resources of the state. Because the demand for wood-based products in Texas exceeds Texas production, the wood-based industry could well be one such opportunity.

Consider the breakdown of Texas' primary and secondary wood-based industries presented in Chapter 5 (Figures 5-10, 5-16, and 5-17). It is quite reasonable to say that if more primary wood products could be produced in East Texas and transported to secondary wood and paper products converting plants and marketing outlets near the large metropolitan areas of Texas, then fewer timber and wood-based imports would be needed. Therefore, the wood-based industry could begin to become part of the state's economic base. Currently, only one segment of the industry might be considered as a

TEXAS ECONOMIC BASE INDUSTRIES DEPENDENCY INDICATORS 1970 AND 1980

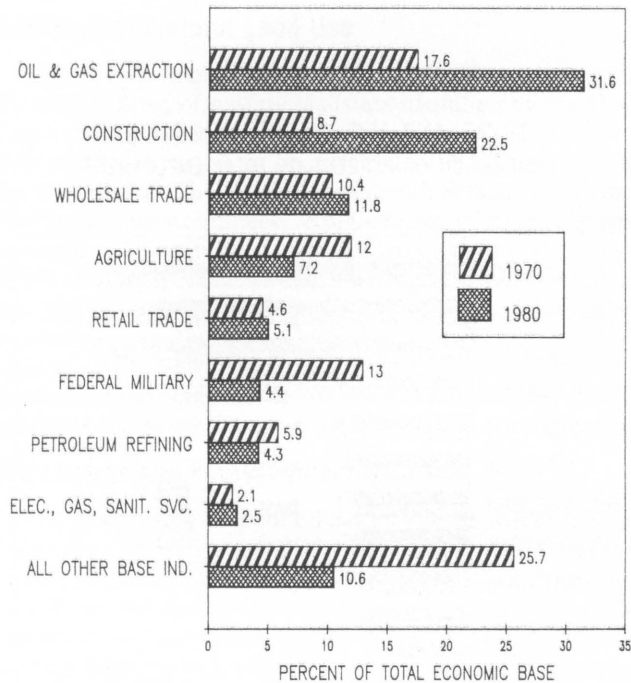


Figure 9-2. Texas economic base industries characterized by percent of total economic base in both 1970 and 1980. (Source: Schallau and others 1987).

base industry. The processing of secondary lumber and wood products—millwork, pallets, and treated lumber, posts, and poles—is the only Texas wood-based industry with employment that approaches the national norm (Figure 9-3).

But there are, of course, many problems involved in expanding the Texas wood-based industry. On the demand side, it appears that the current situation and anticipated population growth would mean that the Texas market will demand more wood-based products than can be currently manufactured in Texas. Projections of future demand by the U.S. Forest Service, which are discussed in Chapter 10, reveal increasing timber demand in the region (USDA Forest Service 1987a).

On the supply side, one problem is the large quantity of Canadian softwood lumber that has flooded the Texas and U.S. lumber market in the 1980s. Some of these lumber imports may be reduced by an export tax that Canada levied on its producers in 1987 to calm troubled international trade waters. But even if Texas received no Canadian lumber imports, a fundamental supply side question needs to be answered. Can the forests of East Texas support industrial expansion? Or, would timber have to be imported to support new wood-based manufacturing capacity in Texas?

Forest Resource Self-Sufficiency

The sufficiency of the forest resource is a measure of its ability to supply raw material to wood-based manufacturing facilities. As can be discerned from Figure 9-4, in 1977, softwood timber harvests constituted 83 percent of the growth in that year. In 1978, softwood harvests exceeded growth. Softwood harvest levels declined until 1982 when removals were 85 percent of growth. As general economic conditions began to recover after the depths of the recession in 1982, so did softwood timber harvest levels. Hardwood harvests have been at about half the rate of hardwood growth. But removals have increased 48 percent since 1982, while growth increased only 9 percent.

As previously mentioned in Chapter 5, the level of timber harvested in Texas can produce enormous quantities of wood-based products, but still not enough to supply the vast markets in the 3 Texas cities that are among the nation's 10 largest cities. Improvements in wood utilization technology can extend timber supplies to meet further demands. But when timber harvest levels are very near the level of annual timber growth, as they are in Texas, increased timber supplies must come from either: a) forests in other states or countries, b) the Texas timber growing stock, or c) additions to Texas annual timber growth. The latter of these is preferable for Texas landowners, but these landowners need to take some action to provide the additional timber supplies that could support industry growth.

The 1986 Texas timber inventory conducted by the U.S. Forest Service showed a high percentage of trees in the more valuable sawtimber classes (Figure 2-5). Seventy-six percent of the softwood volume was in the sawtimber class, and 51 percent of the hardwood volume was in sawtimber. This would seem to indicate that as it currently is being managed,

TEXAS AND U.S. WOOD-BASED INDUSTRY COMPARISON OF PERCENT OF TOTAL EMPLOYMENT 1982

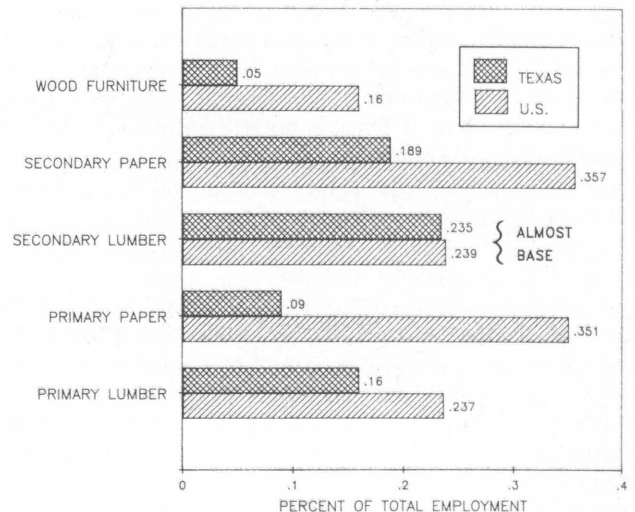


Figure 9-3. Comparison of total wood-based employment in Texas and the U.S. Data is used to determine economic base industries. (Source: USDC Bureau of the Census 1985b).

TEXAS TIMBER RESOURCE TRENDS GROWTH AND HARVEST RELATIONSHIP 1964-1986

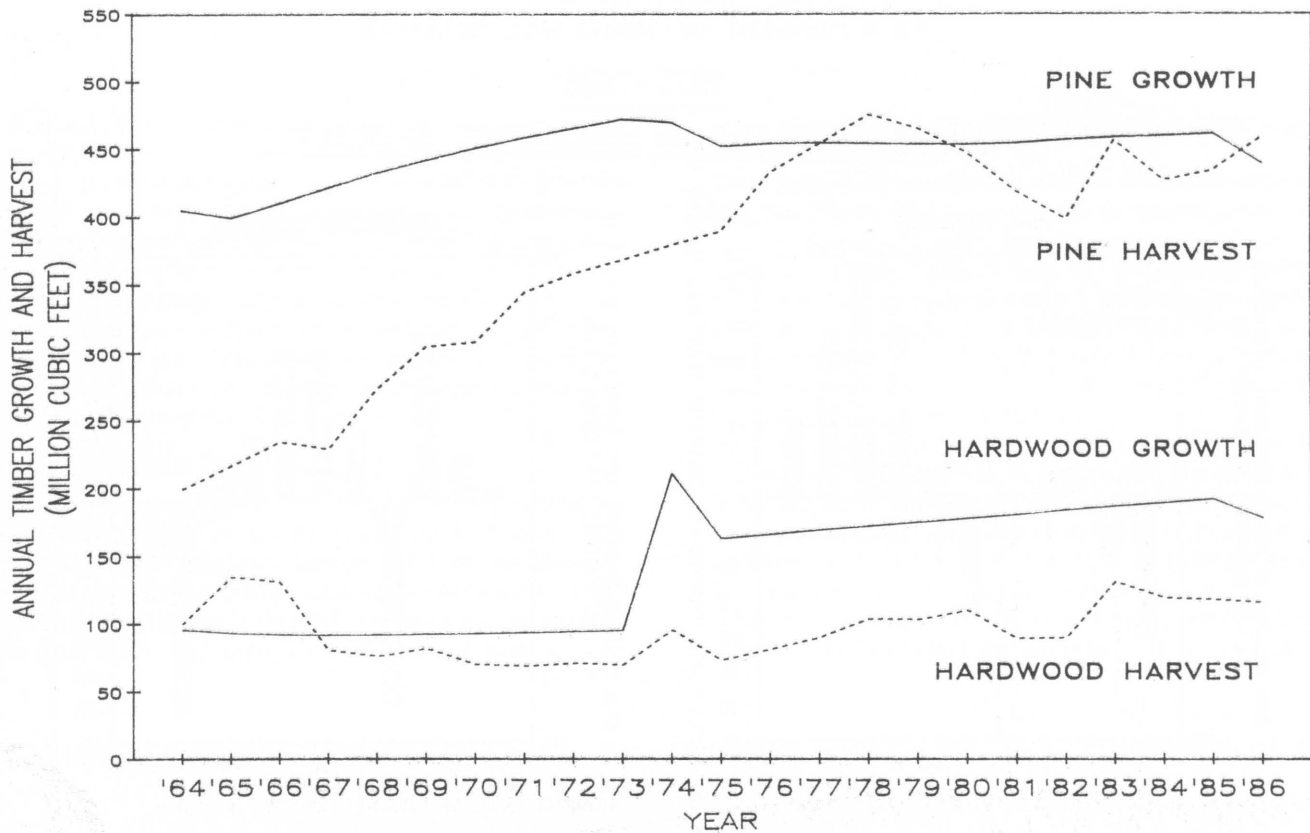


Figure 9-4. Trends in Texas timber resource growth and harvest relationships. (Source: TFS, Texas Forest Resource Harvest Trends).

the Texas forest resource will be capable of supporting the existing forest products industry.

However, annual surveys by the Texas Forest Service (Skove and Lord 1986) indicate that in 1985, Texas was a net exporter of timber products. By applying an average annual timber price (TFS 1985c) to the quantity of timber imports and exports, on balance the net export value of timber products was \$2.75 million (Figure 9-5). This net export value is about 1 percent of the total stumpage value received by Texas landowners. In 1985, there was a net import balance of \$2.25 million in pine sawlogs. Pine pulpwood showed a net export balance of \$4.5 million that was transferred out of Texas to be processed in neighboring states. Various hardwood timber products made up a net import balance of roughly \$500,000. But as Figure 9-5 indicates, the quantity of timber exports and imports vary significantly from year to year. The only constant seems to be significant exports of pine pulpwood.

In recent years, almost all interstate trade in timber products has been at less than 5 percent of the mill requirements of the Texas wood-based industry (Figure 9-5). The major exception to this is the large quantity and value of pine pulpwood that is leaving Texas to be processed and have value added in the paper mills of neighboring states just beyond the Texas border (Figure 5-5).

However, the major concern regarding the sufficiency of the Texas forest resource to sustain and support growth in the wood-based industry is not interstate trade, but the lack of pine regeneration on non-industrial private forest lands. Without adequate planning and action now, the future wood product needs of a growing Texas population must be met with either timber or wood-based products, or both, produced in other states or countries. In other words, an opportunity to expand the Texas wood-based industry will have been lost.

TEXAS TIMBER HARVEST TRENDS

NET IMPORT AND EXPORT VOLUME OF TIMBER PRODUCTS

AS A PERCENT OF TEXAS MILL RECEIPTS

1975-1985

1985 NET EXPORT STUMPAGE VALUE BALANCE: **\$2,750,000**

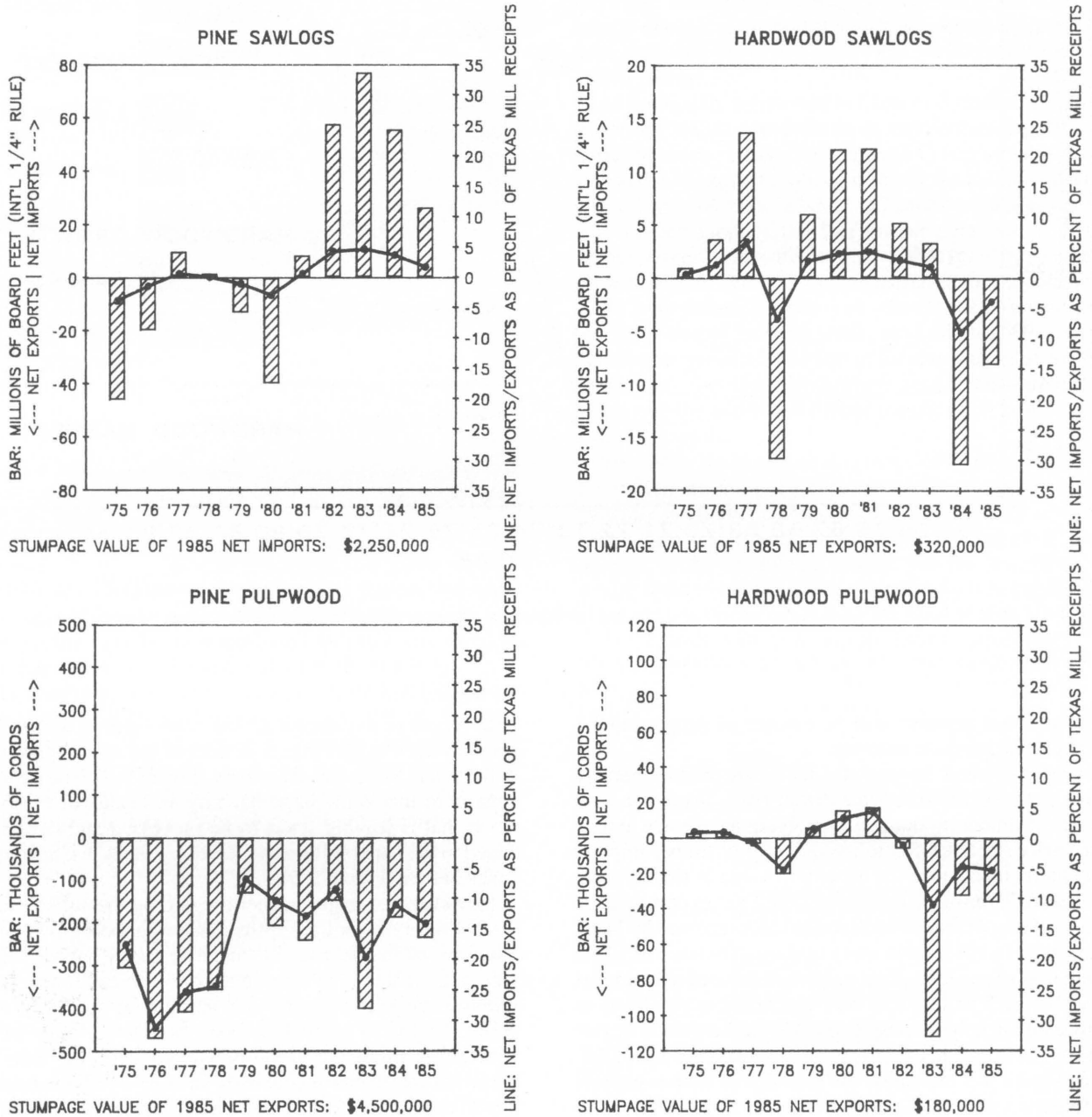


Figure 9-5. Trends in net timber imports and exports as a percent of Texas mill receipts (indicated by line graphs). Bar graphs indicate appropriate scale of measurement for each timber product. (Sources: TFS, Texas Forest Resource Harvest Trends; TFS 1985c).

10. Future of the Forest Resource and Forest Industry

The status of the existing timber resource was presented in Chapter 2. One of the objectives of *The South's Fourth Forest: Alternatives for the Future* report (USDA Forest Service 1987a) was to project the future outlook for the timber resources of each of the southern states, including Texas. This concluding chapter summarizes projections of timberland acreage by forest type; softwood and hardwood timber inventories; projections of future timber demand and price; and current efforts and opportunities to replenish harvested timberlands, and thus increase future timber supplies to support growth in the wood-based industry.

Timber Resource Outlook

Timberland Acreage: Projections of forest type acreage in Texas parallel those for the South as a whole (Figure 10-1). Increases in pine plantation acreage will continue as natural pine stands are harvested and converted to plantations. There will be a slight decline in the total acreage of pine stands until the year 2000, and then a leveling off of pine acreage.

Hardwood and mixed pine-hardwood stand acreage is projected to remain fairly stable.

Total timberland acreage has steadily decreased since the mid-1950s (Figure 10-1). A number of factors influenced the decline in timberland acres, including urban development, reservoirs, highway rights-of-way, and shifts to agriculture that have converted approximately 5 million acres—6 percent of the total acreage in the South in 1962—from timberland to other land uses. The U.S. Forest Service projects the loss of another 5 million acres over the next 50 years in the South (USDA Forest Service 1987a).

In Texas, timberland declined by 894,000 acres between 1952 and 1985 (Figure 10-1). Although pine plantation acreage has increased dramatically during that time, the loss of natural pine acreage leaves a net loss of 1.5 million acres of pine timberland. This acreage has either been converted to other land uses, or to the upland hardwood forest type.

There have been 2.5 million acres of trees planted in Texas since 1952 (USDA Forest Service 1986; 1987d). This raises

TIMBERLAND ACREAGE TRENDS BY FOREST TYPE ON ALL OWNERSHIPS
1952-1985, WITH PROJECTIONS TO 2030

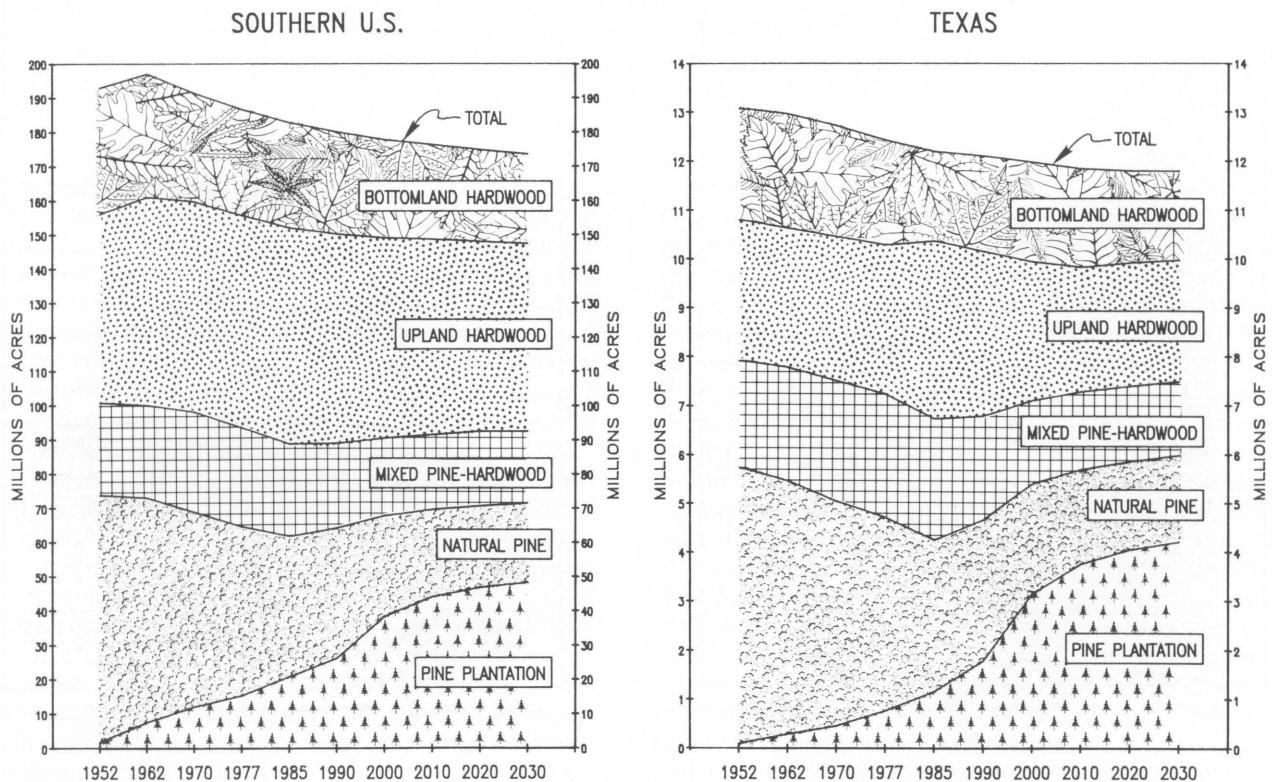


Figure 10-1. Projections of timberland acreage in Texas and the South by forest type on all ownerships (using different scales of measurement). (Source: USDA Forest Service 1987a).

the question of why only 1.2 million acres of pine plantations show up in the forest survey inventory data (USDA Forest Service 1987a; Lang and Bertelson 1987). The answer, apparently, is that the U.S. Forest Service counts more than 600,000 acres of plantations as mixed pine-hardwood or hardwood type because there are more hardwood stems than pines. This implies that some management effort is needed for these plantations to reach their productive potential. Since most of them are on forest industry lands, it is likely that the necessary investments will be made to control hardwoods in these stands.

U.S. Forest Service projections for future timberland acreage in Texas show the forest industry almost tripling its pine plantation acreage, from the low base of 869,000 acres to 2.5 million acres by 2030. NIPFs are projected to increase their pine plantation acreage from 235,000 acres in 1985 to 1.5 million acres by 2030, an increase of almost seven times the current situation (Figure 10-2).

Perhaps the NIPF base acreage in 1985 is too low, but even if it were doubled, NIPF pine plantation acreage must more than triple to reach levels projected by the U.S. Forest Serv-

ice. Projections have NIPFs eventually owning 37 percent of the pine plantations in East Texas; today, they own 20 percent.

Are NIPFs planting enough to reach these projected acreage figures? The answer is a qualified yes. At the rate they are planting now—an average of about 25,000 acres per year—NIPFs will reach the projected plantation acreage in 50 years.

Are forest industry companies planting enough to reach their projected acreage? They have planted an average of 135,000 acres per year since 1977. At that rate, they will reach the projected acreage for 2030 in only 12 years. And this is using the low base acreage, without the 600,000 acres of pine plantations that contain a large proportion of hardwoods.

The major factor that will influence future timber resources is not the projected acreage of timberland, but how timberland acreage is being managed to meet its productive potential. Since 1952, softwood inventories in the South have nearly doubled (Figure 10-3), and hardwood inventories have increased by more than 50 percent (Figure 10-4). These increases have come during a period of rapid expansion in the southern wood-based industry, with accompanying increases in timber harvest levels and economic impact.

TEXAS TIMBERLAND ACREAGE TRENDS BY FOREST TYPE ON PRIVATE OWNERSHIPS 1952-1985, WITH PROJECTIONS TO 2030

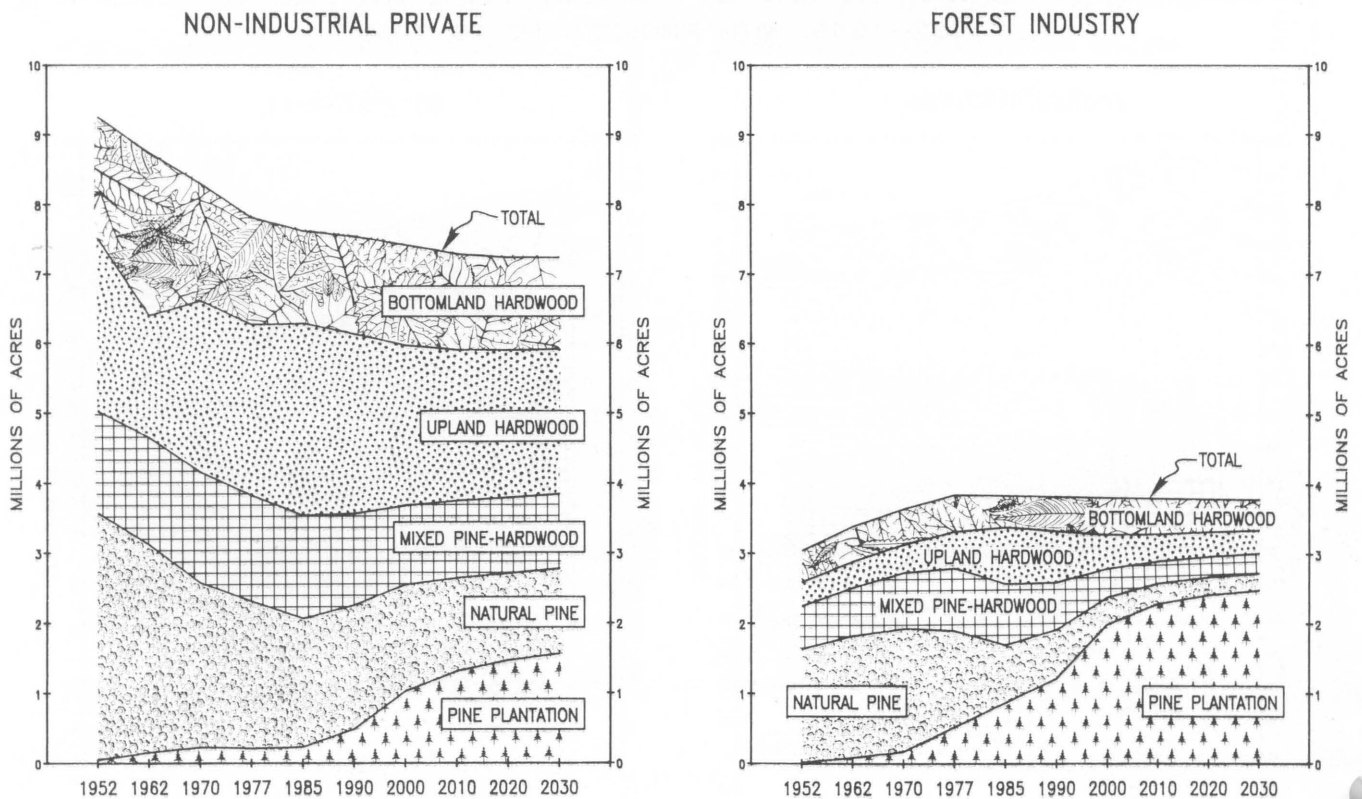
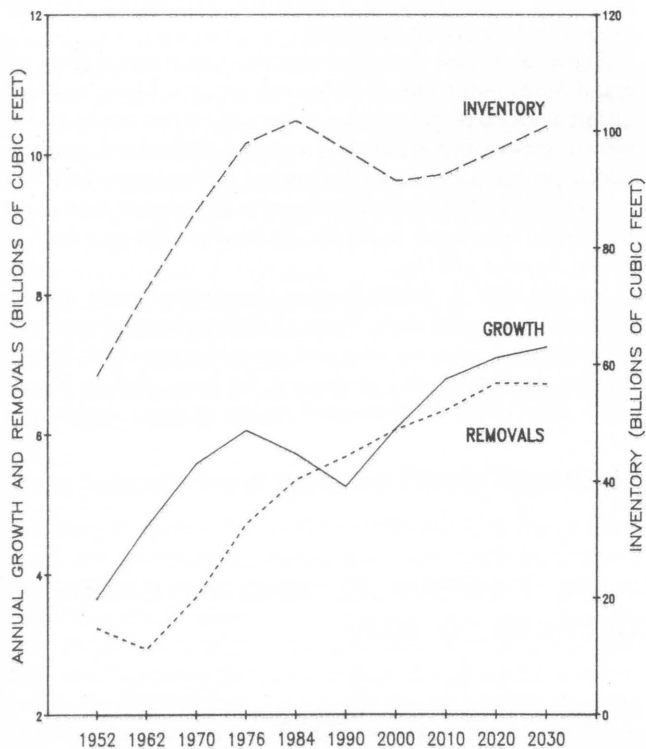


Figure 10-2. Projections of timberland acreage in Texas by forest type on forest industry and non-industrial private forest ownerships. (Source: USDA Forest Service 1987a).

SOFTWOOD TIMBER TRENDS IN GROWTH, REMOVALS, AND INVENTORY 1952-1984, WITH PROJECTIONS TO 2030

SOUTHERN U.S.



TEXAS

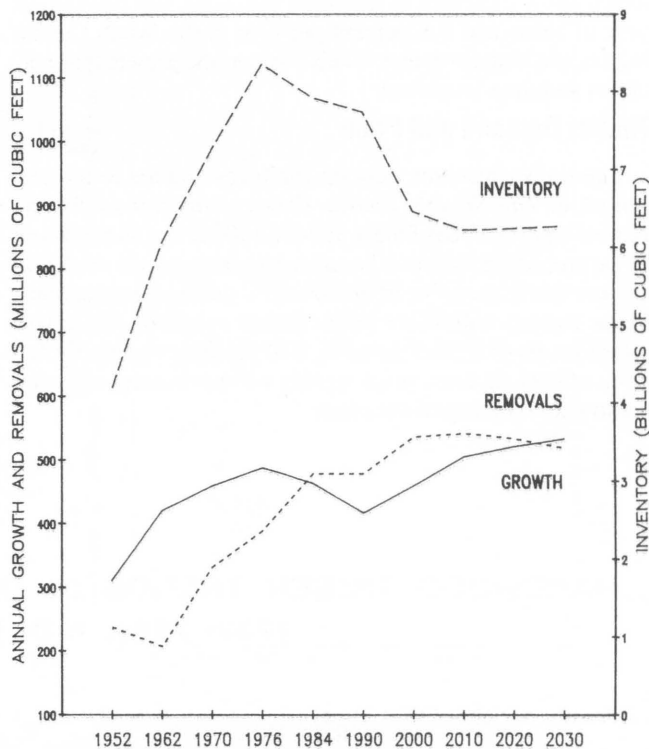


Figure 10-3. Softwood timber trends in growth, removals, and inventory for the Southern U.S. and Texas (using different scales of measurement). (Source: USDA Forest Service 1987a).

Softwood Inventory Trends: Regarding future timber inventories in the South, the bottom line is that sufficient hardwood and softwood inventories and a broad spectrum of economic opportunities are available to increase the output of timber. If taken, these opportunities will help Texas wood-based industry companies maintain their economic position and expand their share of domestic and international markets. But levels of forest management must expand beyond their present levels (NFPA 1987). Otherwise, timber inventories and forest industry prospects will steadily decline (USDA Forest Service 1987a). To understand these findings, the underlying assumptions in future projections need to be carefully assessed. The key assumption is the management behavior of the major timberland ownership group, the non-industrial private forest landowners.

Softwood inventory projections for the South (Figure 10-3) show a decline in the near future as timber harvests exceed annual growth. Inventory levels will rebound as the growth from recent pine plantation efforts makes an impact around the turn of the century. These projections are based on modest increases in annual timber harvest levels, and are dependent upon and extremely sensitive to today's forest management practices. The Texas outlook is less favorable

than the South's as a whole. Increases in removals shown in Figure 10-3 are projected at an average compound rate of only 0.2 percent per year from now until 2030. This modest rate of increase is less than the average annual compound rate of 0.6 percent per year that is projected for the South Central region. Timber cannot be harvested and processed if it is not available.

Texas timber growth is projected to begin increasing in 1990, but the increase will not be as rapid as in the entire South (Figure 10-3). The driving force behind these trends are the actions of landowners. An analysis of the management practices that affect future timber supplies is presented later in this chapter.

Hardwood Inventory Trends: Hardwood inventory projections for the South (Figure 10-4) are different than those for pine. At the present time, hardwood growth is at a peak and comfortably exceeds removals. Growth is now beginning to trend downward, as is pine growth. Projections indicate that hardwood removals will begin to exceed growth before the turn of the century as new technologies are adopted that can better utilize the hardwood resource. In the long-term future, hardwood inventories are projected to be at lower levels than they are today, which results in rising prices for hardwood

timber. This scenario could change with more intensive management of the hardwood resource. Very little hardwood management is practiced today because of its seeming abundance.

Projections of hardwood supplies in Texas show declines in inventory that will occur sooner and are steeper than the general downward trend in the South (Figure 10-4). Both trends show increases in removals averaging 0.9 percent per year in Texas and 0.8 percent per year in the South Central region, pushing inventory levels down as the growth trend declines and then levels out.

Timber Demand and Price

The timber resource outlook for Texas and the South presented in *The South's Fourth Forest: Alternatives for the Future* report (USDA Forest Service 1987a) and summarized in the preceding section is based on a timber growth modeling system that is sensitive to landowners' management actions. These actions will affect future timber supplies, and at projected levels of timber demand, will produce various timber price effects. In turn, price signals will have some effect on landowners' management plans.

However, due to the long production periods in forestry, today's price signals don't have much of an effect. Wisdom (1986) says that econometric studies have determined that forest demand and supply elasticities, in the range of 0.3 to 0.7, are quite price inelastic. A review of these studies by Cabbage (1986) emphasizes the point that changes in timber stumpage prices are not a significant influence on landowners' reforestation behavior.

The U.S. Forest Service projections of future timber demand were made using 15 different scenarios. These included different levels of exports and imports of timber products, improved processing efficiency, reduced timberland area, reduced timber growth, and increased management intensity on southern private timberlands, crop and pasture lands, and industrial timberlands in the Pacific Northwest region (USDA Forest Service 1987a).

Results of U.S. Forest Service simulations made with an econometric model using these 15 timber demand scenarios in the three primary wood-based product groups of softwood lumber, plywood, and pulpwood are presented in Figure 10-5. Abt (1986) disaggregated results of these simulations

HARDWOOD TIMBER TRENDS IN GROWTH, REMOVALS, AND INVENTORY 1952-1984, WITH PROJECTIONS TO 2030

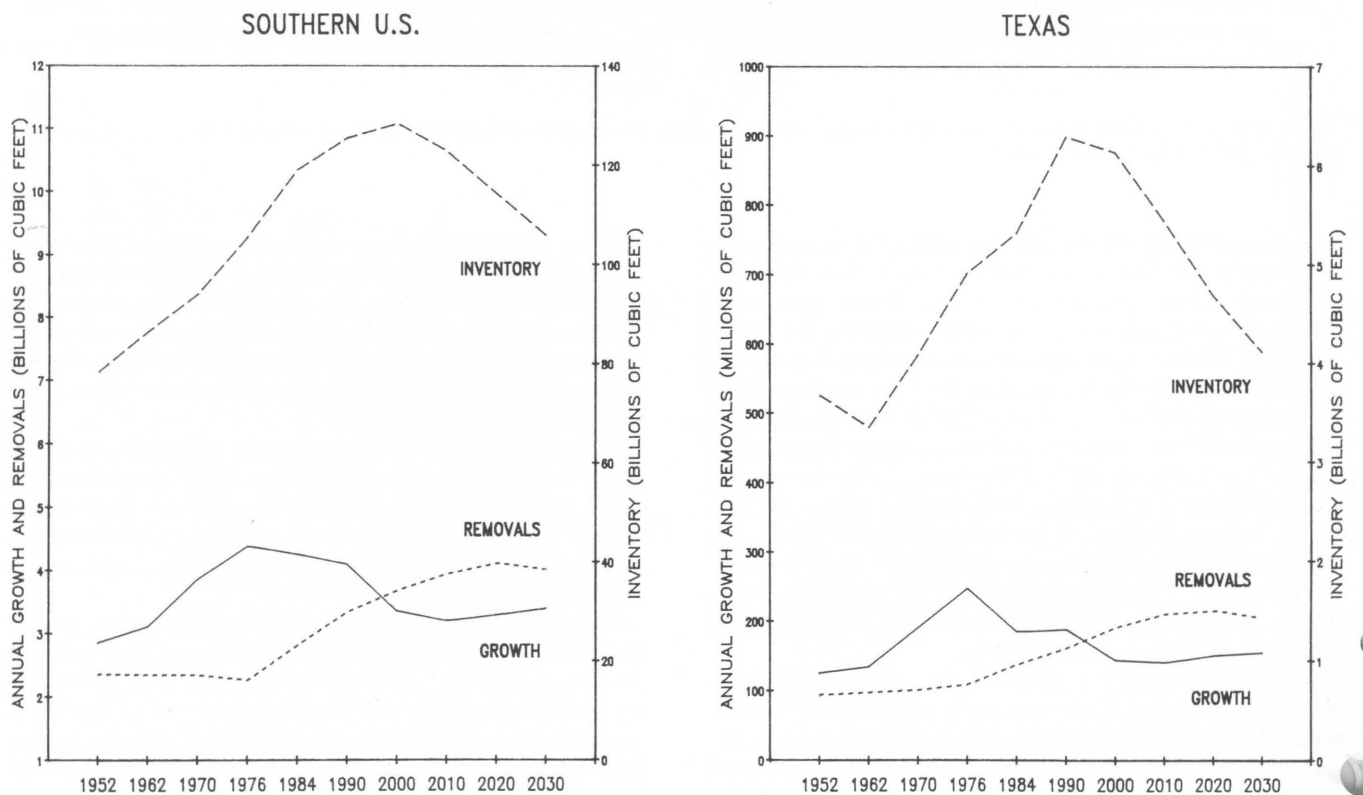


Figure 10-4. Hardwood timber trends in growth, removals, and inventory for the Southern U.S. and Texas (using different scales of measurement). (Source: USDA Forest Service 1987a).

SOFTWOOD TIMBER DEMAND PROJECTIONS BY PRODUCT
SOUTH CENTRAL REGION
1984-2030

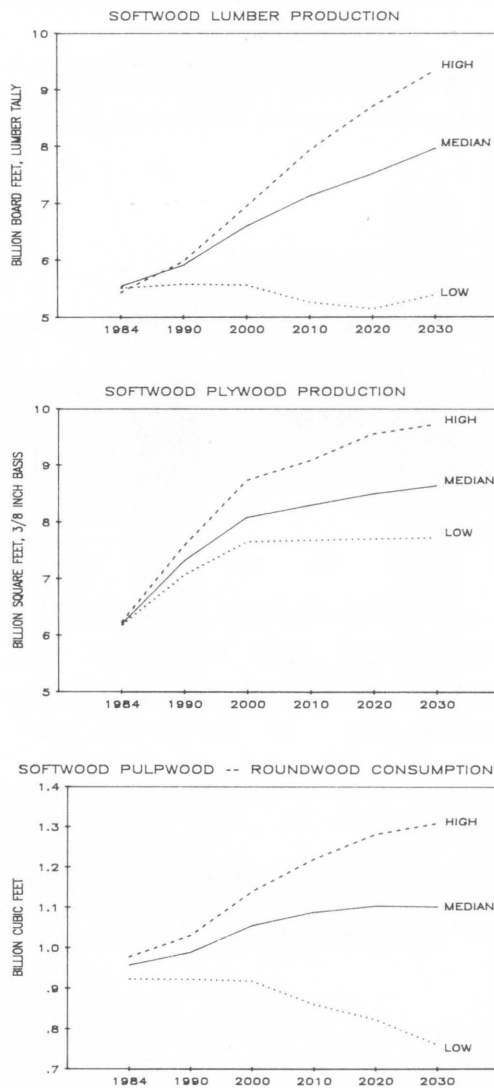


Figure 10-5. Projected softwood timber demand by major product group in the South Central U.S. Depicts highest, lowest, and median (base level) projections of 15 different timber demand scenarios in the three primary wood-based product groups. Appropriate scales of measurement are used for each timber product. (Source: USDA Forest Service 1987a).

to state levels, but only for the base level projection scenario used in *The South's Fourth Forest: Alternatives for the Future* report (USDA Forest Service 1987a).

Taken in total, the overall increasing trend in timber product demand at the base level projection—which is, in effect, the median of the 15 demand scenarios—is expected to increase at a faster rate than base level projections of timber supplies. Projected stumpage prices for softwood sawtimber and pulpwood are presented in Figure 10-6. At the base level scenario, in the 46-year period between 1984 and 2030, the average annual rate of real price increase for sawtimber is projected to be 1.7 percent; for pulpwood, it is expected to be an average of 1.8 percent per year.

As indicated in Figure 10-6, timber will be relatively less plentiful from now and the year 2000 in the South Central region than it will in later time periods. This reflects the plantation investments being made by private landowners that will provide additional future timber supplies. Because Texas timber inventory levels are not projected to increase in the future at base level management intensity (Figure 10-3), Texas timber prices may be expected to remain higher than those in other South Central states.

Texas Reforestation of Harvested Private Timberland

During the period from 1975 to 1986, the U.S. Forest Service forest inventory estimated that Texas NIPF landowners harvested 42 percent of their pine timberlands, a total of 963,700 acres. Evidence from the forest survey indicates that only 16 percent of this was clearcut, and 81 percent was “partially cut,” meaning that it was harvested with a pine-selection cut, a diameter-limit cut, a salvage cut, or a heavy thinning in sawtimber-size stands. Thinnings in pole-timber-size stands are excluded. Only 3 percent of the harvested pine stands were managed with a seed-tree or shelterwood cut. On mixed pine-hardwood forest types, NIPF landowners harvested 21 percent of their forests between 1975 and 1986, for a total of 601,900 acres. The proportion of these stands that was clearcut, partially cut, or seed-tree cut is approximately the same as the pure pine types, except that seed-tree cuts were used on only 1 percent of the harvested acreage (McWilliams and Skove 1987).

Between 1975 and 1986, a total of 248,700 acres of NIPF pine or mixed pine-hardwoods were clearcut, and 1.28 million acres were partially cut (McWilliams and Skove 1987). During the same period, NIPF landowners planted 237,105 acres (USDA Forest Service 1986; 1987d). It appears, at first glance, that NIPF landowners are planting almost all of their land that is clearcut. But that does not take into account whatever acreage of old field or pasture is being converted to pine plantation. Nonetheless, considering how much acreage is clearcut and how much is planted, NIPFs aren't doing such a bad job of timberland stewardship.

However, they could be doing a much better job. Many partial cutting techniques are abusive forest management practices, in that adequate provision for regeneration is not considered. Partial cuts account for more than 80 percent of the harvests made on NIPF pine and mixed pine-hardwood acres.

Figure 10-7 compares the effectiveness of reforestation efforts by forest industry companies and NIPFs. With comparable acreage of pine and mixed pine-hardwood forest types harvested between 1975 and 1986, the forest industry has

only 15 percent of the harvested acres in the low pine stocking class, compared to 27 percent for NIPFs. It may be concluded that as a result of cutting practices and planting efforts, the forest industry has 262,000 acres of recently harvested land with low stocking levels of pine. This is significantly less than the NIPFs' comparable acreage of 413,000 with low pine stocking, and the industry companies harvested 220,000 more acres of their pine timberlands than did the NIPFs.

Evidence from the past 10 years indicates that NIPF landowners have replanted 1 acre for every 10 harvested. Excluding harvested hardwood stands and pine seed-tree cuts,

SOFTWOOD TIMBER STUMPAGE PRICE LEVEL PROJECTIONS SOUTH CENTRAL REGION 1984-2030

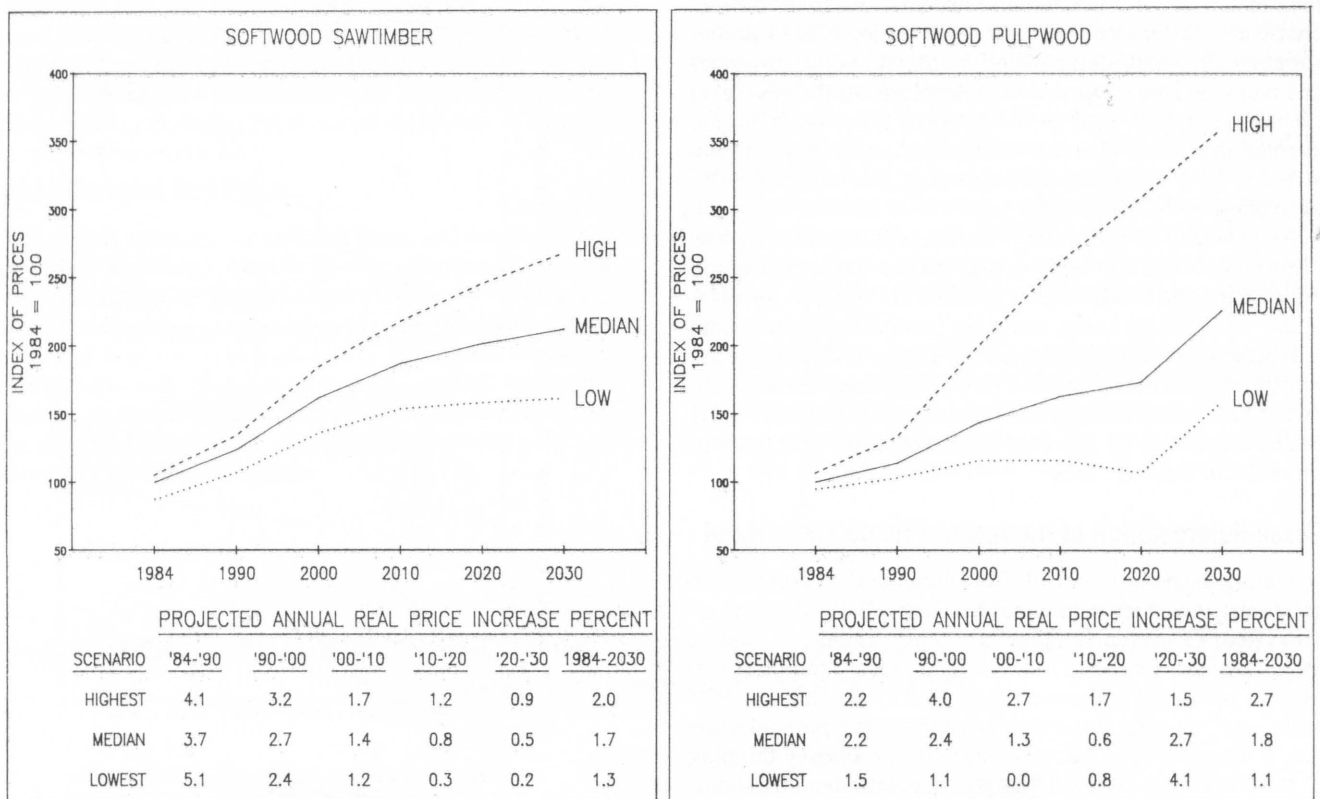


Figure 10-6. Projected softwood timber price indices in the South Central U.S. with real price changes per decade. Presents stumpage price indices for softwood sawtimber and pulpwood based on highest, lowest, and median (base level) projections of 15 different timber demand scenarios. (Source: USDA Forest Service 1987a).

NIPFs have replanted 1.5 acres of pine timberland for every 10 acres harvested. Forest industry companies replanted 6.5 acres for every 10 that were harvested. Excluding harvested hardwood stands and pine seed-tree cuts, industry companies replanted 8.5 acres for every 10 acres harvested.

Both NIPFs and industry have doubled their tree planting efforts since 1975, while harvest levels have remained relatively constant. It could now be said, based on planting and harvest levels in 1984-1985, that NIPFs are replanting 1.5 acres for every 10 acres of harvested pine timberland. Forest industry companies are currently replanting 9.3 acres for every 10 acres of harvested pine land that is not being naturally regenerated with seed tree cuts.

The significant difference between the NIPFs and the forest industry in replanting per harvested acre reflects the reliance of Texas NIPF landowners on partial cutting methods.

NIPF Reforestation: Problem or Opportunity?

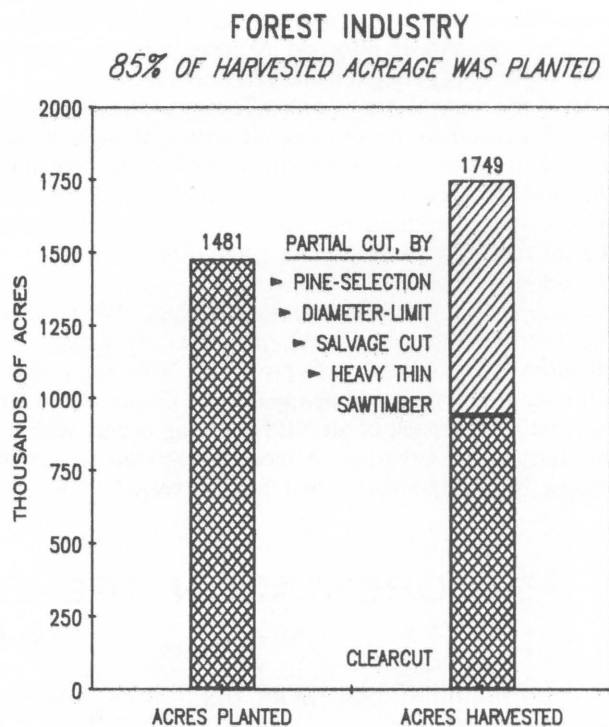
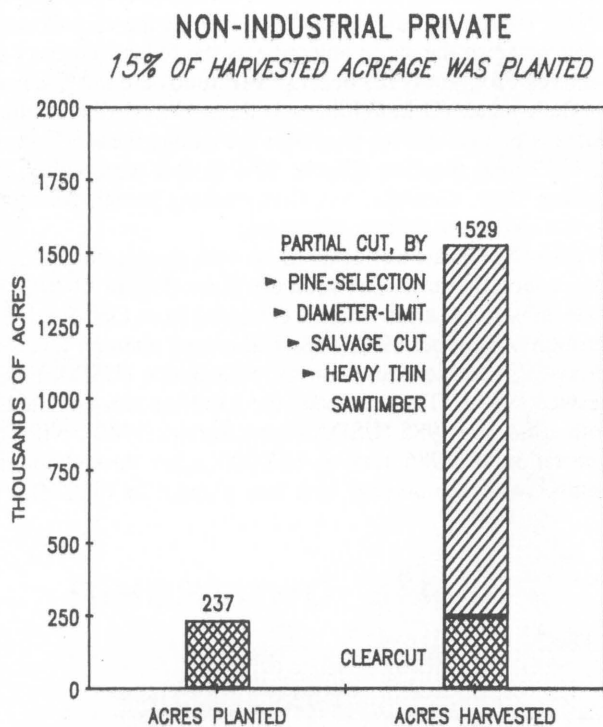
The major factor influencing timber resources in the South is the non-industrial private forest (NIPF) landowner. Approximately 67 percent of the timberlands in the South and

60 percent of those in Texas are owned by NIPFs. Management practices on these lands vary with the individual landowners and greatly affect projections of future timber inventories, upon which growth in the forest products industry depends.

Members of the forestry community have long been aware of the problem of inadequate regeneration of pine acres after harvest on lands owned by NIPFs. Figure 10-8 illustrates the historic data for reforestation in the South and in Texas. The proportion of planting by NIPFs in relation to their two-thirds majority of the timberland is obvious cause for concern. The high peaks in NIPF planting resulted from policies that subsidized NIPF tree planting. The high spike in 1959 is from the "Soil Bank" program. NIPFs responded well to the financial incentives for planting. As this program was phased out, planting on NIPF lands dropped off sharply. The increase in NIPF planting since 1975 is a result of the Forestry Incentives Program, a federally funded program that shares the cost of reforestation with qualifying NIPF landowners. Reforestation tax incentives that became effective in the 1981 planting season have also helped.

TEXAS REFORESTATION EFFORT AND EFFECTIVENESS

1975-1986

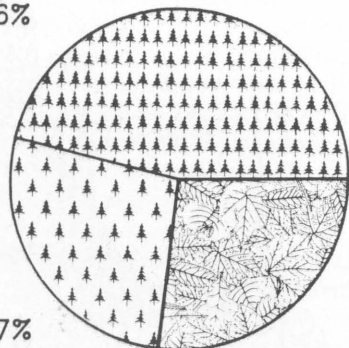


EFFECTIVENESS

PERCENT OF HARVESTED ACRES WITH HIGH, MEDIUM, AND LOW PROPORTIONS OF PINE STEMS

NON-INDUSTRIAL PRIVATE

HIGH 46%

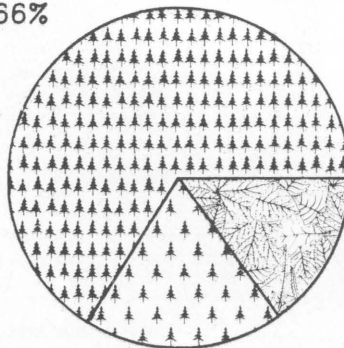


MED 27%

27% LOW

FOREST INDUSTRY

HIGH 66%



15% LOW

MED 19%

HIGH: >60% PINE
 MED: 30%-60% PINE
 LOW: <30% PINE

Figure 10-7. Comparison of the effectiveness of reforestation efforts by non-industrial private forest owners and forest industry companies. Comparable pine and mixed pine-hardwood forest acreage was owner-harvested using clearcut and partial cut methods. (Sources: USDA Forest Service 1986; USDA Forest Service 1987d; McWilliams and Skove 1987).

Forest industry companies have increased their pine plantation acreage dramatically (Figure 10-8). Their incentive may be described as self preservation. If the companies cannot be assured of timber from other landowners, they must make certain that their massive capital investments in wood-based manufacturing plants have adequate supplies of timber. That explains why they own and manage timberland. They are in the lumber, plywood, or paper industry—not the timber industry (O’Laughlin and Ellefson 1982).

The historic tree planting trend in Texas parallels that in the South (Figure 10-8). An obvious difference, though, is that Texas NIPF landowners are planting at a lower rate than most of the other southern states. This, more than any other factor, explains why projections of Texas softwood inventories do not keep pace with the rest of the South (Figure 10-3).

Again in Texas, the NIPF landowners’ tree planting efforts are closely related to subsidy programs. Texas NIPFs respond quite favorably to cost-sharing programs (Hickman and Gelhausen 1981). Without such programs, NIPF landowners plant only a few thousand acres of trees (Figure 10-9). In Texas, only 15 percent of all NIPF planting occurs without some form of cost-sharing. A recently reported survey of southern NIPF landowners that had harvested timber re-

vealed that between 60 percent and 80 percent of those who reforested used either special reforestation tax incentives, cost-sharing assistance, or both (Royer and Moulton 1987).

In the South, six states have cost-sharing assistance programs for tree planting: Virginia, Mississippi, North Carolina, South Carolina, Texas, and Florida (USDA Forest Service 1986). These programs were undertaken by the various states to accomplish the same objective as the federal Forestry Incentives Program (FIP) because FIP funds are not adequate for these states (O’Laughlin and others 1983). All 6 southern states with cost-sharing programs are among the top 10 states in NIPF tree planting (Figure 10-10). But remarkably, the leading state, Georgia, and third-ranking leader, Alabama, do not have cost-sharing programs.

Texas NIPFs are not keeping up with the planting pace of their counterparts in other southern states (Figure 10-10). The 1986 planting season—which extended from October 1985, through September 1986—reached record planting levels of almost 2.4 million acres on all ownerships (USDA Forest Service 1987d). This exceeded the 2 million acres planted in both 1984 and 1985 (USDA Forest Service 1986). NIPF reforestation in 1986 totaled 883,000 acres throughout the South, twice the acreage that was planted in 1982. But in

REFORESTATION TRENDS BY PRIVATE OWNERSHIP 1945–1987

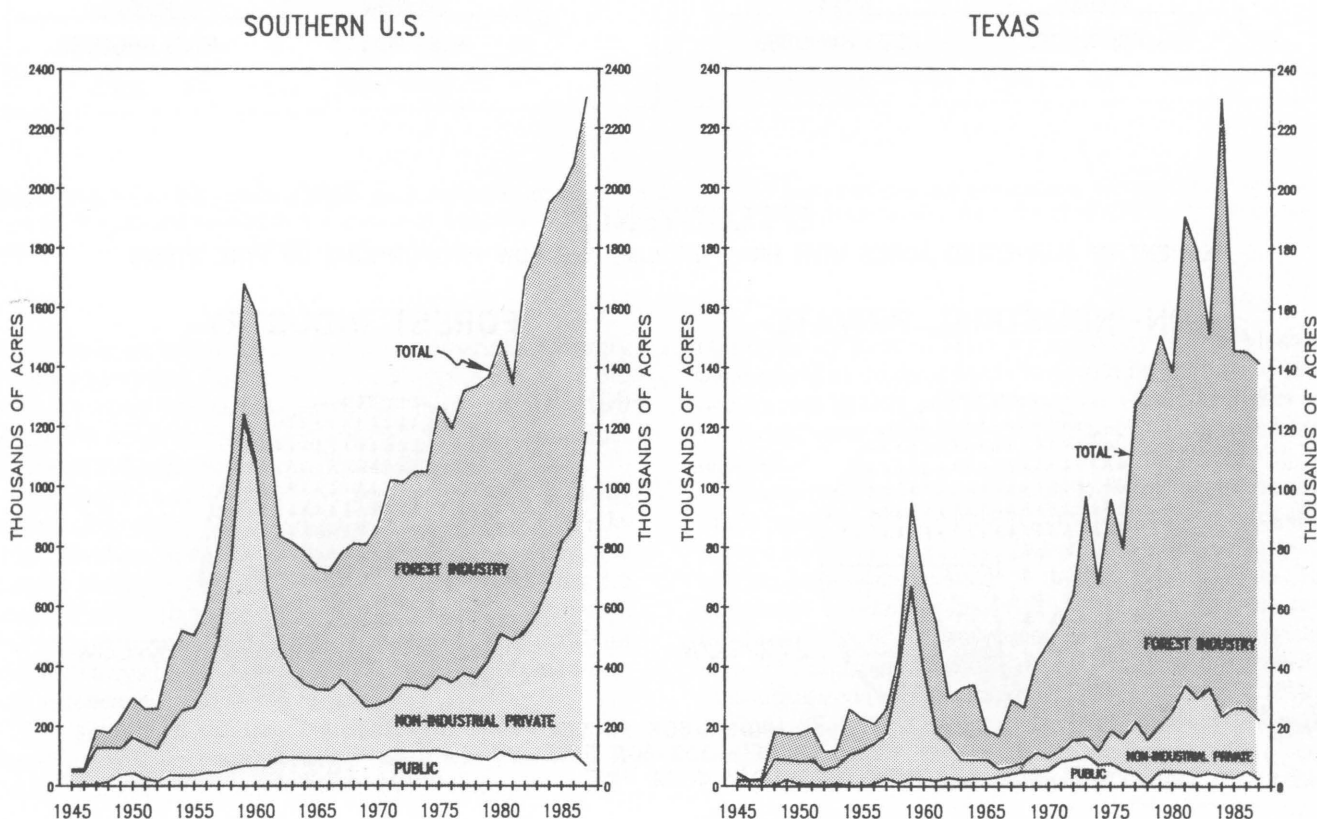


Figure 10-8. Historic reforestation trends in the private forest ownership sector in the Southern U.S. and Texas (using different scales of measurement). (Sources: USDA Forest Service 1986; USDA Forest Service 1987d; Dangerfield and Gunter 1987).

TEXAS REFORESTATION NON-INDUSTRIAL PRIVATE FOREST LANDS 1945-1987

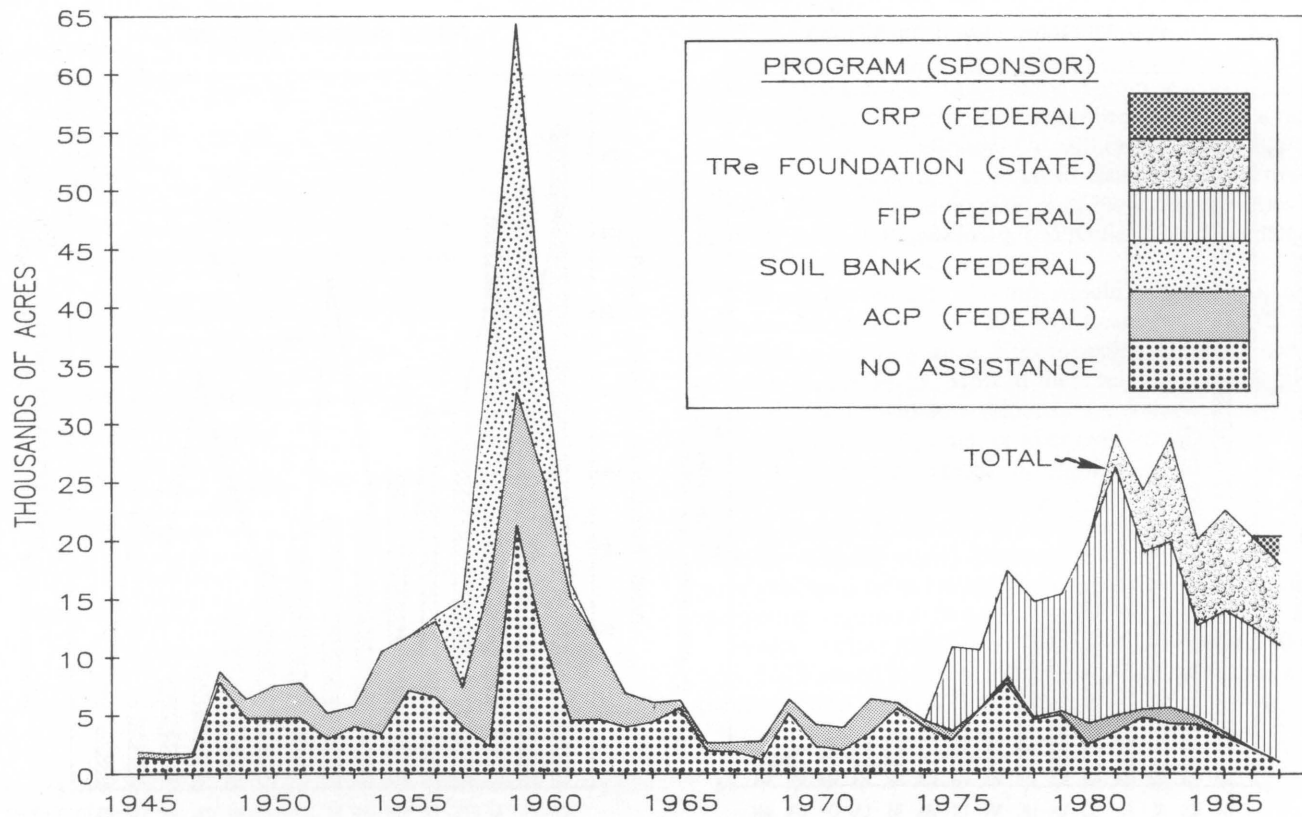


Figure 10-9. Historic reforestation trends on non-industrial private forest lands in Texas. Depicts reforestation both with and without various financial assistance programs. (Sources: USDA Forest Service 1986; USDA Forest Service 1987d; Dangerfield and Gunter 1987; TFS, Texas Forest Resource Harvest Trends).

Texas, NIPF acreage planted in 1986 was only slightly more than 20,000 acres, which is about the same acreage planted in 1980. Texas NIPF planting approached 30,000 acres in 1981, but according to Dangerfield and Gunter (1987), it decreased to 17,320 acres in 1986-1987, of which only 761 acres were planted without some form of subsidy (Figure 10-9).

Further indications of the limited amount of NIPF planting in Texas appear in Figure 10-10. The line on the figure indicates the relative efficiency of NIPF planting in each of the top 15 planting states, which includes Texas. Texas' efficiency rating on NIPF planting is among the lowest of the southern states.

Many Texas NIPF landowners do not clearcut and reforest their lands by planting seedlings because the capital investment required for tree planting is substantial—somewhere between \$75 to \$250 per acre—depending on the amount of work necessary to prepare the site for tree planting. Natural regeneration methods can be effective, but require adequate planning before a timber harvest and skilled management hereafter. And natural stands will, at best, achieve only two-thirds of the productive potential of well-managed plantations.

Forest industry companies, in comparison to NIPFs, are doing a much better job of tree planting (Figure 10-10). Texas companies rank among those with the heaviest commitment to tree planting, as the efficiency index on Figure 10-10 indicates.

TRe Foundation: Unique Approach to Aid NIPFs

The state cost-sharing assistance program for NIPF tree planting in Texas, mentioned in the preceding section and in Figure 10-9, is worthy of some discussion.

The TRe ("Tree") Foundation, Inc., shares half of the cost of reforestation and timber stand improvement with non-industrial private forest landowners. It is the only program of its kind to approach the problem of reforestation on NIPF lands with a private sector initiative.

The TRe Foundation was established in 1981 to provide funds to aid NIPFs with reforestation and improvement of their timberlands. Voluntary contributions from companies in the Texas wood-based industry provide the source of funds. Administration of the program is the responsibility of the Texas Forestry Association. Technical forestry assistance for landowners is provided by the Texas Forest Service. As of

TOP 15 STATES RANKED BY ACRES OF TREE PLANTING ON PRIVATE TIMBERLANDS 1986

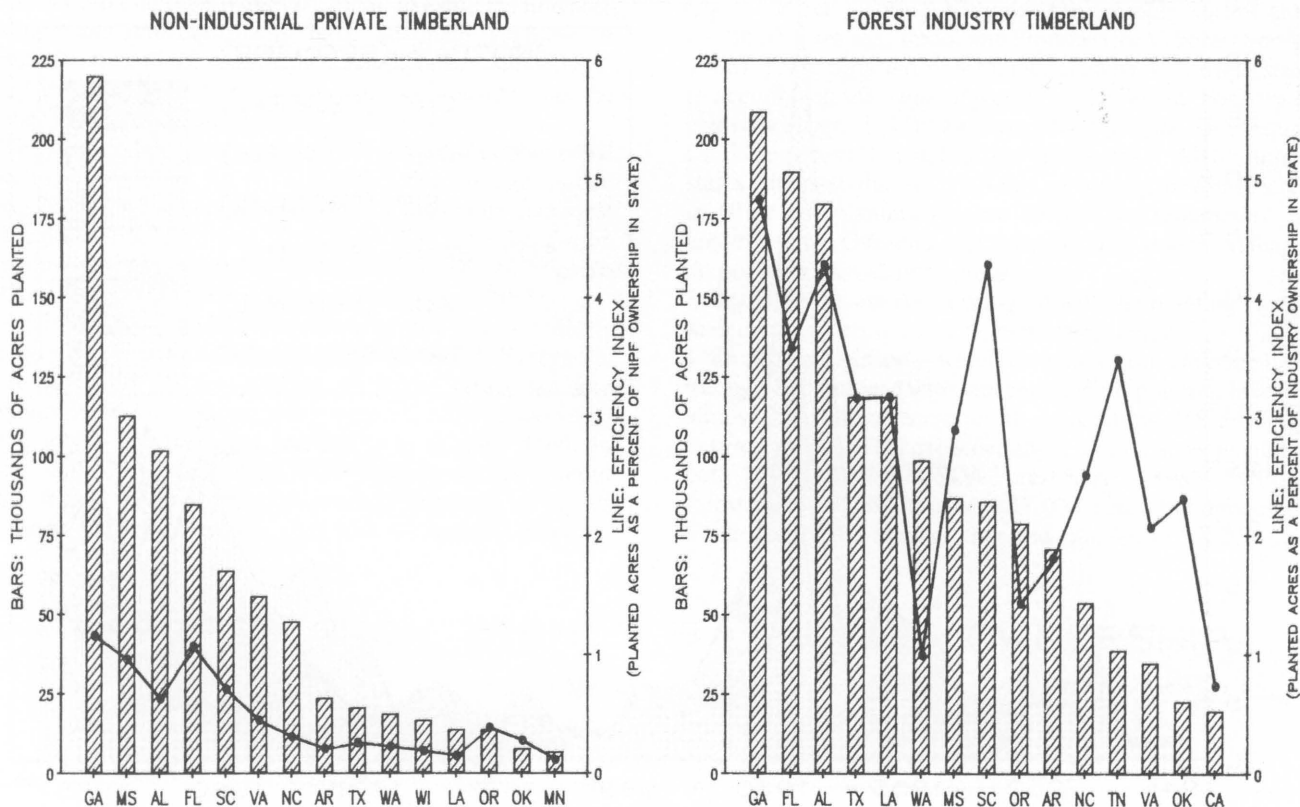


Figure 10-10. Top 15 states categorized by ownership and ranked by thousands of acres of trees planted on private timberlands (indicated by bar graphs). Line graphs indicate planted acres as a percentage of total timberland acres in forest industry and non-industrial private forest ownership. (Source: Adapted from USDA Forest Service 1987d).

mid-1987, more than \$2 million had been distributed to landowners from the TRe Foundation. Some of the cost-sharing funds are used for timber stand improvement, but most are used for tree planting.

TRe Foundation funds have planted more than 50,000 acres of timberlands owned by 710 individuals. As depicted in Figure 10-9, TRe funds planted 8,553 acres in 1985. The federal Forestry Incentives Program (FIP) planted 10,844 acres on NIPF lands in 1985.

Increasing Timber Supplies and Landowner Income

Texas timberlands are as productive as any in the South, but barely are achieving more than half of their productive potential. The comparative advantages of the southern U.S. as a tree-growing region are well known (Sedjo 1983). Indeed, the investment returns achievable from pine plantations in the southern U.S. outstrip any other region in the northern hemisphere (Figure 10-11).

There are only two problems with a forestry investment. First, land costs are a substantial consideration, especially in

Texas. But all of the productive timberlands in East Texas are already owned by someone, so this hurdle is not a problem for NIPFs: They own their land. Second, planted pines cannot be harvested as a cash crop until at least 15 years after planting. Many Texans are apparently unwilling to tie up their money for that length of time.

Many forest management opportunities exist for landowners to increase the supply of raw material from their East Texas timberlands and thus create more income from their forests. There are many financially attractive opportunities on existing timberlands as summarized below. Information in this section is compiled from recent U.S. Forest Service reports (USDA Forest Service 1987a; Vasievich 1987). All rates of return mentioned exclude three important costs: 1) land acquisition, 2) property taxes, and 3) income taxes.

The projected rates of return are in real terms, over and above whatever rate of general price inflation affects prices and investment returns. Almost any cited return on any investment alternative includes inflation. To compare these rates of return with other investment alternatives, 4 or 5 percentage points should be added to allow for inflation.

WORLDWIDE FORESTRY PLANTATION INVESTMENT RETURNS

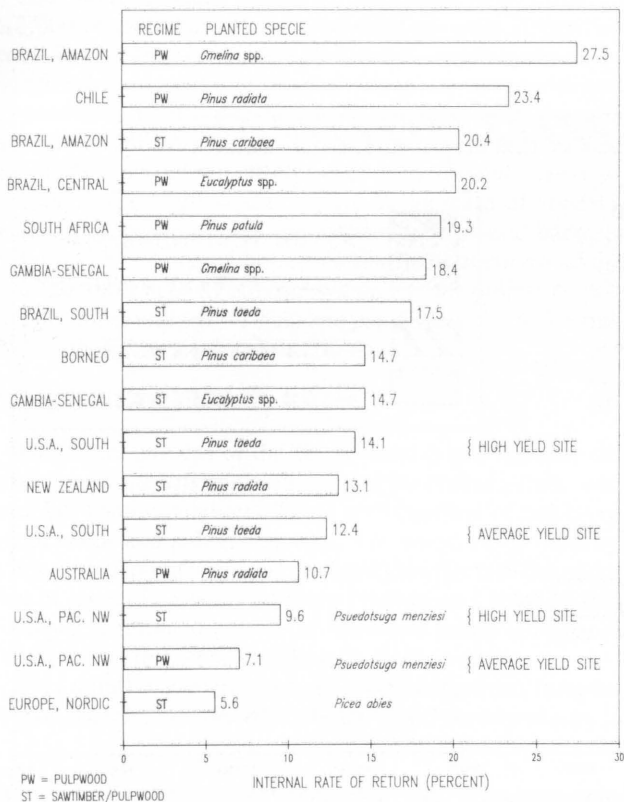


Figure 10-11. Worldwide forestry plantation investment returns ranked by rate of return on representative plantations. Graph assumes constant 1979 prices and does not include land costs. (Source: Sedjo 1983).

The projected rates of return include the base level projection of timber demand and supply that produce the real price increases indicated on Figure 10-6.

Opportunities to increase net annual growth and landowner income on existing timberland acreage include reforestation of existing timberland by planting pine stands, conversion of stands of undesirable tree species to desirable species, and manipulation of stand density by thinning. There are 5.1 million timberland acres that need some type of treatment to allow them to achieve their potential productivity. That makes up almost half of the timberland acreage in East Texas. The potential returns on these opportunities are detailed in Figures 10-12 and 10-13, and discussed in the following text.

Investments Yielding More Than 4 Percent: More than 4.4 million of the acres needing treatment promise to earn at least a 4 percent real⁷ rate of return on the treatment investment. If all these acres were treated, there would be an additional 207 million cubic feet of timber available for harvest annually. This would be a 44 percent increase in annual softwood timber growth in Texas.

Not surprisingly, the majority of the acreage needing treatment (71 percent) is held by non-industrial private forest

(NIPF) landowners. The total amount required for all NIPF investments that would earn in excess of 4 percent is \$350 million. Forest industry companies have 23 percent of the opportunities for improvement that promise to earn more than 4 percent. They would need to invest \$102 million to realize all these opportunities.

Investments Yielding More Than 10 Percent: Almost two million of the acres needing treatment promise to earn greater than a 10 percent real rate of return. If improved, this acreage alone could add an additional 114 million cubic feet of wood each year, or a 24 percent increase in annual softwood timber growth. Three-fifths or 60 percent of these opportunities are on NIPF lands. Forest industry companies have 31 percent of these high-yielding opportunities.

A 10 percent real rate of return should be an exciting prospect for landowners. The top five treatment opportunities available to achieve these high investment returns are detailed in Figure 10-13. Most of them relate to tree planting, either after a site with low-valued or understocked stands has been prepared for planting, or after over-mature natural pine stands have been harvested. A significant amount of additional acreage of high-yielding investments is in stand density control. These timber stand improvements are made either by thinning young overstocked pole timber stands that were produced from natural regeneration, or by controlling competing vegetation in a variety of stand types.

To realize these high investment yields that exceed 10 percent, NIPFs need to invest \$95 million. Forest industry companies need to invest \$50 million.

TEXAS OPPORTUNITIES TO INCREASE TIMBER SUPPLIES

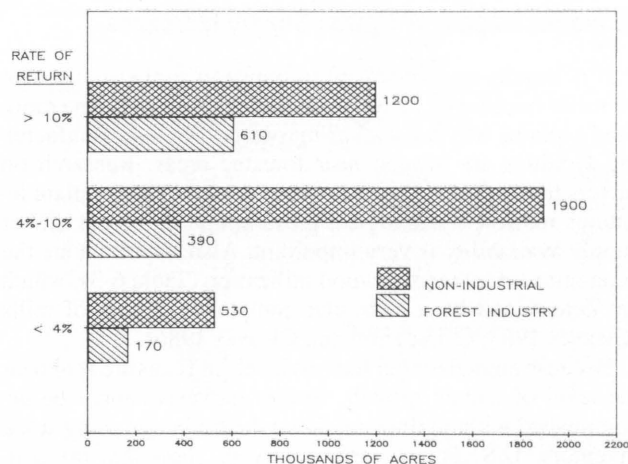


Figure 10-12. Opportunities to increase timber supplies in Texas. Amount of private timberland acreage by projected pre-tax investment returns on forest management activities by ownership category. Uses base level demand and price scenarios from Figures 10-5 and 10-6. (Source: USDA Forest Service 1987a).

⁷The real rate of return is an inflation-adjusted, pre-tax rate.

TEXAS OPPORTUNITIES TO INCREASE TIMBER SUPPLIES

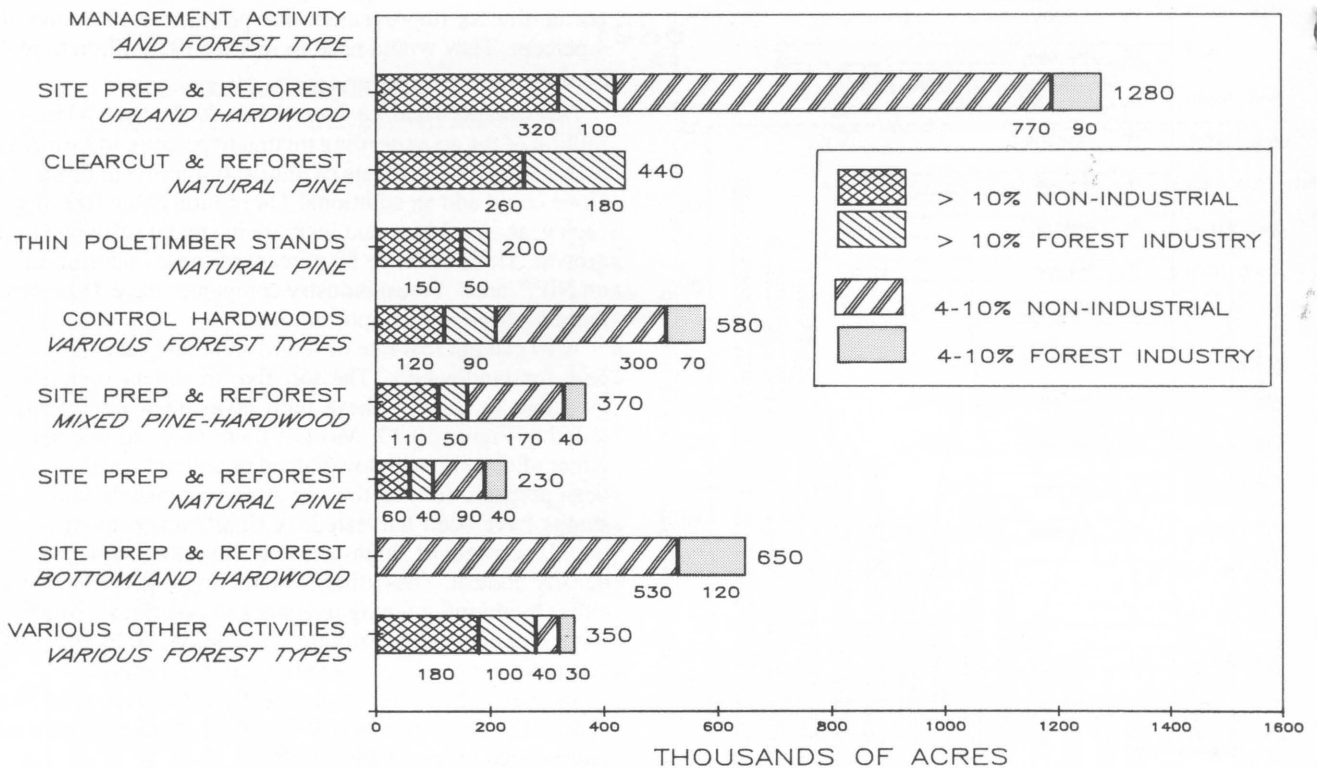


Figure 10-13. Opportunities to increase timber supplies in Texas. Management activities and forest types by private ownership category, ranked by acreage of investments projected to earn greater than a 10 percent return. Uses base level demand and price scenarios from Figures 10-5 and 10-6. (Source: USDA Forest Service 1987a.)

Economic Impact of Timber Supply Increases

It is usually uneconomical to transport timber more than 50 miles because of its relatively low value-to-volume ratio. This explains why most all primary wood-based manufacturing facilities are located near forested areas. Research on factors that influence primary wood-based industry plant locations reinforces the logical presumption that local timber supply availability is very important. Also important are the economics of integrated wood utilization (Table 6-3), which are determined by a particular company's system of mills (Cleaves 1983; O'Laughlin and Cleaves 1986).

Because annual timber harvest levels in Texas are at or near the level of annual growth, further harvests cannot be accomplished without drawing down the timber growing stock inventory. U.S. Forest Service surveys show that the softwood inventory is already beginning to decline, and will continue to do so at current and projected harvest levels (Figure 10-3). Without additional growth in local timber supplies, industrial expansion is unlikely to occur. Indeed, Forest Service projections indicate that fewer forest industry jobs will be available in the future unless current timber management efforts are intensified (USDA Forest Service 1987a).

If the annual growth of Texas timber increased, what would that mean in terms of economic impact? The reply to

this question depends on several assumptions. First, it is assumed that additional timber supplies beyond current harvest levels are needed to fuel industrial expansion. Many of the preceding points in this report support such an assertion. Second, it is assumed that the outputs from additional timber processing capacity will have a market. Third, there will be no downward price effects of increased timber supplies. These assumptions all seem reasonable in relation to U.S. Forest Service projections (Figures 10-5 and 10-6).

The "average-sized" Texas lumber mill consumes 12 million board feet of softwood sawtimber per year. Approximately a 1.5 percent increase in Texas sawtimber harvests would be necessary to furnish an "average" new lumber mill. The estimated impact on the Texas economy of this new activity would be \$6.9 million, with 38 new jobs (Table 10-1).

The "average-sized" Texas softwood plywood mill consumes 63 million board feet of softwood sawtimber per year. It would take approximately a 10.1 percent increase in Texas veneer log harvests to furnish a new "average" softwood plywood mill. This new activity would have an estimated impact on the Texas economy of \$57.1 million, with 384 new jobs (Table 10-1). However, it needs to be considered that new technology allowing the use of smaller-sized timber in wood-based panel production has changed the Texas plywood industry since 1984.

The "average-sized" Texas pulp and paper mill consumes 212,000 cords of harvested roundwood per year. According to the Texas Forest Service (TFS *Texas Forest Resource Harvest Trends*), this harvested pulpwood represents, on average, 55 percent of a mill's wood needs. The remainder of the pulp is produced from purchased chips, or from chips and sawdust residues from lumber and plywood mills. A new "average" pulp and paper mill would require an increase of approximately 11.2 percent in annual softwood pulpwood harvests in Texas. The estimated impact on the Texas economy of the new economic activity attributable only to the pulpwood portion of timber utilized for pulp and paper would be \$75.1 million, with 773 new jobs (Table 10-1).

Policy Considerations

The future success of the Texas wood-based industry depends upon the environment created by federal, state, and local laws and regulations. These are a function of perceived social needs and public concerns. The wood-based industry is at a critical point as it emerges from the effects of the recession of the early 1980s and faces international competition. To ensure continued growth of the wood-based industry in Texas, there are several policy areas to consider.

This report was prepared to provide background information on the relative importance of the wood-based industry in

Texas, and some future projections for the forest-based sector of the Texas economy. The crucial factor in forestry-related considerations is the long production period. But besides timber production, other policies affect the wood-based industry. An adequate consideration of any of them is well beyond the scope of this report, and would require careful and comprehensive policy analysis. However, it is appropriate to identify some areas of policy that should be addressed in a forest sector policy analysis. Among them are the following:

- **Transportation.** The movement of timber from the forest to the mill is an expensive operation, and one that has major effects on the highway system in East Texas. The movement of manufactured wood-based products to market is also an important consideration that affects wood-based economic activity.
- **Income taxes.** The federal Tax Reform Act of 1986 affected every segment of the U.S. economy. Many previously favorable provisions available to wood-based companies and timber growers were lost due to tax reform. Some of the effects of this act include the loss of investment tax credits for plant and equipment, the reduction of depreciation on capital equipment, the loss of a capital gains income differential, and the establishment of new "passive loss" rulings on the deductibility of timberland ownership and management costs, such

Table 10-1. Estimated statewide economic impact of an increase in Texas timber production.

- Assumptions:**
- Additional primary wood-based manufacturing capacity is to be added in the amount of an "average" mill.
 - Market will absorb additional timber and mill output with no price effects.
- Questions:**
- (1) How much additional timber beyond the 1984 harvest level is needed to feed additional processing capacity?
 - (2) What would be the economic impact in value added, employment, and income of additional timber harvesting and processing?

	Primary Industry Segments		
	Sawmills SIC 2421	Softwood Plywood SIC 2436	Pulp & Paper SIC 262,3
	————— millions of units —————		
	(board feet, Int'l 1/4")		(cords)
Texas timber harvest, 1984 ^a	815.4	626.8	1,890.4
Texas mill receipts, 1984 ^a	868.1	630.0	1,701.5
Number of mills	71 ^a	10 ^b	8 ^{bc}
Timber requirements for an "average" mill	12.2	63.0	212.7
Percent increase in timber harvest to support additional "average" mill	1.5%	10.1%	11.2%
	————— millions of dollars —————		
Delivered value of timber to support additional "average" mill ^{ad}	\$2.3	\$12.8	\$11.8
Stumpage value of timber to support additional "average" mill ^{ad}	\$1.7	\$ 9.2	\$ 3.6
Reply to question (2):			
For additional timber production to feed an additional "average" mill, induced economic impacts are:			
• Value added ^e	\$2.4	\$16.4	\$27.7
• Value of shipments ^e	\$6.9	\$57.1	\$75.1
• Employees ^e	38	384	773
• Personal income ^e	\$.5	\$ 6.8	\$22.2

Sources: ^a TFS, Texas Forest Resource Harvest Trends.

^b USDC Bureau of the Census 1986^a.

^c Miller Freeman, Inc. 1984.

^d Timber Mart—South 1984.

^e Table 6-3. (Induced economic impacts per dollar of timber).

as property taxes and interest charges. Effects on timber growing were briefly addressed in Chapter 7.

- **Property taxes.** Texas timberland owners have been allowed to claim special use valuation for *ad valorem* taxes since 1979. The effectiveness of this provision as a stimulus to timber production has yet to be evaluated, but additional tax burdens on landowners would likely discourage production.
- **Environmental quality regulations.** Air and water quality standards substantially impact forest land management and wood-based manufacturing.
- **Land use changes.** Shifting land use from timber production to other uses, and vice-versa, will have some effect on the wood-based industry.
- **Forest protection.** Fire and pests are agents of destruction that plague forest landowners and reduce timber supplies.
- **Federal timberlands.** Continuing demands for non-timber forest outputs are likely to make public forests even less important sources of raw material than they are today. This is a particularly important issue in the West, but will have major impacts on the South because almost half of the softwood inventory in the U.S. is on federal lands.
- **Private timberlands.** For decades, the forestry community's biggest challenge has been to stimulate timber production from the non-industrial private forest landowners who hold the majority of the nation's timberlands. In view of the statistics presented in this report, it is clear that the challenge still remains in Texas. The Texas Forest Service (TFS 1987b) proposes several solutions to this challenge, including research, financial assistance, "reasonable regulations," technical assistance, and protection.
- **Timber utilization.** New uses of timber and more efficient production processes will have major effects on timber demands and supplies. The plywood industry has been substantially affected by lathe technology, which allows the use of small diameter veneer logs. The quite recent introduction of "oriented strand board" technology in Texas also affects this segment of the industry. Because integrated wood utilization is important in the industry, it also has effects on other segments of the industry. The economics of integrated wood utilization are poorly understood.
- **International markets and competition.** Exports and imports of wood-based products represent opportunities and threats for wood-based companies. This report barely scratched the surface of this increasingly important dimension of the wood-based industry.
- **Education, research, and extension.** The answers to many of the questions posed in the aforementioned policy areas likely can best be addressed by sustained commitments in research accompanied by extension to communicate acquired knowledge to those who can benefit from it. Because forestry is technical and specialized, educated professionals can best use the results of current research and assist landowners with the development of management plans that will help ensure

the wise use of timberland acreage in accordance with the landowner's objectives. Research and education, not only at universities, but also through other public and private agencies, keeps forestry professionals at the leading edge of knowledge in forestry practices.

Conclusions

The forest products or wood-based industry in Texas grew rapidly during the 1960s and 1970s, taking advantage of an abundance of timber. Texas became a prominent leader in many facets of the southern and national wood-based industry (Figures 5-11 and 5-13). The industry has recently recovered from the effects of a severe and prolonged economic recession in the early 1980s.

Timber harvests are now being conducted at levels very close to timber growth (Figure 9-4). When annual timber harvests exceed annual growth, the timber capital, or growing-stock inventory, is reduced. The U.S. Forest Service reports that without additional timber supplies, the wood-based industry cannot sustain current levels of employment (USDA Forest Service 1987a). This is an unhealthy situation for the wood-based industry, and the downward trend in timber inventory is already underway (Figure 10-3). But the U.S. Forest Service is quick to point out that it is not too late to remedy the situation—specifically, to plant trees on non-industrial private forest lands.

According to the U.S. Forest Service, annual timber growth in Texas could be increased by 24 percent if private landowners were encouraged to invest \$145 million. These investments would earn a real (inflation-adjusted) pre-tax rate of return in excess of 10 percent. Two-thirds of these investment opportunities are on non-industrial private forest lands. The remaining one-third are on lands owned by companies in the wood-based industry (USDA Forest Service 1987a).

If half of these high-yielding opportunities to increase timber growth were realized, a one-time investment of \$72.5 million would be required. The economic impact of the resulting 12 percent increase in annual Texas timber production could be as much as \$187 million per year if all the additional timber production was processed through new processing capacity in Texas. Of this total, \$63 million would be value added, and \$33 million in personal income resulting from 1,300 new jobs (Table 10-1).

Growth opportunities in the Texas wood-based industry are worth considering, given the presence of an already strong forest products industry and the comparative advantages of the South as a timber-growing region. The wood-based industry is the leading manufacturing industry in East Texas, employing more than one-fourth of the rural populace engaged in manufacturing. Timber grown in East Texas is one of the state's most valuable agricultural crops.

Current economic indicators call for a reexamination of the future direction of the Texas economy. The world energy glut continues to keep oil and gas prices at levels that imply a need for further diversification of an already quite diverse Texas economy. New opportunities for jobs and income for Texans need to be discovered.

Substantial markets for forest products are established in the state. And they will grow as the Texas population grows. Everyone needs wood-based products, and many Texans desire the non-timber outputs of the forest.

The companies with mills to make wood-based products are operating in the state. They are ready to grow. Indeed, they must grow to survive.

Timber is available in Texas to support current levels of wood-based manufacturing activity. According to the U.S. Forest Service, at today's levels of timber management intensity, it is doubtful that increased timber supplies will be available to support growth in the industry without cutting deeply into timber growing-stock inventories.

The U.S. Forest Service has identified opportunities to increase the productive potential of the Texas timber resource by up to 40 percent with present levels of forestry technology. With biotechnology and other developing techniques, growth potential can be improved further. But these high technology approaches are not yet economically viable.

By increasing annual timber growth by one-fourth, the U.S. Forest Service projects that landowners could receive more than a 10 percent real (inflation-adjusted) pre-tax return on their investment. To accomplish this, landowners must identify and take advantage of appropriate forest management opportunities. Fulfillment of these opportunities requires sustained efforts by members of forestry organizations involved in education, research, and extension.

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⁸ USDA is an abbreviation for the U.S. Department of Agriculture.

⁹ USDC is an abbreviation for the U.S. Department of Commerce.

¹⁰ USDL is an abbreviation for the U.S. Department of Labor.

GLOSSARY

Note: Cross-referencing to other definitions is indicated by *italics*.

Board foot. A piece of lumber measuring one foot square and one inch thick. *MBF*, an abbreviation for one thousand board feet, is the common measure for both *sawtimber* and lumber.

Capital expenditure. Money spent on fixed assets such as a manufacturing plant and equipment with a useful life of more than one year, such as a truck or machinery. Monies spent to reforest timberland are considered capital expenditures.

Construction. Activities involved in the fabrication of houses, non-residential buildings, and other fixed structures from lumber, *plywood*, and wood-based building board (Phelps 1980).

Cord. A pile of stacked wood containing 128 cubic feet within its outside surfaces. The standard dimensions are 4 feet by 4 feet by 8 feet (USDA Forest Service 1982). There are approximately 82 cubic feet of wood in a cord (TFS 1985c), the remainder being air and bark.

Diameter at breast height (DBH). A measurement used to determine diameter of a tree at a standardized point, which is 4 feet 6 inches above the ground level, a convenient height for girth-tape readings (SAF 1983).

Establishment. An economic unit, generally at a single physical location where business is conducted or where services or industrial operations are performed (USDA Forest Service 1982).

Forest type. A classification of *forest land* based upon the tree species comprising the plurality of live-tree stocking (USDA Forest Service 1982).

Forest products industry. A general term for the collection of *industries* involved in the growing, harvesting, *primary manufacture*, and *secondary manufacture of timber* and wood products. Also see *wood-based industry*.

Forest land. Land at least 10 percent stocked by forest trees of any size (USDA Forest Service 1982). Subcategories are *timberland* and *woodland*.

Forest land ownership classifications. (adapted from USDA Forest Service 1982).

Private:

Non-industrial private forest (NIPF). In general, all private ownerships except *forest industry*. NIPF owners do not have manufacturing facilities to process *timber*. There are three subclassifications:

Farmer (NIPF). Owned by a person who operates a farm, doing the work or directly supervising the work.

Corporate (NIPF). Business organizations that own forest land but do not have wood-using processing plants. This is a new category used by the U.S. Forest Service for classifying land ownership.

Individual (NIPF). All other non-industrial privately owned forest lands.

Forest industry. Individuals or business organizations that own wood-using processing plants to process *timber*.

Public:

National forest. Federal lands designated by Executive Order or statute as national forests or purchase units, and other lands under the administration of the U.S. Department of Agriculture, Forest Service (USDA Forest Service 1982).

Other public. Other federal forest lands, including Indian reservations; and state, county, and municipal forest lands.

Forest site productivity class. A classification of *forest land* based on the potential cubic-foot volume of wood *growth* per acre at the culmination of mean annual increment in fully stocked natural *stands* (USDA Forest Service 1982).

Growing-stock. Live *sawtimber* trees, *poletimber* trees, *saplings*, and *seedlings* meeting specified standards of quality and vigor.

Growth. See *net annual growth*.

Harvest. Amount of *timber* products removed from the forest by *harvesting* activities. Distinctly different than *timber removals*.

Harvesting. The cutting of trees into *sawlogs*, *pulpwood*, or chips and transportation of these products to *primary manufacturing* facilities (Phelps 1980).

Hardwoods. A conventional term for the *timber* of broad-leaved trees, and the trees themselves (SAF 1983). Dicotyledonous trees, usually broad-leaved and deciduous (USDA Forest Service 1982).

Industrial wood. All commercial *roundwood* products except fuelwood (USDA Forest Service 1982).

Industry. Generally defined as a group of *establishments* producing a single product or a closely related group of products (USDC Bureau of the Census 1985b).

Integrated utilization. The grouping together of complementary production processes in order to secure maximum return from common inputs (Cleaves and O'Laughlin 1986).

Multipliers. Economic impact multipliers are used to estimate changes resulting from the addition of one unit in a particular *industry* on a state or regional economy. Type I multipliers measure the change due to interactions among *industries*. Type II multipliers measure the changes resulting from *industry* interactions and the induced effect of household spending (Porterfield and others 1978).

Net annual growth. The net increase in the volume of trees during a specified year. Components include the incremental growth in net volume of trees at the beginning of the year, plus net volume of trees reaching the minimum size class during the year, minus trees that die, and minus trees that become rough or rotten (USDA Forest Service 1982).

NIPF. An acronym for non-industrial private forests. See *forest land ownership classifications*.

Oriented strand board. A panel product or board comprised of flakes of wood that are aligned and bonded in a glue matrix under heat and pressure. One of a family of substitutes for sheathing grade plywood; others in the family are flakeboard, waferboard, and waferwood.

Plantation. A man-made forest; a forest crop or *stand* raised artificially, either by sowing or planting (SAF 1983).

Plywood. A composite panel product composed of cross-banded layers of *veneer*, bonded with an adhesive under heat and pressure.

Poletimber. Trees of commercially valuable species at least 5.0 inches *DBH* but smaller than *sawtimber* size, and of good form and vigor (USDA Forest Service 1982).

Primary manufacture. Activities involved in the processing of logs and related products into lumber, *plywood*, *veneer*, pulp and paper, turpentine, and other products. An *establishment* is classified by the Census of Manufactures into an *SIC* group according to the products manufactured. Wood-based industry segments of primary manufacture include the following, listed by *SIC* code (Phelps 1980):

SIC 24: Lumber and wood products, includes: logging (SIC 2411), sawmills (SIC 242), hardwood veneer (SIC 2435), and softwood veneer (SIC 2436).

SIC 26: Paper and allied products, includes: pulp mills (SIC 261), paper mills (SIC 262), paperboard mills (SIC 263), and building paper mills (SIC 266).

Productivity class. A classification of *forest land* in terms of potential *growth* in cubic feet of fully stocked natural *stands* (USDA Forest Service 1982).

Pulpwood. Wood that is cut for manufacture into paper products, which must first be converted to *wood pulp* during *primary manufacture*.

Removals. The net volume of *growing-stock* or *sawtimber* trees removed from the inventory by *harvesting*; cultural operations, such as timber stand improvement; land clearings; or changes in land use (USDA Forest Service 1982).

Roundwood. Logs, bolts, or other round sections cut from trees (USDA Forest Service 1982).

Saplings. Live trees of commercial tree species 1.0 inches to 5.0 inches *DBH* and of good form and vigor (USDA Forest Service 1982).

Sawlog. A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter inside bark of 6 inches for *softwoods*, and 8 inches for *hardwoods* (USDA Forest Service 1982).

Sawtimber trees. Live trees that are of commercially valuable species, contain at least a 12-foot *sawlog*, and meet regional specifications for freedom from defect. *Softwoods* must be at least 9.0 inches *DBH*, and *hardwoods* at least 11.0 inches *DBH* (USDA Forest Service 1982). The lower-grade "tops" of sawtimber trees may have considerable volumes of *pulpwood*.

Secondary manufacture. Activities involved in the remanufacture of lumber, *plywood*, paper, and other products into intermediate or finished goods such as millwork (doors and window frames), furniture, writing paper, newsprint, and paper packaging materials, including cartons and boxes. An *establishment* is classified by the Census of Manufactures according to the products manufactured. *Wood-based* industry segments in secondary manufacturing include the following, listed by *SIC* code (Phelps 1980; Ellefson and Stone 1984; Schallau and others 1987):

SIC 24: Lumber and wood products, includes: millwork (SIC 243, except hardwood veneer SIC 2435, and softwood veneer SIC 2436), wood containers (SIC 244), wood buildings (SIC 245, except mobile homes SIC 2451), and miscellaneous wood products (SIC 249), including wood preserving (SIC 2491).

SIC 25: Furniture and fixtures, includes wood furniture only: wood household furniture (SICs 2511, 2512), wood television, etc., cabinets (SIC 2517), wood office furniture (SIC 2521), and wood partitions and fixtures (SIC 2541).

SIC 26: Paper and allied products, includes: miscellaneous converted paper products (SIC 264) and paperboard containers and boxes (SIC 265).

Seedlings. Established live trees of commercial species less than 1.0 inches *DBH* and of good form and vigor (USDA Forest Service 1982).

SIC (Standard Industrial Classification). A system of classifying *establishments* into *industries*, based on considerations such as similarity of manufacturing processes, types of materials used, types of customers, etc. There are 20 major groups (two-digit SIC), 143 industry groups (three-digit SIC), and approximately 450 four-digit SIC industries (USDC Bureau of the Census 1985b).

Softwoods. Coniferous tree species, usually evergreen, having needle or scale-like leaves (USDA Forest Service 1982).

Stand. A community of trees possessing sufficient uniformity in relation to species, age, spatial arrangement, or condition to be distinguishable from adjacent communities (SAF 1983).

Stumpage. The value of *timber* as it stands uncut (SAF 1983).

Timber. A general term for forest crops and *stands* (SAF 1983).

Timber inventory. *Growing-stock* volume of live *sawtimber* and *poletimber* measured to a minimum 4-inch top (USDA Forest Service 1981).

Timberland. *Forest land* that is producing, or is capable of producing crops of *industrial wood* and is not withdrawn from timber production (Lang and Bertelson 1987).

Transportation. Activities involved in the transportation of logs and related products from local delivery points to manufacturing plants or other customers; transportation of *primary* and *secondary* products from points of manufacture to final customers (Phelps 1980).

Value added. A measure of manufacturing activity derived by subtracting the costs of materials, supplies, containers, fuel, purchased electricity, and contract work from the *value of shipments* for the products manufactured (USDC Bureau of the Census 1985b). The remainder (value added) is the

amount available for salaries, wages, and profits in that particular *establishment* or *industry*.

Value of shipments. The received or receivable net selling values of all products shipped from an *establishment*, exclusive of freight and taxes (USDC Bureau of the Census 1985b).

Veneer. A thin sheet of wood of uniform thickness produced by rotary cutting or by slicing or sawing. Used to produce *plywood*, and with high grade *hardwoods* to produce furniture.

Wood-based industry. Another term for the *forest products industry* used by some economists (Ellefson and Stone 1984; Foster, undated; Gregory 1987). The industry is also variously referred to as timber-based industry (Phelps 1980), forest-based industry (Flick 1986), paper and forest products industry (*Business Week* magazine), and forest industry.

Woodland. *Forest land* incapable of yielding crops of *industrial wood* because of adverse site conditions.

Wood pulp. Wood fibers separated by mechanical or chemical means for use in manufacturing paper, textiles, and many other products derived from cellulose (SAF 1983).

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