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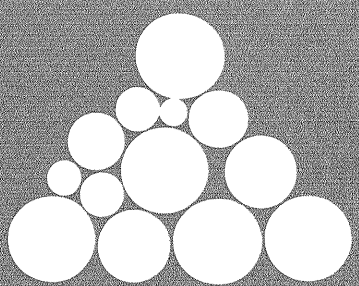

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FUELWOOD PRODUCTION IN RURAL MINNESOTA, 1975

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HISTORICAL BACKGROUND

Fuelwood was considered a minor forest product of diminishing value at the time of the Arab oil embargo in 1973. Its annual production had been declining for many years. Our oil shortage during the embargo gave impetus to a search for alternate fuel sources. Fuelwood use is climbing rapidly as an alternate and supplementary fuel in homes and manufacturing plants.

During 1975, fuelwood production in rural Minnesota was 343,000 cords including 302,000 cords from roundwood (bolts from trees) and 41,000 cord equivalents from residue (such as slabs, edgings, sawdust, and veneer cores) at primary wood-using plants. Comparisons of 1975 production with 1960 and 1970 estimates indicate the steep decline before the embargo and the sharp rise afterwards:

Year	Production from roundwood *(thousand cords)*	From mill residue	Total
1960	525	82	607
1970	194	30	224
1975	302	41	343

ROUNDWOOD FUEL

Ninety-four percent of the fuelwood cut in 1975 from roundwood was hardwood. Major hardwoods used were red oak, paper birch, aspen, elm, ash, and white oak (table 1). Jack pine constituted 72 percent of the softwoods.

Three-fourths of the fuelwood was harvested in the Northern Pine and Central Hardwood Units (fig. 1). Since the Aspen-Birch Unit is sparsely populated and more than 100 miles from the Twin Cities metropolitan area, demand for fuelwood from this Unit is relatively low. Fuelwood production was low in the Prairie Unit because only 3 percent of the area is forested.

More than 90 percent of this fuelwood was probably consumed as household fuel and for recreational purposes in fireplaces and campfires.

FUEL FROM RESIDUE

One-fourth of the Minnesota primary mill wood residue generated in 1975 was consumed for fuel, nearly equally divided betweeen domestic and industrial fuel users (table 2). Coarse (chippable) residue was preferred by both industrial and domestic users, but nearly 3 out of 10 cords was fine residue burned chiefly by industry.

Although most hardwoods produce more BTU's per cord than softwoods, more softwood than hardwood residue was burned as fuel. Industrial consumption was primarily softwood while domestic use was mainly hardwood. Since industrial fuel was often

Table 1.—*Fuelwood production from roundwood by Survey Unit and species in rural Minnesota, 1975 (In standard cords, roughwood basis)*[1]

Species	Aspen-birch unit	Northern pine unit	Central hardwood unit	Prairie unit	All units
Softwoods:					
Cedar	—	42	—	572	614
Balsam fir	1,086	252	—	—	1,338
Jack pine	735	9,305	2,313	—	12,353
Red pine	183	336	—	—	519
White pine	34	126	200	—	360
Spruce	125	—	—	—	125
Tamarack	—	840	1,079	—	1,919
Total softwoods	2,163	10,901	3,592	572	17,228
Hardwoods:					
Ash	2,302	4,671	15,691	5,542	28,206
Aspen	20,022	24,601	11,131	572	56,326
Balsam poplar	—	559	1,542	—	2,101
Basswood	34	181	2,127	310	2,652
Paper birch	11,790	39,947	9,598	—	61,335
Yellow birch	—	210	154	—	364
Cottonwood	—	—	200	2,611	2,811
Elm	51	1,147	14,525	12,557	28,280
Hickory	—	210	200	—	410
Hard maple	403	5,075	817	1,525	7,820
Soft maple	—	4,201	308	1,296	5,805
Red oak	220	21,547	39,580	2,168	63,515
White oak	101	3,739	10,566	7,353	21,759
Other hardwoods	17	42	771	2,606	3,436
Total hardwoods	34,940	106,130	107,210	36,540	284,820
All species	37,103	117,031	110,802	37,112	302,048

[1]A cord of fuelwood is 128 cubic feet containing 70 cubic feet of solid wood and 58 cubic feet of bark and air space.

consumed at the mill of origin, transportation and handling costs per BTU were not a critical factor, and therefore, species composition of the fuel was not important. On the other hand, domestic users probably prefer hardwoods with a high BTU content because handling and transportation costs are significant for them.

Slightly more than half the fuelwood came from primary mills in the Aspen-Birch Unit, including all but 7 percent of the industrial fuel. Fifty-three percent of all wood residue generated in the Aspen-Birch Unit was used for fuel compared with 42 percent in the Prairie Unit, 20 percent in the Central Hardwood Unit, and 14 percent in the Northern Pine Unit. Strong pulpwood markets exist for residue in the Northern Pine and Central Hardwood Units and provide competition for fuelwood users.

ANALYSIS AND OUTLOOK

Minnesota fuelwood production from roundwood has increased substantially since 1975. However, based on a recent study in Michigan, it is unlikely that fuelwood production from primary wood-using mill residue in Minnesota can be increased significantly without taking the residue from some other market use such as pulpwood. Most primary mill residue is probably used now and opportunities are minimal for finding residue that is burned as waste or used as landfill.

Barring the unlikely prospect of discovering a cheap, plentiful, energy resource during the 1980's, fuelwood production from roundwood should continue to rise rapidly. If this happens, a unique opportunity may soon exist in Minnesota to produce

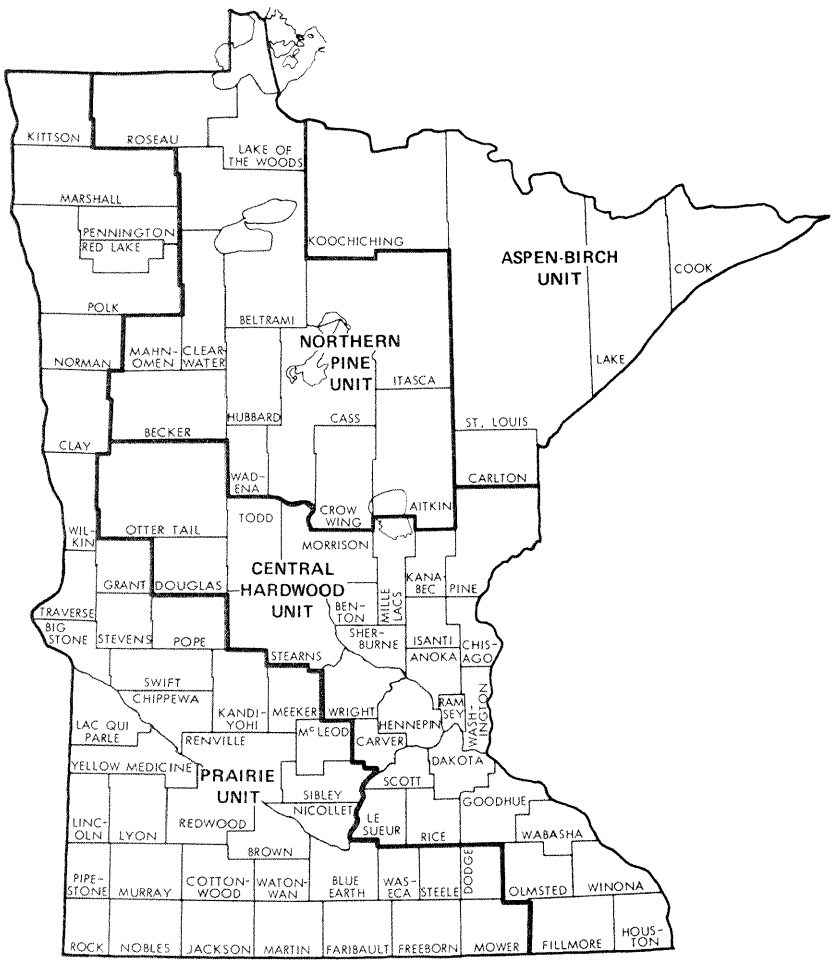

Figure 1.—*Survey Units in Minnesota.*

large quantities of joint products—fuelwood and waferboard bolts. Waferboard, a special type of particleboard, will become an important product manufactured in Minnesota. The only waferboard plant currently operating in Minnesota is doubling its capacity and construction of several other waferboard plants has been announced. Currently, waferboard mills use only specific size wafers from bolewood; tops and limbs are not used for wafers. Unit logging costs could probably be lowered by chipping the tops and limbs for fuel at the time an area is logged for waferboard bolts.

Secondary logging for fuelwood on saw log harvest areas is likely to increase. Perhaps as a cheaper alternative, fuelwood will be taken as a joint product from tops, limbs, and cull material during saw log harvesting. Less slash disposal would be necessary and site preparation costs would be reduced.

Additional timber stand improvements should be feasible with fuelwood produced from thinnings that previously were not marketable. Cull trees, dead trees, and diseased trees will become more valuable for fuel. Finally, if demand for fuelwood accelerated greatly, competition between fuelwood and pulpwood markets could become serious, driving pulpwood prices higher than anticipated.

STUDY METHODS

Roundwood Fuel

The new Rural Area Sampling Frame of the USDA Statistical Reporting Service (now part of Economics, Statistics, and Cooperative Services) was used. Using random starts in each Survey Unit, the Statistical

Table 2.—*Fuelwood production from primary wood-using mill residue by Survey Unit, type of residue, and softwoods and hardwoods, Minnesota, 1975*
(In standard cord equivalents[1])

Survey Unit and type of use	Softwood			Hardwood			All species		
	Coarse[2]	Fine[3]	Total	Coarse	Fine	Total	Coarse	Fine	Total
ASPEN-BIRCH									
Industrial fuel	11,439	7,031	18,470	283	603	886	11,722	7,634	19,356
Domestic fuel	816	27	843	1,406	77	1,483	2,222	104	2,326
Total	12,255	7,058	19,313	1,689	680	2,369	13,944	7,738	21,682
NORTHERN PINE									
Industrial fuel	—	—	—	27	1,280	1,307	27	1,280	1,307
Domestic fuel	3,918	136	4,054	5,029	67	5,096	8,947	203	9,150
Total	3,918	136	4,054	5,056	1,347	6,403	8,974	1,483	10,457
CENTRAL HARDWOOD									
Industrial fuel	—	—	—	86	28	114	86	28	114
Domestic fuel	320	37	357	3,515	2,400	5,915	3,835	2,437	6,272
Total	320	37	357	3,601	2,428	6,029	3,921	2,465	6,386
PRAIRIE									
Industrial fuel	—	—	—	—	—	—	—	—	—
Domestic fuel	14	—	14	2,214	86	2,300	2,228	86	2,314
Total	14	—	14	2,214	86	2,300	2,228	86	2,314
ALL UNITS									
Industrial fuel	11,439	7,031	18,470	396	1,911	2,307	11,835	8,942	20,777
Domestic fuel	5,068	200	5,268	12,164	2,630	14,794	17,232	2,830	20,062
Total	16,507	7,231	23,738	12,560	4,541	17,101	29,067	11,772	40,839

[1]A cord equivalent contains 70 cubic feet of solid wood.
[2]Suitable for chipping such as slabs, edgings, veneer cores, etc.
[3]Not suitable for chipping such as sawdust, veneer clippings, etc.

Table 3.—*Approximate segment size and number by Survey Unit*

Survey Unit	Open country segments		Agri-urban segments	
	Size	Number	Size	Number
	Sq. miles		*Sq. miles*	
Aspen-birch	4	100	0.1	5
Northern pine	4	102	0.1	5
Central hardwood	3	34	0.1	10
Prairie	3	31	0.1	15
Total	—	267	—	35

Reporting Service drew a systematic random sample of area segments in each Survey Unit from the open country strata and agri-urban substrata in Minnesota (table 3). No sampling was done in the urban substrata.

By using random starts, the sample was relatively evenly distributed geographically in each Survey Unit.

Thus, sampling was done on an area basis rather than by location of households. The boundaries of each sample segment were transferred to county highway maps for use by the enumerators. Roads, streams, and other readily identifiable topography were used for boundaries.

Resources Evaluation field personnel of the North Central Forest Experiment Station canvassed the sample areas in the Aspen-Birch Unit and in three counties in the Northern Pine Unit. Minnesota Department of Natural Resources personnel canvassed all other sample areas in Minnesota.

All owners of land in a sample segment were personally interviewed (using a standard questionnaire) if they lived within or adjacent to the segment. Information about fuelwood production from land held by private absentee owners was obtained from knowledgeable nearby residents. When public land was found in a segment, the administrator of that land was interviewed. From these interviews with landowners, 1975 fuelwood production was ascertained in each segment. An expansion factor was determined in each Unit by dividing the number of area segments in the Unit by the number of area segments sampled in the Unit. Fuelwood production in the Unit was estimated by multiplying the expansion factor times the fuelwood production in the sample segments in the Unit.

Fuel from Residue

All primary wood-using mills (those using logs and bolts) in Minnesota were canvassed to determine their log receipts in 1975 and how their wood and bark residue was used. Wood residue was divided into two categories—coarse wood (chippable) and fine wood (not chippable). Softwoods and hardwoods were separate categories. For each residue category, and for softwood and hardwoods separately, the percentage of residue in 1975 was determined at each mill for six types of disposal. The percentages totaled 100 for each residue and species category. Two of the types of disposal were industrial fuelwood and domestic household fuel.

Conversion factors, developed from past studies, were used to estimate the quantity of residue generated at the primary mills in 1975 based upon their log receipts. These residue quantities were then distributed by disposal category for each mill. Finally, the quantity by residue category was determined in each county. All of the calculations and summaries were processed by computer.

DEFINITION OF TERMS

Standard cord.—A pile of logs $4 \times 4 \times 8$ feet (128 cubic feet including air space and bark). A cord of fuelwood contains 70 cubic feet of wood and 58 cubic feet of bark and air space.

Primary wood-using mills.—Mills receiving roundwood or chips from roundwood.

Primary wood-using mill residue.—Wood materials (coarse and fine) and bark not utilized for principal products at manufacturing plants using roundwood. This residue includes wood products (by-products) obtained incidental to production of principal products, and wood materials not utilized for some product.

Coarse mill residue.—Wood residue suitable for chipping such as slabs, edgings, and veneer cores.

Fine mill residue.—Wood residue not suitable for chipping, such as sawdust and veneer clippings.

Roundwood.—Logs and bolts from harvested trees including chips from harvested trees.

SAMPLING ERROR

Roundwood Fuel

All the reported figures are estimates based on sampling procedures designed to give accurate estimates of fuelwood production from roundwood. A measure of reliability of these figures is given by sampling errors. These sampling errors may be interpreted as meaning that the chances are two out of three that the results for the sample differ, by no more than the amount indicated, from the results

that would have been obtained if all of the fuelwood cut in rural Minnesota had been determined from all the landowners.

Sampling errors for fuelwood harvested in 1975 in each Survey Unit and the State are:

Survey Unit	Quantity *(cords)*	Sampling error *(percent)*[1]
Aspen-Birch	37,103	21.9
Northern Pine	117,031	23.2
Central Hardwood	110,802	24.1
Prairie	37,112	25.5
All Units	302,048	13.3

[1] *At the 68-percent probability level.*

Fuel from Residue

Because all primary wood-using firms were canvassed to determine fuelwood production from their wood and bark residue, there is no sampling error.

STUDY LIMITATIONS

Fuelwood production was not estimated for urban Minnesota. Therefore, two components of total fuelwood production in Minnesota were excluded in this study—fuelwood harvested in urban areas and fuelwood produced from wood residue generated at secondary wood-using mills such as millwork plants, furniture plants, and office and store fixture manufacturers. Most secondary mills are located in urban areas.

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Discusses and analyzes 1975 fuelwood production in rural Minnesota from roundwood and primary wood-using mill residue. Compares production in 1975 with production in 1960 and 1970. Assesses outlook for future fuelwood production and potential impact on Minnesota's forest industry.

KEY WORDS: Roundwood, coarse residue, fine residue, waferboard.

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