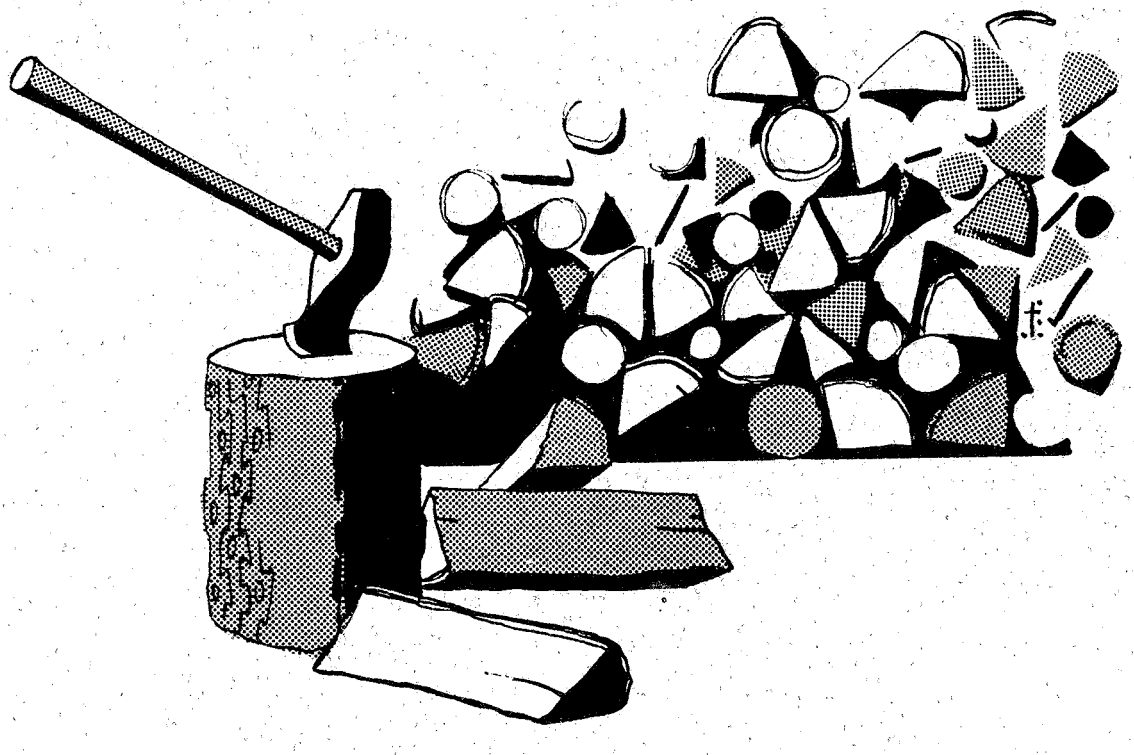
MINNESOTA
RESIDENTIAL FUELWOOD SURVEY

1995-96 Heating Season



Minnesota
DEPARTMENT OF NATURAL RESOURCES

EXECUTIVE SUMMARY

During the 1995–96 heating season, approximately 751,000 cords of fuelwood were burned by private households. This is a continuation of the decline which began after the 1984-85 heating season, and is a substantial decrease (28%) from the 1,039,000 cords consumed during the 1988–89 heating season. There was a corresponding decline (from 33% to 23%) in the proportion of Minnesota households using fuelwood for some or all of their heating needs. Those still burning fuelwood are more likely to cut their own (62% of the volume compared to 51% in 1988-89). The location of wood burning households has also shifted heavily to rural areas (increased from 55% to 81%). These changes are especially significant because the proportion and location of homes with wood heating units had been constant in the three previous surveys.

Households using wood as their major source of heat consumed more than 45 percent of the fuelwood burned and represent 14 percent of all fuelwood consumers. This is a moderate decrease from previous surveys. However, there has been a significant shift from use of fuelwood for supplemental heat (decreased from 46% to 36%) to burning for pleasure (increased from 36% to 49%). This is also reflected in changes in the type of wood burning units. Regular and modified fireplaces now represent 63 percent of the wood burning units compared to 39 percent in 1989. All these changes correspond to an increased availability of natural gas in cities and towns of all sizes throughout the state.

The species of wood utilized for fuelwood have remained relatively constant. More volume is being reported as mixed species, but oak continues to be the most important (25%). Birch and aspen remain the next most popular firewood species. The proportion of fuelwood cut from growing stock has also remained relatively constant (25% compared to 23% in 1988-89), though the volume has declined from 237,000 cords to 188,000 cords.

The volume of fuelwood utilized by residential households appears to be closely tied to the cost of fossil fuels, particularly to the availability of natural gas. Unless there is an energy crisis like that of the early 1970s the volume of fuelwood consumed is likely to remain near current levels or decline further.

INTRODUCTION

During the summer of 1996, the Minnesota Department of Natural Resources conducted a survey to determine the volume of residential fuelwood burned during the 1995–96 heating season. Similar surveys had been conducted in 1979–80, 1984–85, and 1988–89. Less structured surveys were conducted in 1960 and 1970.

This study is part of a long-term effort to monitor trends in the use of fuelwood by residential households.

Study Objectives

The objectives of this study are to:

1. Estimate the total volume of fuelwood consumed in Minnesota during the 1995–96 heating season by species.

2. Identify the suppliers of fuelwood (cut their own, purchased, free).

3. Estimate the volume of fuelwood from various sources (different land ownerships, live or dead trees, slash, scrap lumber, etc.), with particular attention to fuelwood derived from growing stock trees.

4. Determine the geographic distribution of households burning fuelwood by type of use (primary heat, supplementary heat, or for pleasure) and type of wood burning unit.

5. Identify trends in residential fuelwood consumption over time.

Study Methods

The study consisted of two telephone surveys, one of residential households and the other of loggers. Data from studies of industrial wood waste and urban tree waste were used to supplement the two surveys.

Household Survey

The same telephone survey methods were utilized as in the three most recent residential fuelwood surveys. These methods have proven to be cost-efficient, and maintaining continuity permits more direct comparison of data over time. The survey sample was based on the total number of households in Minnesota. The Minnesota State Demographer's office supplied estimates of households for each county. The counties were then grouped into the five U.S. Forest Service Survey Units for

Minnesota forests, with the seven county Twin Cities metropolitan area broken out as an additional unit. All statistics were calculated by survey unit and aggregated to provide statewide totals.

The number of households was nearly the same as during the previous survey, so the same target sample sizes were utilized as in the 1988-89 survey (Table 1). To assure a representative and statistically valid sample, a blind list of household telephone numbers were obtained from Survey Sampling, Inc., of Fairfield, Connecticut.

The telephone survey was conducted over a five-week period beginning May 8, 1996. To assure a high response rate, telephone calls were made primarily during evening hours. Telephone numbers that were busy or where no one answered, were re-dialed on successive days until a response was obtained. After the fifth call-back, if there was no response, the number was treated as a non-response. Due to a large number of no response numbers, additional names were randomly selected from local telephone books in some survey units. Despite these efforts it was only possible to contact 1,278 households (Table 1). However, this was still adequate to meet minimum statistical standards.

Table 1: Households Sampled by Survey Unit

Survey Unit	Number of Households Sampled		Total Number of Households
	Target Number	Actual Number	
Aspen-Birch	300	235	102,872
Northern Pine	250	219	99,080
Central Hardwoods	386	266	362,392
Prairie	482	265	288,203
Metro	435	293	883,000
Total	1,853	1,278	1,735,547

As in the previous surveys, responding households were classified by: a) location by county, b) population size class, and c) fuelwood-use class.

Four population size classes were defined:

1. **Rural** - Households located in population centers of less than 2,500 people.
2. **Small Town** - Households located in population centers of 2,500 to 10,000 people.
3. **Large Town** - Households located in population centers of 10,000 to 100,000 people.
4. **Very Large Town** - Households located in population centers of 100,000 or more people.

Four fuelwood use classes were also identified:

1. **Nonuser** - Households that do not burn fuelwood.
2. **Major** - Fuelwood provides the main source of heat in the home. The user may have another fuel system for back-up purposes. More than 50 percent of the household heat is from wood.
3. **Supplementary** - Fuelwood is used as a back-up heating system, with another fuel providing the major source of heat. Less than 50 percent of the household heat is from wood.
4. **Pleasure** - Fuelwood is burned for pleasure only. Some heating benefit may result, but fuelwood is not relied on as a heating system.

Households were also asked the type of wood burning unit(s) used, species of wood burned, whether they purchased or cut their own fuelwood, the ownership they harvested the wood from, the type (live, cull, or dead) and portion (main trunk or top) of the tree utilized for fuelwood, and the location the fuelwood was used (primary home or secondary home or building).

Logger Survey

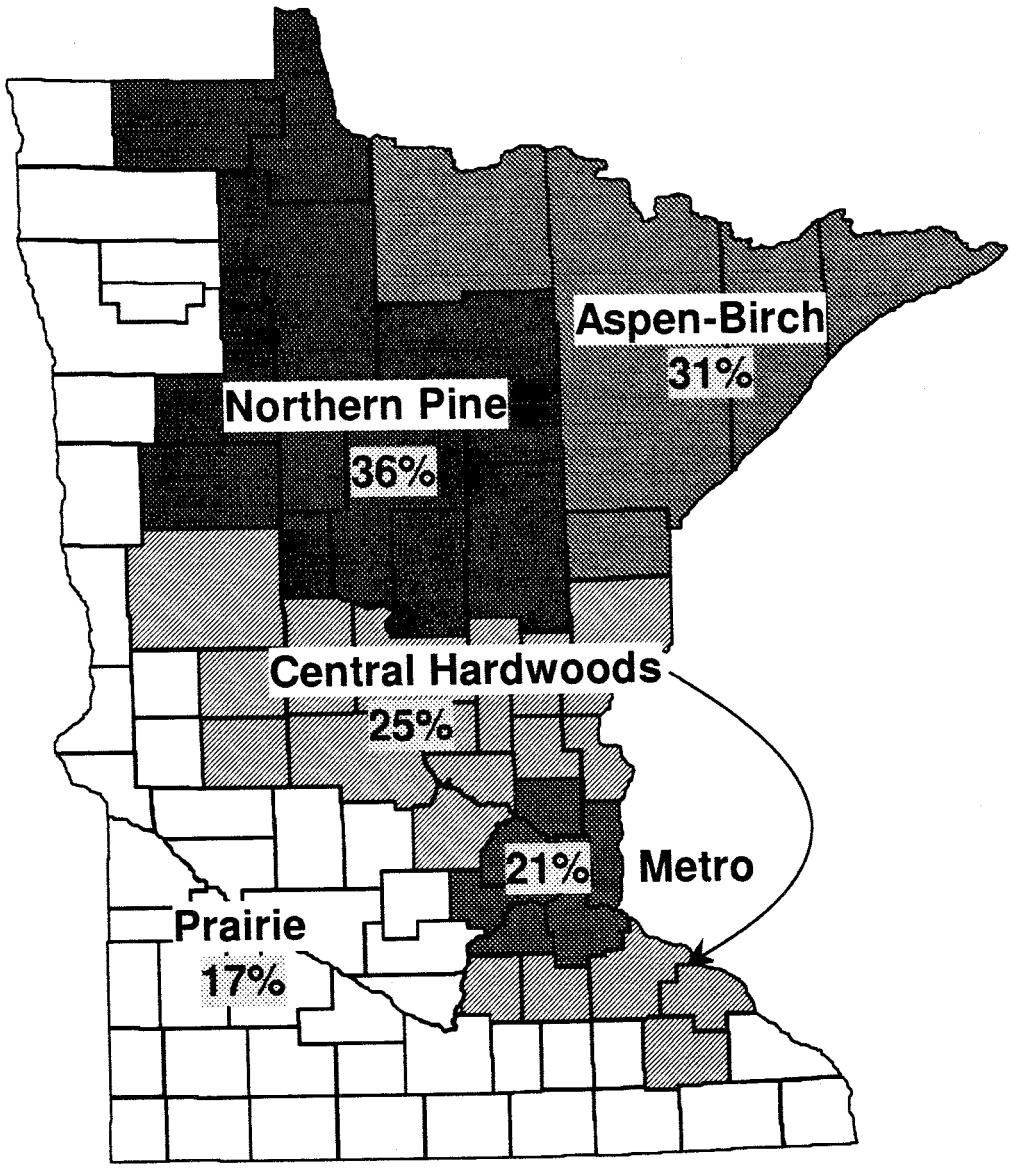
A substantial portion of the fuelwood consumed in Minnesota is purchased from commercial suppliers. In an attempt to identify the sources of this portion of the fuelwood supply 100 loggers were surveyed as part of the 1988-89 fuelwood study. A similar survey was conducted for this study.

One hundred twenty-six loggers were randomly selected from a statewide list of state timber sale permittees and contacted by phone in May and June, 1996. They were surveyed to determine the species and volume of fuelwood they sold during the 1995-96 heating season, what ownerships they harvested on, and whether the fuelwood came from growing stock trees or slash and cull trees. The results were expanded to an estimated statewide population of 1,400 logging businesses. It was not possible to stratify loggers by survey unit.

Map 1

Percent of Households Burned Fuelwood by Survey Unit

1995/96 Burning Season



CHARACTERISTICS OF FUELWOOD USERS

Statewide, 25 percent of the households burn fuelwood (Table 2). This is a significant decrease from the 33 percent identified in the three previous surveys. Each survey unit had a similar reduction in the proportion of households burning fuelwood. As shown in Map 1, the percent of households burning fuelwood within each survey unit varies from 17 percent to 36 percent.

Approximately 21 percent of Minnesota households used fuelwood as their major or primary source of heat during the 1995-96 heating season. Nearly 43 percent burn wood as a supplementary source of heat. These are both moderately lower than for the 1988-89 heating season (28% and 36% respectively). However, there was a substantial increase in the proportion of households burning wood for pleasure only (up to 36% from 26%) (Table 3).

Fuelwood use varies considerably by survey unit (Table 3). The percentage of households burning wood as their major source of heat, is highest in the northern pine and central hardwoods units of the state. The highest proportion of households burning fuelwood as a supplementary heat source is in the central hardwoods and prairie units. Households burning primarily for pleasure are most heavily represented in the metro unit.

Fuelwood use also varies by population density (Table 4). Households consuming fuelwood as a major or supplementary source of heat are most likely to live in rural areas and cut their own fuelwood. Households burning primarily for pleasure are more evenly distributed through out the state, and more likely to purchase their fuelwood. This represents a significant shift away from fuelwood for heat in small towns, large and major cities compared to previous studies.

Five categories of wood burning units were identified by households using fuelwood. The substantial increase in the proportion of regular and modified fireplace units (63% in 1995-96 compared to 39% in 1988-89) reflects the strong shift toward burning wood for pleasure (Table 5).

Table 2: Percent of Households Burning Fuelwood by Survey Unit

	Major	Supplementary	Pleasure	Overall
Aspen-Birch	19	27	19	22
Northern Pine	45	21	15	24
Central Hardwoods	21	27	13	21
Prairie	9	15	16	14
Metro	6	10	37	19
Total	100	100	100	100

Table 3: Percent of Fuelwood Burned by Use Class and Survey Unit

	Major	Supplementary	Pleasure	Overall
Aspen-Birch	54	39	7	13
Northern Pine	72	22	6	19
Central Hardwoods	57	40	3	29
Prairie	46	39	15	14
Metro	13	39	48	25
Overall	48	44	8	

Table 4: Percent of Volume Burned by Population Unit - Statewide

	Major	Supplementary	Pleasure	Overall
Rural	85	75	27	59
Small Town	3	6	25	13
Large Town	9	13	24	16
Very Large Town	3	6	24	12
Total	100	100	100	100

Table 5: Percent of Volume Burned by Type of Wood Burning Units - Statewide

Stove	46
Reg. Fireplace	17
Mod. Fireplace	2
Furnace	26
Stove/Reg. Fireplace	2
Stove/Mod. Fireplace	1
Stove/Furnace	—
Furnace/Fireplace	6
Total	100

VOLUME OF FUELWOOD BURNED

The total volume of fuelwood consumed in Minnesota during the 1995-96 heating season for heating residential homes and second buildings was 751,000 cords.[1] This is a decline of nearly 28 percent from the 1988-89 heating season (Figure 1). The volume consumed for heating primary residences declined 24 percent to 719,000 cords, while the volume consumed to heat second homes and other buildings declined nearly 65 percent to 32,000 cords.

Statewide, approximately 48 percent of the fuelwood is burned as the major heat source and 36 percent for supplementary heating of homes and second buildings (Table 3). This is true within all the survey units except the metro. The largest volume of fuelwood was consumed in the central hardwoods unit, 207,000 cords (first homes only). The aspen-birch and prairie units reported the least volume of fuelwood burned (92,000 and 100,000 cords respectively for first homes).

The average number of cords burned by household using fuelwood as a major heat source has increased significantly compared to previous surveys (Table 6). Statewide, major users burned an average of seven cords during a heating season, with households in the aspen-birch and northern pine units burning more wood per household than those in the other survey units.

Table 6: Average Number of Cords Burned per Household by Use Class - Statewide

	1995-96	1988-89
Major	7.1 cords	6.1 cords
Supplementary	2.0 cords	2.3 cords
Pleasure	0.7 cords	0.5 cords

Fuelwood Species Consumed

The results of this survey were less specific than previous ones regarding the species of wood consumed. Mixed species accounted for more than 32 percent of the volume reported. This is twice the proportion found in 1989 (15%). Oak was still the single most important species (Table 7). The proportion of elm consumed declined by more than 80 percent. This probably

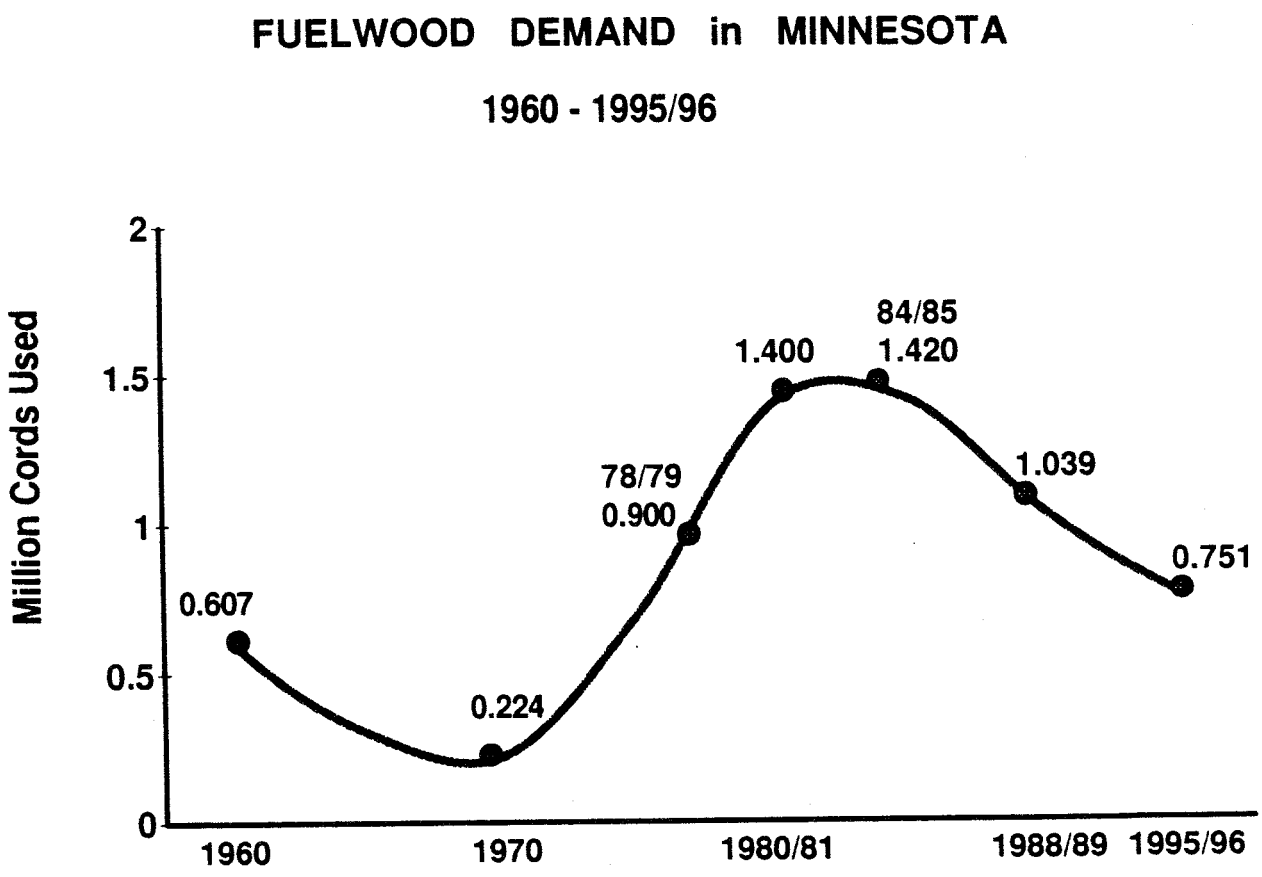
[1]One standard cord is equal to 128 cubic feet of wood or a stack of wood four feet high by four feet deep by eight feet long.

Table 7: Percent of Fuelwood Burned by Species - Statewide

	1995-96	1988-89
Oak	27	32
Birch	14	13
Ash	4	8
Elm	3	14
Maple	4	8
Aspen	10	7
Other Species	6	3
Mixed Species	32	15

Note: Slabs and scrap lumber are included in this species breakdown.

Figure 1



VOLUME OF FUELWOOD HARVESTED

Sixty-two percent of the fuelwood consumed was cut by the homeowners themselves (Table 8). Thirty-eight percent was purchased. It was desirable to identify the sources of this wood to assess the impacts on different land ownership categories and competing uses of wood. The volumes cut by homeowners and loggers are reported separately because of significant differences in the data.

Table 8: Percent of Fuelwood Cut by Homeowners by Use Class - Statewide

	1995-96	1988-89
Major	54	50
Supplementary	37	45
Pleasure	9	5

Fuelwood Cut by Homeowners

Individual households cut 444,000 cords of fuelwood (first home only) for the 1995-96 heating season, nearly a 25 percent decline in volume from the previous survey. The volume cut by households in the central hardwoods unit remained nearly the same, but declined by more than 30 percent in the other survey units. Households using fuelwood as a major source of heat harvested 54 percent of the fuelwood cut by homeowners (Table 9), a slight increase from the 50 percent reported for 1988-89.

Ninety-four percent or 436,000 cords of fuelwood cut by homeowners was harvested from private land (Table 10). In the prairie unit, all the households sampled cut from private lands.

Most of the wood cut (81 percent) by residential households comes from dead or downed trees, land clearing, and logging residues (Table 11). Less than 19 percent (87,000 cords) comes from live standing trees (growing stock) in the forest.

Table 10: Percent of Fuelwood by Harvest Location - Statewide

Harvest Location Ownership	Harvested by: Homeowners	Loggers
Forest Industry	---	9
Private	95	42
Federal	---	2
State	4	29
County Municipal	1	18
Total	100	100

Table 11: Percent of Fuelwood Cut by Homeowners by Type of Removal - Statewide

	1995-96	1988-89
Live Standings Trees	19	14
Dead & Down Trees	75	53
Tops & Logging Residue	6	2
Land Clearing	---	31

Purchased Fuelwood

Over 275,000 cords of fuelwood were purchased by households for residential use during the 1995-96 heating season. This is a decline of 22 percent from the 1988-89 heating season. Minnesota loggers only supplied 115,000 cords to this market, a 34 percent decline from the previous survey.

About 50 percent of the fuelwood harvested by loggers came from lands administered by public agencies, 40 percent from private land, and 9 percent from forest industry lands (Table 10). Only 111,000 cords of the firewood harvested by loggers came from forest land. The remaining volume (4,000 cords) came from pasture and other non-forest acres.

Unlike homeowners that cut their own fuelwood, paper birch not oak made up the largest portion (38%) of fuelwood cut by loggers (Table 12). This is due to species availability in the area of the state in which most loggers work. However, oak is second in importance, representing 31 percent of the volume.

Only forty-five percent (50,000 cords) of the fuelwood harvested by loggers from forest lands came from live trees (growing stock) (Table 13), a decline of 98,000 cords from 1988-89. This reflects the

TRENDS IN HOUSEHOLD FUELWOOD CONSUMPTION

The volume of fuelwood burned by Minnesota households declined 28 percent since the 1988–89 heating season. Nearly 1,039,000 cords were burned at that time, compared to only 751,000 cords in 1995-96 (Figure 1).

This drop is primarily attributable to four factors. The most important is probably the decline in fossil fuel prices and the increased availability of natural gas. The increased industrial demand for wood to manufacture paper and other products is also important. The latter has had the greatest impact on the availability of aspen, birch, and maple. Other factors contributing to the decline in residential fuelwood use include; the amount of work associated with producing your own fuelwood, the inconvenience stoking and cleaning a wood burning unit, and the increased incidence of building fires attributed to wood heating units.

The trend may continue downward in the near future. One indicator is the number of households considering installing wood burning facilities. The number has shrunk dramatically (67%) from over 49,000 in 1989 to only 16,000 in 1996 (Table 15).

Table 15 Number of Households Planning to Install Wood Burning Units - Statewide

Use Class	Heating Season 1995-96	1988-89
Major	2,000	0
Supplementary	4,000	12,000
Pleasure	10,000	9,000
Total	16,000	21,000

Appendix

Fuelwood Tables

Table 1: Volume of Fuelwood Burned by Use Class and Survey Unit

Survey Unit	Use Class			Total 1st Home	Total 2nd Building	Total
	Major	Supplemental	Pleasure			
Aspen-Birch	49,687	35,415	6,742	--	--	91,843
Northern Pine	102,024	31,173	7,692	--	--	140,888
Central Hardwoods	118,525	82,833	5,858	--	--	207,216
Prairie	46,219	39,044	14,465	--	--	99,727
Metro	24,110	70,218	85,287	--	--	179,614
Total	340,564	258,681	120,043	31,926	--	751,215

Table 2: Total Survey Samples as Compared to Households Burning Wood

Survey Unit	Total Samples	Burned Wood	Households
Aspen-Birch	235	72	102,872
Northern Pine	219	78	99,080
Central Hardwoods	266	66	362,392
Prairie	265	46	288,203
Metro	293	62	883,000
Total	1,278	324	1,735,547

Table 3: Volume (in Cords) Sampled by Population Unit and Use Class.

Population Unit	Use Class			Total
	Major	Supplemental	Pleasure	
Rural	441.5	211.3	15.7	668.5
Small Town	10.0	27.2	23.1	60.3
Large Town	20.0	23.8	19.6	63.4
Very Large Town	5.0	7.5	19.9	32.4
Total	476.5	269.8	78.3	824.6

Samples with less than 10 are not reliable and should be cautiously used.

Table 4: Number of Samples Used Fuelwood by Population Unit and Use Class.

Population Unit	Use Class			Total
	Major	Supplemental	Pleasure	
Rural	57	103	32	192
Small Town	2	9	30	41
Large Town	6	18	28	52
Very Large Town	2	9	28	39
Total	67	139	118	324

Samples with less than 10 are not reliable and should be cautiously used.

Table 5: Total Volume Burned by Species and Use Class (First Homes)

Species Name	Use Class			Total
	Major	Supplemental	Pleasure	
Oak	72,209.2	85,801.2	38,643.3	196,653.7
Birch	55,851.8	30,579.5	15,658.4	102,089.7
Ash	14,410.1	7,816.0	6,906.1	29,132.2
Elm	5,501.2	10,344.3	5,442.4	21,287.9
Maple	15,150.4	9,575.9	4,196.4	28,922.7
Aspen	47,198.3	21,867.2	4,488.7	73,554.2
Basswood	8,161.3	0.0	0.0	8,161.3
Mixed Hardwoods	107,548.6	79,252.7	40,657.4	227,458.7
Other Hardwoods	4,489.1	10,235.5	3,016.2	17,740.8
Pine	7,209.3	1,760.5	641.1	9,610.9
Mixed Softwoods	2,927.5	795.5	0.0	3,723.0
Other Softwoods	0.0	817.4	136.2	953.6
Total	340,656.8	258,845.7	119,786.2	719,288.7

Table 6: Total Volume Burned by Species and Use Class: Aspen-Birch Unit

Species Name	Use Class			Total
	Major	Supplemental	Pleasure	
Oak	1,534.7	1,710.1	83.3	3,328.1
Birch	18,526.5	13,374.1	3,915.8	35,816.4
Ash	0.0	2,872.2	337.6	3,209.8
Elm	0.0	0.0	57.0	57.0
Maple	6,138.9	5,240.0	241.2	11,620.1
Aspen	16,640.9	4,823.5	1,403.2	22,867.6
Mixed Hardwoods	6,138.9	6,226.6	701.6	13,067.1
Pine	789.3	1,074.3	13.2	1,876.8
Total	49,769.2	35,320.8	6,752.9	91,842.9

Table 7: Total Volume Burned by Species and Use Class: Northern Pine

Species Name	Use Class			Total
	Major	Supplemental	Pleasure	
Oak	5,763.6	7,890.6	2,337.5	15,991.7
Birch	17,885.4	3,041.9	2,255.1	23,182.4
Ash	9,514.5	343.1	0.0	9,857.6
Elm	869.1	2,515.9	0.0	3,385.0
Maple	2,744.6	45.7	878.3	3,668.6
Aspen	22,642.7	10,543.7	823.4	34,009.8
Mixed Hardwoods	37,326.2	6,198.2	1,207.6	44,732.0
Pine	2,332.9	686.1	0.0	3,019.0
Mixed Softwoods	2,927.5	114.4	0.0	3,041.9
Total	102,006.5	31,379.6	7,501.9	140,888.0

Table 8: Total Volume Burned by Species and Use Class: Central Hardwoods

Species Name	Use Class			Total
	Major	Supplemental	Pleasure	
Oak	53,949.7	23,677.9	2,043.6	79,671.2
Birch	12,261.3	2,724.7	408.7	15,394.7
Ash	544.9	0.0	0.0	544.9
Elm	4,632.0	5,326.9	408.7	10,367.6
Maple	6,266.9	272.5	0.0	6,539.4
Aspen	953.7	4,087.1	0.0	5,040.8
Basswood	1,907.3	0.0	0.0	1,907.3
Mixed Hardwoods	32,696.8	42,519.5	2,861.0	78,077.3
Other Hardwoods	1,226.1	2,724.7	0.0	3,950.8
Pine	4,087.1	0.0	0.0	4,087.1
Mixed Softwoods	0.0	681.2	0.0	681.2
Other Softwoods	0.0	817.4	136.2	953.6
Total	118,525.8	82,831.9	5,858.2	207,215.9

Table 9: Total Volume Burned by Species and Use Class: Prairie Unit

Species Name	Use Class			Total
	Major	Supplemental	Pleasure	
Oak	7,341.7	9,843.3	3,263.0	20,448.0
Birch	7,178.5	4,350.6	0.0	11,529.1
Ash	4,350.6	4,600.8	3,099.8	12,051.2
Elm	0.0	2,501.6	0.0	2,501.6
Maple	0.0	2,207.9	271.9	2,479.8
Aspen	6,961.0	0.0	0.0	6,961.0
Basswood	6,254.0	0.0	0.0	6,254.0
Mixed Hardwoods	10,876.6	15,259.8	7,504.8	33,641.2
Other Hardwoods	3,263.0	271.9	0.0	3,534.9
Pine	0.0	0.0	326.3	326.3
Total	46,225.4	39,035.9	14,465.8	99,727.1

Table 10: Total Volume Burned by Species and Use Class: Metro Unit

Species Name	Use Class			Total
	Major	Supplemental	Pleasure	
Oak	3,619.4	42,679.2	30,916.0	77,214.6
Birch	0.0	7,088.1	9,078.7	16,166.8
Ash	0.0	0.0	3,468.6	3,468.6
Elm	0.0	0.0	4,976.7	4,976.7
Maple	0.0	1,809.7	2,805.1	4,614.8
Aspen	0.0	2,413.0	2,262.1	4,675.1
Mixed Hardwoods	20,510.1	9,048.6	28,382.4	57,941.1
Other Hardwoods	0.0	7,238.9	3,016.2	10,255.1
Pine	0.0	0.0	301.6	301.6
Total	24,129.5	70,277.5	85,207.4	179,614.4

Table 11: Total Volume Cut by Homeowners by Survey Unit and Use Class

Survey Unit	Use Class					
	Major	Supplemental	Pleasure	1st Home	2nd Bldg	Total
Aspen-Birch	20,684.4	15,650.1	2,750.0	39,084.5	--	--
Northern Pine	58,703.3	15,269.6	1,760.0	75,732.9	--	--
Central Hardwoods	105,992.1	63,350.1	3,814.6	173,156.8	--	--
Prairie	37,520.1	18,814.4	3,480.1	59,814.6	--	--
Metro	15,068.3	53,281.6	28,027.1	96,377.0	--	--
Total	237,968.2	166,365.8	39,831.8	444,165.8	19,716	463,882

Growing Stock Harvested by Homeowners - Statewide

First Home	83,499 Cords
Second Building	3,706 Cords
Total	87,205 Cords

Table 12: Percent of Fulewood Cut by Homeowners by Harvest Location by Survey Unit - Statewide

	Aspen-Birch	Northern Pine	Central Hardwoods	Prairie	Metro	Overall
State	1	1	4	22	--	4
County	3	--	--	--	--	1
Federal	--	--	--	--	--	--
Private	96	98	96	78	100	95
Forest Industry	--	1	--	--	--	--
Total	100	100	100	100	100	100
Overall	19	35	27	12	7	100

Table 13: Total Cords Cut by Homeowners by Survey Unit and Type of Removal: First Home

Survey Unit	Live Standing Trees	Dead Trees / Stand Down	Tops & Logging Residues	Rural & Agric. Land Clearing	Resid. & Urban Land Clearing	Total Volume (in Cords)
Aspen-Birch	11,493.9	27,590.6	--	--	--	39,084.5
Northern Pine	14,357.9	52,007.1	9,367.9	--	--	75,732.9
Central Hardwoods	33,961.9	135,363.7	3,831.2	--	--	173,156.8
Prairie	19,863.0	25,957.3	13,994.4	--	--	59,814.7
Metro	3,822.3	92,395.9	158.9	--	--	96,377.1
Total	83,499.0	333,314.6	27,352.4	--	--	444,166.0

Table 14: Total Cords Purchased by Survey Unit and Use Class: First Home

Survey Unit	Use Class			Total
	Major	Supplemental	Pleasure	
Aspen-Birch	29,002.4	19,764.4	3,991.7	52,758.5
Northern Pine	43,320.4	15,903.0	5,931.6	65,155.0
Central Hardwoods	12,532.9	19,482.6	2,043.7	34,059.2
Prairie	8,698.6	20,229.4	10,984.7	39,912.7
Metro	9,041.7	16,936.3	57,259.5	83,237.5
Total	102,596.0	92,315.7	80,211.2	275,122.9

Table 15: Number of Loggers Sampled for Fuelwood Production (1996)

Cut More Than 20 Cords*	68.0
Cut from 1 to 20 Cords	25.0
Cut No Fuelwood	33.0
Total	126.0

* Estimates of logger harvest of fuelwood for resale were based on those that harvested more than 20 cords. The others were assumed to be cutting primarily for personal use.

Table 16: Volume of Fuelwood Cut by Loggers from Forest Land (Woodland)

Volume Cut from Woodland	110,650.0
Volume Cut from Non-Woodland	3,972.0
Total Volume	114,622.0

Table 17: Total Expanded Fuelwood Cut by Loggers from Growing Stock Trees (Includes 20 Cords Over/Survey)

Species	Total Cords
Black Ash	3,827.5
Elm	168.6
Aspen	1,568.9
Paper Birch	19,073.7
Sugar Maple	7,855.4
Basswood	566.7
Oak	15,783.3
Conifer	1,294.4
Other	3.6
Total	50,142.1

Table 18: Total Fuelwood Cut by Loggers from Woodland Minnesota Logger Survey - 1996 - (Excludes Fuelwood Volume Cut Less Than 20 Cords/Logger Survey)

Source	Total Cords
Standing Live Trees	50,144.2
Logging Waste	54,383.3
Dead Tree	1,122.5
Other	5,000.0
Total	110,650.0

Table 19: Total Expanded Fuelwood Volume Cut by Loggers from Land Ownerships Minnesota Logger Survey - 1996 - (Includes 20 Cords and Over/Logger Survey)

Ownership	Total Cords
Forest Industry	10,588.9
Private Land	47,351.1
National Forest Land	2,411.1
Other Federal	163.9
State	33,507.2
County/Municipal	20,600.0
Total	114,622.2

Table 20: Estimated Total Represented Households Burned Fuelwood

Survey Unit	Use Classes			Total
	Major	Supplemental	Pleasure	
Aspen-Birch	5,691	16,197	9,631	31,519
Northern Pine	13,573	13,573	8,144	35,290
Central Hardwoods	19,073	50,408	20,436	89,917
Prairie	6,525	22,839	20,664	50,028
Metro	12,055	42,191	132,599	186,845
Total	56,917	145,208	191,474	393,599

Table 21: Number of Households by Type of Facility Used

Facility Name	Use Class			Total
	Major	Supplemental	Pleasure	
Stove	24,512	52,079	22,264	98,855
Regular Fireplace	7,841	63,860	151,626	223,327
Modified Fireplace	4,376	5,464	14,957	24,797
Furnace	17,482	14,922	0	32,404
Stove/Regular Fireplace	1,814	1,964	452	4,230
Stove/Modified Fireplace	0	2,267	0	2,267
Stove/Furnace	0	1,328	0	1,328
Fireplace/Furnace	890	3,326	2,175	6,391
Total	56,915	145,210	191,474	393,599

Table 22: Number of Households by Type of Facility: Aspen-Birch

Facility Name	Use Class			Total
	Major	Supplemental	Pleasure	
Stove	4,815	6,566	2,189	13,570
Regular Fireplace	0	5,253	7,442	12,695
Furnace	438	1,751	0	2,189
Stove/Regular Fireplace	0	876	0	876
Stove/Furnace	0	876	0	876
Fireplace/Furnace	438	876	0	1,314
Total	5,691	16,198	9,631	31,520

Table 23: Number of Households by Type of Facility: Northern Pine

Facility Name	Use Class			Total
	Major	Supplemental	Pleasure	
Stove	6,334	6,787	905	14,026
Regular Fireplace	452	1,810	6,334	8,596
Modified Fireplace	0	0	452	452
Furnace	5,882	3,619	0	9,501
Stove/Regular Fireplace	452	0	452	904
Stove/Modified Fireplace	0	905	0	905
Stove/Furnace	0	452	0	452
Fireplace/Furnace	452	0	0	452
Total	13,572	13,573	8,143	35,288

Table 24: Number of Households by Type of Facility: Centrals Hardwoods

Facility Name	Use Class			Total
	Major	Supplemental	Pleasure	
Stove	8,174	23,160	0	31,334
Regular Fireplace	1,362	17,711	19,073	38,146
Modified Fireplace	1,362	1,362	1,362	4,086
Furnace	6,812	5,450	0	12,262
Stove/Regular Fireplace	1,362	0	0	1,362
Stove/Modified Fireplace	0	1,362	0	1,362
Fireplace/Furnace	0	1,362	0	1,362
Total	19,072	50,407	20,435	89,914

Table 25: Number of Households by Type of Facility: Prairie

Facility Name	Use Class			Total
	Major	Supplemental	Pleasure	
Stove	2,175	6,525	1,088	9,788
Regular Fireplace	0	11,963	16,313	28,276
Modified Fireplace	0	1,088	1,088	2,176
Furnace	4,350	1,088	0	5,438
Stove/Regular Fireplace	0	1,088	0	1,088
Fireplace/Furnace	0	1,088	2,175	3,263
Total	6,525	22,840	20,664	50,029

Table 26: Number of Households by type of Facility: Metro

Facility Name	Use Class			Total
	Major	Supplemental	Pleasure	
Stove	3,014	9,041	18,082	30,137
Regular Fireplace	6,027	27,123	102,464	135,614
Modified Fireplace	3,014	3,014	12,055	18,083
Furnace	0	3,014	0	3,014
Total	12,055	42,192	132,601	186,848

Table 27: Number of Households Planning to Install Facilities

Facility Name	Use Class			Total
	Major	Supplemental	Pleasure	
Stove	1,800	0	3,452	5,252
Regular Fireplace	0	1,088	6,479	7,567
Furnace	452	1,814	0	2,266
Fireplace and Furnace	0	1,088	0	1,088
Total	2,252	3,990	9,931	16,173

Table 28: Total Households Planning to Install Facilities by Survey Unit

Facility Name	Use Classes			Total
	Major	Supplemental	Pleasure	
For Survey Unit 1: Aspen-Birch				
Stove	438	0	438	876
For Survey Unit 2: Northern Pine				
Regular Fireplace	0	0	452	452
Furnace	452	452	0	904
Total	452	452	452	1,356
For Survey Unit 3: Central Hardwoods				
Stove	1,362	0	0	1,362
Furnace	0	1,362	0	1,362
Total	1,362	1,362	0	2,724
For Survey Unit 4: Prairie				
Regular Fireplace	0	1,088	0	1,088
Fireplace & Furnace	0	1,088	0	1,088
Total	0	2,176	0	2,176
For Survey Unit 5: Metro				
Stove	0	0	3,014	3,014
Regular Fireplace	0	0	6,027	6,027
Total	0	0	9,041	9,041
Statewide Total	2,252	3,990	9,931	16,173

Secondary Calculation of Fuelwood Volumes

A. From "Minnesota Wood Waste Studies, 1994" by the Minnesota Department of Natural Resources, Division of Forestry

Primary mills, Sawmills and other primary wood processing industries

See Appendix Table II-F Volume by Fuel Use Class by Residue Category.

97,257 green tons of slabs and edgings utilized for domestic fuel at 2.293 tons/cords = 39,797 cords.

Secondary Wood Processors, Cabinet, millwork, window and related companies

See Appendix III-H Total Expanded Residue Volume by MN County & Residue Use Class.

127,495 dry tons (8% moisture) of fuel sold or given away. Assume: 1 dry ton = 1.84 green tons, 2.293 green tons = 1 cord. This means 1 dry ton would = 1.84/2.293 = 0.80 cords/ton. 127,495 tons X 0.80 cords/ton = 101,996 cords.

Assume the ration of domestic (residential) to other fuel uses as observed for the primary mills (20.5%). 101,996 cords X .205 = 21,909 cords utilized for domestic fuel.

B. From "Urban Tree Residue, An Assessment of Wood Residue From Tree Removal And Trimming Operations in the Seven-County Metro Area of Minnesota", March 1992, by the Minnesota Department of Natural Resources, Division of Forestry.

See the tabular breakdown of data on page 11.

The total tonnage of tops and brush and mixed wood sold or given away is 12,281 green tons. Assume 2.293 tons = 1 cords. 12,281 tons/2.293 tons/cord = 5,356 cords.

C. Growing stock inappropriately identified as logging waste in the logger fuelwood survey.

A total of 54,383 cords fuelwood were identified by loggers as being derived from logging waste. The questions on the survey did not make it clear that trees the logger did not have a ready market for should not be included in logging waste. While there is not scientific way to account for this, it was felt some adjustment would be appropriate. For this reason it was assumed that 25 percent or approximately 14,000 cords of the logging waste volume was actually from growing stock.

D. Growing stock portion of wood burned in second homes and other buildings.

31,926 cords of fuelwood were consumed heating second homes and other buildings. The household survey did not breakdown this volume by source or species because of the small sample size. Therefore it is assumed the breakdown is the same as for first homes. For first homes 719,229 cords were consumed, with 83,499 cords harvested from live standing trees (growing stock). (83,499/719,229) X 31,926 = 3,706 cords.

E. Growing stock included in fuelwood from unidentified sources.

It is possible that a significant portion of the 90,000 cords of fuelwood from unidentified sources came from forest lands in Minnesota. For purposes of estimation assume that 70 percent came from Minnesota, and the proportion of growing stock was the same as that for fuelwood harvested by loggers (58%). The volume of growing stock would be 36,540 cords.