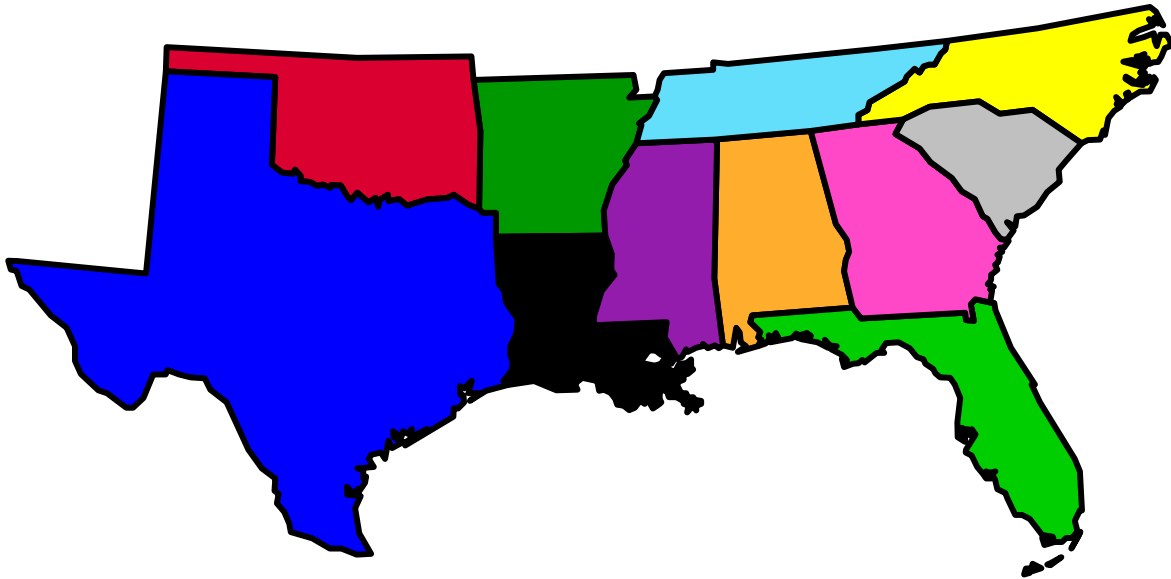


An Overview of Public Information Sources for Forest and Wood-based Manufacturing Residuals and Waste Generated in the U.S. South

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August 8, 2003

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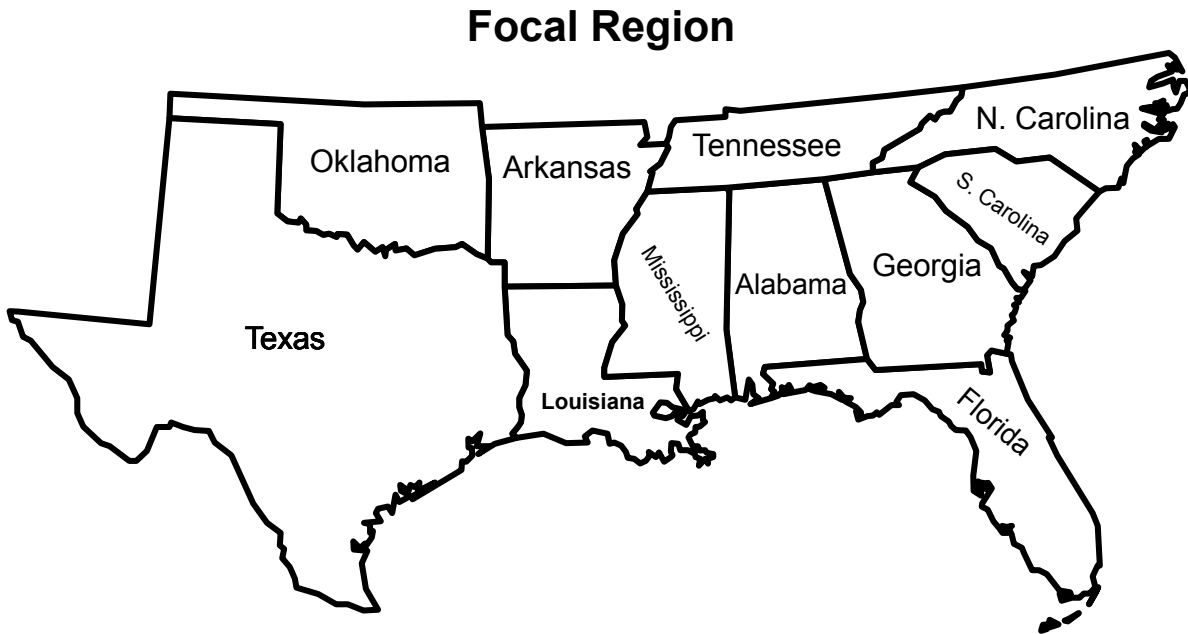
Introduction

Wood-waste and residuals that are by products of logging and silvicultural forest activities are increasingly being utilized. Uses of these materials include generating co-generation for facility operations, production of wood-based or wood-other material composites and in landscaping.

This report offers an overview of wood-based residuals and waste generated in the U.S. South. Information in this report was gleaned from most up to date public sources, primarily the U.S. Forest Service and state reports.

Figure 1 shows the states that are included in this report. All states except for Oklahoma have significant wood producing industries and timberlands.

Figure 1. Focal Region of Interest



II. Summary Tables and Figures

Table 1. Primary Wood Products Outputs (Most Recent Year-USFS)

	Roundwood Output Billion Cubic Feet	Pulpwood Output Million Cubic Feet	Sawlog Output Million Cubic Feet
Alabama	1.12	641	426
Arkansas	0.69	285	320
Florida	0.50	261	167
Georgia	1.24	594	509
Louisiana	0.50	352	144
Mississippi	1.00	454	493
North Carolina	0.79	272	422
Oklahoma	0.16	40	74
South Carolina	0.63	324	242
Tennessee	0.33	121	185
Texas	NA	NA	NA

Figure 2. Roundwood Output (billion board feet) (Most Recent Year-USFS)

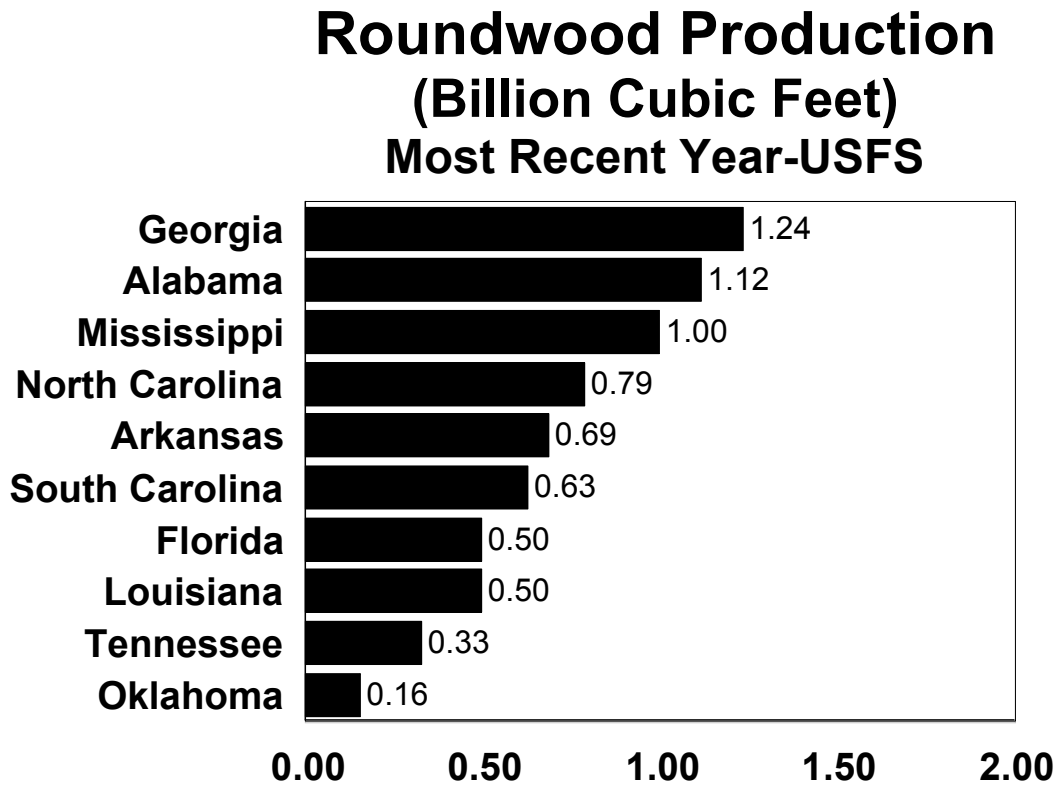


Figure 3. Pulpwood Output (million cubic feet) (Most Recent Year-USFS)

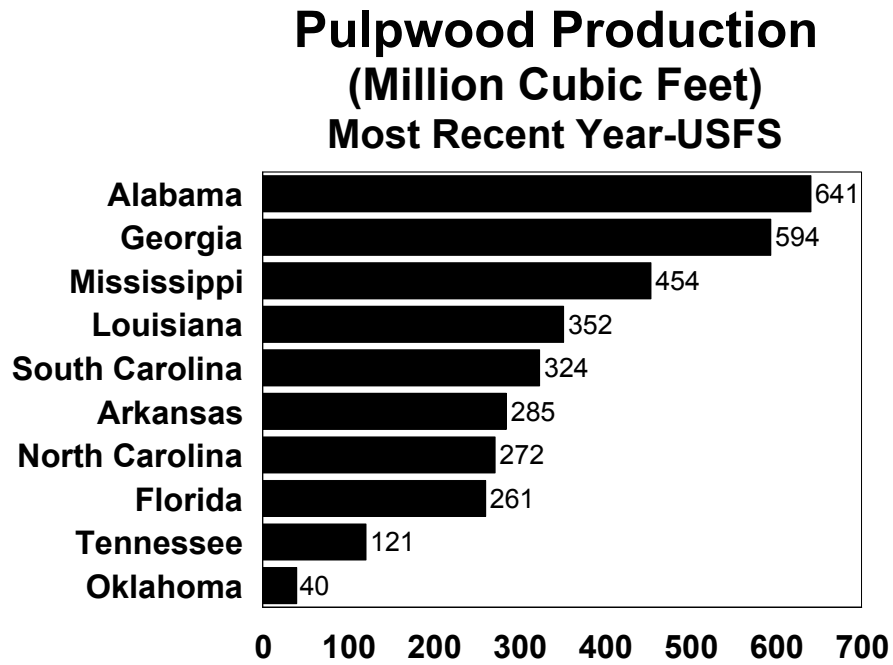


Figure 4. Sawlog Output (million cubic feet) (Most Recent Year-USFS)

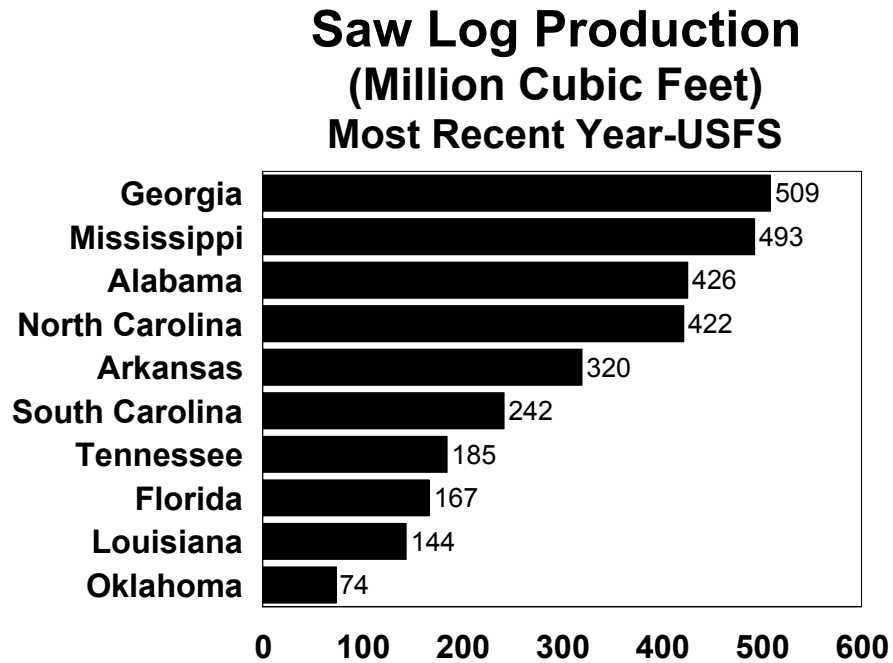


Table 2. Number of Plants (Most Recent Year-USFS)

	Sawmill	Pulp	Veneer	Other Industrial Products
Alabama	121	15	23	22
Arkansas	128	8	10	10
Florida	53	6	4	30
Georgia	129	12	12	31
Louisiana	23	11	5	0
Mississippi	84	7	10	2
North Carolina	240	7	24	4
Oklahoma	68	2	1	2
South Carolina	63	7	12	8
Tennessee	440	5	2	4
Texas	NA	NA	NA	NA

Figure 5. Number of Mills (Most Recent Year-USFS)

Number of Mills Most Recent Year-USFS

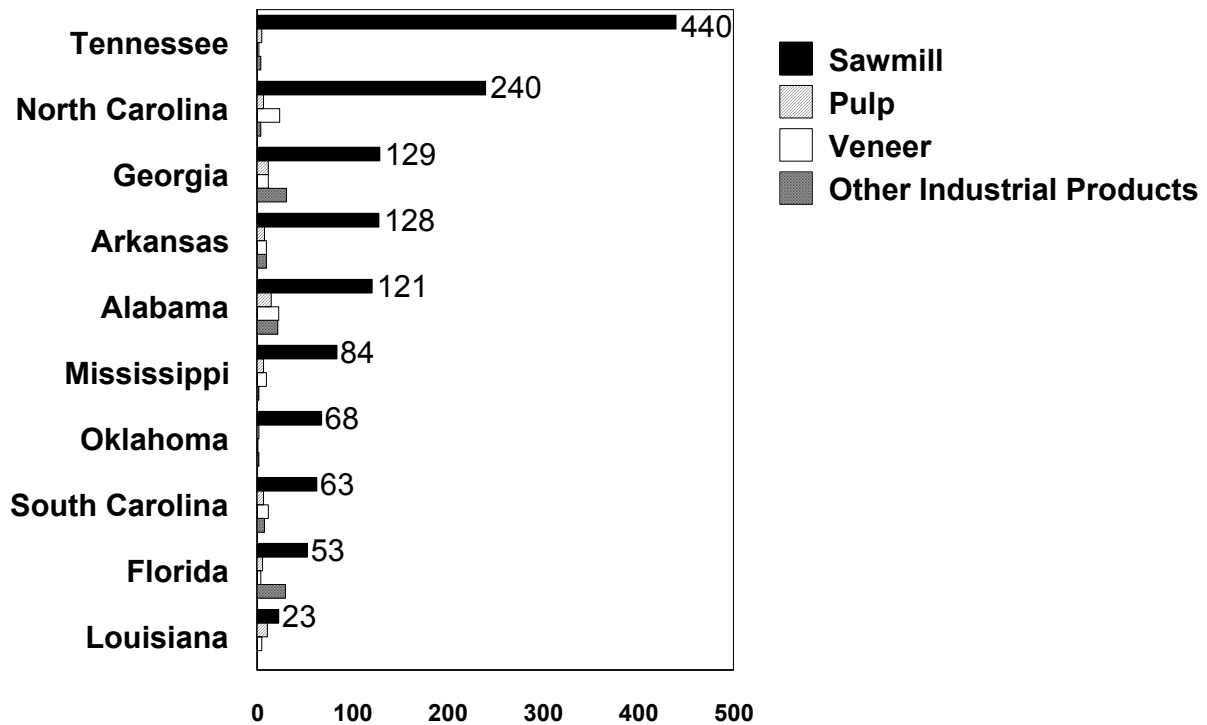


Table 3. Residue Generation by State (Most Recent Year-USFS)

	Total Mill Residuals Avail. For Energy	Total Primary Products Residuals	Sawdust/Shavings		Forest Residues
	Million Dry Tons	Million Cubic Feet	Percent	Percent NOT Used	Million Dry Tons
Alabama	7.8	469	28	1	1.9
Arkansas	4.7	290	34	0	1.7
Florida	2.7	152	29	0	1.0
Georgia	8.0	483	30	2	2.0
Louisiana	3.2	195	24	2	1.6
Mississippi	6.0	365	37	2	1.8
North Carolina	5.0	312	35	1	2.0
Oklahoma	0.3	42	33	NA	0.2
South Carolina	3.4	167	32	1	1.2
Tennessee	2.0	125	28	10	1.7
Texas	4.0	NA	NA	NA	1.0

Figure 6. Total Residues Available for Energy (Most Recent Year-USFS)

Total Residues Available for Energy (Million Dry Tons) Most Recent Year-USFS

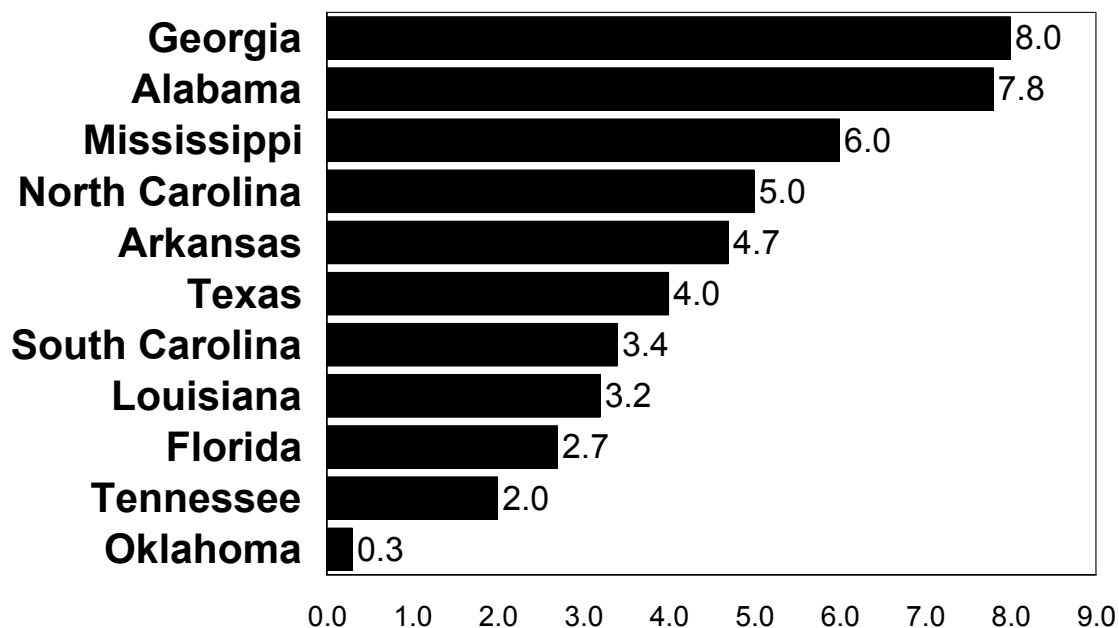


Figure 7. Total Primary Products Residuals (Most Recent Year-USFS)

Total Primary Products Residues (Million Cubic Feet) Most Recent Year-USFS

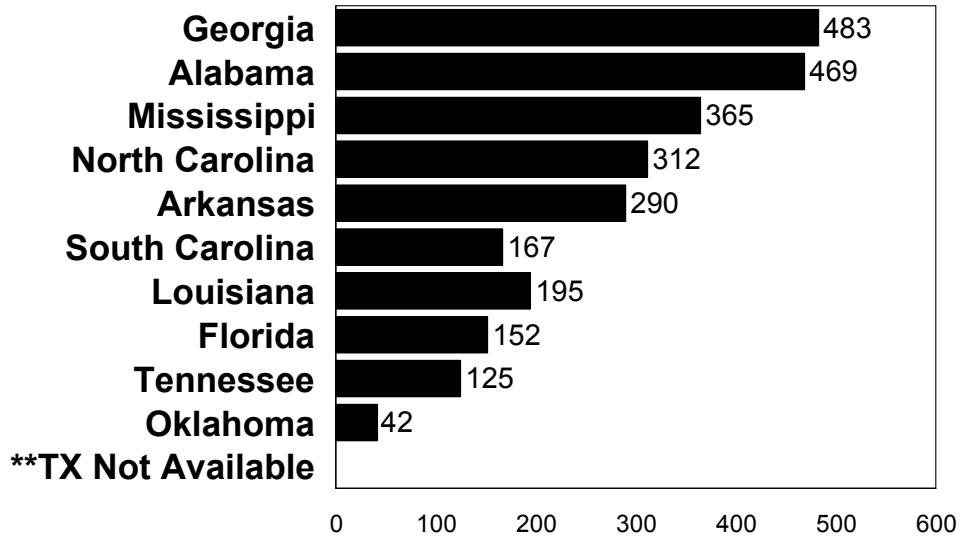
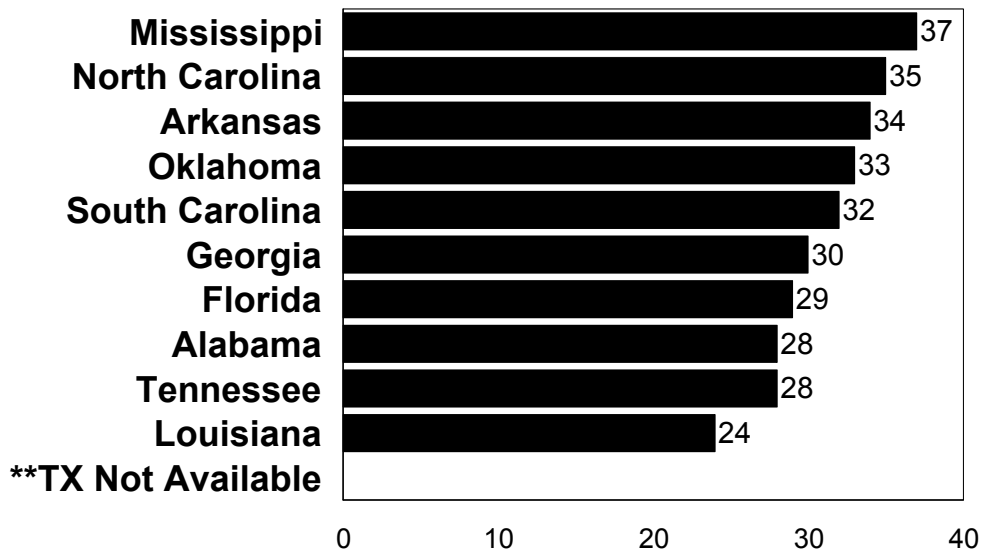


Figure 8. Sawdust/Shavings Percent of Residuals Produced (Most Recent Year-USFS)

Percent Sawdust/Shavings Percent of Total Residuals Most Recent Year-USFS



U.S. South Industry Overview¹

The U.S. South's forest products industry has experienced explosive growth and an unprecedented increase in capital projects during the past few years. After decades of being considered a poor cousin to the old-growth forests in the U.S. West and the SPF resource of Canada, the South is the place to be today. The South is now the largest forest-products producing region in North America. Building on the massive hardwood furniture industry already firmly established in its eastern zones, an equally dynamic softwood industry continues to evolve.

The raw material needs of the U.S. South's forest products manufacturing sector have risen above the annual growth of its forests, and the timber inventory in this region is, therefore, shrinking by some degree. This downward trend in timber inventory has been most pronounced among the softwood species. As a result, the number of acres of pine forests under intensive management in the South may not be sufficient to maintain the softwood timber harvest at current levels using present management regimes. For the remainder of the 1990s and beyond, the U.S. South's timber resource will face particularly strong demand pressures. Softwood lumber production is considered to be nearing its record-setting peak and may see only small gains in output over the next few years. However, it is expected that the South will remain close to its current levels over the next five-year period, as capital investments improve log-to-lumber recoveries and plantations move closer to maturity.

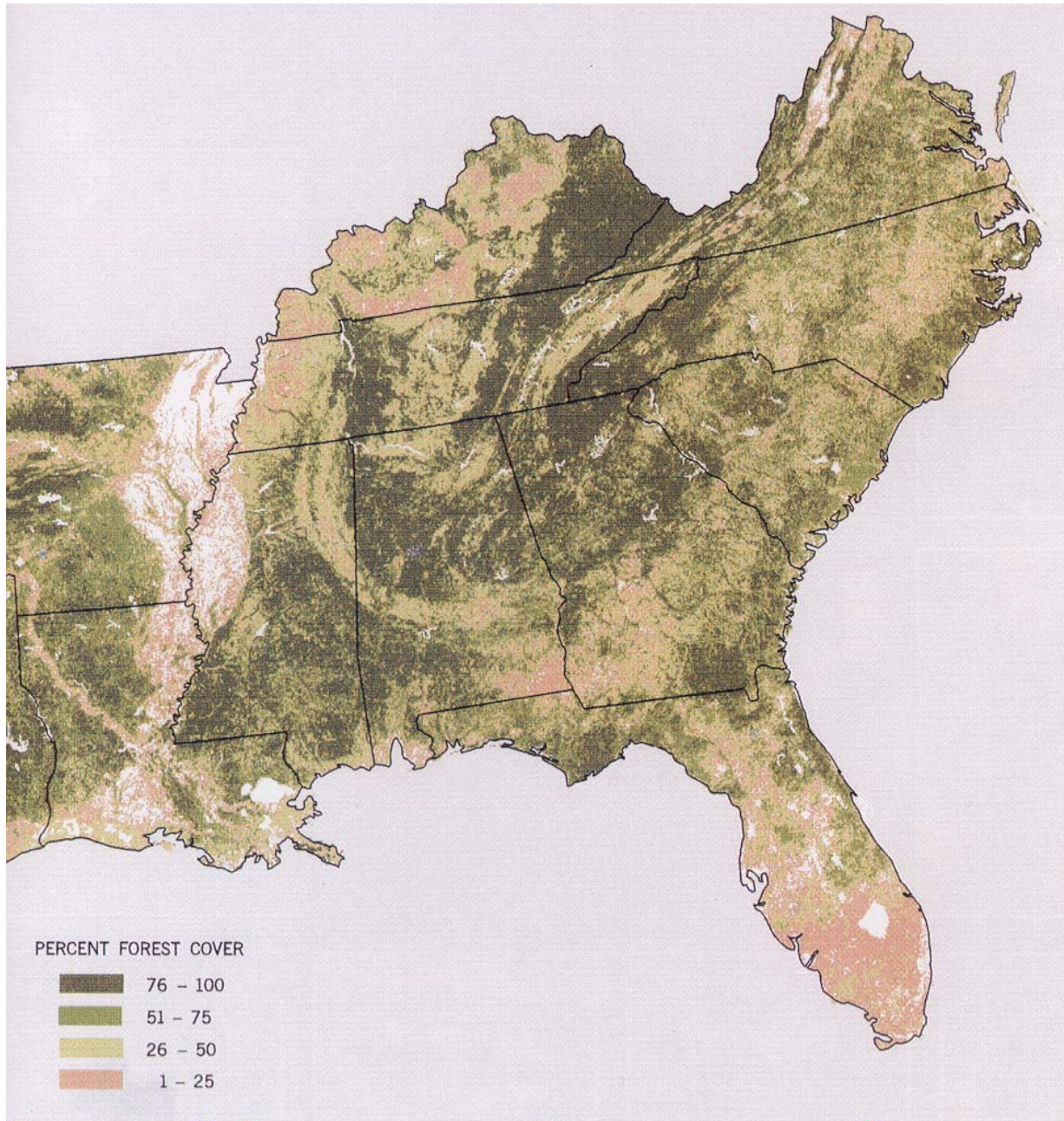
Timber Resource

With 200 million acres of timberland, the U.S. South lays claim to 40% of the total supply of the continental U.S. In land ownership, the South is unique. In comparison to the U.S. West or Canada, 90% of all forestland is private, with the balance administered federally. Individuals, farmers or other landowners control more than three-quarters of the U.S. South's private timberland, with only one-quarter controlled by the forest industry. As a result, there is likely to be little impact on this region's timber harvest as a result of any policy shifts in the management of public timberlands; the major role will continue to be played by the independent landowner.

¹ 2000 Edition Wood Markets, The Solid Wood Products Outlook 2000 to 2004 on the North American Solid Wood Products Industry. International Wood Markets Research, Inc. 1999

*South Forest Cover*²

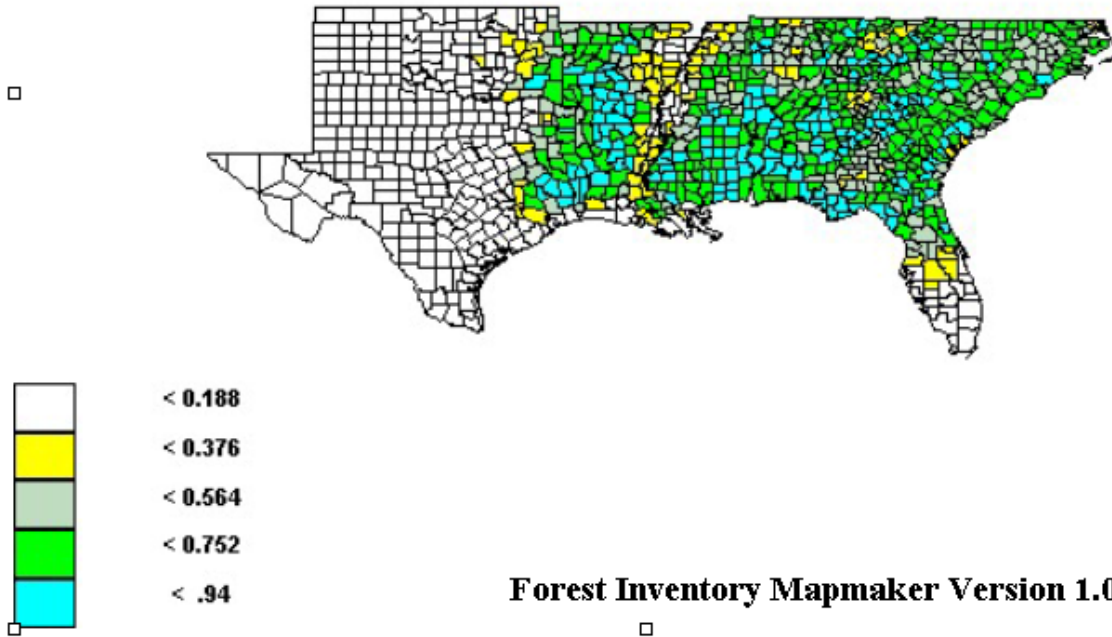
Figure 9. Forest Cover of the South



² Forests of the South, Southern Forest Based Economic Development Council

Figure 10. Area of Timberland as a Percentage of Total Land Area in the South

Area of Timberland (acres) Divided by the
 Total Area of Land in Each County (acres).
Mininum value= 0 Maximum value= .94

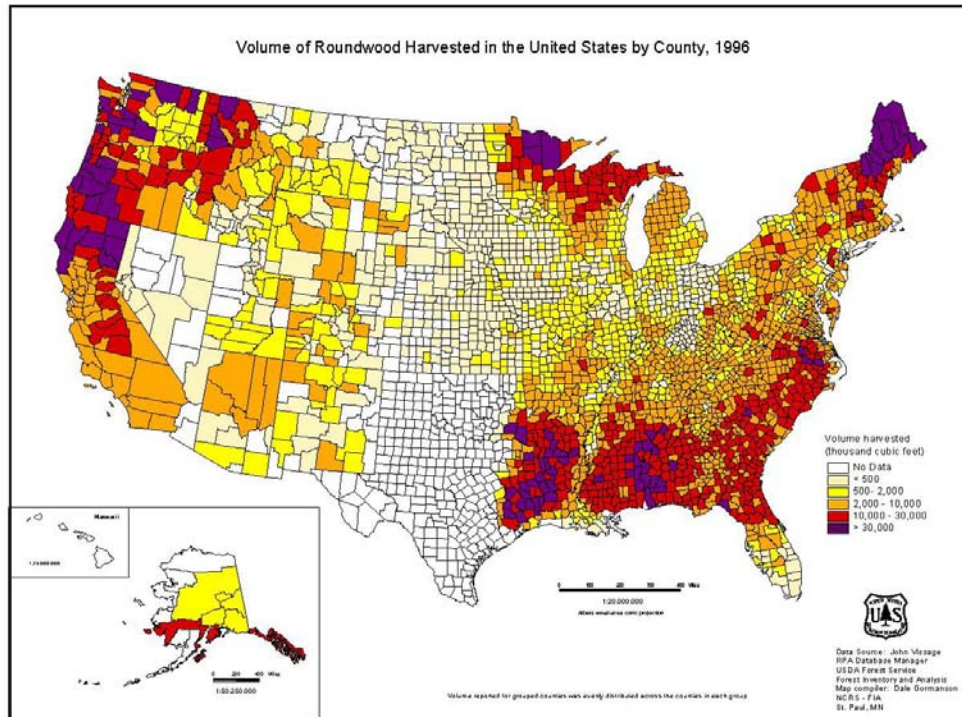


Timber Harvest

Potential timber harvest increases are an emerging theme for the U.S. South in both softwoods and hardwoods. Since 1970, the softwood harvest has increased by 50% to 150 million m³ (approximately 30 billion bf) by 1994, and has risen consistently since then. In the same period, the hardwood harvest has doubled to nearly 85 million m³ (17 billion bf). Combined, these harvests levels account for just under 50% of the continental U.S.'s total timber harvest. One forecast released by the USFS indicates potential rises in both the softwood and hardwood timber harvest of up to 50% in the next 30-year period.

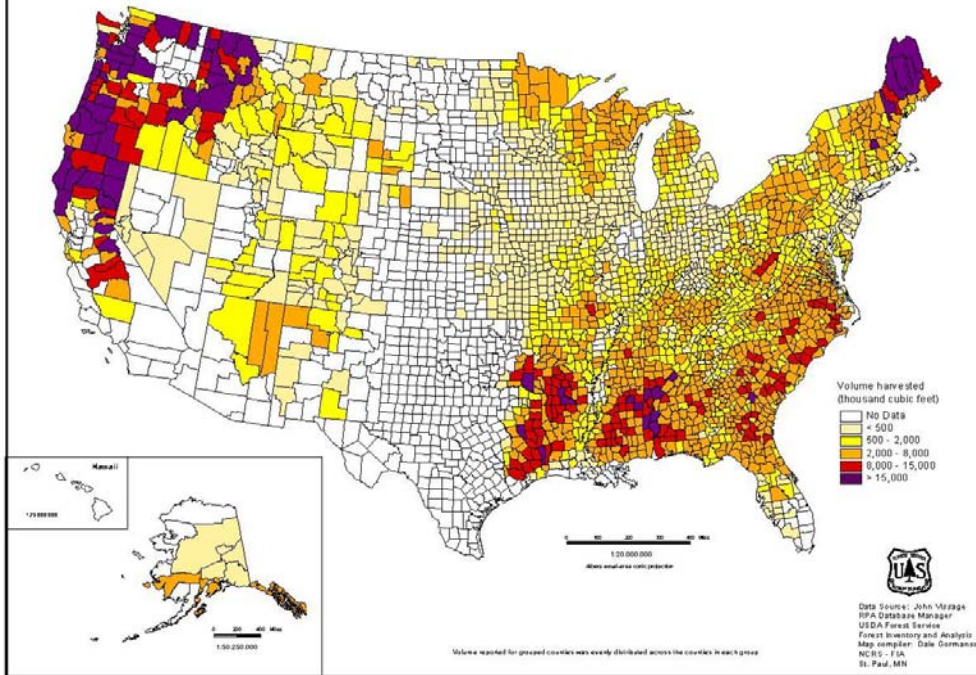
Roundwood Harvest-1996³

Figure 11. Volume of Roundwood Harvested in the US by County- 1996



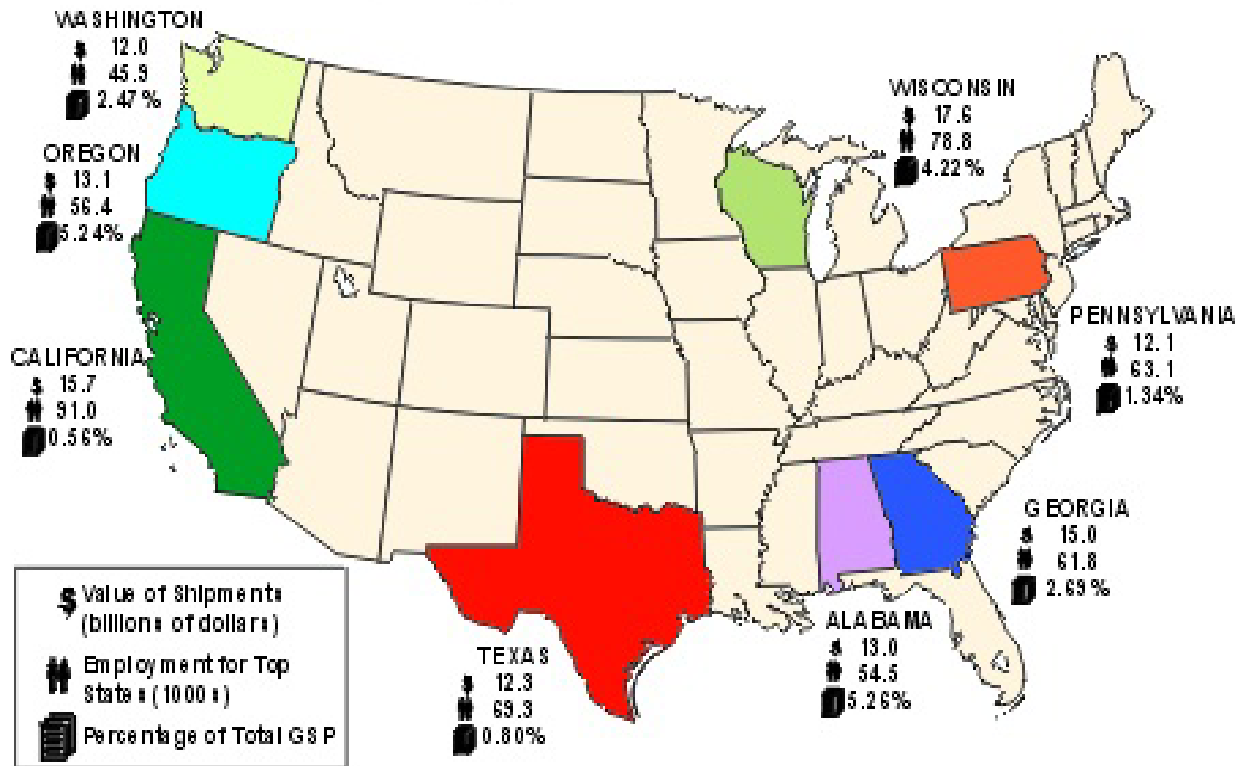
³ Forest Inventory and Analysis (FIA) Timber Products Output (TPO) Database Retrieval System

Volume of Sawlog Products Harvested in the United States by County, 1996



U.S. Forest Products

Value of Shipments for Top Eight States – 1996



1996 Annual Survey of Manufactures, U.S.

The Southern Region Overview Output of Timber Products⁴

In 1996, timber product output (TPO) from the Southern Region (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia) amounted to 9.6 billion cubic feet. This region, with **40 percent of the Nation's timberland, accounted for 58 percent of the total roundwood output.**

Between 1991 and 1996, the volume of roundwood products increased 979 million cubic feet, or 11 percent, from 8.6 to 9.6 billion cubic feet. Output of softwood and hardwood roundwood products was up 12 and 11 percent to 6.2 and 3.4 billion cubic feet, respectively.

Roundwood Products

Other industrial 1%

Fuel-wood 10%

Pulpwood 41%

Veneer logs 9%

Composite panels 1%

Saw logs 38%

Total 9.6 billion cubic feet

Saw logs and pulpwood were the principal roundwood products in 1996. Combined output of these two products totaled 7.6 billion cubic feet and accounted for 79 percent of the region's total roundwood output.

Growing-stock volume from timberland sources, which included sawtimber and poletimber, accounted for 89 percent, or 8.6 billion cubic feet, of total roundwood output. Nongrowing stock or other sources contributed an estimated 1.0 billion cubic feet.

Southern roundwood production by source, 1996.

Sawtimber 67%

Other 11%

Poletimber 22%

Total 9.6 billion cubic feet

Nonindustrial private forest (NIPF) lands accounted for 65 percent, or 6.3 billion cubic feet, of the total round-wood output. Forest industry lands contributed 2.8 billion cubic feet, or 29 percent, of the output. Public lands made up the remaining 6 percent, or 524 million cubic feet.

⁴ United States Timber Industry-An Assessment of Timber Product Output and Use, 1996. USDA Forest Service. Tony G. Johnson and John S. Vissage, Forester, USDA Forest Service, Southern Research Station, Asheville, NC; Research Forester, USDA Forest Service, Starkville, MS, respectively.

Ownership

Non-industrial private 65%
National forest 3%
Forest industry 29%
Other public 3%
Total 9.6 billion cubic feet

Major Species

Softwood

Loblolly-short leaf pine 71%
Longleaf-slash pine 21%
Other pines 6%
Other softwoods 2%

Total 6.2 billion cubic feet

Hardwood

Oaks 48%
Blackgum-tupelo 5%
Maple 4%
Sweet gum 15%
Hickory 6%
Other hardwoods 14%
Yellow-poplar 8%

Total 3.4 billion cubic feet

Softwood made up 64 percent of the South's roundwood production. For the softwood species group, the loblolly and shortleaf pine group provided the most volume, accounting for 71 percent, or 4.4 billion cubic feet, of the total softwood output. The longleaf and slash pine type accounted for 21 percent with 1.3 billion cubic feet for hardwoods, the red oak and white oak groups accounted for 1.6 billion cubic feet, or 48 percent, of total hardwood output. Sweetgum, yellow poplar, and hickories accounted for 15, 8, and 6 percent, respectively.

Georgia and Alabama were the leading producers of roundwood products at 1.4 billion cubic feet each; they were followed by **Mississippi** with 1.1 billion cubic feet **and North Carolina** with 954 million cubic feet. These States accounted for 51 percent of the Southern Region's total roundwood production.

Saw Logs

Saw logs, at 3.7 billion cubic feet, accounted for 38 per-cent of the region's total roundwood output and more than half of the Nation's total saw-log production in 1996. Output of softwood saw logs increased 17 percent from 2.3 to 2.7 billion cubic feet (15.0 billion board feet), while hardwood saw logs declined 7 percent to 959 million cubic feet (5.7 billion board feet) Growing stock accounted for 96 percent of the saw-log production at 3.5 billion cubic feet.

The NIPF owners supplied 2.5 billion cubic feet, or 67 percent, of saw-log volume for the Southern Region. Forest industry provided 27 percent, and public lands provided the remaining 6 percent of saw-log volume.

Softwoods accounted for 74 percent, or 2.7 billion cubic feet, of the saw-log production with the loblolly and shortleaf pine group making up 73 percent of softwood output. Hardwoods supplied nearly 1.0 billion cubic feet of saw-log output. The red oak and white oak groups accounted for 466 million cubic feet, or 49 percent, of total hardwood saw-log production. Sweetgum and yellow poplar each accounted for 11 percent, and hickories accounted for 8 percent.

Georgia accounted for 15 percent of the region's total saw-log output with 552 million cubic feet. **Mississippi** and **Alabama** each accounted for 13 percent of sawlog output with 493 and 473 million cubic feet, respectively.

Sawmills by State⁵

Table 2. Industry Statistics for Selected States: 1997

[States that are disclosures or with less than 100 employees are not shown. For explanation of terms, see appendixes. For meaning of abbreviations and symbols, see introductory text]

Industry and geographic area	E ¹	All establishments		All employees		Production workers			Value added by manufacture (\$1,000)	Cost of materials (\$1,000)	Value of shipments (\$1,000)	Total capital expenditures (\$1,000)
		Total	With 20 employees or more	Number	Payroll (\$1,000)	Number	Hours (1,000)	Wages (\$1,000)				
321113, SAWMILLS												
United States	1	4 403	1 363	118 954	3 172 315	102 395	211 613	2 518 788	8 540 717	16 229 478	24 656 573	1 081 252
Alabama	1	138	70	5 877	152 327	5 055	11 367	117 333	435 685	889 923	1 319 311	51 134
Alaska	—	19	3	219	8 894	178	387	6 598	23 945	25 681	44 747	1 203
Arkansas	—	164	55	5 521	143 722	4 902	10 870	120 047	434 633	810 630	1 229 150	84 516
California	1	97	48	8 122	271 361	7 081	15 577	223 574	780 894	1 268 418	2 059 180	54 407
Colorado	1	25	6	388	8 422	338	614	6 836	18 558	29 135	46 162	3 434
Florida	1	52	21	1 814	44 359	1 475	3 347	34 948	136 942	261 372	403 209	19 159
Georgia	—	127	60	6 371	162 532	5 118	11 676	120 460	490 671	1 220 313	1 705 937	53 935
Idaho	—	66	33	3 676	125 764	3 283	6 982	105 208	282 468	688 969	967 204	28 063
Illinois	3	57	4	415	8 870	362	591	6 873	17 294	23 217	40 528	1 601
Indiana	2	122	26	1 886	40 848	1 558	2 970	30 767	97 589	126 515	221 300	10 467
Kentucky	2	181	54	3 671	65 917	3 241	5 941	52 552	171 563	221 508	391 409	24 320
Louisiana	1	71	28	2 270	59 975	1 922	4 235	47 778	173 933	381 867	553 707	24 475
Maryland	3	41	16	939	19 895	738	1 448	15 734	53 361	66 649	119 167	5 089
Massachusetts	3	37	8	415	9 363	317	587	6 931	21 487	25 118	45 903	2 018
Michigan	3	156	34	2 211	53 588	1 891	3 684	40 796	124 393	192 688	316 458	17 565
Minnesota	2	80	10	918	21 812	773	1 514	16 270	49 614	66 324	115 588	3 791
Mississippi	1	138	74	5 732	142 163	5 105	11 216	117 371	452 434	949 950	1 400 637	67 653
Missouri	5	232	26	2 010	36 189	1 764	2 728	28 298	93 058	148 512	241 356	9 973
Montana	—	52	19	2 289	67 357	2 074	4 091	58 565	183 450	342 406	520 460	8 375
New York	4	138	38	2 627	69 638	2 144	4 584	50 959	187 365	311 711	503 668	21 376
North Carolina	1	246	85	6 074	158 921	5 225	10 881	121 673	452 531	677 796	1 126 813	92 891
Ohio	3	132	31	1 978	39 967	1 713	3 103	32 963	104 676	154 080	260 451	11 327
Oregon	—	147	84	10 668	342 279	9 449	19 521	281 431	848 373	2 301 513	3 132 321	117 076
Pennsylvania	3	342	64	4 965	103 922	4 212	7 342	76 718	294 984	432 503	720 675	24 938
South Carolina	—	72	40	3 285	94 410	2 795	6 152	69 217	311 000	570 286	882 819	31 323
South Dakota	2	10	3	406	10 758	357	692	8 991	26 414	42 267	69 813	2 336
Tennessee	3	249	50	3 420	72 558	2 880	5 079	53 410	158 380	242 072	400 326	20 120
Texas	1	112	40	3 002	70 369	2 550	5 458	58 470	201 191	413 456	605 684	26 467
Virginia	1	241	78	4 513	107 011	3 897	7 883	83 337	277 343	390 636	666 343	44 943
Washington	1	189	74	9 664	326 028	8 389	17 837	284 345	794 926	1 740 864	2 508 611	119 938
West Virginia	2	154	47	2 798	56 102	2 562	4 783	47 630	168 724	255 149	422 082	13 091
Wisconsin	2	163	39	3 122	68 639	2 504	4 656	47 594	156 981	218 857	376 636	14 689

¹ Hawaii has no incorporated places in the sense of functioning governmental units; however, in agreement with Hawaiian law, the Bureau of the Census reports data for census designated places (CDPs) which have been designated as place equivalents. Those CDPs, only for the state of Hawaii, with 2,500 or more population are recognized.

⁵ Some payroll and sales data for small single-establishment companies with up to 20 employees (cutoff varied by industry) were obtained from administrative records of other government agencies rather than from census report forms. These data were then used in conjunction with industry averages to estimate statistics for these small establishments. This technique was also used for a small number of other establishments whose reports were not received at the time data were tabulated. The following symbols are shown where estimated data based on administrative-record data account for 10 percent or more of the figures shown: 1–10 to 19 percent; 2–20 to 29 percent; 3–30 to 39 percent; 4–40 to 49 percent; 5–50 to 59 percent; 6–60 to 69 percent; 7–70 to 79 percent; 8–80 to 89 percent; 9–90 percent or more.

Pulpwood

Between 1991 and 1996, southern pulpwood production increased 15 percent, from 3.4 to 3.9 billion cubic feet, and accounted for 41 percent of the region's total roundwood TPO. Pulpwood from the South accounted for 77 percent of the Nation's total output. Softwood output increased 7 percent to 2.4 billion cubic feet (33.2 billion cords), while hardwood output increased 29 percent to 1.5 billion cubic feet (19.7 billion cords). Growing stock accounted for 90 percent of the pulpwood production, or 3.5 billion cubic feet.

The NIPF owners supplied 2.4 billion cubic feet, or 63 percent, of pulpwood output. Forest industry provided 32 percent and public lands the remaining 5 percent of pulpwood output. Softwoods accounted for 62 percent of the pulpwood production. The loblolly and shortleaf pine and the longleaf and slash pine groups made up 67 and 25 percent of the region's total softwood output, respectively. For hardwoods, the red oak and white oak groups accounted for 47 percent of pulpwood output.

The region and the Nation's leaders in pulpwood production were: **Alabama** with 698 million cubic feet, **Georgia** with 617 million cubic feet, and **Mississippi** with 454 million cubic feet. These States supplied 46 percent of the region's pulpwood output.

Veneer Logs

Output of veneer logs in 1996 totaled 825 million cubic feet, accounting for 9 percent of the region's total roundwood TPO volume. Softwood veneer production increased 2 percent to 736 million cubic feet (4.4 billion board feet), while output of hardwood veneer logs increased 16 percent, from 77 million cubic feet in 1991 to 89 million cubic feet (550 million board feet) in 1996.

Veneer-log production comes almost exclusively from growing-stock sources. The NIPF landowners provided 58 percent of the veneer production and forest industry supplied 35 percent.

The loblolly and shortleaf pine group accounted for 84 percent of the softwood veneer production.

Texas, Louisiana, and Alabama were the leading producers of veneer in the South. These States combined accounted for 53 percent of the region's total veneer output.

Other Industrial Products

Roundwood harvested for other industrial products such as poles, posts, composite panels, and all other industrial uses totaled 245 million cubic feet, a 16-percent increase from 1991. Other industrial products accounted for only 2 percent of the region's total roundwood output.

Softwood output increased 27 percent to 189 million cubic feet, while hardwood output declined 12 percent to 56 million cubic feet. Growing stock made up 87 percent of the other industrial output.

Seventy-two percent of the other industrial volume was harvested from NIPF lands.

The loblolly and shortleaf pine group made up 60 percent of the softwood used for other industrial purposes, while the red oak and white oak groups made up 45 percent of the hardwood used for other industrial products.

All Removals

In addition to roundwood output for products, logging residues and other removals were calculated for an estimate of total removals. Logging residues and other removals combined with roundwood products placed total removals from all sources at 12.3 billion cubic feet for the Southern Region.

Logging residues from all sources amounted to 1.5 billion cubic feet, or 12 percent, of total removals, while other removals from all sources totaled 1.2 billion cubic feet, or 10 percent, of total removals.

Total Removals

Other removals 10%
Logging residues 12%
Roundwood products 78%
Total 12.3 billion cubic feet

Georgia ranked number one in the region for total removals at 1.8 billion cubic feet, followed by **Alabama** and **Mississippi** at 1.6 and 1.4 billion cubic feet, respectively.

Plant Byproducts

In 1996, processing of primary products in southern mills generated 3.2 billion cubic feet (52.4 million dry tons) of wood and bark residues. Coarse residues from industrial roundwood products amounted to 1.3 billion cubic feet, or 40 percent, of total residue produced. Bark volume totaled 915 million cubic feet, or 29 percent, of total residues. Fine materials made up of sawdust and shavings accounted for 31 percent of total residues, or 971 million cubic feet

Residuals Produced

Sawdust and shavings 31%
Bark 29%
Coarse 40%

Total 3.2 billion cubic feet

Residue Disposal 1996

Miscellaneous 12%

Not used 1%

Fuelwood products 49%

Fiber products 38%

Total 3.2 billion cubic feet

Virtually all of the wood and bark residues were used for a product; only 1 percent of the residues were not used, while 49 percent of the residues were used for industrial or domestic fuelwood.

More than 1.0 billion cubic feet, or 83 percent, of the coarse residues were used for fiber products. Most of the bark was used for industrial fuel or other miscellaneous products, while 67 percent of the fine residues, or sawdust and shavings, were used for industrial fuel.

State Analyses

*Alabama*⁶

In 1999, roundwood output from Alabama's forests totaled 1.2 billion cubic feet. Mill byproducts generated from primary manufacturers amounted to 469 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 641 million cubic feet; saw logs ranked second at 426 million cubic feet; veneer logs were third at 109 million cubic feet.

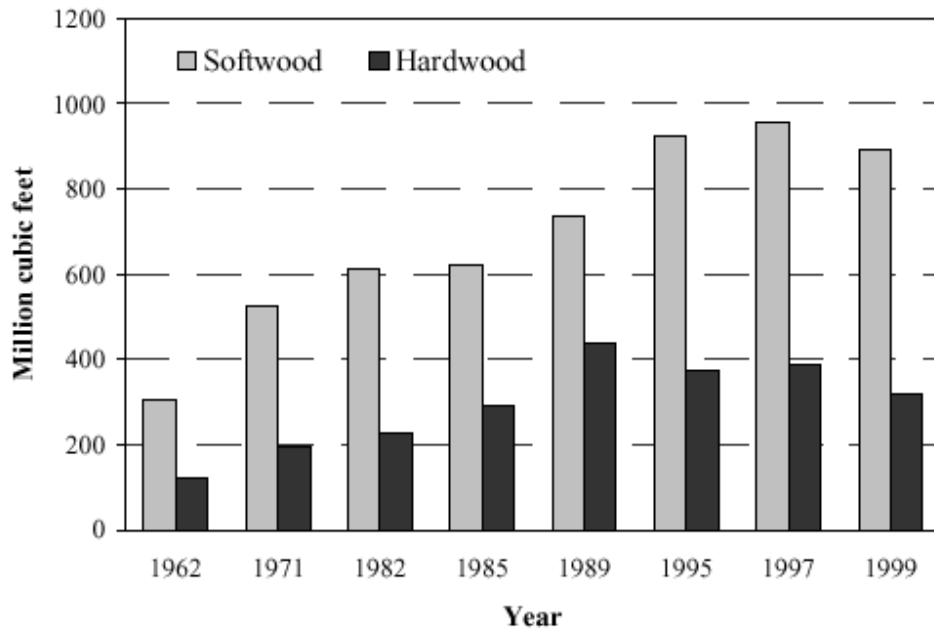


Figure 2—Roundwood production for all products by species group and year (see page 10 for references for individual years).

⁶ Howell, Michael; Gober, Jim R.; Nix, J. Stephen. 2002. Alabama's timber industry - an assessment of timber product output and use, 1999. Resour. Bull. SRS-75. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 39 p. USDA/Forest Service - Southern Research Station

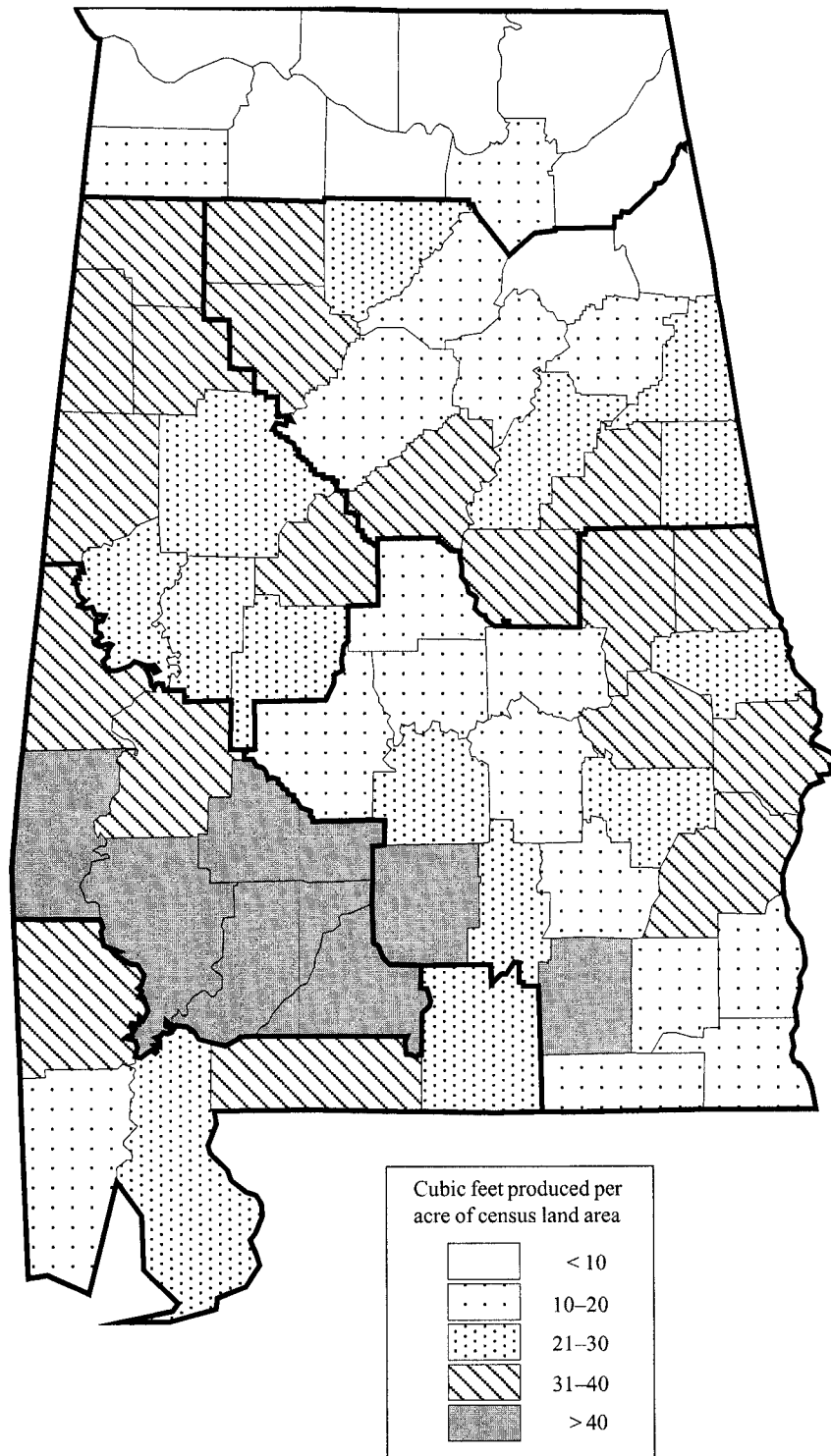


Figure 3—Intensity of roundwood softwood output for all industrial products in Alabama by county, 1999.

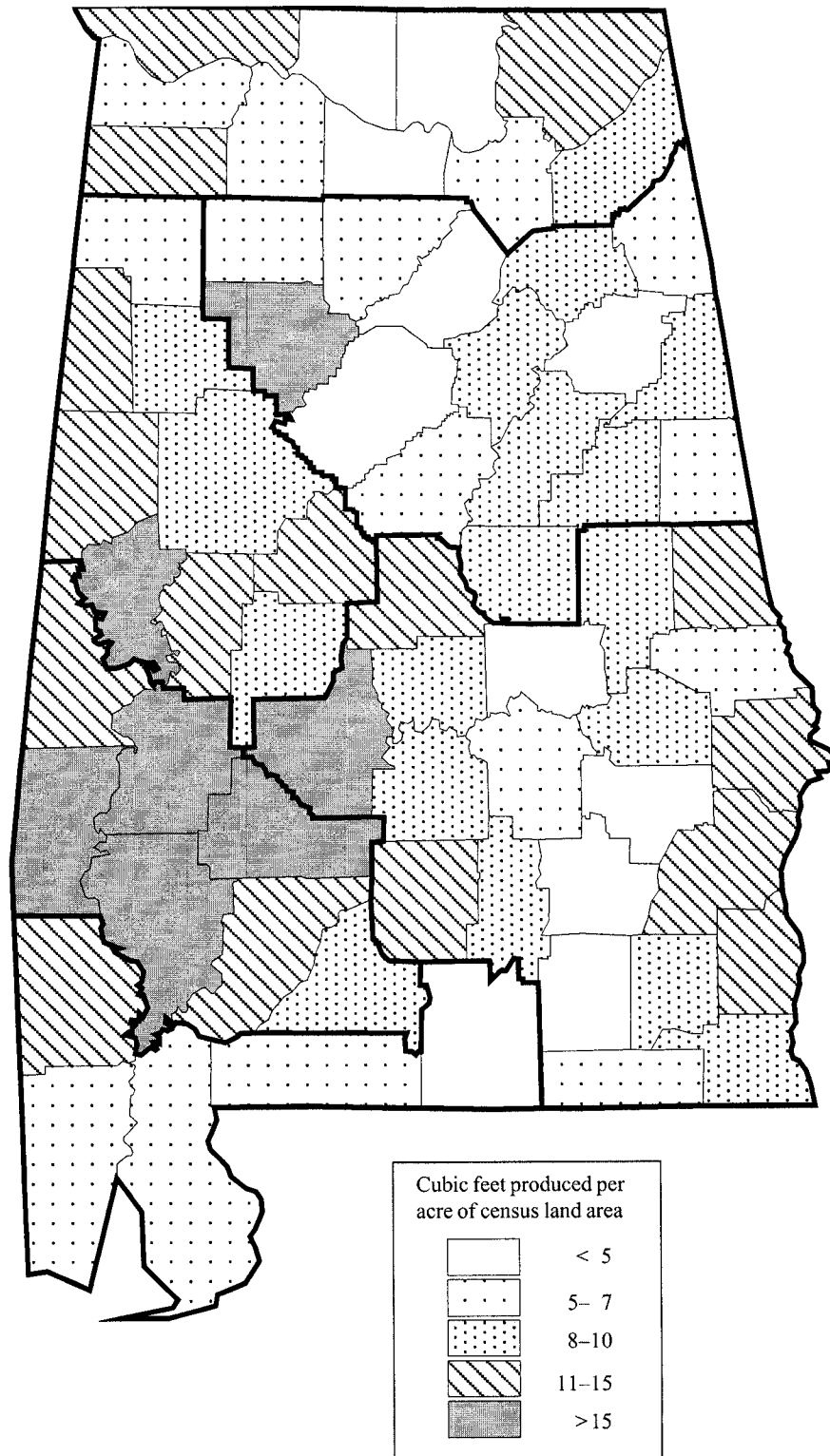


Figure 4—Intensity of roundwood hardwood output for all industrial products in Alabama by county, 1999.

Pulpwood and saw logs were the principal roundwood products in 1999. Combined output of these products totaled 1.07 billion cubic feet and accounted for 88 percent of Alabama's total roundwood output.

Saw logs accounted for 35 percent of the State's total roundwood products.

Roundwood harvested for other industrial uses, such as poles, posts, mulch, firewood, composite panels, and all other industrial products, declined 8 percent to 35 million cubic feet. Other industrial product volume accounted for 3 percent of the State's total TPO volume. Softwood made up 99 percent of the other industrial product volume.

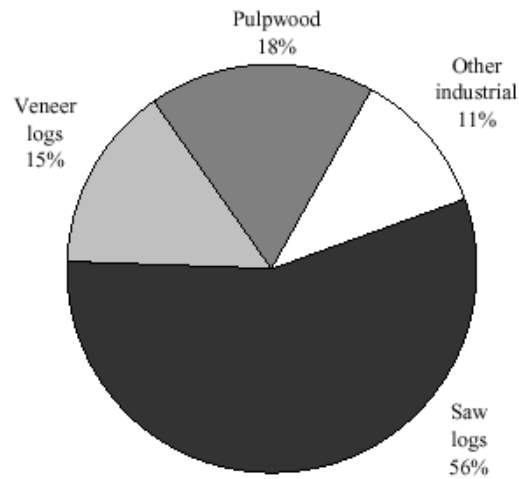
- The number of primary processing plants was 181. Total receipts amounted to 1.3 billion cubic feet
- In 1999, Alabama had 121 sawmills, a net loss of 24 mills since 1997
- Fifteen pulp mill facilities were operating and receiving roundwood in Alabama in 1999, one fewer than in 1997.
- Twenty-three veneer mills were operating in Alabama in 1999.
- A total of 22 plants produced other industrial products in 1999.

Plant Byproducts

In 1999, processing of primary products in Alabama mills generated 469 million cubic feet of wood and bark residues. Coarse residues from all primary products were 172 million cubic feet, while bark volume totaled 168 million cubic feet. Sawdust and shavings made up 28 percent of total residues, or 129 million cubic feet.

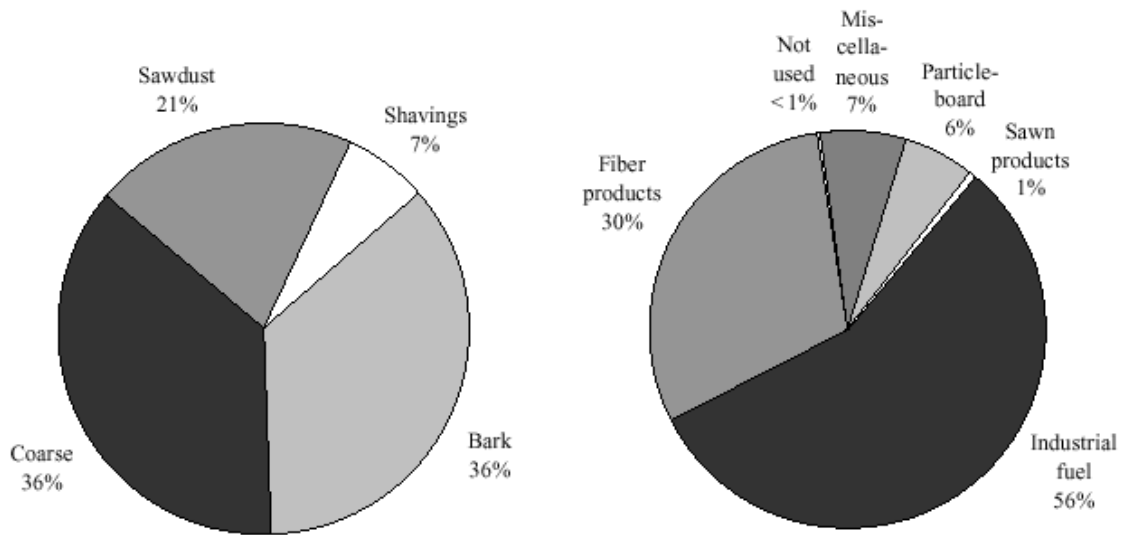
Virtually all of the wood and bark residues were used for a product; less than 1 percent was not used, while 56 percent of the residues were used for industrial fuel. More than 137 million cubic feet, or 80 percent, of the coarse residues were used to manufacture fiber products. Most of the bark was used for industrial fuel or other miscellaneous products, while 68 percent of the sawdust and shavings were used for industrial fuel.

The processing of saw logs generated 263 million cubic feet of mill residues, accounting for 56 percent of the total residues produced.



Total 469 million cubic feet

Figure 12—Primary mill residue produced by roundwood type, 1999.



Total 469 million cubic feet

Figure 10—Primary mill residue by residue type, 1999.

Total 469 million cubic feet

Figure 11—Disposal of residue by product, 1999.

Alabama Wood Biomass Availability⁷

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Alabama are 1,373,000 and 7,802,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Alabama is 1,899,000 dry tons per year.

⁷ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=AL

Arkansas⁸

In 1999, roundwood output from Arkansas' forests totaled 692 million cubic feet. Mill byproducts generated from primary manufacturers were 290 million cubic feet. Almost all plant residues were used, primarily for fuel and fiber products. Saw logs were the leading roundwood product at 320 million cubic feet; pulpwood ranked second at 285 million cubic feet; veneer logs were third at 84 million cubic feet. The number of primary processing plants was 336 in 1999. Receipts for those mills totaled 681 million cubic feet.

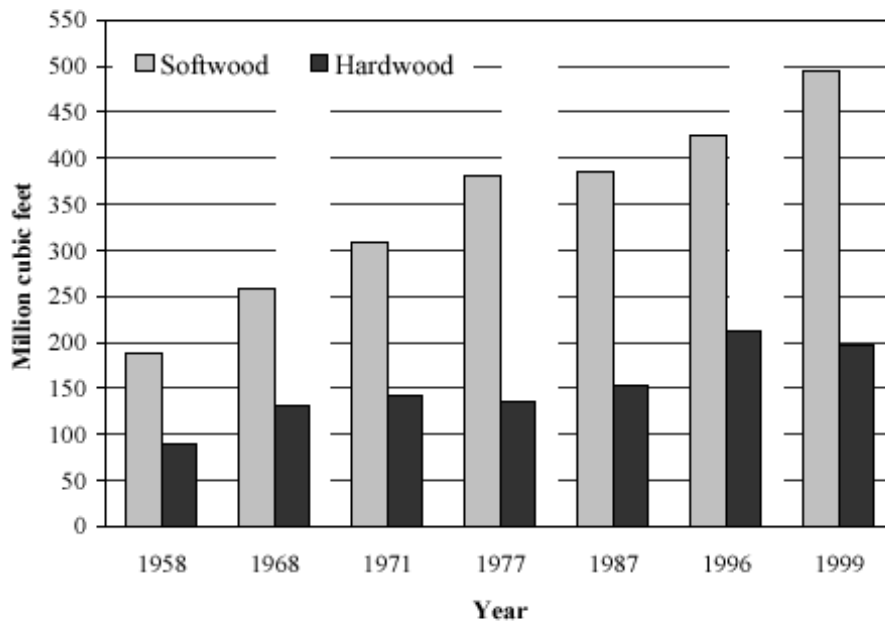


Figure 2—Roundwood production for all products by species group and year (see page 10 for references for individual years).

⁸ Bentley, James W.; Johnson, Tony G.; Howell, Michael. 2002. Arkansas' timber industry - an assessment of timber product output and use, 1999. Resour. Bull. SRS-79. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 40 p.

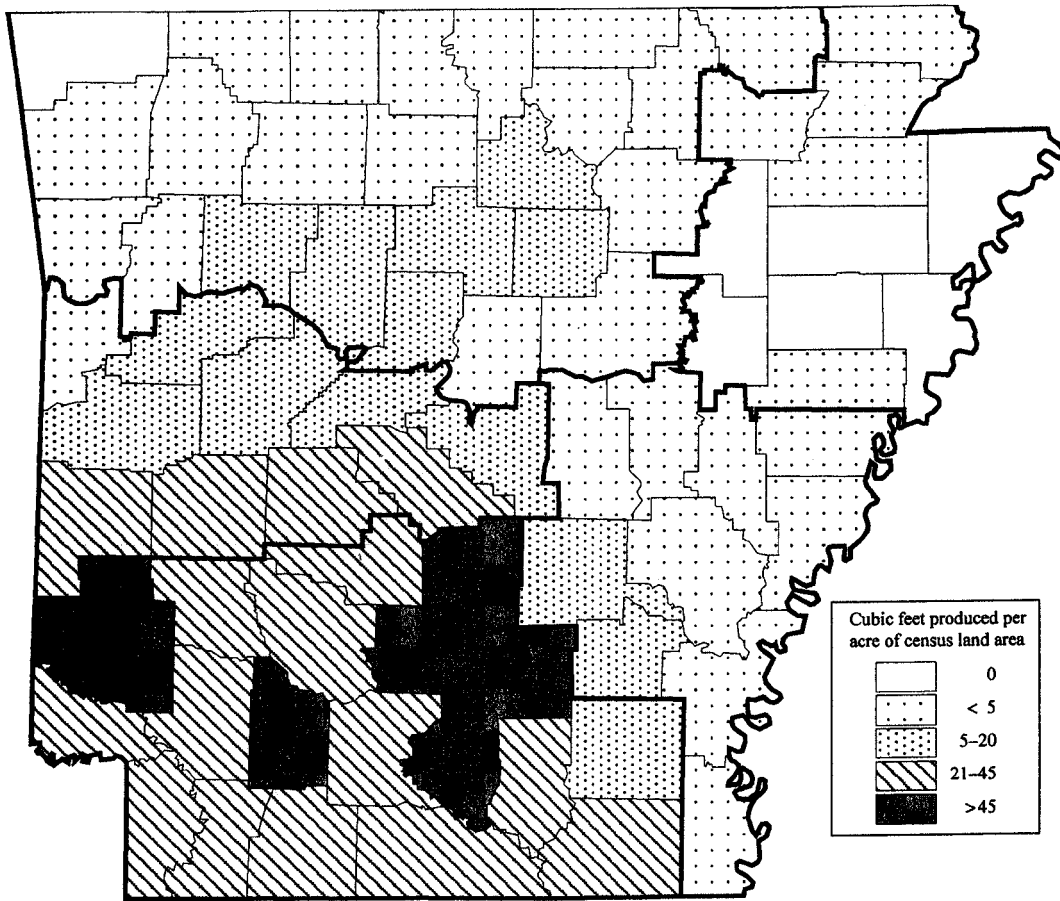


Figure 3—Intensity of roundwood softwood output for all industrial products in Arkansas by county, 1999.

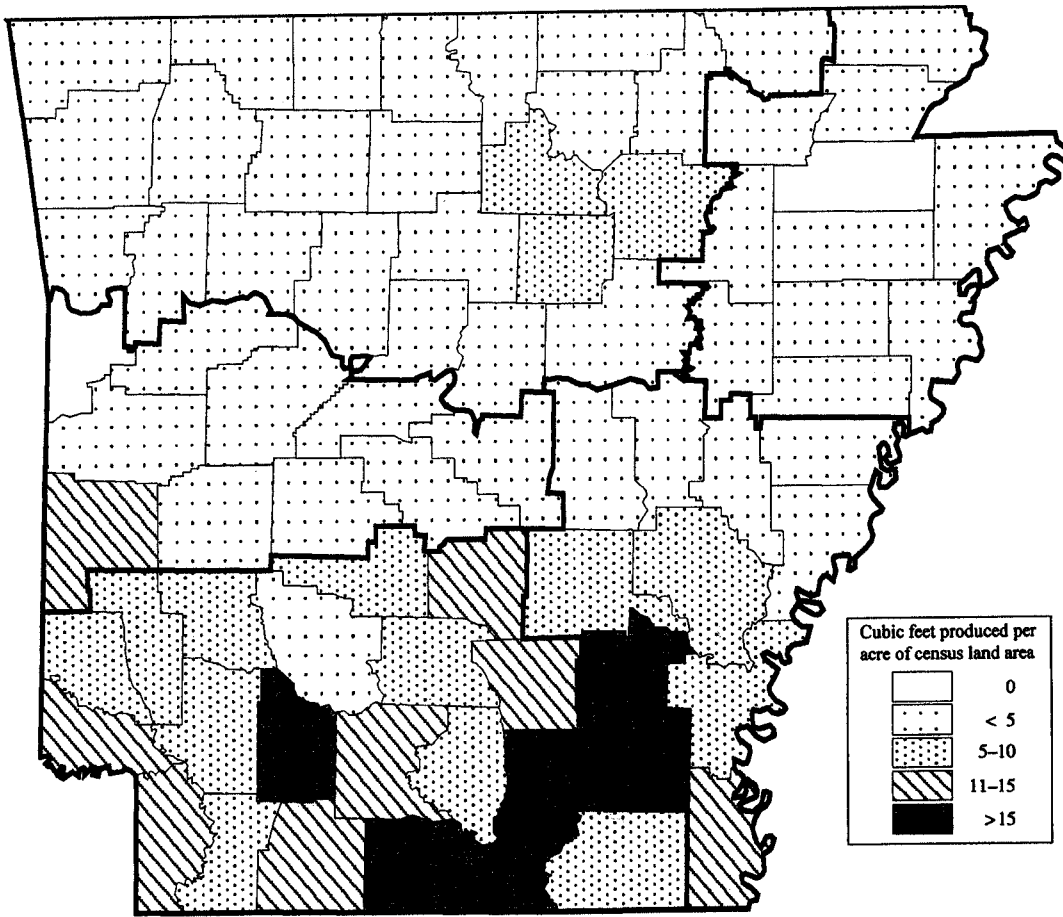


Figure 4—Intensity of roundwood hardwood output for all industrial products in Arkansas by county, 1999.

Saw logs and pulpwood were the principal roundwood products in 1999. Combined output totaled 605 million cubic feet and accounted for 87 percent of the State's total roundwood output.

Saw logs accounted for 46 percent of the State's total roundwood products.

Roundwood harvested for other industrial uses such as poles, posts, mulch, firewood, logs for log homes, and other industrial products, declined 36 percent to 3 million cubic feet. Softwood constituted 99 percent of the other industrial product volume.

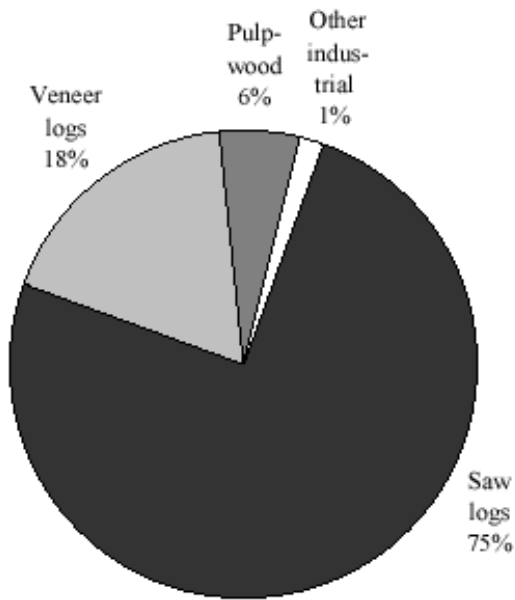
- In 1999, 128 sawmills were canvassed for this report, an increase of 1 mill since 1996. Those mills with production under 1 million board feet were not included.
- Eight pulp mills were operating and receiving roundwood in 1999, the same as in 1996.
- Between 1996 and 1999, the number of veneer mills operating in Arkansas remained at 10.
- Ten plants manufactured other industrial products.

Plant Byproducts

In 1999, processing of primary products in Arkansas mills generated 290 million cubic feet of wood and bark residues. Coarse residues from all primary products amounted to 136 million cubic feet, while bark volume totaled 54 million cubic feet. Sawdust and shavings constituted 34 percent of total residues, or 100 million cubic feet.

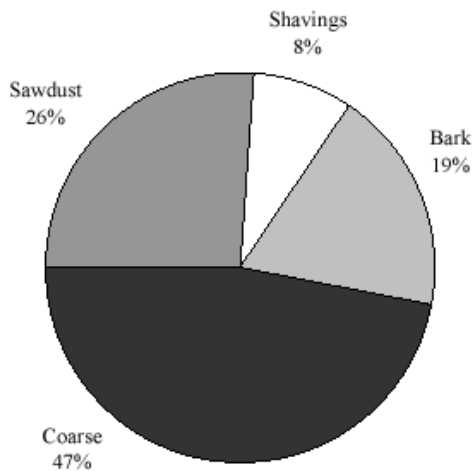
Virtually all of residues were used for a product. One hundred and nine million cubic feet, or 80 percent, of the coarse residues were used for fiber products. Most bark was used as industrial fuel or miscellaneous products, while 79 percent of the sawdust and shavings was used for industrial fuel.

The processing of saw logs generated 217 million cubic feet of residue, accounting for 75 percent of the total residue produced.



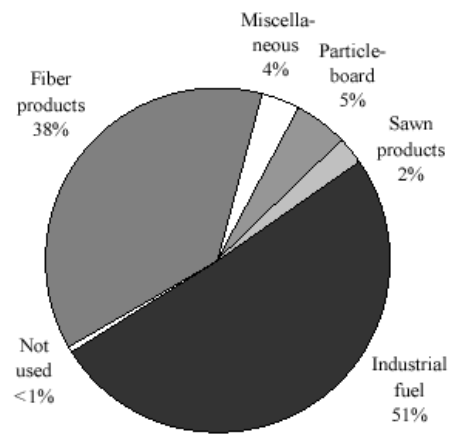
Total 290 million cubic feet

Figure 12—Primary mill residue produced by roundwood type, 1999.



Total 290 million cubic feet

Figure 10—Primary mill residue by residue type, 1999.



Total 290 million cubic feet

Figure 11—Disposal of residue by product, 1999.

Arkansas Wood Biomass Availability⁹

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Arkansas are 667,000 and 4,705,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Arkansas is 1,738,000 dry tons per year.

⁹ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=AR

Florida¹⁰

In 1999, volume of roundwood output from Florida's forests totaled 499 million cubic feet, 4 percent less than in 1997. Mill byproducts generated from primary manufacturers decreased to 152 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 261 million cubic feet; saw logs ranked second at 167 million cubic feet; veneer logs were third at 34 million cubic feet. Total receipts declined 7 percent to 494 million cubic feet. The number of primary processing plants declined from 101 in 1997 to 93 in 1999.

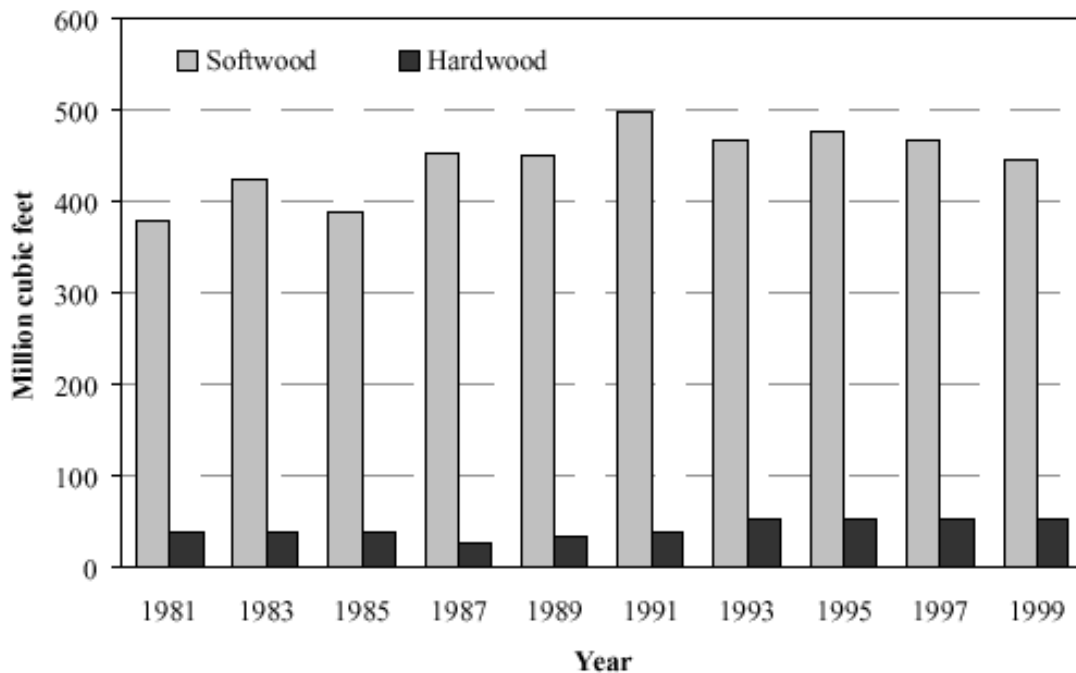


Figure 2—Roundwood production for all products by species group and year (see page 10 for references for individual years).

¹⁰ Bentley, James W.; Johnson, Tony G.; Ford, Eric. 2002. Florida's timber industry - an assessment of timber product output and use, 1999. Resour. Bull. SRS-77. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 37 p.

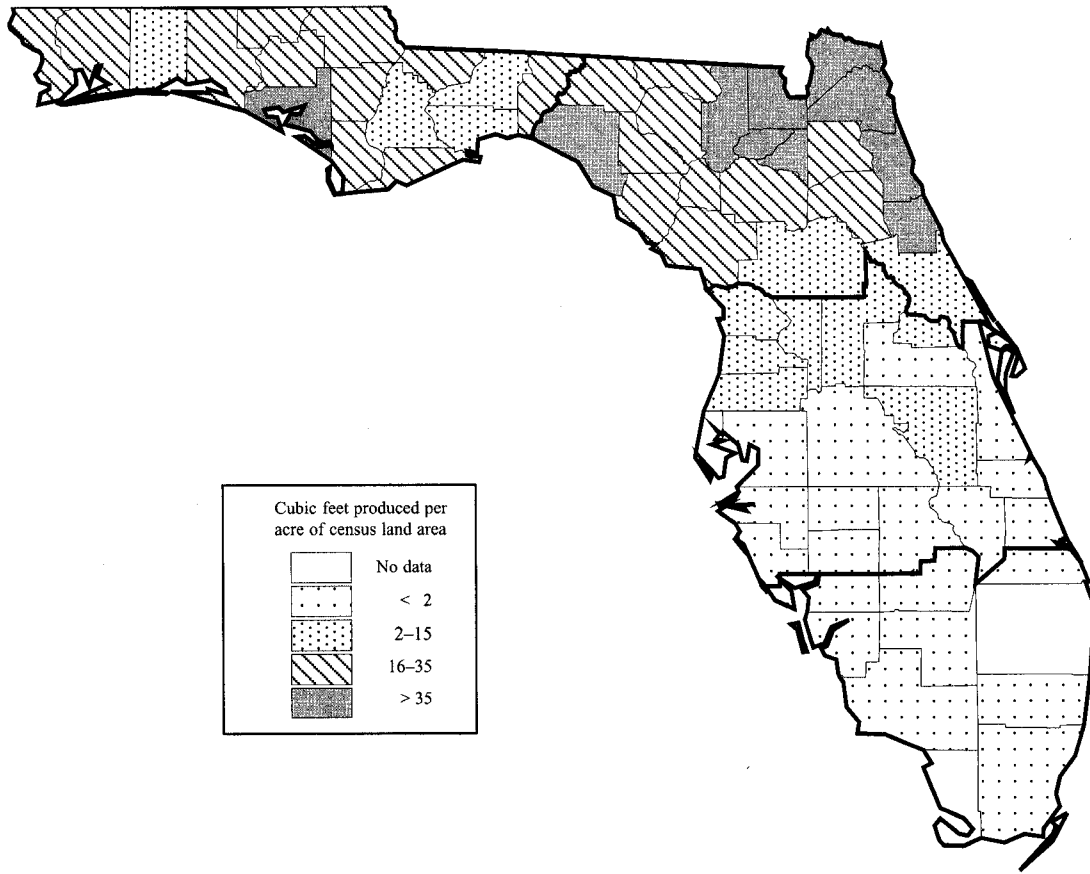


Figure 3—Intensity of roundwood softwood output for all industrial products in Florida by county, 1999.

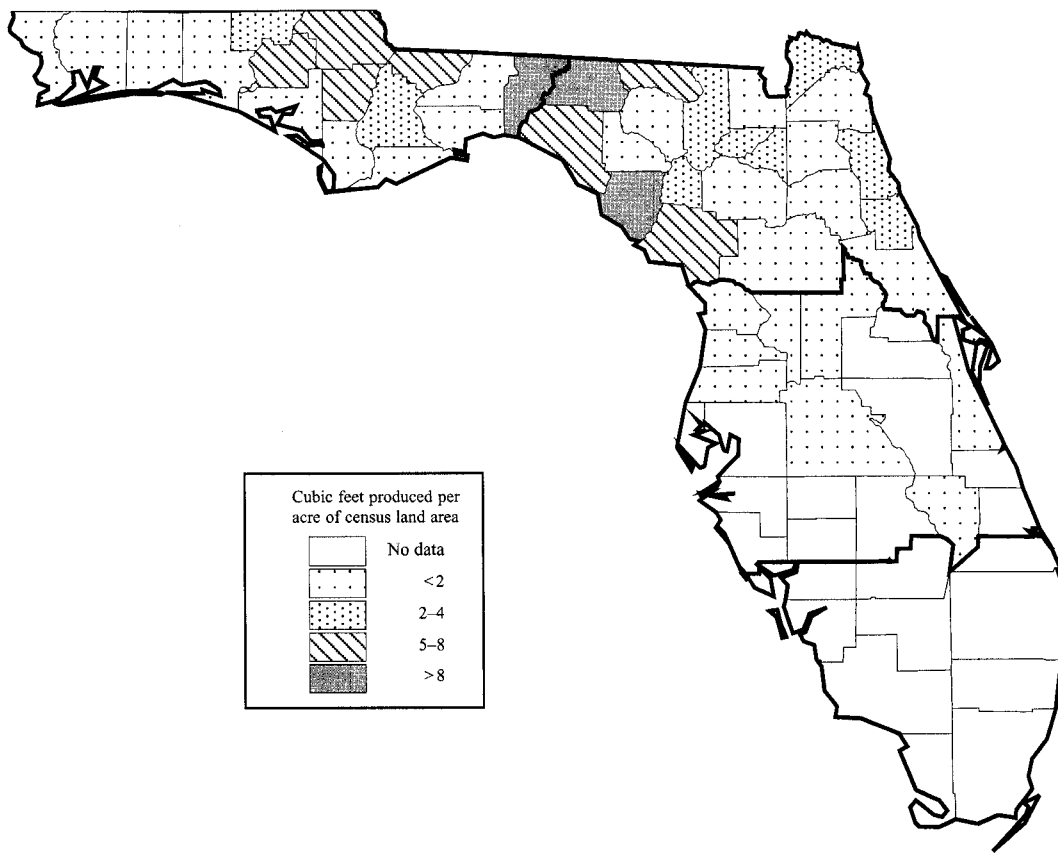


Figure 4—Intensity of roundwood hardwood output for all industrial products in Florida by county, 1999.

Pulpwood and saw logs were the principal roundwood products in 1999. Combined output of these products totaled 429 million cubic feet and accounted for 86 percent of Florida's total roundwood output.

Saw logs accounted for 34 percent of the State's total roundwood products.

Roundwood harvested for other industrial uses, such as poles, posts, mulch, firewood, logs for log homes, and all other industrial products, declined 10 percent to 29 million cubic feet. Softwood made up 98 percent of the other industrial products.

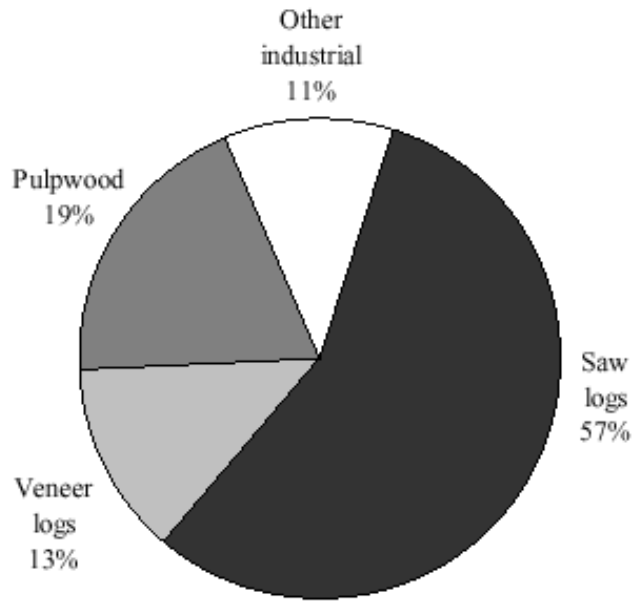
- The number of primary roundwood-using plants in Florida declined from 101 in 1997 to 93 in 1999.
- In 1999, Florida had 53 sawmills, a loss of 5 mills since 1997.
- Six pulp mills were operating and using roundwood in Florida in 1999, two fewer than in 1997.
- The number of veneer mills operating in Florida dropped from five in 1997 to four in 1999.
- Between 1997 and 1999, the number of plants producing other industrial products remained at 30.

Plant Byproducts

In 1999, processing of primary products in Florida mills generated 152 million cubic feet of wood and bark residues. Coarse residues from all primary products amounted to 56 million cubic feet, and bark volume totaled 52 million cubic feet. Sawdust and shavings made up 29 percent of total residues, or 44 million cubic feet.

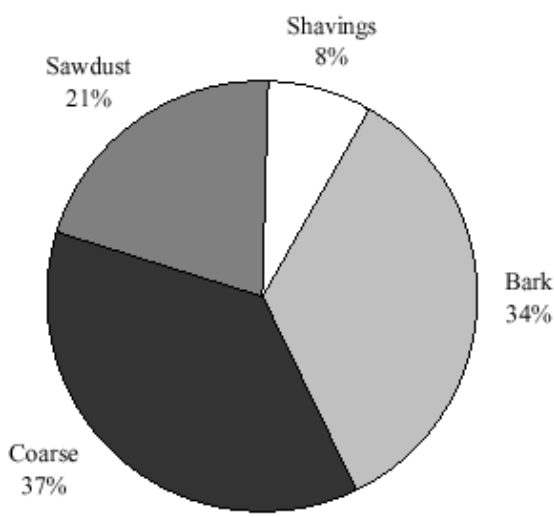
Virtually all residues were used for a product. Forty-five million cubic feet, or 80 percent, of the coarse residues were used to manufacture fiber products. Most of the bark was used for industrial fuel or other miscellaneous products, and 67 percent of the sawdust and shavings was used for industrial fuel.

The processing of saw logs generated 85 million cubic feet of mill residues, accounting for 56 percent of the total residues produced.



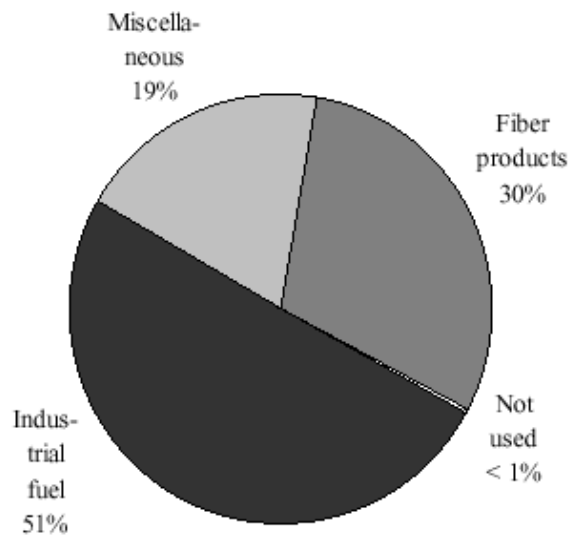
Total 152 million cubic feet

Figure 12—Primary mill residue produced by roundwood type, 1999.



Total 152 million cubic feet

Figure 10—Primary mill residue by residue type, 1999.



Total 152 million cubic feet

Figure 11—Disposal of residue by product, 1999.

Florida Wood Biomass Availability¹¹

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Florida are 4,597,000 and 2,678,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Florida is 976,000 dry tons per year.

¹¹ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=FL

Georgia¹²

In 1999, industrial roundwood output from Georgia's forests totaled 1.24 billion cubic feet, 3 percent less than in 1997. Mill byproducts generated from primary manufacturers declined 1 percent to 474 million cubic feet. Almost all plant residues were used, primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 594 million cubic feet; saw logs ranked second at 509 million cubic feet; veneer logs were third at 75 million cubic feet. The number of primary processing plants increased from 186 in 1997 to 188 in 1999. Total receipts declined 7 percent to 1.3 billion cubic feet.

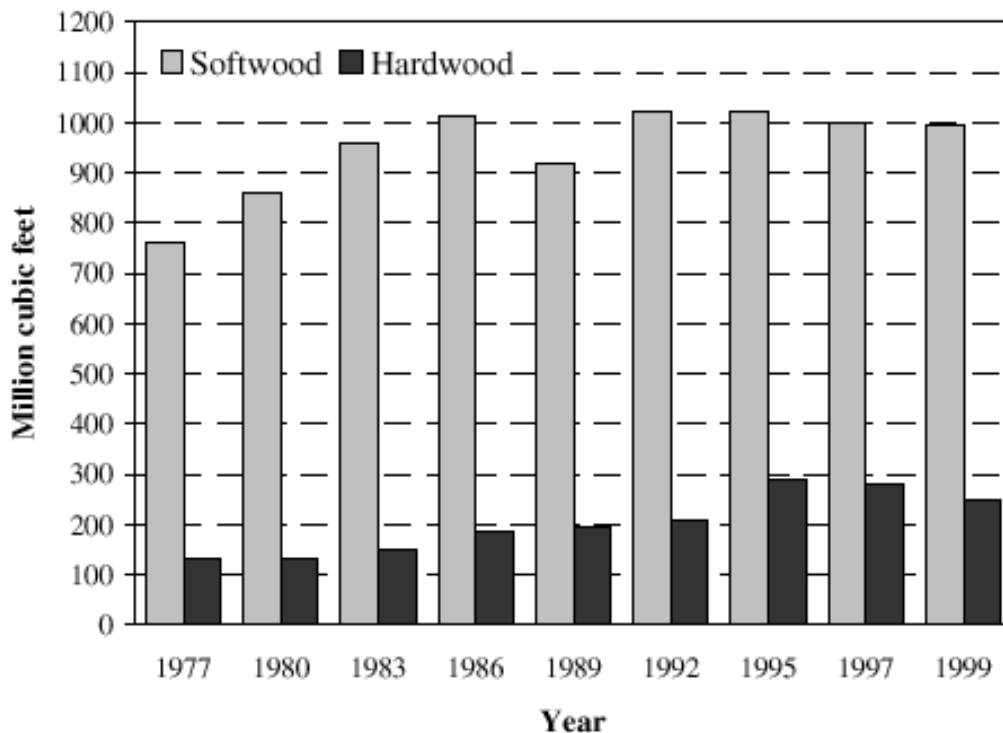


Figure 2—Roundwood production for all products by species group and year (see page 10 for references for individual years).

¹² Johnson, Tony G.; Wells, John L. 2002. Georgia's timber industry - an assessment of timber product output and use, 1999. Resour. Bull. SRS-68. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 40 p.

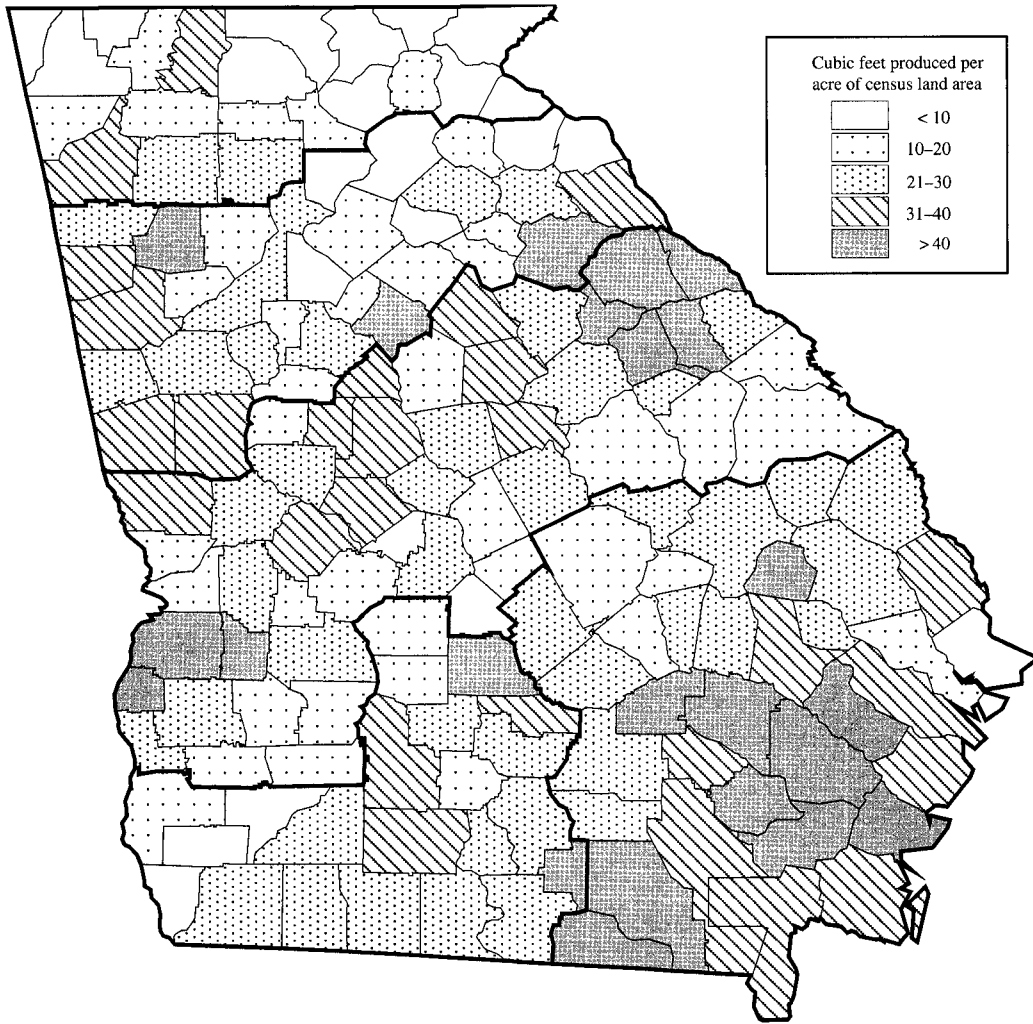


Figure 3—Intensity of roundwood softwood output for all industrial products in Georgia by county, 1999.

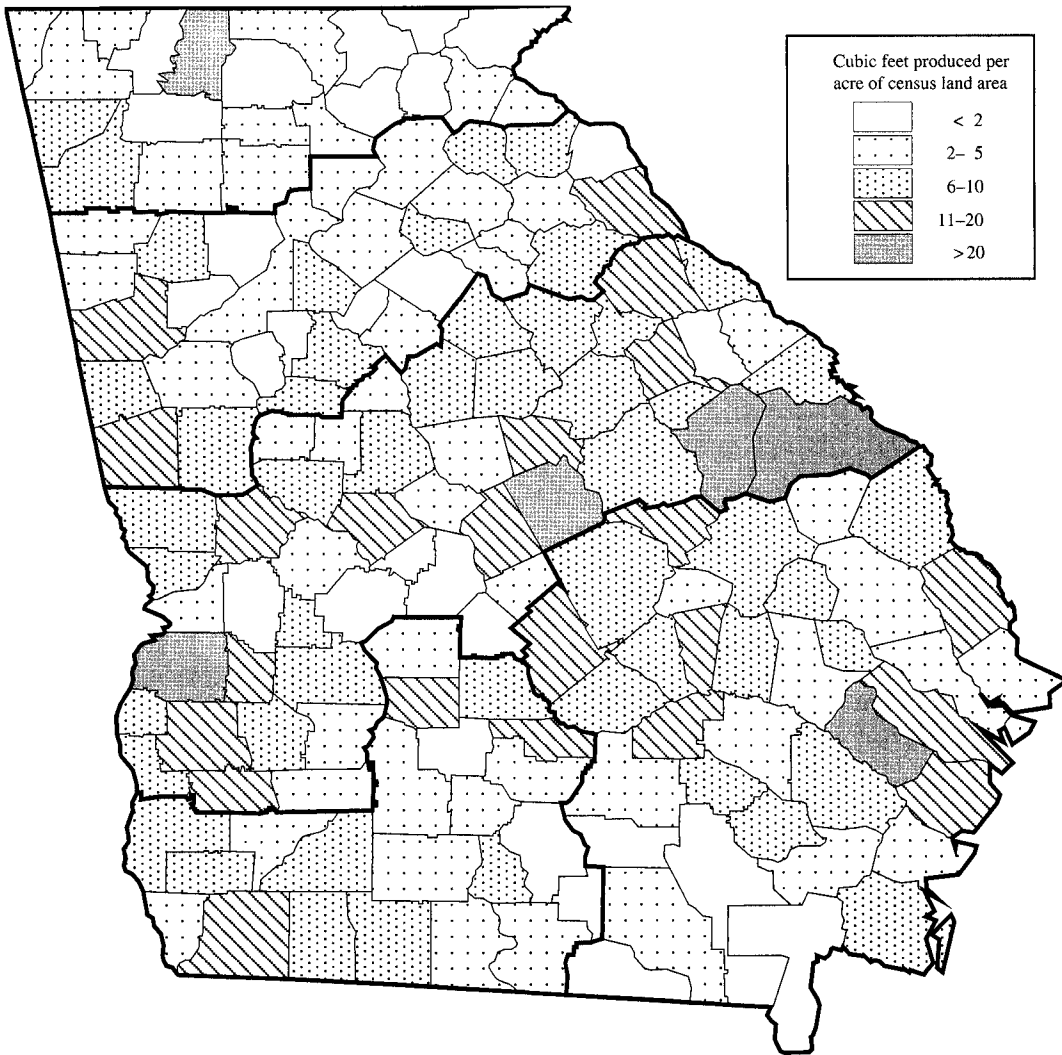


Figure 4—Intensity of roundwood hardwood output for all industrial products in Georgia by county, 1999.

Pulpwood and saw logs products were the principal products produced in 1999. Combined output of these two products totaled 1.1 billion cubic feet and accounted for 89 percent of the State's total industrial roundwood output.

Saw logs accounted for 41 percent of the State's total roundwood products.

Roundwood harvested for other industrial uses such as poles, posts, mulch, firewood, logs for log homes, and all other industrial products totaled 21 million cubic feet, a 24 percent increase from 1997. Softwood made up 96 percent of the other industrial products volume.

- Georgia currently has 129 sawmills, the same as in 1997. This does not include numerous one-man operations.
- Twelve pulp mill facilities were operating and receiving roundwood in Georgia in 1999, one less than in 1997.
- The number of veneer mills operating in Georgia increased from 11 to 12 since 1997.
- The number of plants producing other industrial products increased from 28 to 31 since 1997.

Plant Byproducts

In 1999, processing of primary products in Georgia mills generated 483 million cubic feet of wood and bark residues. Coarse residues from all primary products amounted to 193 million cubic feet, while bark volume totaled 145 million cubic feet. Collectively, sawdust and shavings made up 30 percent of total residues, or 145 million cubic feet.

More than 474 million cubic feet, or 98 percent, of the wood and bark residues were used for a product. While 2 percent of the residues were not used for a product, 39 percent of the residues were used for industrial fuel and 35 percent were used for fiber products. More than 160 million cubic feet, or 83 percent, of the coarse residues were used for fiber products. Most of the bark was used for industrial fuel or other miscellaneous products, while 46 percent of the sawdust and shavings were used for industrial fuel.

The processing of saw logs generated 324 million cubic feet of mill residues, accounting for 67 percent of the total residues produced.

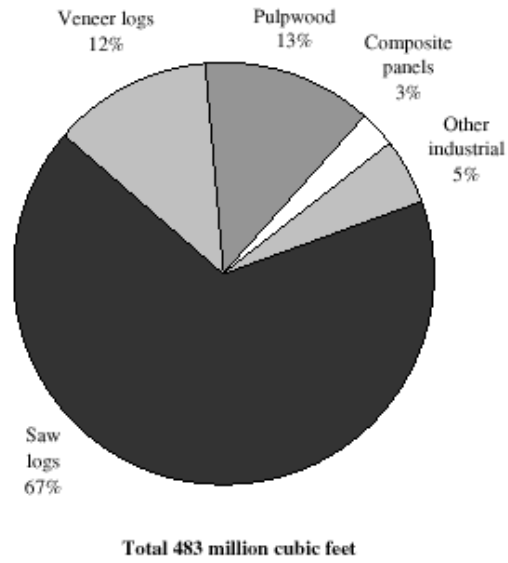


Figure 12—Primary mill residue produced by roundwood type, 1999.

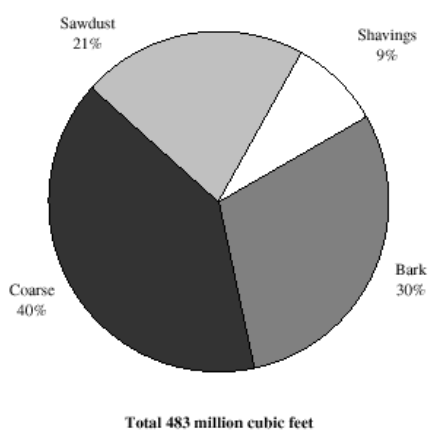


Figure 10—Primary mill residue by residue type, 1999.

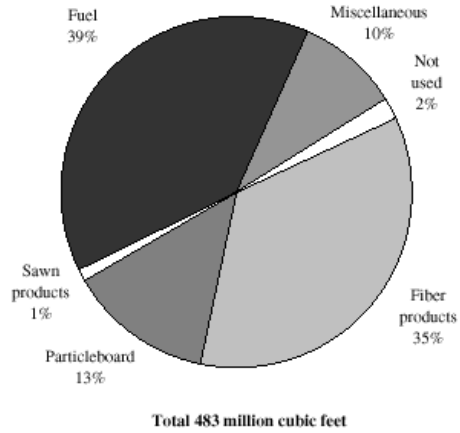


Figure 11—Disposal of residue by product, 1999.

Georgia Wood Biomass Availability¹³

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Georgia are 1,437,000 and 7,969,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Georgia is 1,968,000 dry tons per year.

¹³ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=GA

Louisiana¹⁴

- Pulpwood and saw logs were the principal round-wood products in 1996. Combined output of these two products totaled 496 million cubic feet and accounted for 79 percent of the State's total round-wood output.
- Saw logs accounted for 29 percent of the State's total roundwood products.

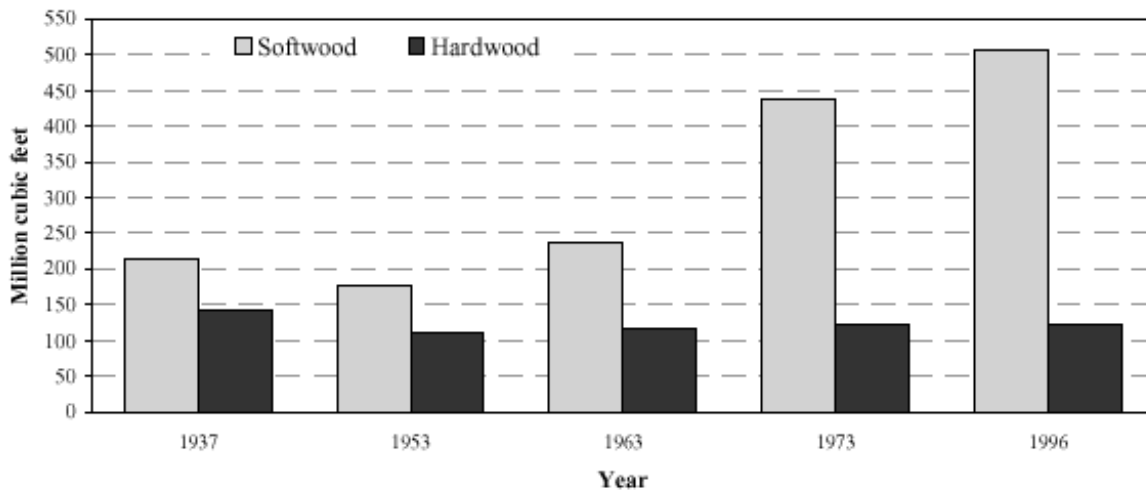


Figure 2—Roundwood production for all products, by species group and year.

- Louisiana currently has 23 sawmills. The total number picked up in this survey.
- Eleven pulp mill facilities were operating and receiving roundwood in Louisiana in 1996.
- Louisiana had 5 veneer mills operating in 1996.

Plant Byproducts

In 1996, processing of primary products in Louisiana mills generated 195 million cubic feet of wood and bark residues. Coarse residues from all primary products amounted to 69 million cubic feet, while bark volume totaled more than 72 million cubic feet.

Sawdust made up 24 percent of the residue total with 47 million cubic feet. Shavings made up four percent of total residues, or 7 million cubic feet.

Virtually most of the wood and bark residues were used for a product; 2 percent was not used, while 58 percent of the residues were used for industrial fuel. Sixty-two million cubic feet, or 90

¹⁴ Stratton, Daniel P. and Robert F. Westbrook. 1998. Louisiana's timber industry - an assessment of timber product output and use, 1999. Resour. Bull. SRS—(unpublished). Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 26 p.

percent, of the coarse residues were used for fiber products. Ninety-seven percent of the bark was used for industrial fuel, while 79 percent of the sawdust and shavings combined were used for industrial fuel.

Sawmills generated 74 million cubic feet of mill residues, accounting for 38 percent of the total residues produced.

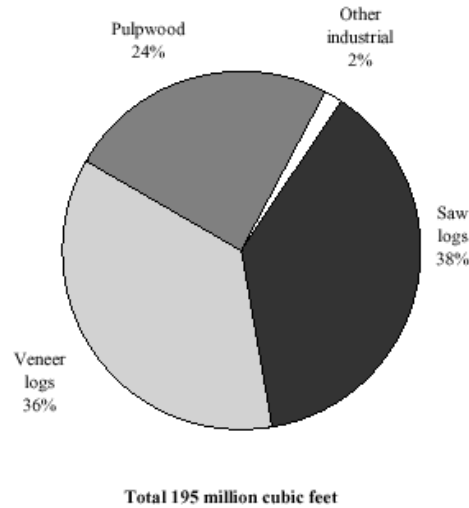


Figure 9—Primary mill residue produced by mill type.

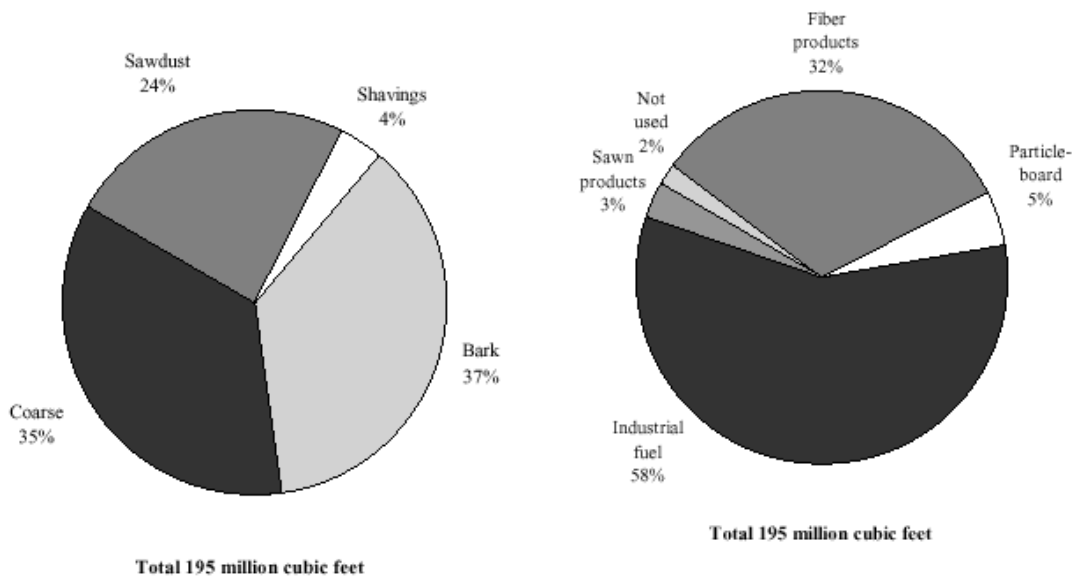


Figure 7—Primary mill residue, by residue type.

Figure 8—Disposal of residue, by product.

Louisiana Timber Resources¹⁵

- Louisiana currently has 13,783,000 acres of timberland. The predominant forest type group is oak-gum-cypress, 4,349,900 acres. The loblolly-shortleaf pine type is continuing to close the gap.
- Sawtimber stands occupy 59 percent of Louisiana's timberland.
- Removals have increased dramatically, leaving a removal-to-growth ratio of 1.27 to 1. Current removals are 669.0 million ft³ per year, up 49 percent since 1984. Hardwood removals increased 18 percent since 1984.
- A total of 4,373,500 acres of timberland underwent some form of commercial harvest since 1984.
- This is 32 percent of all Louisiana timberland.

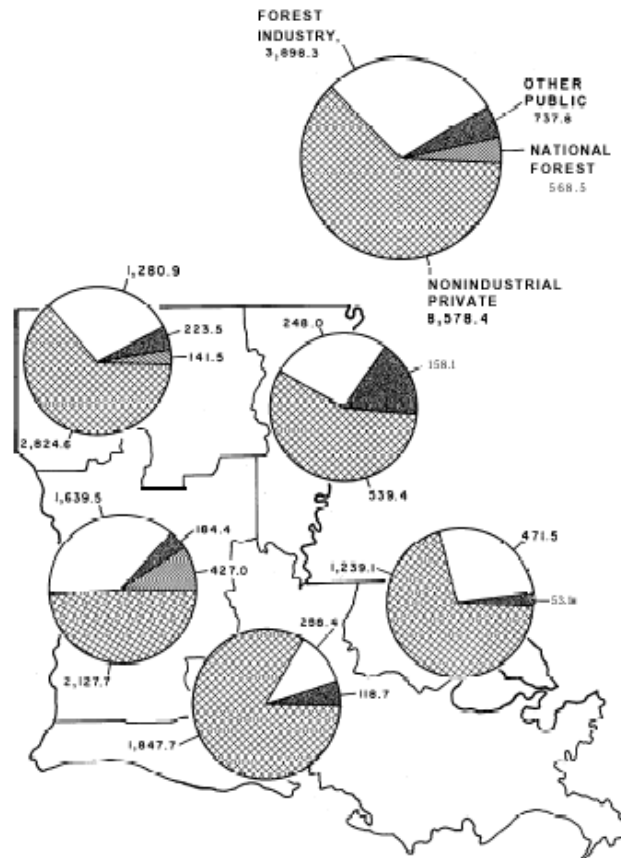


Figure 4.—Proportion of timberland, in thousand acres, by ownership, Louisiana, 1991.

¹⁵ Rosson, James F., Jr.. 1995. Forest Resources of Louisiana, 1991. USDA Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana, Resource Bulletin SO-192, June 1995

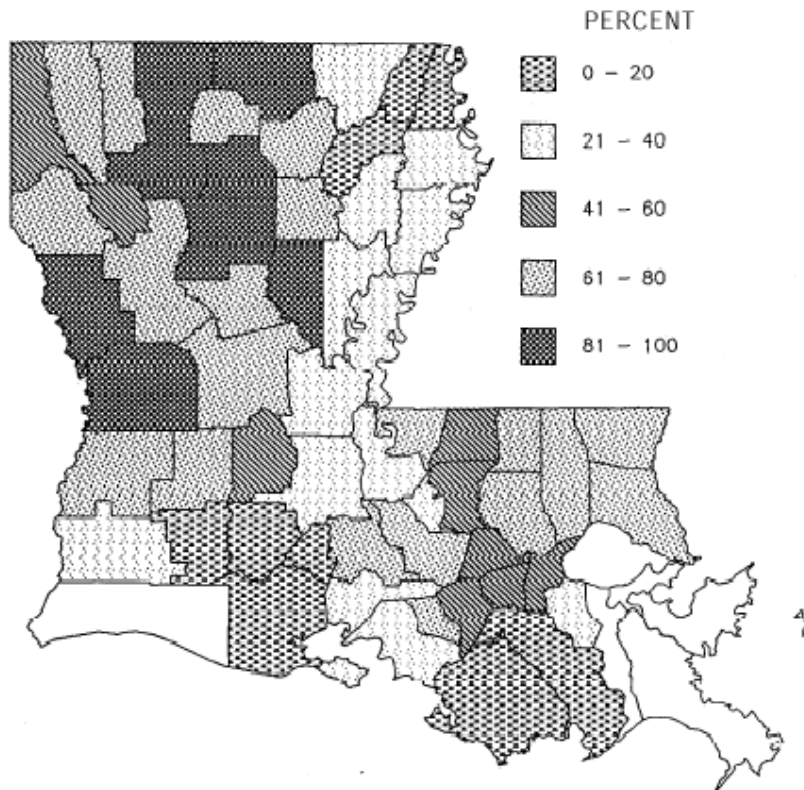
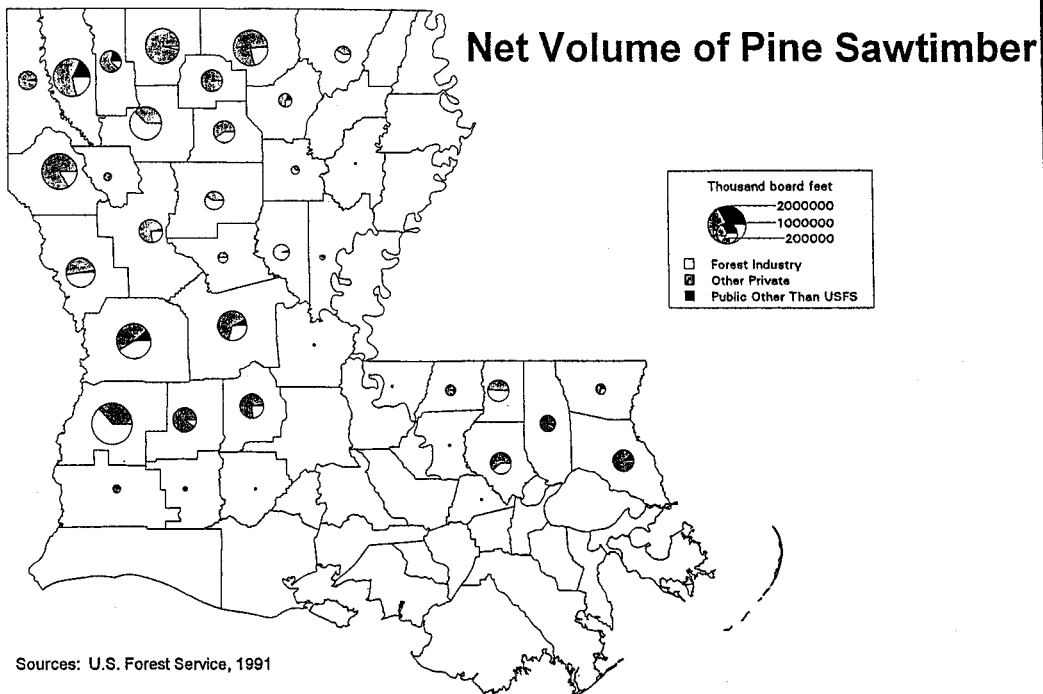


Figure 3. -Percentage of parish area in timberland, Louisiana, 1991. Parishes in white were not included in the survey.



Wood Residue¹⁶

In total, 4,706,335 tons of wood waste including bark, lumber waste, chips and sawdust, were produced in Louisiana in 1994. Of that total, 4,652,406 tons were produced and used exclusively for energy. This number includes volume in terms of dumpsters. Assuming that a dumpster hold 38 yds³, and that most of the residue is sawdust, we assumed a shaken degree of compaction and took the factor of 18.4 lbs. per ft³. This factor is taken from Utilization of the Southern Pines, by Peter Koch (U.S.D.A. 1972), page 1,556.

Only 5 firms indicated that cofiring occurred at their plant. The secondary firms reported usage of their wood residue for energy specified that the residue was used as firewood in-house. In addition, the secondary firms reported having given away unspecified volumes of horse bedding and landscaping. The residual, approximately 53,929 tons, was landfills, presumably in accordance with DEQ regulations. Hauling fees can cost as \$12 per ton.⁶ In addition to hauling rates there are tipping fees. If the residue is clean, tipping fees cost approximately \$8 per yd³. Contaminated residue can cost up to \$54 per yd³.

Most of the tonnage available for sale or the landfill is located in Union, Livingston, Beauregard and Allen parishes.

The primary processors generate most of the wood residue in the state and most of that residue is used as feedstock for energy.

However, almost none of the wood residue produced by the secondary industry is utilized. We can speculate that the entire population of secondary processors probably generates 80,742 tons of wood residue annually.

Unlike the secondary processor population, 61 % of the primary processor population responded to the survey. But, of the 61 %, most of the respondents were the well known large-scale primary processors. The survey captured an estimated 75 % of the primary processor production. Hence, not only do their reported tonnages account for most of the total large scale primary processors, but it can be inferred that the survey information contains most of the total primary processor population biomass tonnage.

To estimate the total amount of wood residue generated by primary processors, the reported tonnage of 4,685,087 can be multiplied by 1.64 to arrive at 7,683,542.68 tons to estimate the primary processor population's biomass production.

It is possible that these figures underestimate the total amount of wood residue being generated by primary processors. Many of the small processors are suspicious of university generated surveys and do not want to reveal the true scope of their waste disposal challenges. When a company submitted suspiciously low data, our team made informal personal visits to obtain more accurate data. The larger mills have generally utilized most of their own wood residues. The smaller mills typically have contracts to sell their wood residues to paper mills (for both pulp and fuel).

¹⁶ Chang, Sun, Niels deHoop and Susan Kleit. 1994. Survey and Mapping of Biomass Energy Users and Producers in Louisiana. Tennessee Valley Authority. Environmental Research Center. Muscle Shoals, Alabama. August.

The total amount of wood residue generated by the secondary industry is small because the industry is very small. Louisiana's ratio of value-added is \$0.11 per \$1 of lumber produced, compared to Mississippi (\$0.78), Tennessee (\$1.33) and Alabama (\$0.52). The largest one in the state, Acadian Wood Products, Lafayette, has about 100 employees. This would be considered a small operation in many other states. The secondary industry in Louisiana is highly fragmented. A few more firms have about 30 employees. But the majority of the industry (75 %) have 10 or fewer employees.'

Processors who do not efficiently use their residue (burn or sell) are sometimes impeded by lack of information. They are oftentimes situated far from large pulp mills that use wood residue for a feedstock. Because there has been little innovation by entrepreneurs to exploit this potentially free material for other uses, processors often pay waste management companies to haul the waste away to a landfill. Some secondary millers report they pay about \$500 per week in hauling and tipping fees.

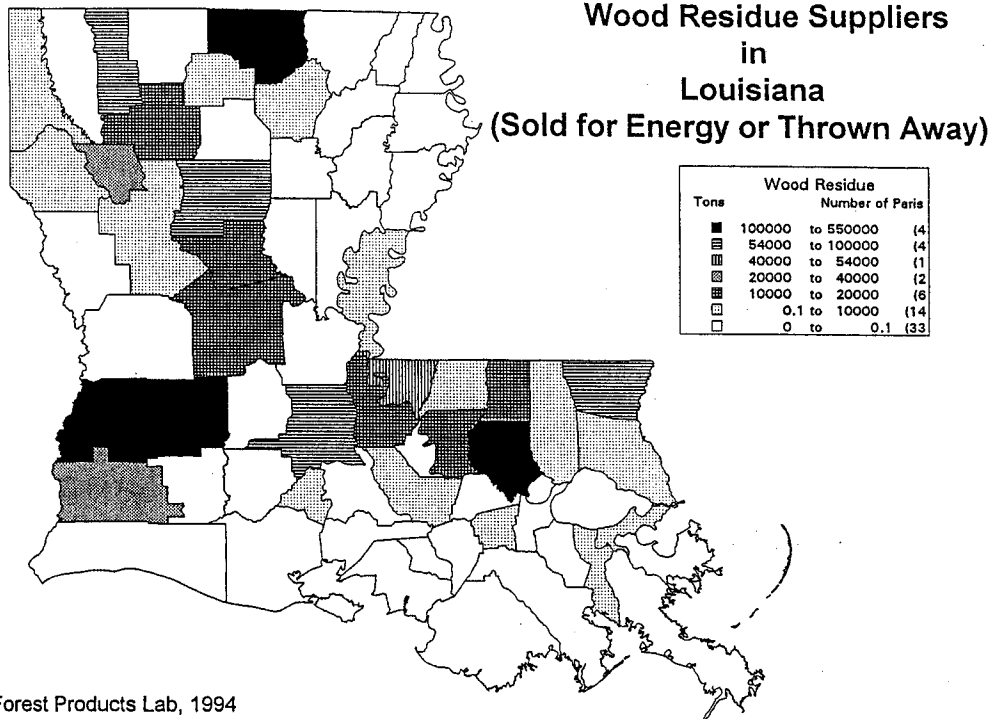
Study Conclusions

- An estimated 7.8 million tons of wood residue is generated annually, of which 7.6 millions are utilized. This is in addition to wood that is chipped for pulp/paper (Pulp chips are not longer considered a residue material in the industry).
- The primary forest products industry (sawmills, plywood, etc.) produced 7.68 million tons of wood residues, of which 7.63 million are utilized. The larger mills typically burn their own wood residue for dryers, hot presses, kilns or electrical cogeneration. Excesses are typically sold to a pulp/paper mill that cogenerates.
- The smaller sawmills that have no lumber kilns have relatively low energy needs. They typically sell all the wood residue that they can to a pulp/paper mill that cogenerates. The prices that they get for wood residue is equal to the transportation cost at best. The incentive for such operators to sell their residues (mostly bark and sawdust) is to prevent the material from piling up on the property. Annually, 54,000 tons of wood residue produced by the primary industry goes unutilized. This material is green (high moisture content).
- The development of manufacturing facilities that utilize wood residues should be encouraged in Louisiana. Possibilities include particleboard (there is currently one in northern Louisiana), fibreboard, urethane board, wood alcohol, beverage flavoring and other chemical facilities.
- The secondary forest products industry (cabinets, furniture, etc.) is very small in Louisiana but wastes nearly all of its 81,000 tons of wood residues. This is an economic burden to most operators since they are typically located on small properties and must landfill all of their waste. These operators are also too small to interest the large pulp/paper mills in contracts to vend wood residues.

Unused Wood Residue: How Much Is Out There? Table 1 outlines the estimates for both wood residue that is used and unused. An estimated 134,000 tons are unused each year. This figure was gleaned by the sample of responses.

Aggregates of Wood Residue Produced, Used and Wasted in Louisiana

	Data from sample	Estimated Population
Total Produced	4,706,335	7,764,285.08
Total produced by primaries	4,685,087	7,683,542.68
Total produced by secondaries	21,248	80,742.4
Total Tons Not Used	53,929	134,324.12
Tons wasted by primary	32,688	53,608.32
Tons wasted by secondary	21,241	80,715.8
Total Tons Used	4,652,406	7,629,960.96
Tons Used by primary	4,652,399	7,629,934.36
Tons Used by secondary	7	26.6



Source: Louisiana Forest Products Lab, 1994

Wood Residue Supplies Within a 40 Mile Radius

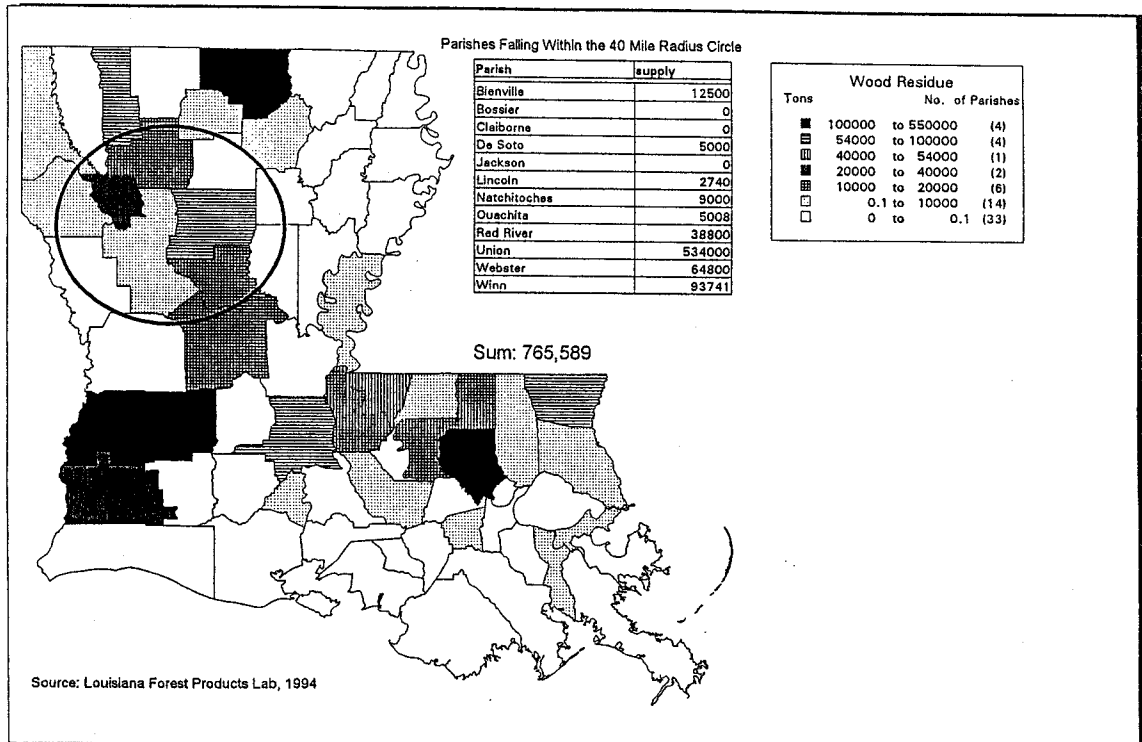


Figure 1 Wood Residue Supplies Within a 40 Mile Radius of Saline Lake

Louisiana Wood Biomass Availability¹⁷

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Louisiana are 754,000 and 3,245,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Louisiana is 1,642,000 dry tons per year.

¹⁷ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=LA

Mississippi¹⁸

In 1995, roundwood output from Mississippi's forests totaled 1.0 billion cubic feet. Mill byproducts generated from primary manufacturers were 357 million cubic feet. Almost all plant residue was used primarily for fuel and fiber products. Saw logs were the leading roundwood product at 493 million cubic feet; pulpwood ranked second at 454 million cubic feet; veneer logs were third at 63 million cubic feet. There were 105 primary processing plants operating in Mississippi in 1995. Receipts totaled 878 million cubic feet.

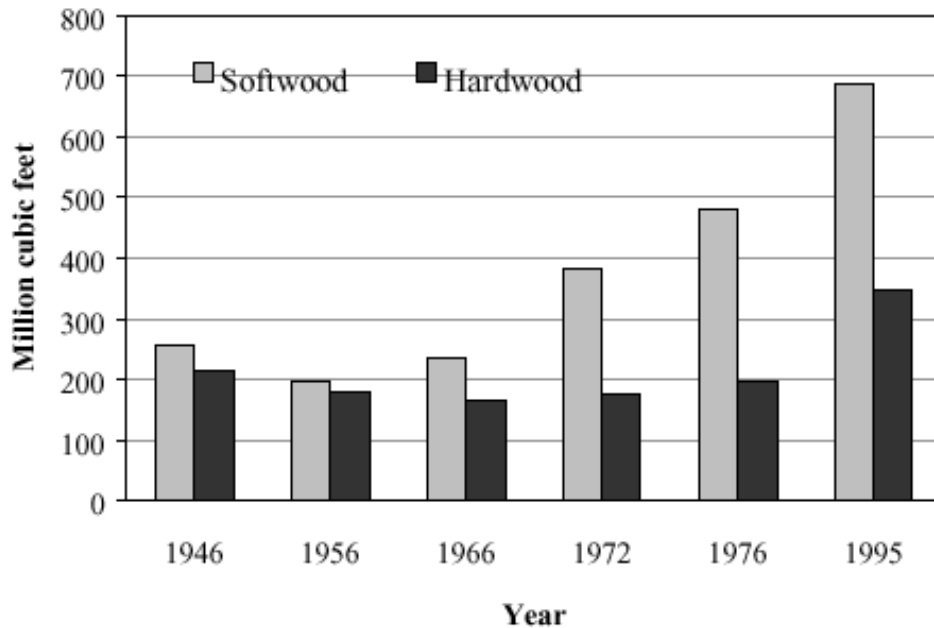


Figure 2—Roundwood production for all products by species group and year (see references on page 7 for individual years).

¹⁸ Stratton, Daniel P.; Howell, Michael; Rometry, Randal. 1998. Mississippi's timber industry and assessment of timber product output and use, 1995. Resource Bulletin SRS-29. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 23 p.

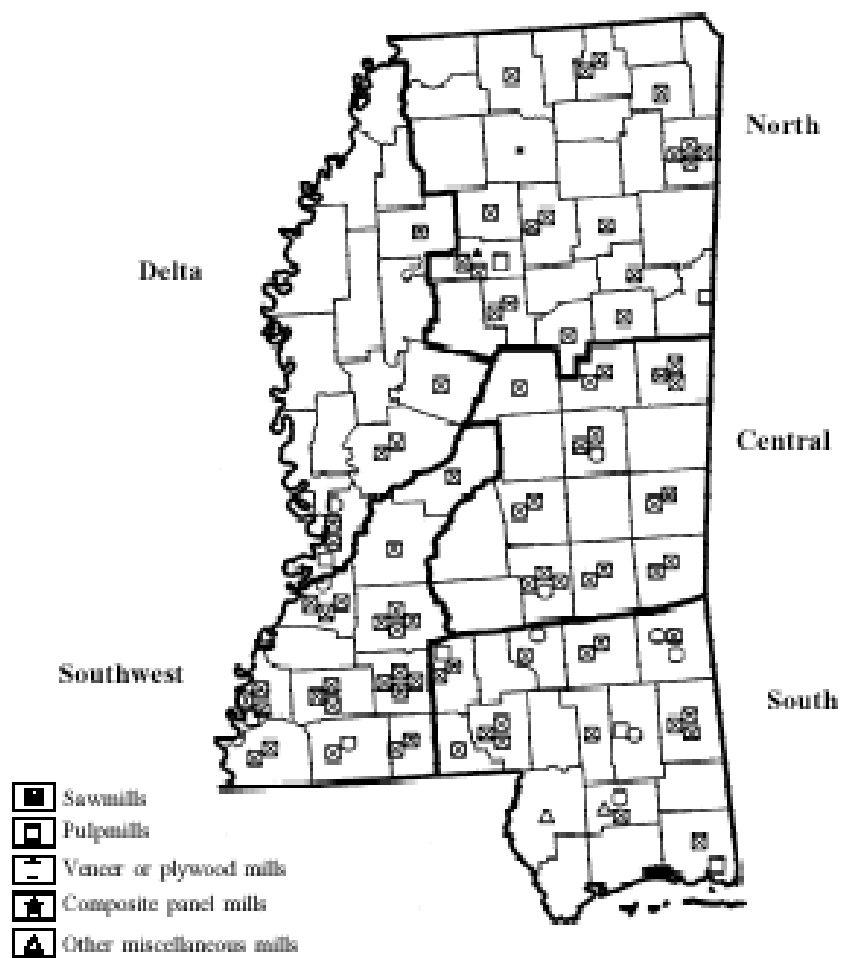


Figure 11—Primary wood-using mills by region, 1993.

Pulpwood and saw logs were the principal roundwood products in 1995. Combined, they totaled 946 million cubic feet and accounted for 92 percent of the State's total roundwood output.

Softwood saw logs accounted for 48 percent of the State's total roundwood products.

Roundwood harvested for other industrial uses such as poles, posts, mulch, and other industrial products totaled more than 1 million cubic feet. Softwood constituted 100 percent of the other industrial product volume.

- In 1995, Mississippi had 84 sawmills. The total number of sawmills did not include sawmills with fewer than 10 employees.
- Seven pulp mill facilities were operating and receiving roundwood in 1995.
- Mississippi had 10 veneer mills operating in 1995.
- There were two composite panel mills operating in Mississippi.
- There were two plants producing other industrial products in Mississippi.

Plant Byproducts

The manufacture of primary products in Mississippi mills generated more than 365 million cubic feet of wood and bark residues. Coarse residues from all primary products were more than 138 million cubic feet, while bark volume totaled more than 91 million cubic feet. Sawdust and shavings constituted 37 percent of total residues, or 136 million cubic feet.

Virtually all of the wood and bark residues were used in product manufacture; 2 percent was not used. Fifty-one percent was used for industrial fuel. One hundred thirty million cubic feet, or 94 percent, of the coarse residues were used for fiber products. Most bark was used as industrial fuel or miscellaneous products, while 74 percent of the sawdust and shavings was used for industrial fuel.

Sawmills generated 282 million cubic feet of residue, accounting for 77 percent of the total residue produced.

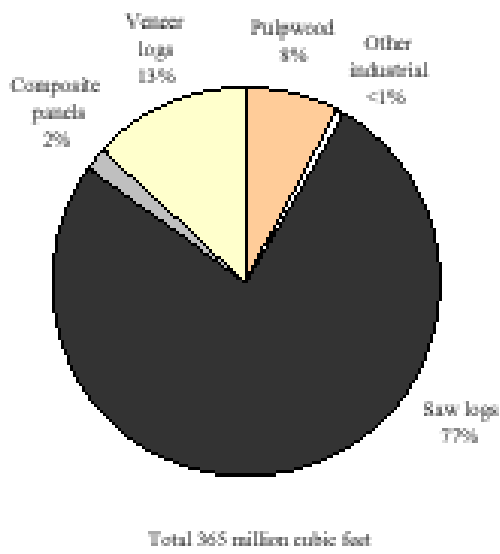


Figure 10—Primary mill residue produced by mill type, 1995.

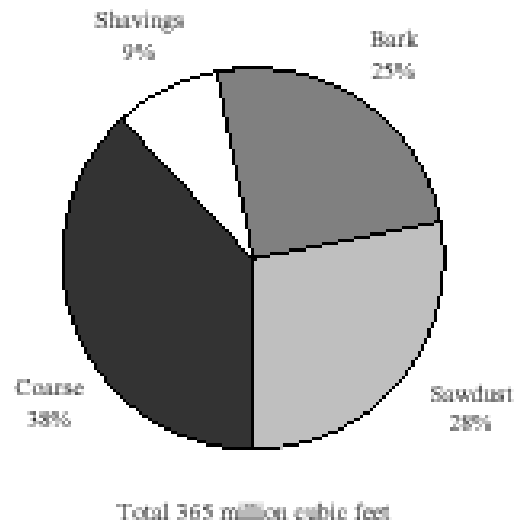


Figure 11—Primary mill residue by residue type, 1995.



Figure 12—Disposal of residue by product, 1995.

Mississippi Wood Biomass Availability¹⁹

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Mississippi are 785,000 and 6,029,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Mississippi is 1,775,000 dry tons per year.

¹⁹ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=MS

North Carolina²⁰

In 1999, industrial roundwood output from North Carolina's forests totaled 793 million cubic feet, 9 percent less than in 1997. Mill byproducts generated from primary manufacturers increased 1 percent to 311 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Saw logs were the leading roundwood product at 422 million cubic feet; pulpwood ranked second at 272 million cubic feet; veneer logs were third at 61 million cubic feet. The number of primary processing plants declined from 280 in 1997 to 278 in 1999. Total receipts declined 2 million cubic feet to 769 million cubic feet.

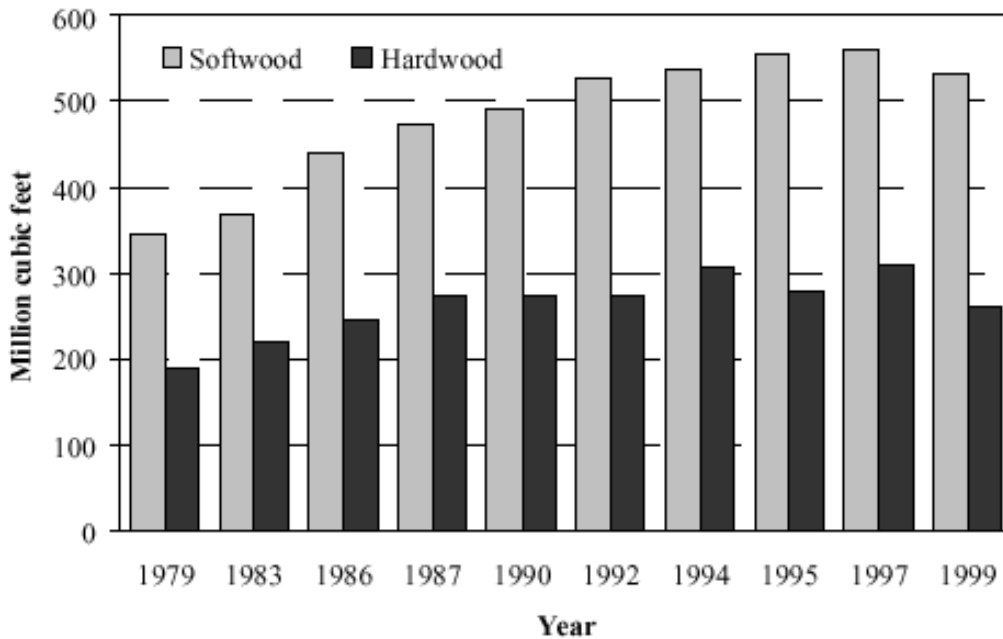


Figure 2—Roundwood production for all products by species group and year (see page 11 for references for individual years).

²⁰ Johnson, Tony G.; Brown, David R. 2002. North Carolina's Timber Industry--An Assessment of Timber Product Output and Use, 1999. USDA Forest Service, Southern Research Station, Resource Bulletin SRS-073.

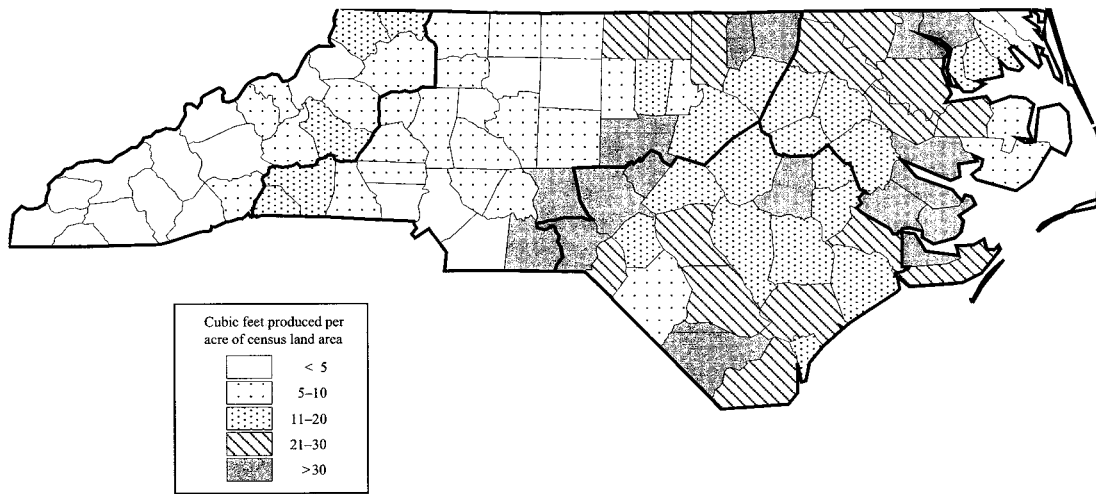


Figure 3—Intensity of roundwood softwood output for all industrial products in North Carolina by county, 1999.

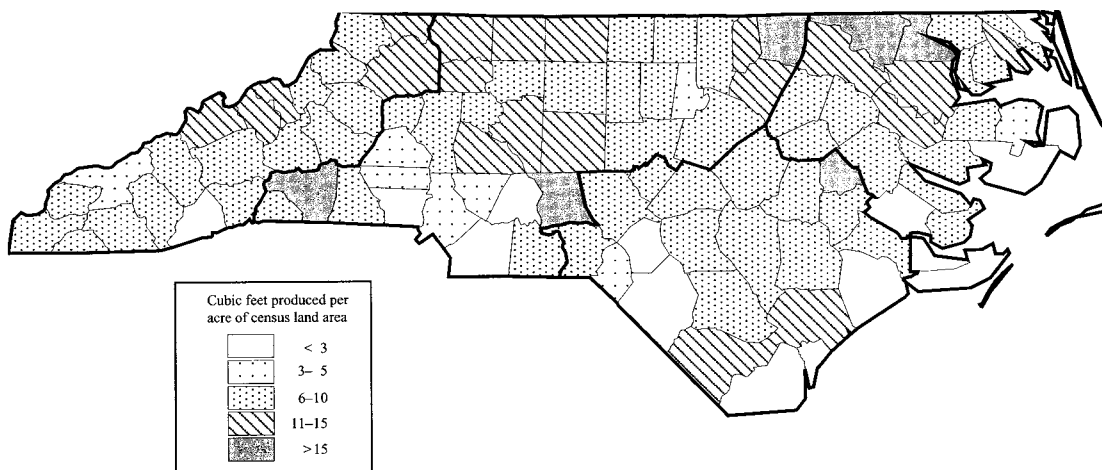


Figure 4—Intensity of roundwood hardwood output for all industrial products in North Carolina by county, 1999.

Saw logs and pulpwood were the principal roundwood products in 1999. Combined output of these products totaled 694 million cubic feet and accounted for 87 percent of the State's total roundwood output.

Saw logs accounted for 53 percent of the State's total roundwood products.

Roundwood harvested for other industrial uses, e.g., poles, posts, mulch, firewood, logs for log homes, and all other industrial products, totaled 1.8 million cubic feet, down 30 percent from 1997. Softwood made up all of the other industrial products volume.

- In 1999, North Carolina had 240 sawmills, a net loss of 3 mills since 1997.
- Seven pulp mill facilities were operating and receiving roundwood in North Carolina in 1999, the same as in 1997.
- The number of veneer mills operating in North Carolina increased from 23 in 1997 to 24 in 1999.
- The number of plants producing other industrial products remained at four in 1999, the same as in 1997.

Plant Byproducts

In 1999, processing of primary products in North Carolina mills generated 312 million cubic feet of wood and bark residues. Coarse residues from all primary products amounted to 131 million cubic feet, while bark volume totaled 73 million cubic feet. Sawdust and shavings made up 35 percent of total residues, or 108 million cubic feet.

Less than 1 percent of the wood and bark residues were not used for a product, while 38 percent of the residues were used for industrial fuel. More than 120 million cubic feet, or 92 percent, of the coarse residues were used to manufacture fiber products. Most of the bark was used for industrial fuel or other miscellaneous products, while 80 percent of the sawdust and 8 percent of the shavings were used for industrial fuel. Shavings were used primarily for particleboard manufacture or miscellaneous uses such as bedding.

The processing of saw logs by sawmills generated 253 million cubic feet of mill residues, or 81 percent of the total residues produced.

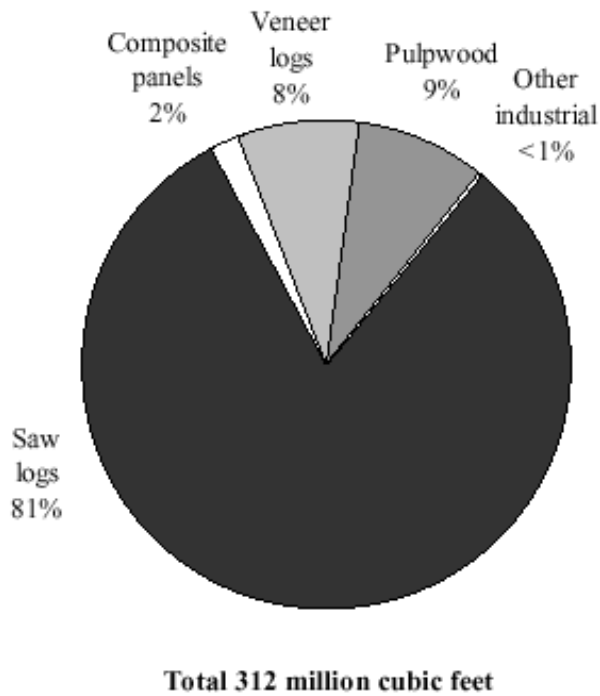


Figure 12—Primary mill residue produced by roundwood type, 1999.

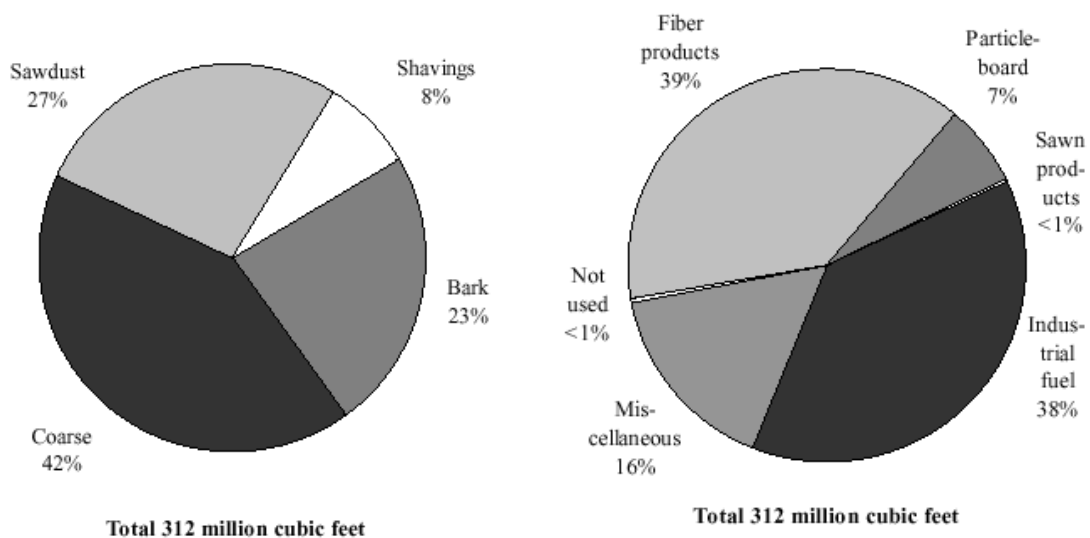


Figure 10—Primary mill residue by residue type, 1999.

Figure 11—Disposal of residue by product, 1999.

North Carolina Wood Biomass Availability²¹

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in North Carolina are 1,060,000 and 5,028,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for North Carolina is 2,005,000 dry tons per year.

²¹ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=NC

Oklahoma²²

Between 1984 and 1996, the combined industrial timber products output (TPO) from roundwood and plant byproducts increased 55 percent, from 100 to 155 million cubic feet.

Timber products output from roundwood was up 58 million cubic feet, doubling to 113 million cubic feet, while output of plant byproducts declined 3 million. Output of softwood roundwood products increased 126 percent, to 93 million cubic feet, while output of hardwood roundwood products increased 41 percent, to 20 million cubic feet.

Saw logs and pulpwood were the principal roundwood products in 1996. Combined product output was 94 million cubic feet and accounted for 84 percent of the State's total roundwood output.

Total receipts at Oklahoma mills, which included roundwood harvested and retained in the State and roundwood imported from other States, were 110 million cubic feet. The number of primary roundwood-using plants in Oklahoma declined from 100 in 1984 to 73 in 1996.

Saw logs accounted for 48 percent of the State's total roundwood products.

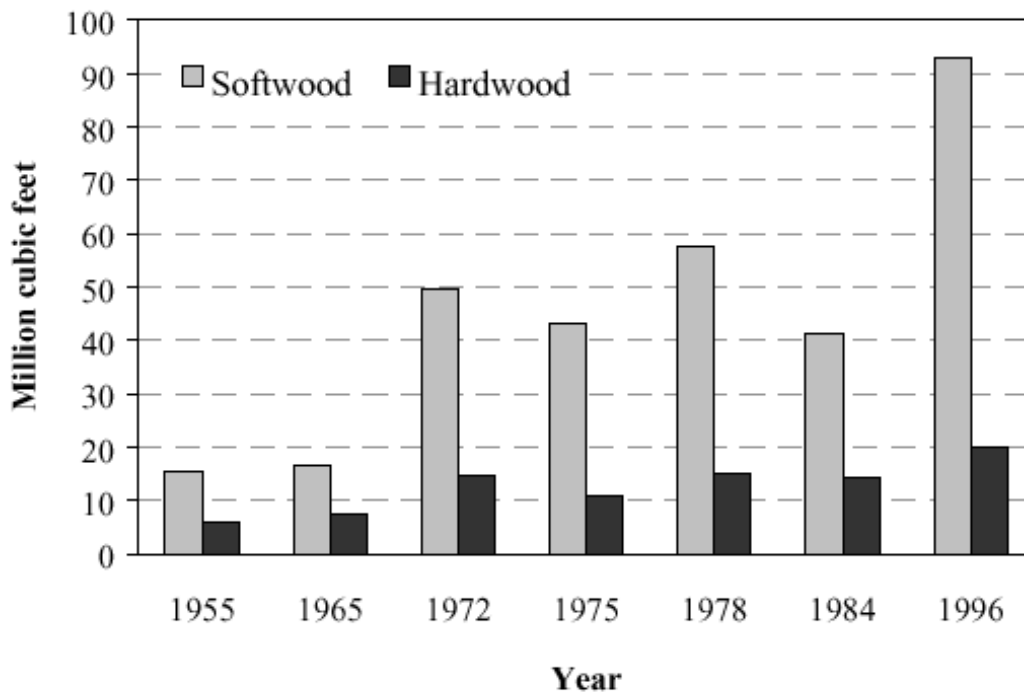


Figure 2—Roundwood production for all products by species group and year (see page 5 for references for individual years).

²² Howell, Michael and Tony G. Johnson. 1999. Oklahoma's Timber Industry-An Assessment of Timber Products Output and Use. USFS Report SRS-30.

- Oklahoma had 68 sawmills, representing a net loss of 16 since 1984.
- Two pulp mill facilities were operating and receiving roundwood in 1996.
- Three veneer and other industrial mills.

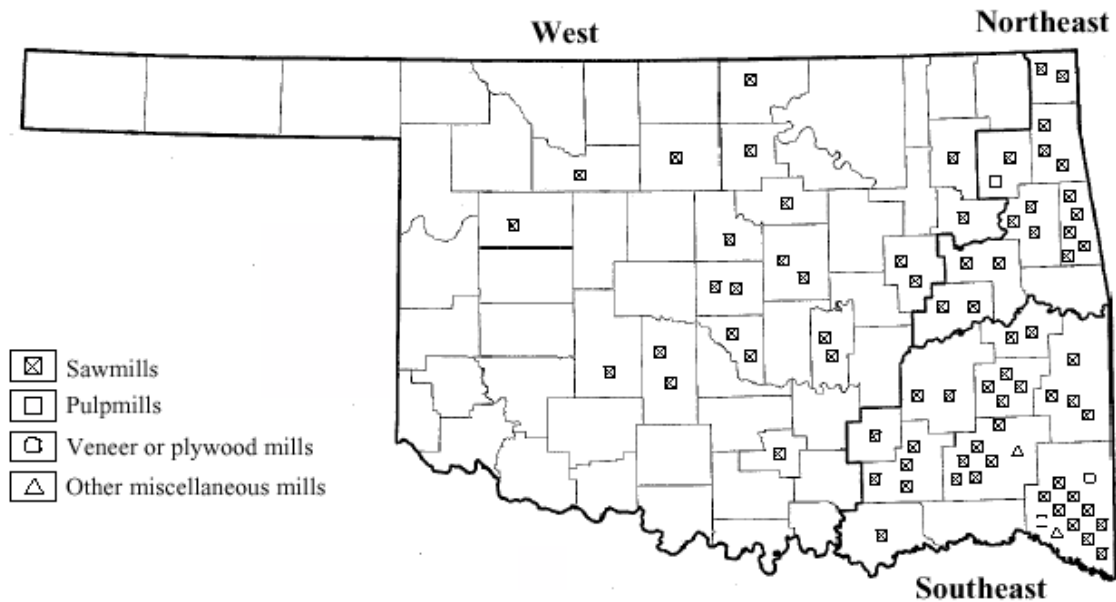


Figure 4—Primary wood-using mills by region, 1996.

Plant Byproducts

The manufacture of primary products in Oklahoma mills generated more than 42 million cubic feet of wood and bark residues. Coarse residues from all primary products were 18 million cubic feet, while bark volume totaled 10 million cubic feet. Sawdust and shavings constituted 33 percent of total residues, or 14 million cubic feet.

Forty-six percent of the wood and bark residue was used for industrial fuel. More than 31 percent was used for fiber products, and the remainder was used for miscellaneous and sawn products. Eighty-four and 91 percent of the bark and sawdust, respectively, were used for industrial fuel, while 96 percent of the shavings were used for other miscellaneous products.

Sawmills generated 31 million cubic feet of residue, accounting for 74 percent of the total residue produced.

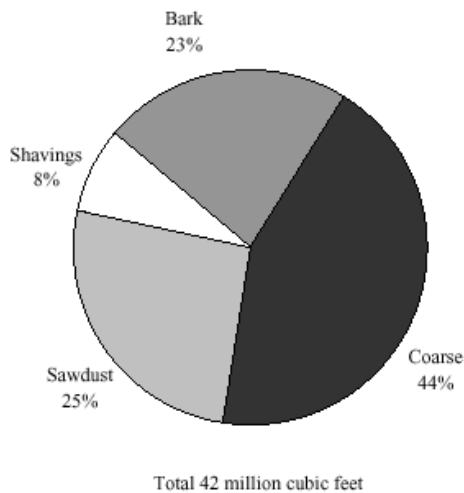


Figure 8—Primary mill residue by residue type, 1996.

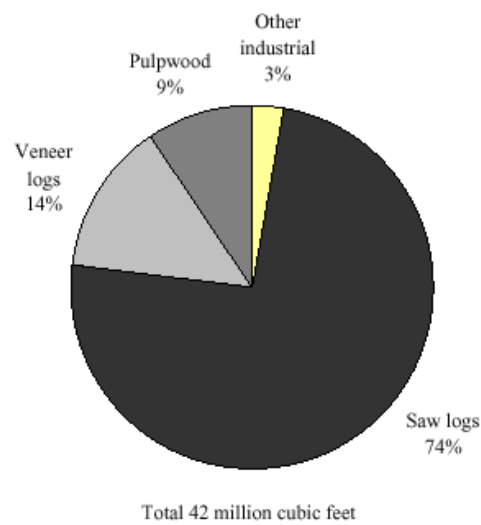


Figure 10—Primary mill residue produced by mill type, 1996.

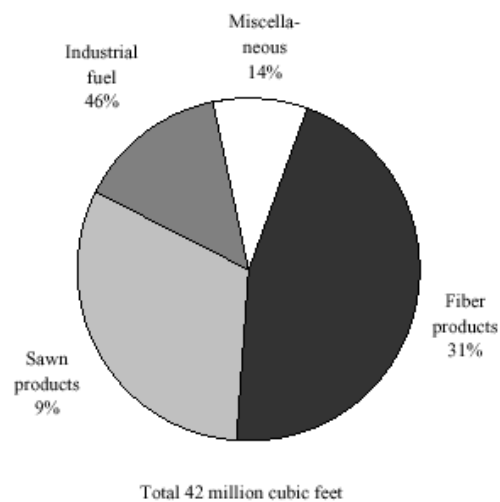


Figure 9—Disposal of residue by product, 1996.

Mill residues. The estimated supplies of urban and mill residues available for energy uses in Oklahoma are 185,000 and 698,000 dry tons per year, respectively.²³

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. The estimated supply of forest residues for Oklahoma is 292,000 dry tons per year.

²³ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=ok

South Carolina²⁴

In 1999, roundwood output from South Carolina's forests totaled 625 million cubic feet, 1 percent less than in 1997. Mill byproducts generated from primary manufacturers declined 2 percent to 197 million cubic feet. Almost all plant residues were used primarily for fuel and fiber products. Pulpwood was the leading roundwood product at 324 million cubic feet; saw logs ranked second at 242 million cubic feet; veneer logs were third at 54 million cubic feet. The number of primary processing plants declined from 92 in 1997 to 90 in 1999. Total receipts declined 5 percent to 587 million cubic feet.

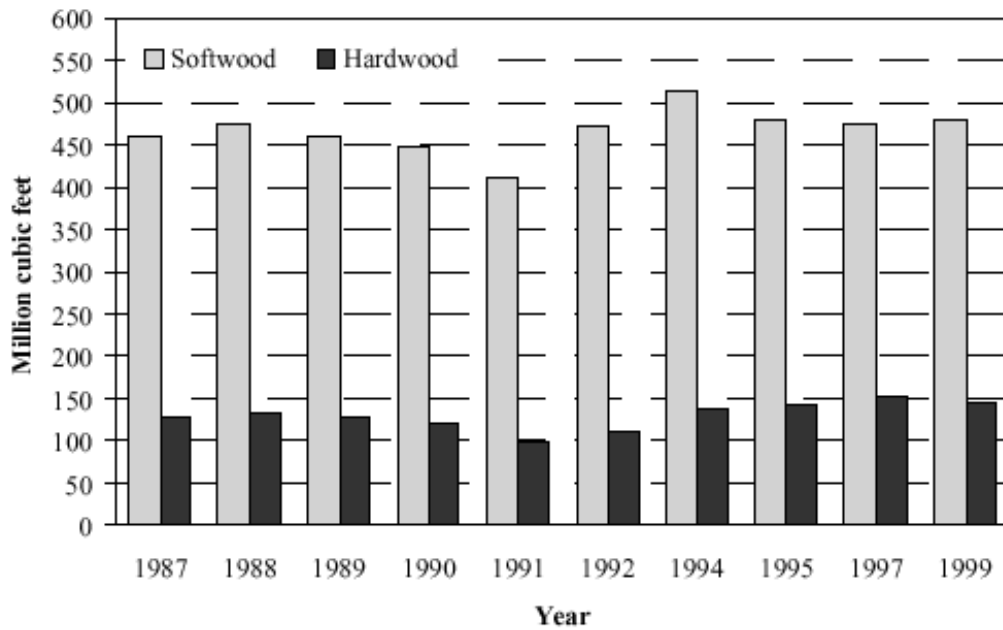


Figure 2—Roundwood production for all products by species group and year (see page 9 for references for individual years).

²⁴ Johnson, Tony G.; Harper, Richard A.; Bozzo, Michael J. 2002. South Carolina's Timber Industry - An Assessment of Timber Product Output and Use, 1999. USDA Forest Service, Southern Research Station, Resource Bulletin SRS-070.

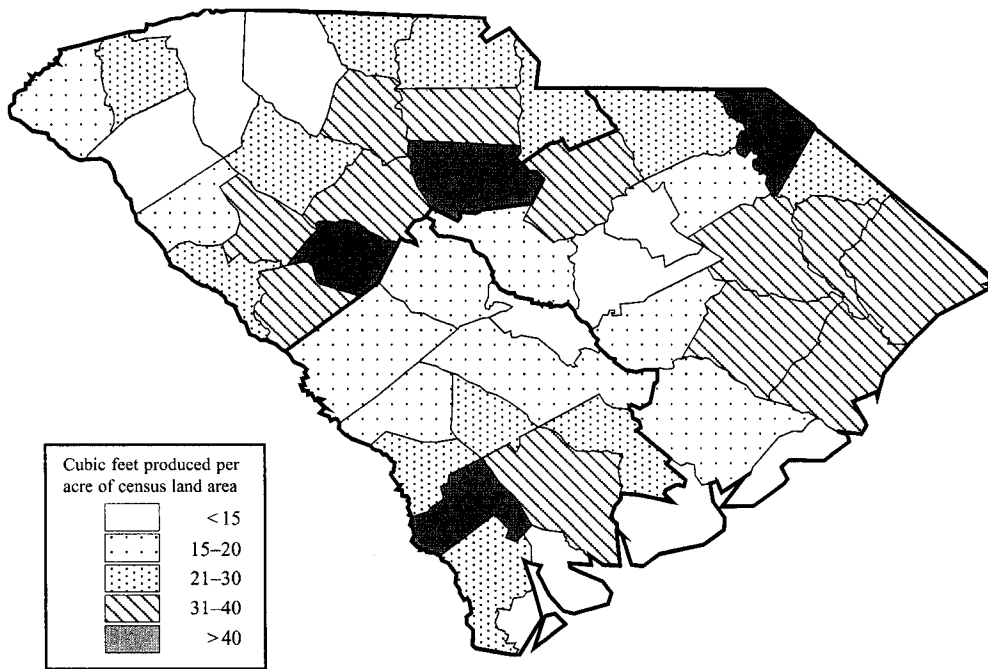


Figure 3—Intensity of roundwood softwood output for all industrial products in South Carolina by county, 1999.

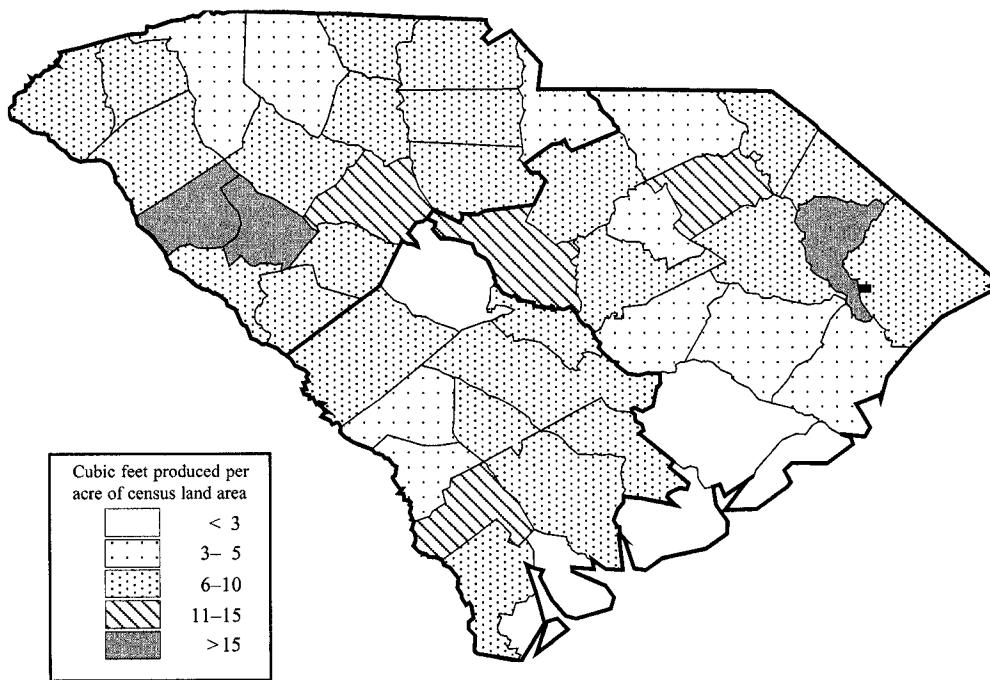


Figure 4—Intensity of roundwood hardwood output for all industrial products in South Carolina by county, 1999.

Pulpwood and saw logs were the principal roundwood products in 1999. Combined output of these products totaled 565 million cubic feet and accounted for 90 percent of South Carolina's total roundwood output.

Saw logs accounted for 38 percent of the State's total roundwood products.

Roundwood harvested for other industrial uses such as poles, posts, mulch, firewood, logs for log homes, and all other industrial products totaled 4 million cubic feet, a 14-percent increase since 1997. Softwood made up all of the other industrial products volume.

- In 1999, South Carolina had 63 sawmills, a net loss of 3 mills since 1997.
- Seven pulp mill facilities were operating and receiving roundwood in South Carolina in 1999, one less than in 1997.
- Twelve veneer mills were operating in South Carolina, the same as in 1997.
- The number of plants producing other industrial products totaled eight in 1999.

Plant Byproducts

In 1999, processing of primary products in South Carolina mills generated 197 million cubic feet of wood and bark residues. Coarse residues from all primary products amounted to 70 million cubic feet, while bark volume totaled 64 million cubic feet. Sawdust and shavings made up 32 percent of total residues, or 63 million cubic feet.

Almost all of the wood and bark residues were used for products. Forty-nine percent of the residue was used for industrial fuel. More than 61 million cubic feet, or 88 percent, of the coarse residues were used to manufacture fiber products. Most of the bark was used for industrial fuel or other miscellaneous products, while 58 percent of the sawdust and shavings were used for industrial fuel.

The processing of saw logs generated 124 million cubic feet of mill residues, accounting for 63 percent of the total residues produced.

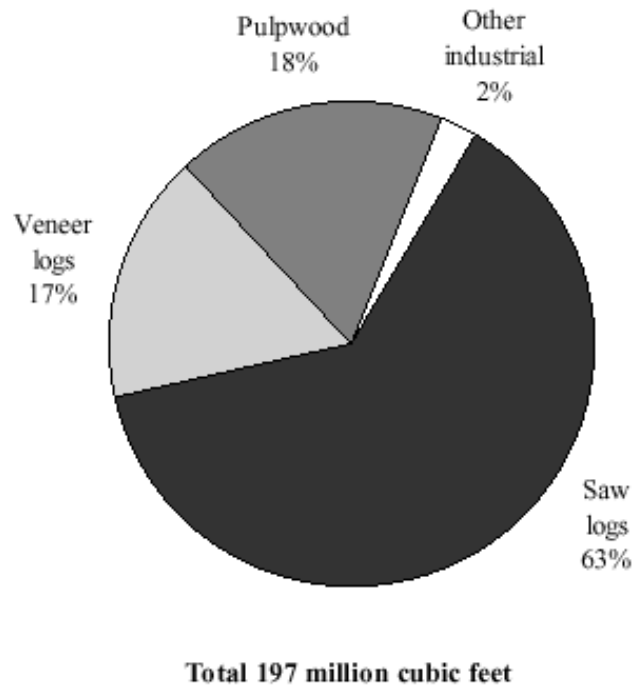


Figure 11—Primary mill residue produced by roundwood type, 1999.

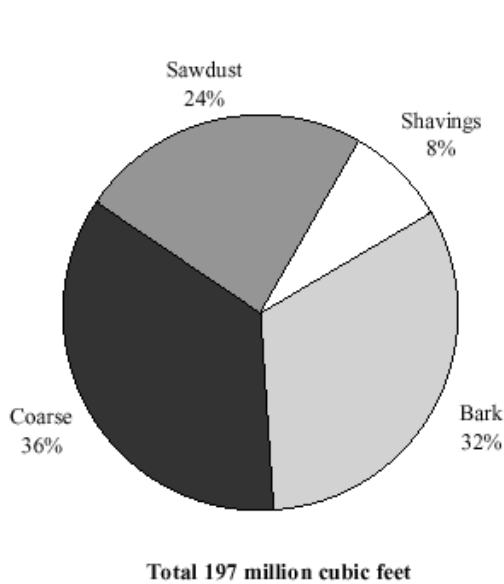


Figure 9—Primary mill residue by residue type, 1999.

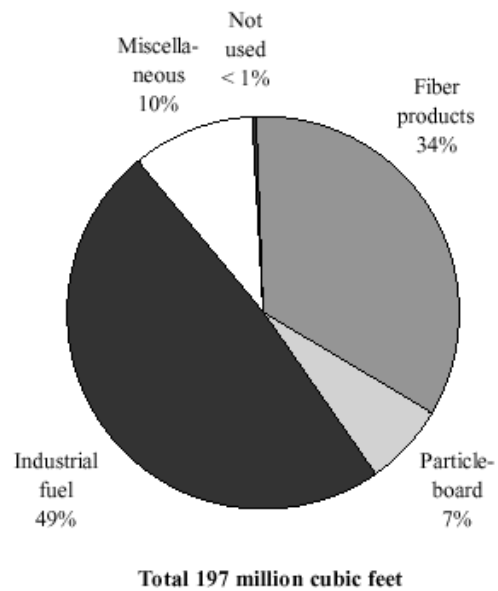


Figure 10—Disposal of residue by product, 1999.

South Carolina Wood Biomass Availability²⁵

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in South Carolina are 2,150,000 and 3,382,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for South Carolina is 1,158,000 dry tons per year.

²⁵ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=sc

Tennessee²⁶

In 1999, roundwood output from Tennessee's forests was 325 million cubic feet. Mill byproducts generated from primary manufacturers totaled 125 million cubic feet. Ninety percent of the plant residues were used primarily for fuel and fiber products. Saw logs were the leading roundwood product at 185 million cubic feet; pulpwood ranked second at 121 million cubic feet; other industrial products were third at 13 million cubic feet. There were 451 primary processing plants operating in Tennessee in 1999. Total receipts amounted to 306 million cubic feet.

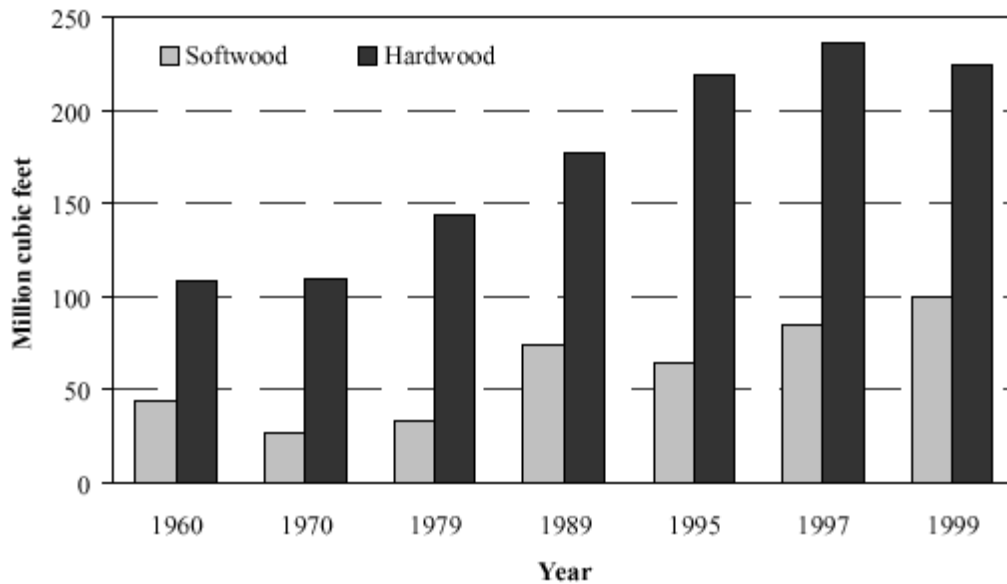


Figure 2—Roundwood production for all products by species group and year (see page 11 for references for individual years).

²⁶ Howell, Michael; Wright, Robert C. 2002. Tennessee's timber industry - an assessment of timber product output and use, 1999. Resour. Bull. SRS-76. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 39 p.

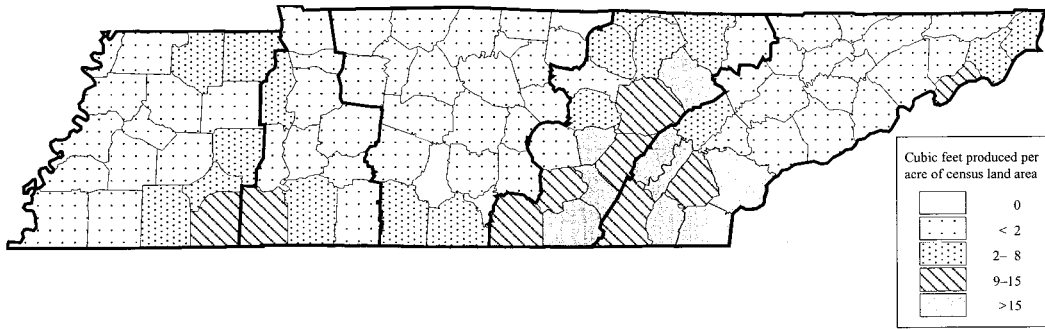


Figure 3—Intensity of roundwood softwood output for all industrial products in Tennessee by county, 1999.

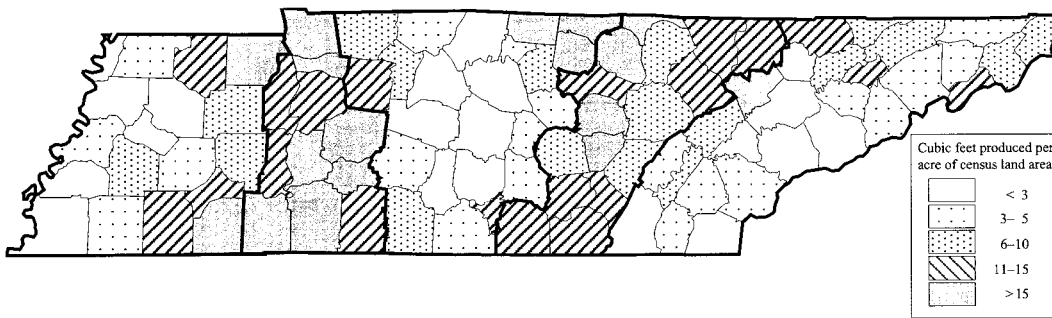


Figure 4—Intensity of roundwood hardwood output for all industrial products in Tennessee by county, 1999.

Saw logs and pulpwood were the principal roundwood products in 1999. Combined output of these products totaled 306 million cubic feet and accounted for 94 percent of Tennessee's total industrial roundwood output.

Saw logs accounted for 57 percent of the State's total industrial roundwood products.

Roundwood harvested for other industrial uses, such as composite panels, poles, posts, mulch, firewood, logs for log homes, and all other industrial products, fell 28 percent from 18 million cubic feet in 1997 to 13 million cubic feet in 1999. Softwoods made up 82 percent of the other industrial product volume.

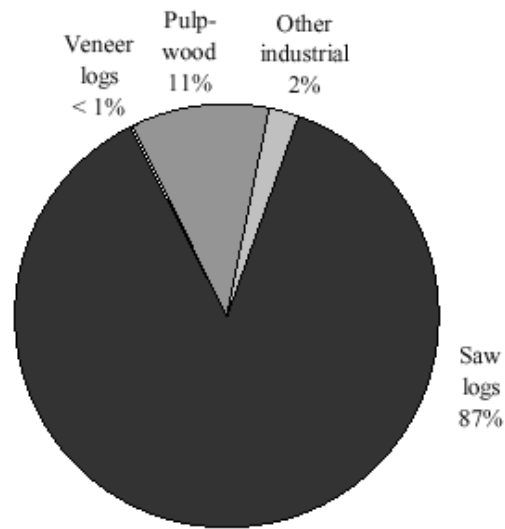
- In 1999, Tennessee had 440 sawmills.
- Five pulp mill facilities were operating and receiving roundwood in 1999.
- The number of veneer mills operating in Tennessee remained at two.
- Only four plants were producing other industrial products.

Plant Byproducts

In 1999, processing of primary products in Tennessee mills generated 125 million cubic feet of wood and bark residues. Coarse residues from all primary products amounted to 57 million cubic feet and bark volume totaled 33 million cubic feet. Sawdust and shavings made up 28 percent of total residues, or 35 million cubic feet.

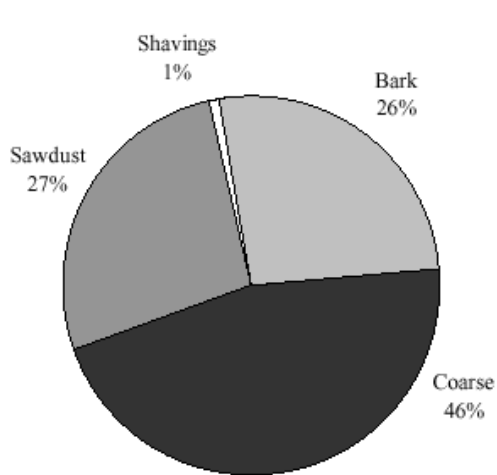
Ten percent of the wood and bark residues were not used for a product, while 42 percent of the residues were used for industrial fuel. Thirty-four million cubic feet, or 59 percent, of the coarse residues were used to manufacture fiber products. Most of the bark was used for industrial fuel or other miscellaneous products, and 71 percent of the sawdust and shavings was used for industrial fuel.

The processing of saw logs generated 109 million cubic feet of mill residues, accounting for 87 percent of the total residues produced.



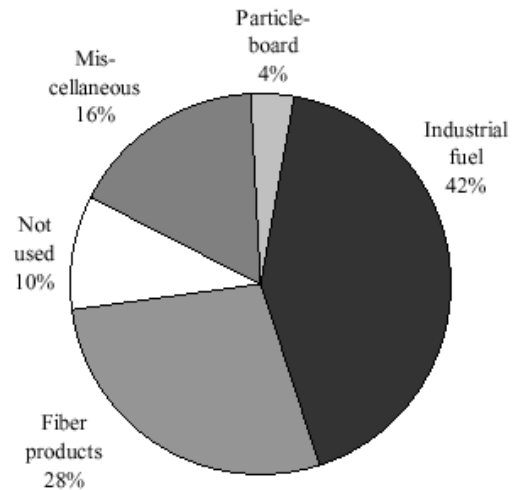
Total 125 million cubic feet

Figure 12—Primary mill residue produced by roundwood type, 1999.



Total 125 million cubic feet

Figure 10—Primary mill residue by residue type, 1999.



Total 125 million cubic feet

Figure 11—Disposal of residue by product, 1999.

Tennessee Wood Biomass Availability²⁷

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Tennessee are 1,127,000 and 2,018,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Tennessee is 1,733,000 dry tons per year.

²⁷ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=TN

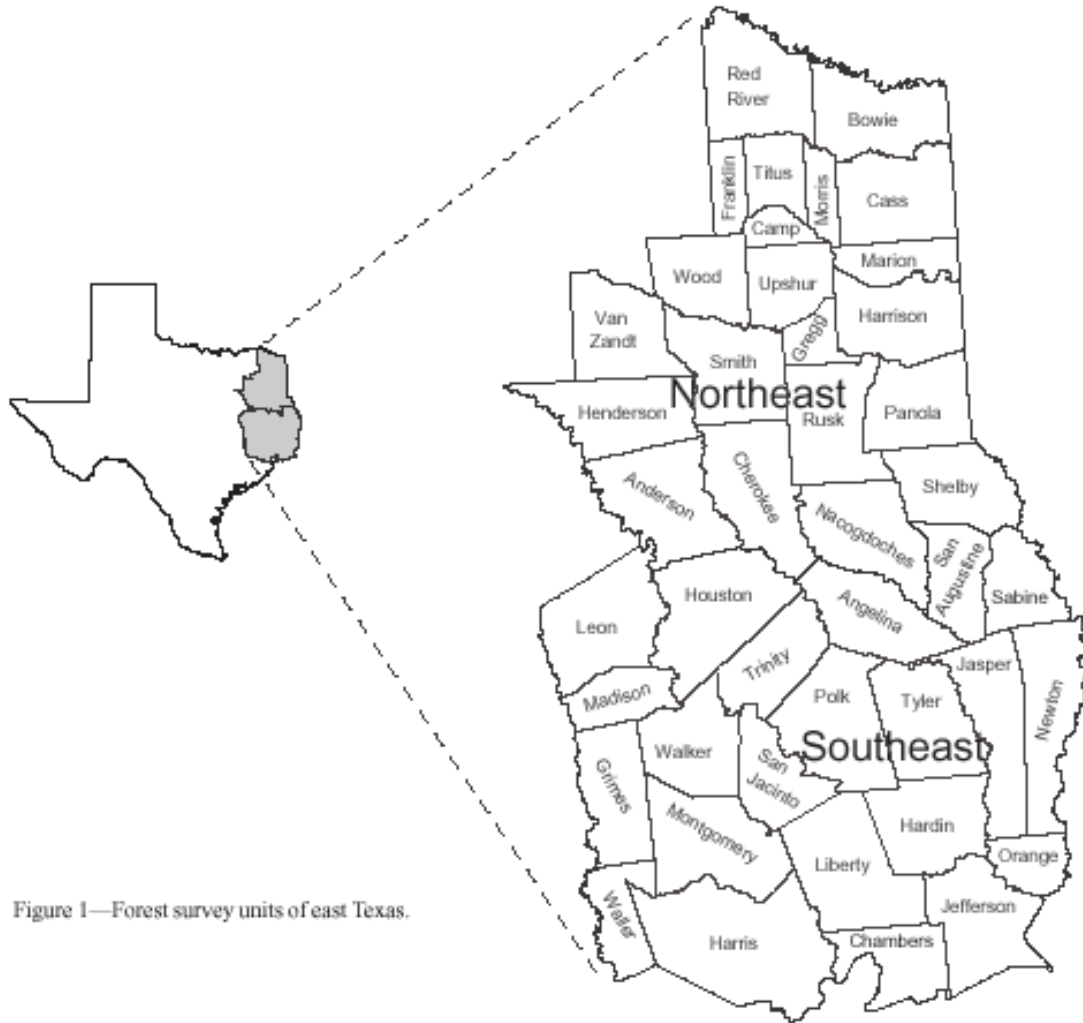


Figure 1—Forest survey units of east Texas.

²⁸ Rosson, James F., Jr. 2000. Forest resources of east Texas, 1992. Resour. Bull. SRS-53. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 70 p.

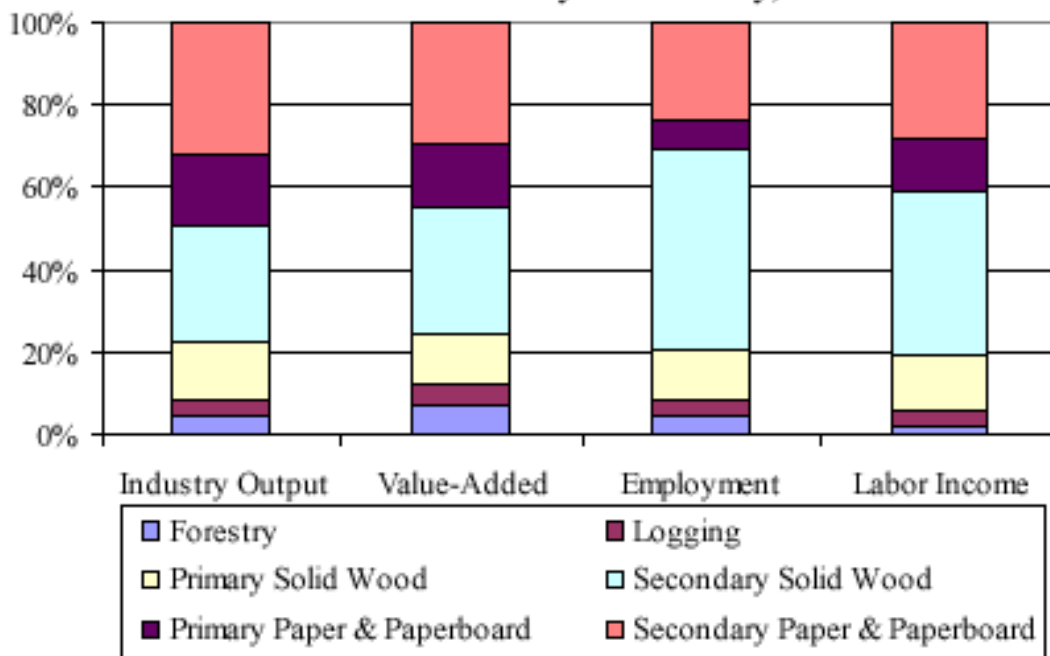
- Timberland area increased by 202,700 acres from 1986 to 11.8 million acres.
- The loblolly-shortleaf pine forest-type group remained the predominant type in east Texas. In 1992, 4.1 million acres were in this type. Oak-hickory was the second most dominant forest-type group, even after losing 242,900 acres since the 1986 inventory.
- The predominant stand-size class was sawtimber with 5.3 million acres (45 percent).
- Approximately 3.3 million acres, or 28 percent of all timberland, underwent some form of commercial harvest.

Industry Output-1999

In 1999, the largest industry output came from the secondary paper & paperboard products industry. In terms of value-added, employment and labor income, the secondary paper & paperboard products industry ranked second. The secondary solid wood products industry ranked second in industry output. Yet, it produced the largest value-added, employed the most labor force, and generated the highest labor income in the forest sector. Primary paper & paperboard products and primary solid wood products industries took the third and fourth places by industry output, value-added, employment and labor income. The smallest industries were forestry and logging with forestry having higher economic impact than logging in all economic indicators except labor income.²⁹

²⁹ Xu, Weihuan. 2002. Economic Impact of the Texas Forest sector. Texas State Forest Service.

Figure 2. Shares of Direct Economic Impact of Texas Forest Sector by Sub-industry, 1999



Texas Wood Biomass Availability³⁰

Mill residues, such as sawdust, bark, and wood scraps from paper, lumber, and furniture manufacturing operations are typically very clean and can be used as fuel by a wide range of biomass energy systems. The estimated supplies of urban and mill residues available for energy uses in Texas are 2,016,000 and 4,043,000 dry tons per year, respectively.

Forest residues include underutilized logging residues, imperfect commercial trees, dead wood, and other non-commercial trees that need to be thinned from crowded, unhealthy, fire-prone forests. Because of their sparseness and remote location, these residues are usually more expensive to recover than urban and mill residues. The estimated supply of forest residues for Texas is 1,051,000 dry tons per year.

³⁰ http://www.eere.energy.gov/state_energy/tech_biomass.cfm?state=TX