

# RESIDENTIAL FUELWOOD ASSESSMENT

STATE OF MINNESOTA

2007 – 2008 Heating Season



Sponsors:



Minnesota Pollution  
Control Agency



Northern Research Station  
Forest Inventory and Analysis



Division of Forestry



## ACKNOWLEDGEMENTS

This project was funded through a grant provided by the Minnesota Pollution Control Agency as part of its emissions inventory from residential biomass burning. The cooperating partners, US Forest Service – Northern Research Station - Forest Inventory and Analysis, Minnesota Department of Natural Resources – Division of Forestry and the Health, Patio and Barbecue Association assisted with the project design.

The report was prepared by:

Mimi Barzen, Minnesota DNR-Forestry, Grand Rapids

Ronald Piva, USFS, Northern Research Station - Forest Inventory and Analysis, St. Paul

Chun Yi Wu, P.E., Minnesota Pollution Control Agency, Environmental Outcomes Division, St. Paul

Rick Dahlman, Minnesota DNR-Forestry, St Paul

### **For more information or to request a copy, contact:**

Mimi Barzen

DNR Forestry

1201 East Highway 2

Grand Rapids MN 55744

218-327-4119

mimi.barzen@dnr.state.mn.us

or

DNR Information Center

Twin Cities: 651-296-6157

Minnesota toll free: 888-646-6367

TTY: 800-657-3929

More information about the Minnesota Department of Natural Resources, Wood Utilization and Marketing Program is available at <http://www.dnr.state.mn.us/forestry/um>

## Table of Contents

	Page
Executive Summary	3
Introduction: purpose, methods, and objectives	5
Minnesota map indicating survey units	8
Results	9
Appendices	
Sources of Secondary Calculations of Fuelwood Volumes	23
Tables	25
Fuelwood Survey Questionnaire	46

## Tables

- Table 1: Number of Households Sampled by Survey Unit and Corresponding Population  
Table 2: Percent of Households Burning Fuelwood by Survey Unit and Reason for Burning  
Table 3: Percent of Volume Burned by Type of Wood-Burning Facility  
Table 4: Number of Cords Burned by Survey Unit and Place of Consumption  
Table 5: Number of Cords Burned by Fuel Type  
Table 6: Percent of Fuelwood Burned by Species and Survey Year  
Table 7: Percent of Fuelwood Consumption by Procurement Method and Reason for Burning  
Table 8: Percent of Fuelwood Consumption from Roundwood Cut by Households by Reason for Burning and Survey Year  
Table 9: Percent and Volume of Fuelwood Harvested by Source of Material

## Figures

- Figure 1: Percent of Households by Survey Unit That Burned Fuelwood During 2007-2008 Heating Season  
Figure 2: Percent of Households that Burn Fuelwood by Reason for Burning and Survey Year  
Figure 3: Fuelwood Consumption in Minnesota by Survey Year  
Figure 4: Percent of Fuelwood Burned by Survey Unit and Reason for Burning  
Figure 5: Percent of Fuelwood Burned by Reason for Burning by Survey Year  
Figure 6: Average Number of Cords Burned per Household by Reason for Burning and Survey Year  
Figure 7: Volume of Fuelwood Harvested by Households and Loggers by Source of Material  
Figure 8: Volume of Fuelwood Harvested from Growing Stock by Survey Year  
Figure 9: Volume of Fuelwood Cut by Households and Loggers in Minnesota by Species, 2007-2008



## **Executive Summary**

A total of 1,434 households responded to the Minnesota residential fuelwood study that was conducted for the 2007-2008 heating season. Approximately 978,900 cords of fuelwood were consumed by 615,900 households in Minnesota between April 2007 and March 2008. This represents a 49 percent increase in volume and a 57 percent increase in the number of households compared to the 656,300 cords of fuelwood consumed by 391,700 households between April 2002 and March 2003, a clear reversal of the steady decline in fuelwood consumption recorded since 1985. This upward swing indicates that almost 30 percent of all Minnesota households burned fuelwood between April 2007 and March 2008.

This increase can partially be attributed to the recent spike in the prices of fossil fuels. However, the use of fuelwood for pleasure rather than as a heat source has increased significantly since 1985. Of those burning fuelwood, 67 percent of the households consume it for pleasure and recreation.

## **Trends From Past Surveys**

Minnesota has surveyed fuelwood consumption periodically since 1960 when 607,000 cords were consumed. Consumption has fluctuated from a low of 224,000 cords in 1970 to a high of 1.42 million cords in the 1984-1985 heating season. Shifts in consumption appear to track closely with petroleum and natural gas prices. Use increased dramatically following the 1970 oil embargo and began to decline steadily as natural gas lines were extended across the state in the late 1980s through the 1990s.

The steady decline in the use of fuelwood as a heat source from 1984-1985 through the winter of 2002-2003 also likely reflects a tightening of insurance companies standards for the use of wood burning facilities of all kinds.

## **Fuelwood Use: Pleasure and Primary and Secondary Heating**

The way fuelwood has been used often does not follow the volume consumed. While fuelwood consumption declined from 1984-1985 to 2002-2003, the use of fuelwood as primary source of heat increased from 48 percent of the total volume in both the 1988-1989 and 1995-1996 heating seasons to 53 percent of the total volume in 2002-2003. It then declined to 45 percent in 2007-2008. At the same time, the use of fuelwood as secondary heat source declined from 44 percent 1988-1989 and 1995-1996 to 35 percent in 2002-2003, and declined further to 26 percent of the total fuelwood consumed in 2007-2008. Over the same time period, burning fuelwood for pleasure increased from 8 percent during the 1988-1989 and 1995-1996 heating seasons to 12 percent of the fuelwood consumed in 2002-2003 heating season. This increased dramatically to 30 percent of the fuelwood consumed in 2007-2008. Much of the increase in the pleasure category could be due to the popularity of fire pits and chimineas, which has occurred in the past few years. While many people no longer burn fuelwood as a heating source, use for recreational purposes, including backyard use and camping, is climbing rapidly.

Even though the volume of fuelwood use increased in the last five years, its use as a primary source of heat dropped from 18 percent of the households that burned in 2002-2003 to 13 percent in 2007-2008. Burning fuelwood as a secondary heat source fell from 30 percent of the households in 2002-2003 to 20 percent in 2007-2008. During this same period, use for pleasure grew from 52 percent of the households to 67 percent statewide. Even though the percentage of households using wood for primary and secondary heat declined, these two uses account for 688,000 cords consumed, or 70 percent of all fuelwood burned.

## Fuelwood Harvesting

Along with the increased volume of fuelwood consumed in 2007-2008, the proportion of fuelwood harvested by households remains high, with 80 percent harvested by households. In addition, 84 percent of the fuelwood harvested in 2007-2008 was removed from private land. The remainder was derived from, in descending order: state, county, and municipal lands, with minor amounts harvested from forest industry and federal lands. This compares to 60 percent of the volume harvested by households in 2002-2003, 62 percent in 1995-1996, and 51 percent in 1988-1989.

Households that burn fuelwood as primary heat source are more likely to harvest their own fuelwood, with a total of 48 percent doing so. This compares to 58 percent of the volume harvested by households for primary use in 2002-2003, 54 percent in 1995-1996 and 51 percent in 1988-1989 heating seasons. Twenty-seven percent of those using fuelwood as a secondary source harvested their own fuelwood in 2007-2008, while 25 percent of households that burned for pleasure cut their own fuelwood.

## Fuelwood Preferences

Oak continues to be the species of choice for roundwood fuelwood consumption, with 30 percent of the total volume. Ash is the next most popular firewood species, with 18 percent of the total. Aspen, elm, birch, and maple combined, account for another 40 percent of the volume of roundwood burned. Other species burned include: pine, basswood, cottonwood, spruce, cedar, and tamarack.

Secondary fuelwood sources of mixed species, which includes: scrap lumber, pallets, sawmill slabs, sawdust, and branches, manufactured fireplace logs, and wood pellets have been highly variable, doubling from 15 percent of the total fuelwood burned in 1988-1989 to 32 percent in 1995-1996, then plunging to 8 percent in 2002-2003 and 2007-2008.

In 2007-2008, 66,400 cords were derived from wood manufacturing residues. This compares to 2002-2003, when 45,000 cords were derived from wood residues, an increase of 47 percent in five years. In addition, a huge jump took place in manufactured logs and wood pellets. In 2002-2003, only 4,900 cords of pellets and waxed logs were purchased. During the 2007-2008 heating season, 12,300 cords were purchased, more than 2.5 times the amount bought in 2002-2003. This reflects the recent expansion of the manufactured fireplace logs and wood pellet industries.

A total of about 161,750 cords of fuelwood was harvested from growing stock on forestland by landowners and loggers for use as fuelwood. This is a 9 percent increase from the 149,000 cords harvested for the 2002-2003 heating season. When compared to the 1995-1996 heating season, this is a reduction of 14 percent from the 188,000 cords reported during that survey and a 59 percent decrease from the 237,000 cords reported for the 1988-1989 heating season.

## Conclusion

Despite the trend toward use of fuelwood for pleasure rather than for heat, the recent economic crisis and the associated downturn in industrial demand for wood could increase the consumption of fuelwood for primary and secondary heating. The impact could be very significant in a short time because more than 100,000 additional households have wood burning facilities that currently do not use fuelwood, and nearly another 40,000 households plan to purchase wood burning facilities in the near future (Appendix Table A).

The spike in the volume of fuelwood consumed and the number of households that utilized fuelwood appear to be closely tied to the cost and availability of fossil fuel, particularly natural gas. With the current cost of energy, the volume of fuelwood consumed is likely to fluctuate with the changing prices of other sources of fuel.

# INTRODUCTION

## Project Purpose

During the spring and summer of 2008, the cooperating partners conducted a survey to determine the volume of residential fuelwood burned during the 2007-2008 heating season. Similar surveys were conducted for the 1960, 1969-1970, 1979-1980, 1984-1985, 1988-1989, 1995-1996, and 2002-2003 heating seasons. These surveys are part of a long-term effort to monitor trends in use of the fuelwood by residential households in Minnesota.

## Survey Objectives

The objectives of this survey were to:

- 1) Estimate the total volume of fuelwood harvested and consumed in Minnesota during the 2007-2008 heating season.
- 2) Identify the suppliers of fuelwood (purchased, given free, or self-harvested).
- 3) Estimate the volume of fuelwood harvested from different land ownership (state, federal, county, forest industry, and private lands).
- 4) Estimate the volume of fuelwood from the following wood supply categories: live and/or dead trees, logging residue, land clearing, yard/boulevard trees, mill residues, lumber scraps, salvage of wood pallets, and commercial fuel products such as wood and paper pellets and manufactured fireplace logs.
- 5) Determine the geographic distribution of households burning fuelwood by type of usage (primary heating source, secondary heating source, and pleasure), type of wood, and type of wood burning facilities used.
- 6) Identify trends in residential fuelwood consumption over time.
- 7) Identify types of residential wood burning facilities
- 8) Identify changes in trends of burning fuelwood

## Methods

The survey consisted of a mailed questionnaire. It was resent to nonresponders approximately one month after the original deadline. The combination of the two surveys resulted in a 1,434-survey sample that reflects not only broad distribution of respondents across the state, but is also large enough for each survey region to meet the statistical sampling standard utilized in previous surveys.

The survey sample was determined based upon the 2007 census data obtained from the State Demographic Center, using the total number of households statewide to identify a statistically adequate sample size. The state was divided up into five survey units based on the four USDA-Forest Service, Forest Inventory and Analysis survey units for Minnesota forests, with the seven metropolitan counties comprising the fifth unit. The units were determined by population densities and consisted of Aspen-Birch in the northeast, Northern Pine in the north central part of the state, Central Hardwoods located north, west, and south of the Twin Cities, the seven metro counties, and Prairie, the largest unit, consisting of 41 counties. The distribution is shown on the map in Figure 1.

Since all units have at least 100,000 households, the sample size was stratified into five equal-size groups. Previous studies were designed to have a sampling error of plus/minus six percentage points at a 95 percent

confidence level. Based on calculations from the Minnesota Center for Survey Research at the University of Minnesota, it was determined that 272 completed surveys from each unit would satisfy the sample error requirement. (See Table 1). Marketing Systems Group, of Port Washington, Pennsylvania provided the 6,600-address list. This total was determined by assuming a rate of deliverable mail at over 90 percent and using an expected response rate of 30 percent. To aid our efforts in obtaining a higher return rate, a postcard was mailed approximately two weeks prior to the survey, to alert potential respondents about the upcoming mailing.

While enough responses were received from the first mailing in the Northern Pine and Aspen-Birch units, the expected number of responses was not obtained in the Prairie, Metro, and Central Hardwoods units. A second mailing of 450 surveys, or 150 surveys per unit, were sent out in late April to random households in the three units with an inadequate return rate, to create a statistically significant sampling.

Survey forms were edited, keypunched and entered into a relational database. All volumes were converted to standard cords. (See “Sources of Secondary Calculations of Fuelwood Volumes, found in the Appendix.) Expansion factors were calculated by dividing the total number of households in each survey unit (based on the U.S. Census Bureau estimates of number of households for 2007) by the number of survey forms that were returned from each survey unit. From this database, all tables were created.

The lists of the state of Minnesota registered loggers and firewood processors/sellers were combined. Duplicates, firewood retailers only, and individual members of a single company that were already on the combined list, were deleted to determine the total number of possible firewood processors in Minnesota. The total number of possible firewood processors in each survey unit was divided by the number of survey forms that were returned in each survey unit.

As in previous surveys, responding households were classified by location, county, and fuelwood-use class.

**Table 1: Number of Households Sampled by Survey Unit and Corresponding Population**

Survey Unit	Number of Households Sampled		Total Number of Households in Each Unit	Population in Each Unit 2007 census
	Target Number	Actual Number		
Aspen-Birch	272	283	111,116	260,185
Northern Pine	272	276	120,089	291,974
Central Hardwoods	272	323	416,067	1,086,451
Prairie	272	308	312,035	764,215
Metro	272	244	1,121,570	2,794,796
Total	1,360	1,434	2,080,877	5,197,621

*Note: Number of households surveyed was based on 2007 census data.*

### **Fuelwood use classes:**

1. Nonuser – Households that do not burn fuelwood.
2. Primary – Fuelwood provided the main source of heat in the home. The user may have another fuel system for back-up purposes, but more than 50 percent of the household heating needs comes from wood.
3. Secondary – Fuelwood is used as a back-up heating system, with another fuel providing the major source for heating. Less than 50 percent of household heating needs comes from wood.
4. Pleasure – Fuelwood is burned for pleasure only. Some heating benefit may occur, but fuelwood is not considered a heating system.

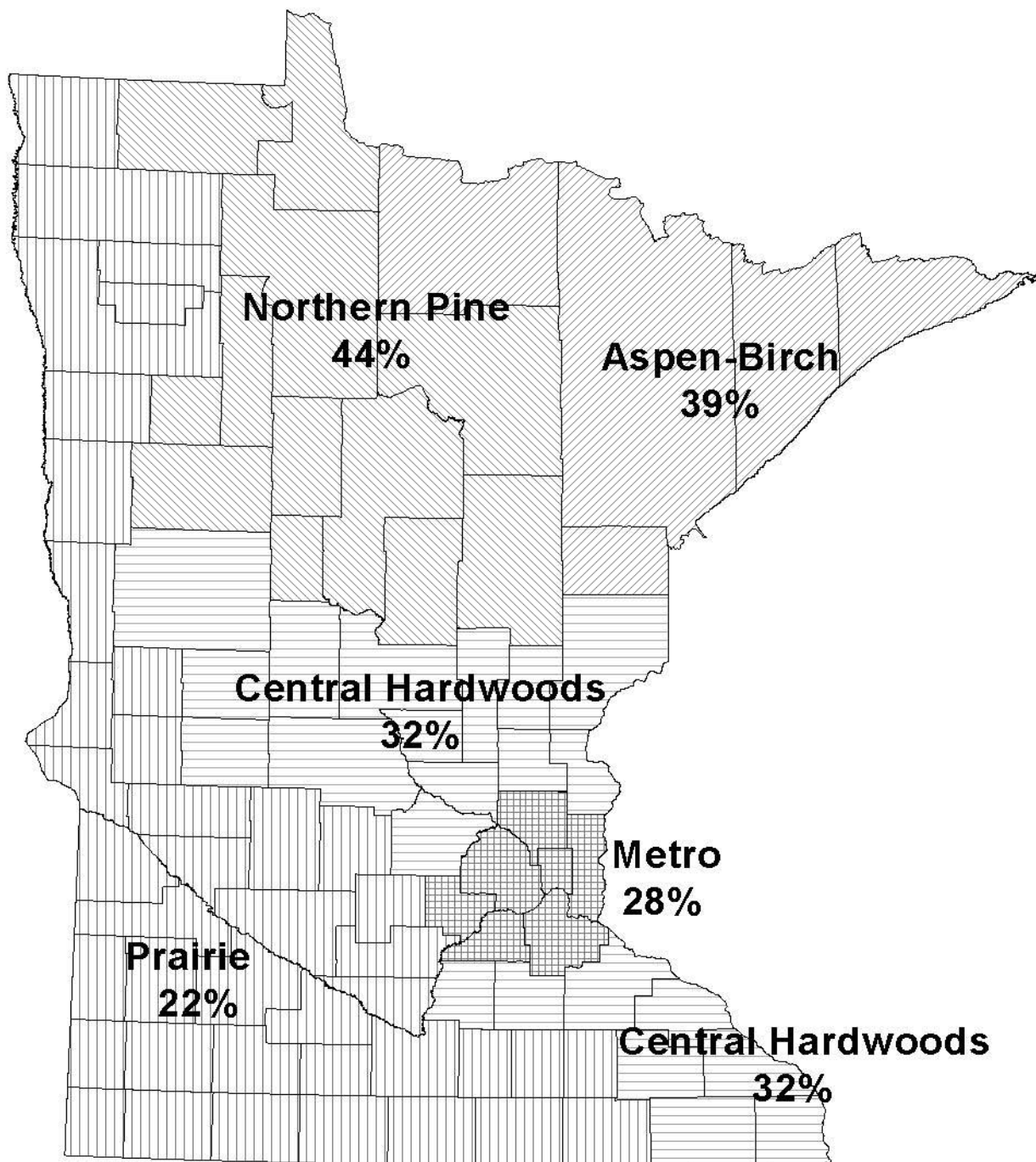


Households were also asked the type of wood burning unit used, species of wood burned, whether they purchased or cut their own fuelwood, ownership where fuelwood was harvested, the location fuelwood was used (primary or secondary home and/or other building), and the source of fuelwood harvested. Woodland included: live trees, dead trees, and logging residue. Non-woodland consisted of: fence rows/windbreaks, rural/agricultural land clearing, rural yard trees, and trees inside city limits.

## **Logger Survey**

A significant portion of fuelwood purchased and consumed by households in Minnesota is from commercial suppliers, primarily loggers. In an attempt to identify and quantify the sources of this portion of fuelwood consumed, 240 loggers were selected from a statewide list of state timber sale permittees. In addition, a list of 60 fuelwood vendors was compiled. Loggers and fuelwood vendors were sent a survey to identify the quantity, species of trees, and source of fuelwood harvested between April 2007 and March 2008. The survey also asked respondents to identify the land ownerships from which they harvested fuelwood, and whether the fuelwood sold came from live trees, dead trees, or logging residue from forest land, or trees from nonforest sources.

The results were then extrapolated to an estimated 1,480 logging and firewood businesses statewide that harvest 95 percent of all timber in Minnesota. An expansion factor for each returned response was calculated based on the number of logging and firewood businesses and the number of returned responses in each survey unit.



**Figure 1: Percent of Households by Survey Unit That Burned Fuelwood During 2007-2008 Heating Season**

## RESULTS

### Characteristics of Fuelwood Users

Statewide, 30 percent of households burn fuelwood. (See Table 2.) This is an increase from the 21 percent identified in the 2002-2003 survey and the 25 percent identified in the 1995-1996 survey. However, this figure was eclipsed by the 33 percent identified in the 1988-1989 survey. In the previous two surveys, each geographic unit had a similar reduction in the proportion of households burning fuelwood. As shown in Figure 1, the percent of households burning fuelwood within each survey unit varies from 22 percent in the Prairie unit where fuelwood is not as accessible, to 44 percent in the Northern Pine unit, which has an abundance of fuelwood available. The way households utilize fuelwood also varies, with 13 percent using it as a primary source of heating, 20 percent as a secondary heat source, and 67 percent for pleasure only.

The percentage of households burning wood as their primary source of heat is highest in the Northern Pine unit with a total of 37 percent. The Aspen-Birch and Prairie units also have a significant number of households using fuelwood as a primary source of heat. As can be expected, the Metro area, where fuelwood costs are the highest and availability the lowest, has just one percent of households using fuelwood as a primary source of heat.

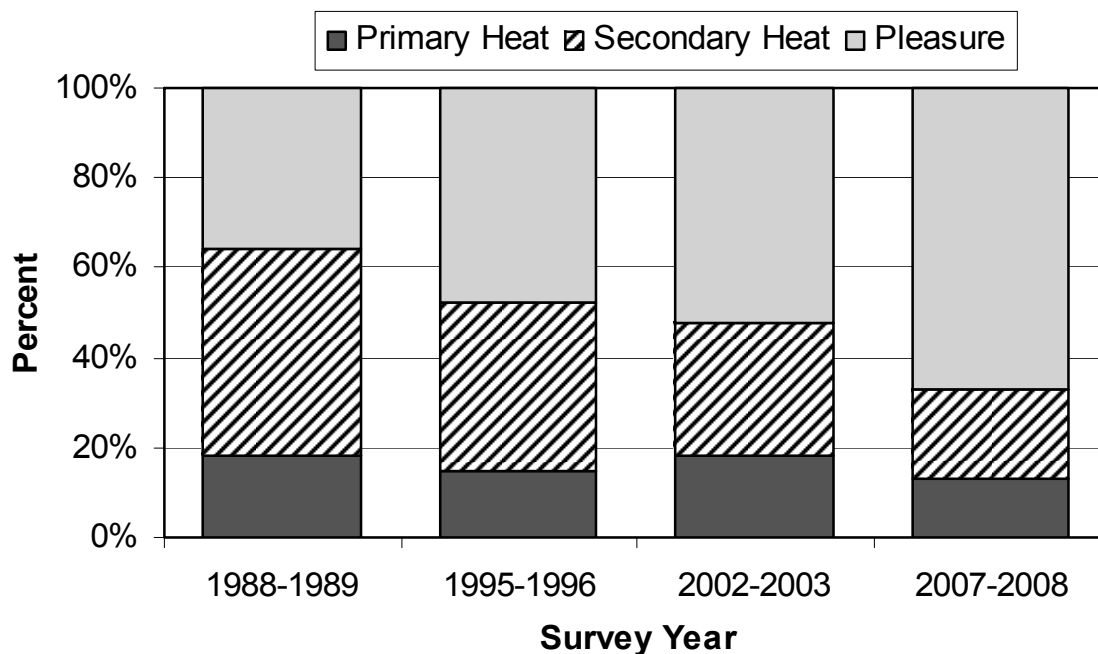
The highest proportion of households burning fuelwood as a secondary heat source is found in the Aspen-Birch unit with 38 percent. Approximately a quarter of households in the Northern Pine, Central Hardwoods and Prairie units use fuelwood as a secondary source of heat. Fourteen percent of Metro area residents use fuelwood for this purpose.

The largest increase in households using fuelwood has been for pleasure, not heating homes. Households burning primarily for pleasure are most heavily represented in the Metro unit with a whopping 80 percent. This is a continuation of the trend moving away from using fuelwood as a primary and supplemental heat source to burning fuelwood for pleasure. (See Figure 2.)

**Table 2: Percent of Households Burning Fuelwood by Survey Unit and Reason for Burning**

Survey Unit	Percentage of Households Burning Wood	Reason for Burning				
		Primary Heat	Secondary Heat	Pleasure	Camping	Other
Aspen-Birch	39	29	38	30	3	--
Northern Pine	44	37	24	36	2	2
Central Hardwoods	32	19	23	55	3	--
Prairie	22	25	25	47	3	--
Metro	28	1	14	80	4	--
Statewide	30	13	20	63	4	0

Note: The category "Other" consists of brush clearing/disposal.



**Figure 2: Percent of Households that Burn Fuelwood by Reason for Burning and Survey Year**

Note: Burning for pleasure also includes volume that was burned for camping or other non heating uses.

Households burning fuelwood identified six categories of wood burning facilities and 14 combination categories of two or more types of wood burning facilities. There has been a substantial decrease in the proportion of wood furnaces and boilers used, while wood stoves saw a substantial increase in use. There also was an increase in the use of fire rings and pits, reflecting the strong shift toward burning wood for pleasure. (See Table 3.)

This data appears to indicate the shift in reasons for consuming fuelwood is largely driven by the cost of alternative fuels and convenience. While there has been a strong shift in the use of fuelwood for pleasure and access to natural gas continues to rise, the cost of this heat source is also rising, prompting many households to use wood stoves as a source of heat. This has caused a resurgence in the purchase and use of wood stoves in the last five years, jumping 14 percent.

It is also important to note that the number of households using fuelwood was relatively constant between the 1995-1996 (393,000) and 2002-2003 (391,000) heating seasons, yet the number of households with a wood burning facility in the 2002-2003 heating season (513,000) was nearly the same as in the 1984-1985 heating season (520,000).

**Table 3: Percent of Volume Burned by Type of Wood-Burning Facility**

Type of Wood-Burning Facility	Percent of Total			
	1988-1989	1995-1996	2002-2003	2007-2008
Wood Stove	46	44	15	29
Wood Pellet or Corn Stove	-	-	-	1
Fireplace	17	9	21	3
Fireplace Insert	2	11	9	6
Wood Furnace or Boiler	26	27	31	16
Fire Pit or Ring	-	-	1	10
Wood Stove/Fireplace or Fireplace Insert	3	4	5	3
Wood Stove/Wood Furnace or Boiler	-	3	4	3
Wood Stove/Wood Pellet or Corn Stove	-	-	-	0
Wood Stove/Fire Pit or Ring	-	-	-	8
Fireplace/ Fireplace Insert	-	-	1	0
Fireplace/Wood Furnace or Boiler	6	-	9	0
Fireplace/Wood Pellet or Corn Stove	-	-	-	1
Fireplace/Fire Pit or Ring	-	-	4	6
Fireplace Insert/Fire Pit or Ring	-	-	-	2
Wood Furnace or Boiler/Fire Pit or Ring	-	-	-	3
Wood Furnace or Boiler/Wood Pellet or Corn Stove	-	-	-	0
Wood Furnace or Boiler/ Fireplace Insert	-	-	-	2
Fire Pit or Ring /Wood Pellet or Corn Stove	-	-	-	0
3 or More Different Types of Wood-Burning Equipment	-	-	-	7
Total	100	100	100	100

*Note: A value of 0 = less than .5%.*

In the 2007-2008 heating season, the number of households with wood burning facilities increased to 734,300, with 615,900 actually burning wood. Despite the trend toward use of fuelwood for pleasure rather than for heat, the recent economic crisis and the associated downturn in industrial demand for wood could increase the consumption of fuelwood for primary and secondary heating. The impact could be very significant in a short time because of the more than 100,000 additional households that have wood burning facilities that currently do not use fuelwood, and the nearly 40,000 households that plan to purchase wood burning facilities in the near future (Appendix Table A).

# Volume of Fuelwood Consumed

The total volume of fuelwood consumed in Minnesota during the 2007-2008 heating season for heating residential homes, secondary building, and burning for pleasure was 978,900 cords <sup>(1)</sup>. This is an increase of 49 percent, a large upturn in consumption after declining a total of 54 percent between the 1984-1985 and the 2002-2003 heating seasons. (See Figure 3.)

<sup>(1)</sup> One standard cord is a stack of wood four feet high by four feet deep by eight feet long, or 128 cubic feet consisting of 70 cubic feet of wood and 58 cubic feet of bark and air space.

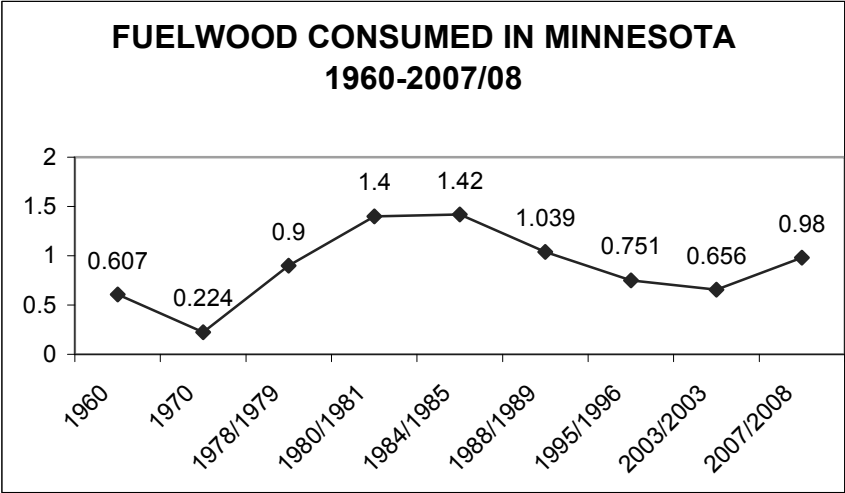


Figure 3: Fuelwood Consumption in Minnesota by Survey Year

Despite the shift toward burning wood for pleasure, the largest volume of fuelwood is still consumed as a primary or secondary heat source for households outside the Metro survey unit. (See Figures 4 and 5.)

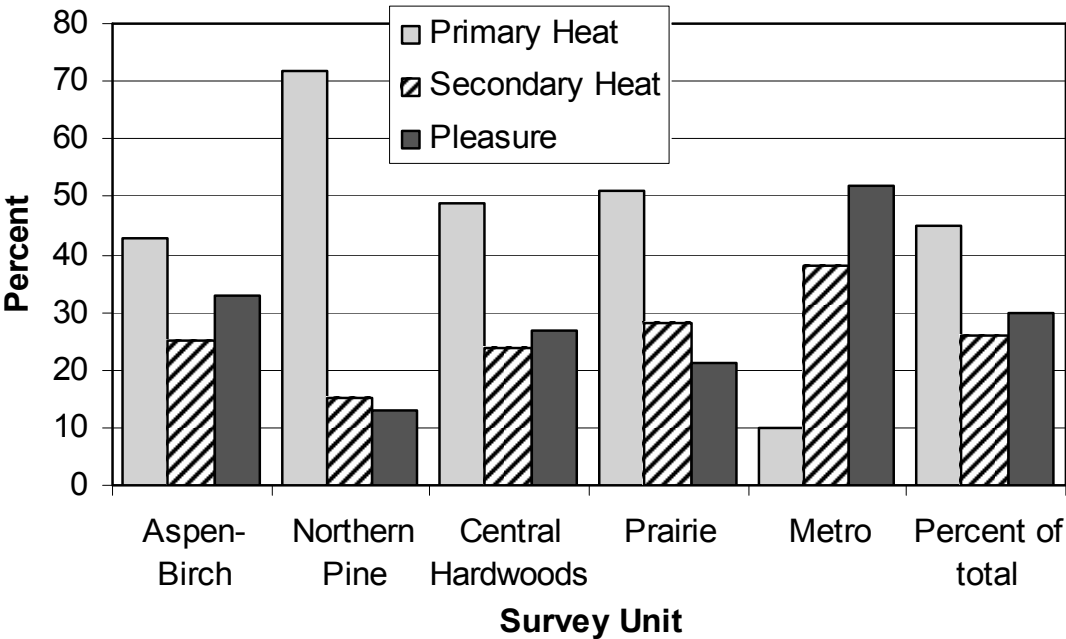
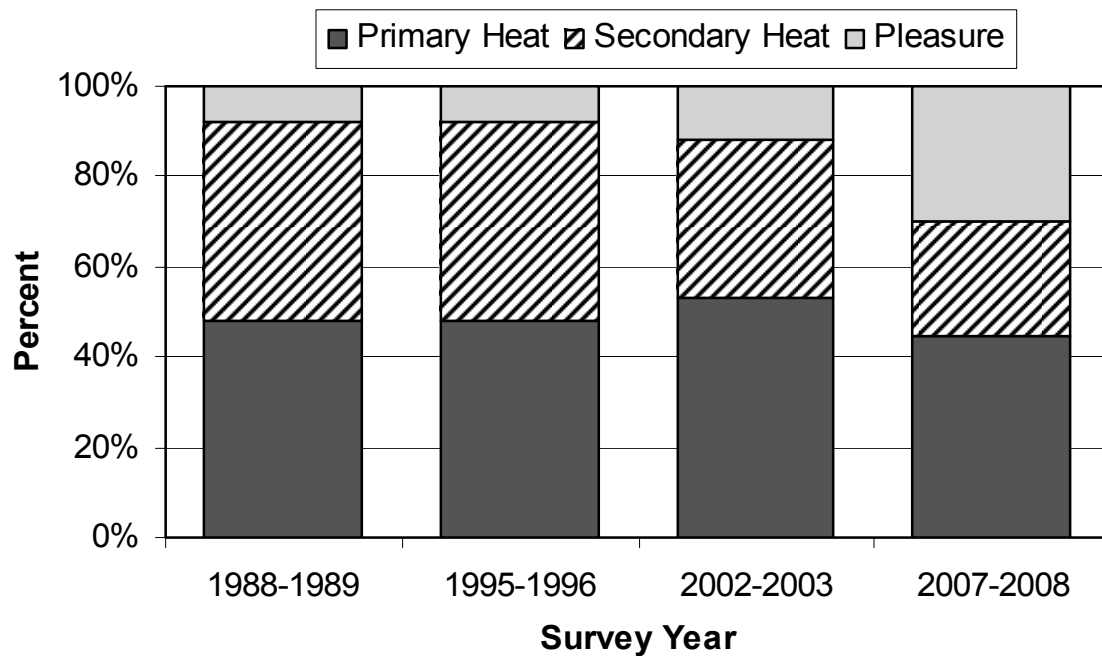


Figure 4: Percent of Fuelwood Burned by Survey Unit and Reason for Burning

Note: Burning for pleasure also includes volume that was burned for camping or other non heating uses.



**Figure 5: Percent of Fuelwood Burned by Reason for Burning by Survey Year**

Note: Burning for pleasure also includes volume that was burned for camping or other non heating uses

The volume of fuelwood consumed for heating primary residences was 813,000 cords, an increase of 40 percent over the volume in 2002-2003 of 581,000 cords. The volume consumed to heat second homes also increased by eight percent while heating of other buildings increased 3.5 times to 121,400 cords. (See Table 4.)

**Table 4: Number of Cords Burned by Survey Unit and Place of Consumption**

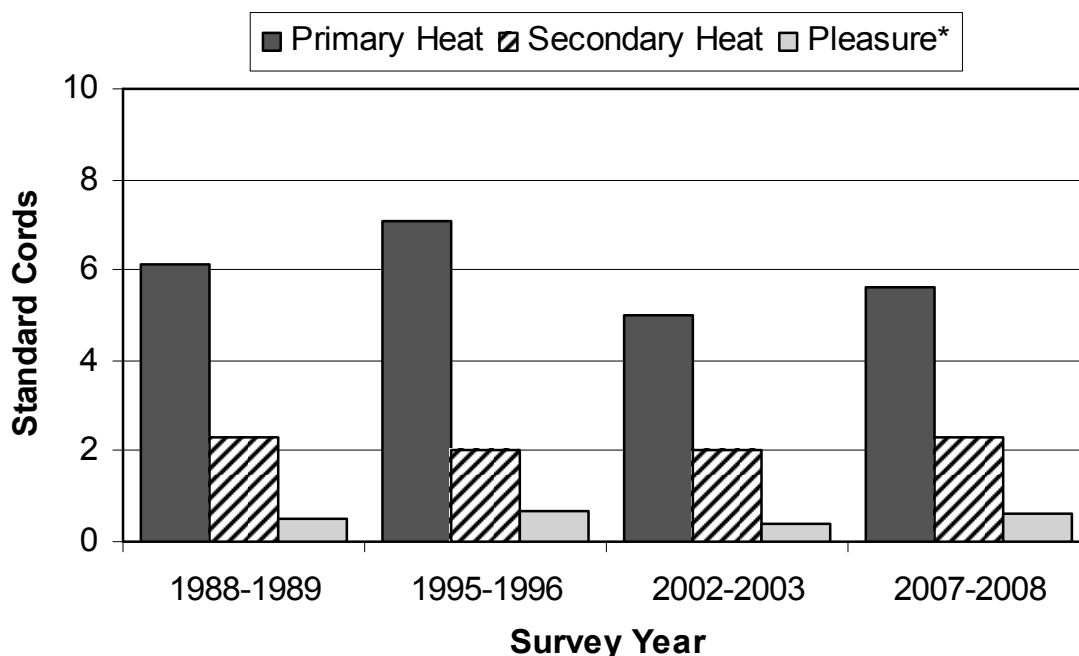
Survey Unit	Number of Wood-Burning Households	Number of Active Wood-Burning Facilities*	Total Volume (Cords)	Place of fuelwood consumption		
				Primary Residence (Cords)	Secondary Residence (Cords)	Other Buildings ** (Cords)
Aspen-Birch	43,190	78,838	154,218	90,562	13,228	50,428
Northern Pine	52,648	94,207	208,755	175,659	11,470	21,626
Central Hardwoods	133,966	183,807	252,066	216,413	9,486	26,167
Prairie	68,891	95,974	146,758	123,864	9,476	13,418
Metro	317,165	376,921	217,098	206,543	766	9,789
Statewide	615,860	829,747	978,895	813,040	44,426	121,429

\*Note: Number of wood-burning facilities does not equal number of wood-burning households because some households have more than one wood burning facility.

\*\*Other buildings include garages, business buildings, recreational buildings, and camping.

The largest volume of fuelwood, 83 percent, was consumed at primary residences. The Central Hardwoods unit used the most wood at primary residences, but the Metro unit was not far behind in volume consumed. The Aspen-Birch unit reported the least volume of fuelwood burned at primary residences.

The average volume burned by households using fuelwood as a primary heat source increased when compared to 2002-2003 survey, but this figure is lower than survey results from previous years. (See Figure 6.) Statewide, major users burned an average of 5.6 cords during a heating season, with households in the Northern Pine unit burning two cords more wood per household than those in the other survey units. This may be a result of differences in severity and length of heating seasons, a lower cost to obtain fuelwood, more storage area for a winter's worth of fuelwood, and/or the use of more efficient burning facilities elsewhere. The Aspen-Birch unit, which had the lowest number of households in the state and a high percent of those households within Duluth city limits, burned the least number of cords statewide.



**Figure 6: Average Number of Cords Burned per Household by Reason for Burning and Survey Year**

\*Note: Burning for pleasure also includes any volume that was burned for camping or other nonheating uses

## Type of Tree Species Burned as Fuelwood

Beginning in 2002-2003 survey, more specific information was requested to determine the type of tree species (roundwood by species) and other wood products including: wood residues from sawmills (slabs, scrap lumber, and recycled pallets), manufactured fireplace logs, and wood or paper pellets, burned by households. This information was requested in the 2007-2008 survey as well because it is important for land managers to determine if there are preferences for the type of tree species burned and to predict potential utilization conflicts. Of the 978,900 cords, 92 percent is derived directly from a roundwood source in the form of logs or split wood. (See Table 5.)



**Table 5: Number of Cords Burned by Fuel Type**

Fuel Type	Standard cords	Percent of Total
Roundwood/logs	312,517	32
Split wood	587,726	60
Slabs	38,463	4
Wood pellets	11,023	1
Wax/manufactured logs	1,272	< 1
Pallets/crates	17,987	2
Scrap lumber	6,415	< 1
Saw dust	1,667	< 1
Branches/brush	1,825	0
Total	978,895	100

Oak continues to be the preferred fuelwood species. (See Table 6.) While the use of oak declined from 2002-2003, it still is the single most important tree species utilized. The proportion of ash consumed more than doubled in 2002-2003, and doubled again in 2007-2008 to 157,600 cords. The use of birch took a tumble from 13 percent to nine percent, while the use of aspen went up by 50 percent and elm nearly doubled.

**Table 6: Percent of Fuelwood Burned by Species and Survey year**

Species	Survey Year			
	1988-1989	1995-1996	2002-2003	2007-2008
Oak	32	27	38	29
Birch	13	14	13	9
Ash	8	4	10	17
Elm	14	3	5	9
Maple	8	4	8	10
Aspen	7	10	8	12
Other Species	3	6	9	10
Slabs and scrap lumber	15	32	8	4

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

## Sources of Fuelwood

Households continue to do much of the fuelwood harvesting themselves. In 2002-2003, households harvested 60 percent of the fuelwood burned. This figure fell slightly, to 58 percent, or 570,500 cords, in 2007-2008. (See Table 7.) In 2007-2008, households purchased 24 percent, or 233,000 cords, of roundwood fuelwood for residential use. Another 18 percent, or 175,300 cords was free wood, leftover wood, gift wood, wood residues, scrap lumber, manufacture logs, and wood pellets. (See Table M in appendix.)

**Table 7: Percent of Fuelwood Consumption by Procurement Method and Reason for Burning**

Procurement Method	Reason for Burning			Percent of Total
	Primary Heat	Secondary Heat	Pleasure	
Roundwood Cut by Households	55	26	19	58
Roundwood Purchased	33	29	38	24
Roundwood Other*	22	15	63	10
<b>Total Roundwood</b>	<b>46</b>	<b>25</b>	<b>29</b>	<b>92</b>
Other Fuelwood Types**	31	27	42	8
<b>Percent of Total</b>	<b>44</b>	<b>26</b>	<b>30</b>	<b>100</b>

NOTE: Burning for pleasure also includes any volume that was burned for camping or other non heating uses.

\*Other sources of roundwood include: free, gift, and wood leftover from previous years

\*\* Other fuelwood types include: wood residues, scrap lumber, manufactured logs, and wood pellets.

Individual households cut 570,500 cords of the fuelwood that was burned during the 2007-2008 heating season, almost 1.5 times the number of cords harvested by households in 2002-2003 when 393,500 cords were cut. The volume cut by households was highest in the Central Hardwoods unit, followed by the Northern Pine unit. Households using roundwood fuelwood as the primary source of heat harvested 46 percent of the total fuelwood cut by households. (See Table 8).

**Table 8: Percent of Fuelwood Consumption from Roundwood Cut by Households by Reason for Burning and Survey Year**

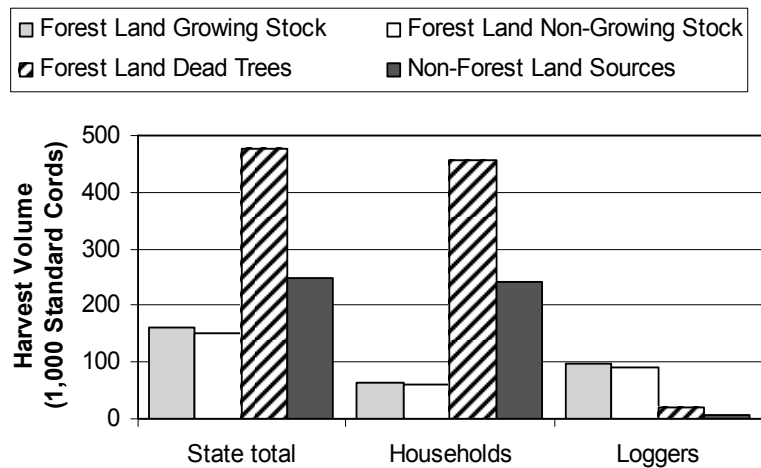
Reason for Burning	Survey Year			
	1988-1989	1995-1996	2002-2003	2007-2008
Primary Heat	50	54	58	46
Secondary Heat	45	37	35	25
Pleasure	5	9	7	29

NOTE: Burning for pleasure also includes any volume that was burned for camping or other non heating uses.

## Volume of Fuelwood Harvested

It is desirable to identify the sources of 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. As can be seen in Table S, located in the Appendix, 92 percent, or 870,200 cords of the fuelwood cut by households was harvested from private land. There were 55,192 cords (1,034,087 cords harvested *minus* 978,895 cords harvested and burned) of firewood that was harvested but not burned by households that was cut in 2007-2008. Some of this firewood was sold or given away to others and the rest will most likely be saved for future heating seasons.

Loggers procure a much higher percent of fuelwood from land administered by public agencies (53 percent) than private households. Like households, a substantial amount of fuelwood, or 45 percent, is also derived from private land.



**Figure 7: Volume of Fuelwood Harvested by Households and Loggers by Source of Material**

Much of the wood cut (61 percent) by residential households comes from dead or downed trees and logging residues. Nine percent comes from live standing trees in the forest. The remainder, 29 percent, is from cropland/pasture, yard, and city trees. This differs from logger's sources of fuelwood, where 57 percent or 119,700 cords, comes from live trees from forestland. (See Figure 7.) Thirty-two percent, or 66,700 cords, is derived from logging residue from forestland. (See Table 9.)

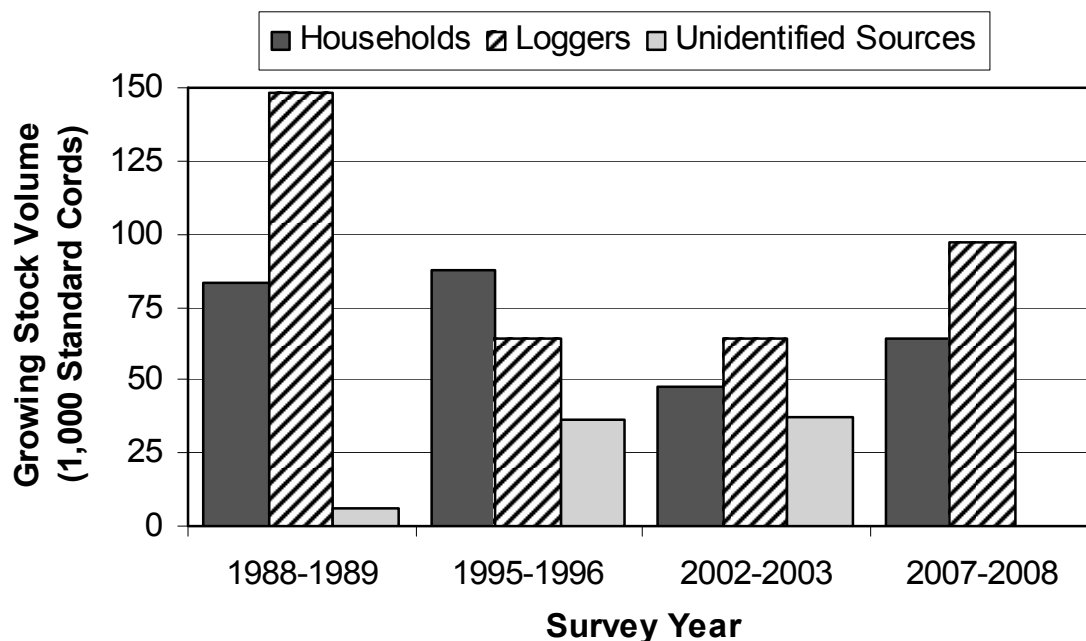
**Table 9: Percent of Fuelwood Cut by Source of Material**

Type of Material	State total		Households		Loggers	
	percent	cords	percent	cords	percent	cords
<b>Live Trees from Forestland</b>						
Growing-stock Trees	12	123,526	6	48,119	36	75,407
Non-growing-stock Trees	7	72,554	3	28,260	21	44,294
Total Live Trees	19	196,080	9	76,379	57	119,701
<b>Logging Residues from Forestland</b>						
From Growing-stock Trees	4	38,226	2	16,209	10	22,017
From Non-growing-stock Trees	7	77,400	4	32,700	21	44,700
Total Logging Residues	11	115,625	6	48,908	32	66,717
Dead Trees from Forestland	46	475,327	55	456,529	9	18,798
Total Forest land	76	787,033	71	581,817	97	205,216
Wooded Strips, Fence Rows, and Wind Breaks	3	28,436	3	28,240	< 1	196
Cropland and Pasture	6	57,702	7	57,196	< 1	506
City Trees	5	47,251	5	43,760	2	3,491
Yard Trees	11	113,666	14	112,037	1	1,629
Total Non-Forestland	24	247,054	29	241,232	3	5,822
Total	100	1,034,087	100	823,049	100	211,038

\*This figure does not equal the total number of cords consumed (978,900 cords) because it does not take into account other wood residue such as slabs, crates, etc.

## Impact of Fuelwood Harvested on Commercial Forestland

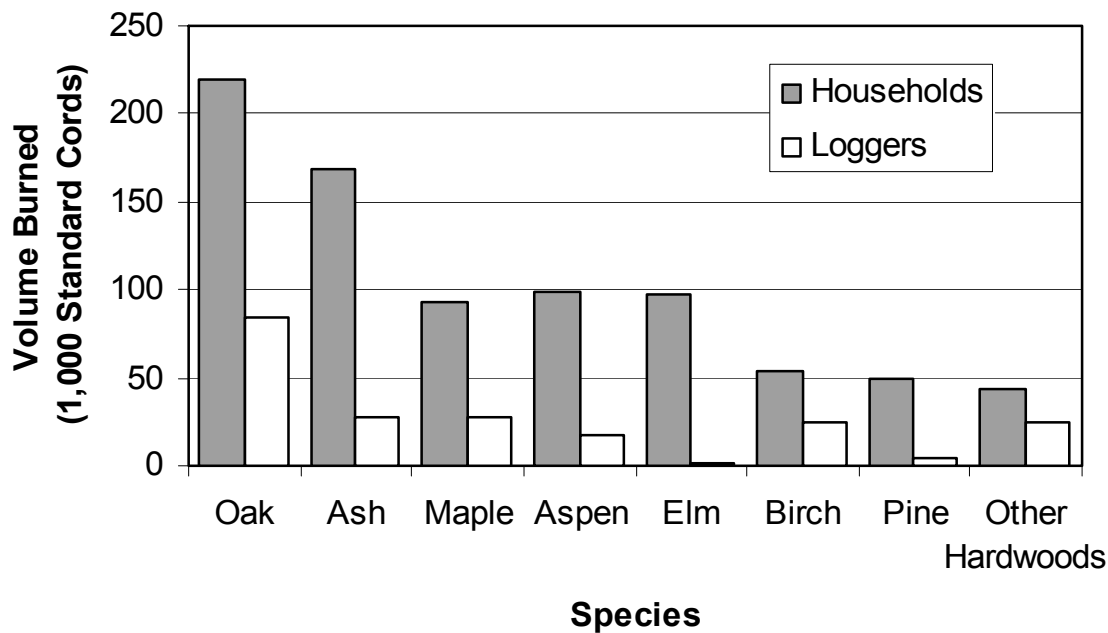
Approximately 161,750 cords of fuelwood produced for the 2007-2008 heating season were harvested from growing stock on forestland. (See Figure 8.) This is a nine percent increase from the 2002-2003 survey, but total roundwood harvested for fuelwood increased by over 60 percent. This indicates a reduced impact of fuelwood use on the availability of growing stock for higher value forest products. This is further delineated by volume that is derived from other sources of timber on forestland. Non-growing stock consists of trees and forest residue that is not usable as a higher value timber product, such as trees with excessive amount of defects or rot. The total volume of fuelwood removed from forestlands remains high, at 76 percent.



**Figure 8: Volume of Fuelwood Harvested from Growing Stock by Survey Year**

The remaining fuelwood harvested in Minnesota comes from logging slash and trees on non-forest land, which includes pastures, residential and commercial lots, parks, roads, and street rights-of-way.

Loggers and households that cut their own fuelwood harvested more oak as a fuelwood source than any other species, while ash followed with 19 percent of the total harvested. (See Figure 9.) When cutting for firewood, loggers cut more volume in species that make better firewood. Oaks, ash, and some maples are a denser wood, thus burn longer and put out more heat. In Minnesota, oak is the preferred firewood species.



**Figure 9: Volume of Fuelwood Cut by Households and Loggers in Minnesota by Species, 2007-2008**

### **Trends in Household Fuelwood Consumption**

Until the 2007-2008 survey, the volume of fuelwood burned by Minnesota households had been decreasing, sharply at times, since the 1984-1985 survey, when 1.42 million cords of fuelwood were burned.

Until now, the decline was primarily attributable to four factors. The most important factor probably was the decline in the price of fossil fuel and the increased availability of natural gas. The increased industrial demand for wood to manufacture paper and other forest products was also an important factor. The latter had and still has the greatest impact on the availability of fuelwood from aspen, birch, and maple.

Other factors contributing to the decline in residential fuelwood consumption include the amount of labor associated with producing one's own fuelwood, the inconvenience of stoking and cleaning a wood burning facility, and the risk of structural fires and associated insurance costs attributed to wood burning facilities. However, steady increases in fossil fuel prices over the past several years has shifted demand back to the use of fuelwood as a source of heat.

Despite the trend toward use of fuelwood for pleasure rather than for heat, the recent economic crisis and the associated downturn in industrial demand for wood could increase the consumption of fuelwood for primary and secondary heating. The impact could be very significant in a short time, because even though 615,900 households are currently consuming fuelwood, there are approximately 734,300 households with wood burning facilities. In addition, the number of households planning to burn fuelwood in 2009-2010 is 631,300, an increase of more than 15,000. This means there still will be more than 100,000 households with the capability of burning fuelwood if they choose to do so. In addition, almost 40,000 households plan to purchase a wood-burning facility in the next year.



# Appendices





## Sources of Secondary Calculations of Fuelwood Volumes

- 1) Calculations of growing-stock and non-growing stock sources on forestland were based on factors obtained from the Minnesota Logging Utilization Study, 1989, and other regional utilization studies.
- 2) A conversion factor of 1.0368 tons per cord was used for sawmill slabs and edgings, based on: *Release No. 232. Cord-Cubic Volume of Relationship of Slabwood and Edgings*, Bell, G. E. and Brooks, E. American Pulpwood Association. New York, NY, 1955.
- 3) A conversion factor of 2.752 tons per cord was used for wood pellets, based on: Jason Berthiaume, Pellet Fuels Institute (PFI). Current standards require a minimum density for PFI-graded pellets of 40lbs/cu ft. Under newly approved standards, which will begin implementation in 2009 and fully phased in by 2010, density for super-premium and premium pellets will be 40-46lbs/cu ft, with standard and utility grades at 38-46lbs/cu ft. As super-premium and premium will make up the vast majority of residential heating pellets, it makes sense to use the 40-46 range. Mid-range of 43 X 128 cubic feet per cord = 2.752 tons per cord.
- 4) A conversion factor of 1.0989 tons per cord was used for wax/manufactured fireplace logs, based on: Houck, J. E. OMNI Consulting Services, Inc. Beaverton, Oregon. July 2002. Email: [houck@omni-test.com](mailto:houck@omni-test.com). He determined 444 typical logs make up a cord. The weighted average mass of wax/sawdust fireplace logs is 4.95 lbs (2.5 lbs, 3.2 lbs, 5 lbs, and 6 lbs logs are sold). The average mass of densified logs sold is 5 lbs.
- 5) A conversion factor of 0.5184 tons per cord was used for wood pallets and crates, based on: WikiAnswers: "How much does a pallet weigh?" And "What is the standard size of a wooden pallet?" It was assumed the Grocery Manufacturers' Association pallet was 48" x 40" and each weighed 45 pounds. Web site: [http://wiki.answers.com/Q/What\\_is\\_the\\_average\\_weight\\_of\\_a\\_wooden\\_pallet](http://wiki.answers.com/Q/What_is_the_average_weight_of_a_wooden_pallet) and Web site: [http://wiki.answers.com/Q/What\\_is\\_the\\_standard\\_size\\_of\\_a\\_wooden\\_pallet](http://wiki.answers.com/Q/What_is_the_standard_size_of_a_wooden_pallet). Both accessed Dec. 4, 2008.
- 6) A conversion factor of 1.60435 tons per cord was used for scrap lumber, based on: WikiAnswers: "How much does a 2 X 4 weigh?" Assuming 400 - 2 X 4s per cord and pine average of 27.5 pounds per cubic foot.  $1.5 \times 3.5 \times 96 = 504$  cubic inches or 0.2917 cubic feet.  $.2917 \times 27.5 = 8.02175$ lbs. per 2 X 4 X 8. Web site: [http://wiki.answers.com/Q/How\\_much\\_does\\_a\\_2\\_x\\_4\\_weigh](http://wiki.answers.com/Q/How_much_does_a_2_x_4_weigh). Accessed Dec. 2, 2008.
- 7) A conversion factor of 1.054815 tons per cord was used for branches, based on: Oregon Department of Environmental Quality; Oregon Material Recovery Survey Attachments; Attachment B: Measurement Standards and Reporting Guidelines. Average yard debris loose and compacted. Website: <http://www.deq.state.or.us/lq/pubs/docs/sw/MRAttachmentB.pdf>. Accessed Dec. 2, 2008.
- 8) A conversion factor of 0.954074 tons per cord was used for sawdust, based on: Oregon Department of Environmental Quality; Oregon Material Recovery Survey Attachments; Attachment B: Measurement Standards and Reporting Guidelines. Average wet and dry. Web site: <http://www.deq.state.or.us/lq/pubs/docs/sw/MRAttachmentB.pdf>. Accessed Dec. 2, 2008.
- 9) An average density of 1.396742 tons per cord was calculated as a weighted average density of 12 species groups burned in the state.



## **Tables**

**Table A: Household Possession and Use of Wood-Burning Facilities by Survey Unit**

**Table B: Residential Fuelwood Consumption by Reason for Burning and Survey Unit**

**Table C: Residential Fuelwood Consumption by Type of Wood-Burning Facility and Reason for Burning**

**Table D: Residential Fuelwood Consumption by Type of Wood-Burning Facility and Survey Unit**

**Table E: Residential Fuelwood Consumption by Place of Burning and Survey Unit**

**Table F: Residential Fuelwood Consumption by Type of Fuelwood, Survey Unit, and Detailed Type of Burning Facility**

**Table G: Residential Fuelwood Consumption in Secondary Residences Within Each Survey Unit by Wood Burners of Each Unit**

**Table H: Survey Units Where Residents of Each Unit Burned Wood**

**Table I: Residential Fuelwood Consumption by Reason for Burning and When First Burned Wood**

**Table J: Residential Fuelwood Consumption by Type of Fuelwood**

**Table K: Residential Fuelwood Consumption by Type of Fuelwood, Survey Unit, and Detailed Type of Burning Facility**

**Table L: Residential Fuelwood Consumption of Roundwood by Species Group and Survey Unit**

**Table M: Residential Fuelwood Consumption by Method of Procurement and Survey Unit**

**Table N: Residential Fuelwood Consumption of Purchased Fuelwood by Survey Unit and Size of Fuelwood**

**Table O: Residential Fuelwood Consumption by Survey Unit and Place of Consumption**

**Table P: Residential Fuelwood Production by Survey Unit and Source of Material**

**Table Q: Residential Fuelwood Production by Species Group and Source of Material**

**Table R: Residential Fuelwood Production by Ownership Class and Source of Material**

**Table S: Residential Fuelwood Production by Species Group and Ownership Class**

**Table T: Residential Fuelwood Production by Species Group and Survey Unit**

**Table U: Residential Fuelwood Production by Homeowners and Loggers and Survey Unit**

**Table A: Household Possession and Use of Wood-Burning Facilities by Survey Unit**

Survey Unit	Numbers					
	Households (Bureau of the Census 2007)	Households with Wood-Burning Facilities	Households Burning Wood in 2007-2008	Households Planning to Burn Wood in 2009	Households Planning to Buy Wood-Burning Facilities	Households Burning Wood and Planning to Buy Wood-Burning Facilities
Aspen-Birch	111,116	49,080	43,190	45,153	1,963	785
Northern Pine	120,089	58,739	52,648	51,342	5,221	4,351
Central Hardwoods	416,067	142,983	133,966	139,118	11,593	7,729
Prairie	312,035	79,022	68,891	73,956	7,092	4,052
Metro	1,121,570	404,501	317,165	321,762	13,790	4,597
Total	2,080,877	734,325	615,860	631,331	39,659	21,514

**Table B: Residential Fuelwood Consumption by Reason for Burning and Survey Unit**

Survey Unit Where Burned and Reason for Burning		Number of Wood Burning Facilities	Volume (cords)	Average Volume (cords per facility)
Aspen-Birch	Pleasure	42,998	50,600	1.18
	Primary Heat	17,779	65,720	3.70
	Secondary Heat	18,061	37,898	2.10
	Total	78,838	154,218	1.96
Northern Pine	Pleasure	52,002	27,852	0.54
	Primary Heat	23,061	150,154	6.51
	Secondary Heat	19,145	30,750	1.61
	Total	94,207	208,756	2.22
Central Hardwoods	Pleasure	114,804	68,356	0.60
	Primary Heat	28,339	123,864	4.37
	Secondary Heat	40,664	59,846	1.47
	Total	183,807	252,066	1.37
Prairie	Pleasure	54,906	30,186	0.55
	Primary Heat	19,249	75,501	3.92
	Secondary Heat	21,819	41,071	1.88
	Total	95,974	146,757	1.53
Metro	Pleasure	321,762	113,888	0.35
	Primary Heat	4,597	20,685	4.50
	Secondary Heat	50,563	82,526	1.63
	Total	376,921	217,098	0.58
All Units	Pleasure	586,471	290,881	0.50
	Primary Heat	93,024	435,923	4.69
	Secondary Heat	150,252	252,091	1.68
	Total	829,747	978,895	1.18

Note: Number of wood burning facilities does not equal number of households because some households have more than one wood burning facility.

**Table C: Residential Fuelwood Consumption by Type of Wood-Burning Facility and Reason for Burning**

Type of facility	Primary heat		Secondary heat		Pleasure	
	Number of Wood-Burning Facilities	Volume (Cords)	Number of Wood-Burning Facilities	Volume (Cords)	Number of Wood-Burning Facilities	Volume (Cords)
Wood Stove	32,284	136,414	49,361	103,751	26,215	42,085
Fireplace	--	--	6,320	8,565	65,998	23,812
Fireplace Insert	1,841	13,909	30,380	33,246	29,839	12,832
Wood Furnace or Boiler	20,752	147,712	2,694	6,539	--	--
Wood Pellet Stove	1,723	1,922	2,969	3,024	--	--
Fire Pit or Ring	--	--	--	--	235,221	97,891
Combination	36,424	135,967	58,528	96,991	229,198	114,235
Total	93,024	435,923	150,252	252,116	586,471	290,856

**Table D: Residential Fuelwood Consumption by Type of Wood-Burning Facility and Survey Unit**

Survey Unit and Reason for Burning		Number of Wood Burning Facilities	Volume (cords)	Average Volume (cords per facility)
Aspen-Birch	Wood Stove	28,432	97,277	3.42
	Fireplace	5,382	1,384	0.26
	Fireplace Insert	3,534	4,042	1.14
	Wood Furnace or Boiler	10,994	3,196	0.29
	Wood Pellet Stove	393	2,945	7.50
	Fire Pit or Ring	393	29	0.07
	Combination	29,711	45,346	1.53
	Total	78,838	154,218	1.96
Northern Pine	Wood Stove	12,183	43,930	3.61
	Fireplace	1,740	1,624	0.93
	Fireplace Insert	4,351	7,512	1.73
	Wood Furnace or Boiler	5,656	55,693	9.85
	Wood Pellet Stove	435	237	0.55
	Fire Pit or Ring	24,906	17,028	0.68
	Combination	44,935	82,731	1.84
	Total	94,207	208,756	2.22
Central Hardwoods	Wood Stove	21,898	48,175	2.20
	Fireplace	11,593	9,930	0.86
	Fireplace Insert	17,478	16,244	0.93
	Wood Furnace or Boiler	10,305	70,598	6.85
	Wood Pellet Stove	3,864	4,681	1.21
	Fire Pit or Ring	47,661	20,333	0.43
	Combination	71,007	82,105	1.16
	Total	183,807	252,066	1.37
Prairie	Wood Stove	13,170	30,962	2.35
	Fireplace	3,039	1,186	0.39
	Fireplace Insert	9,118	21,056	2.31
	Wood Furnace or Boiler	7,092	25,014	3.53
	Fire Pit or Ring	22,956	8,858	0.39
	Combination	40,599	59,682	1.47
	Total	95,974	146,757	1.53
Metro	Wood Stove	32,176	61,906	1.92
	Fireplace	50,563	18,254	0.36
	Fireplace Insert	27,580	11,133	0.40
	Fire Pit or Ring	128,705	48,477	0.38
	Combination	137,898	77,329	0.56
	Total	376,921	217,098	0.58
All Units	Wood Stove	107,860	282,250	2.62
	Fireplace	72,317	32,378	0.45
	Fireplace Insert	62,060	59,987	0.97
	Wood Furnace or Boiler	34,047	154,501	4.54
	Wood Pellet Stove	4,692	7,863	1.68
	Fire Pit or Ring	224,620	94,724	0.42
	Combination	324,150	347,193	1.07
	Total	829,747	978,895	1.18

Note: Number of wood burning facilities does not equal number of households because some households have more than one wood burning facility.

**Table E: Residential Fuelwood Consumption by Place of Burning and Survey Unit**

Place of Burning and Survey Unit		Number of Wood Burning Facilities	Volume (cords)	Average Volume (cords per facility)
Primary Residence	Aspen-Birch	39,656	90,562	2.28
	Northern Pine	56,999	175,659	3.08
	Central Hardwoods	141,695	216,413	1.53
	Prairie	69,904	123,864	1.77
	Metro	330,955	206,543	0.62
	Total	639,209	813,040	1.27
Secondary/Recreational Residence	Aspen-Birch	29,323	54,738	1.87
	Northern Pine	24,381	18,863	0.77
	Central Hardwoods	21,777	18,264	0.84
	Prairie	8,029	10,388	1.29
	Metro	9,193	996	0.11
	Total	92,703	103,248	1.11
Business	Aspen-Birch	--	--	--
	Northern Pine	870	1,876	2.16
	Central Hardwoods	2,576	10,402	4.04
	Prairie	1,013	624	0.62
	Metro	4,597	4,684	1.02
	Total	9,056	17,585	1.94
Garage/shop	Aspen-Birch	3,534	7,672	2.17
	Northern Pine	2,176	9,907	4.55
	Central Hardwoods	5,153	3,517	0.68
	Prairie	4,052	8,332	2.06
	Metro	4,597	1,052	0.23
	Total	19,511	30,481	1.56
Camping	Aspen-Birch	6,325	1,246	0.20
	Northern Pine	9,781	2,450	0.25
	Central Hardwoods	12,606	3,470	0.28
	Prairie	12,976	3,549	0.27
	Metro	27,580	3,824	0.14
	Total	69,268	14,540	0.21
All Units	Aspen-Birch	78,838	154,218	1.96
	Northern Pine	94,207	208,756	2.22
	Central Hardwoods	183,807	252,066	1.37
	Prairie	95,974	146,757	1.53
	Metro	376,921	217,098	0.58
	Total	829,747	978,895	1.18

**Table F: Residential Fuelwood Consumption by Type of Fuelwood, Survey Unit, and Detailed Type of Burning Facility**

Survey Unit Where Consumed and Detailed Type of Burning Facility		Total Volume		Roundwood		Wood Residues or Scrap Lumber		Manufactured Logs or Pellets	
		(Cords)	(Dry Tons)	(Cords)	(Dry Tons)	(Cords)	(Dry Tons)	(Cords)	(Dry Tons)
Aspen-Birch	Woodstove: Conventional, Uncertified	90,851	126,607	90,379	126,236	469	369	2	2
	Woodstove: Catalytic, Certified	8,499	11,877	8,468	11,828	31	49	--	--
	Woodstove: Non-Catalytic, Certified	19,463	27,188	19,446	27,161	17	27	--	--
	Wood Pellet/Corn Stove	385	1,060	--	--	--	--	385	1,060
	Fireplace: Regular	1,938	2,662	1,787	2,496	--	--	151	166
	Fireplace: Insert, Uncertified	3,989	5,512	3,921	5,477	68	35	--	--
	Fireplace: Insert, Non-Catalytic, Certified	2,323	3,249	2,307	3,222	17	27	--	--
	Fireplace: Insert, Catalytic, Certified	1,178	1,645	1,178	1,645	--	--	--	--
	Boiler/Furnace: Indoor	3,392	4,738	3,392	4,738	--	--	--	--
	Boiler/Furnace: Outdoor	13,251	18,508	13,251	18,508	--	--	--	--
	Fire Pit/Ring/Chimenea	8,948	12,120	8,193	11,444	755	676	--	--
Total		154,218	215,166	152,323	212,756	1,357	1,182	538	1,228
Northern Pine	Woodstove: Conventional, Uncertified	43,196	59,301	39,554	55,247	3,643	4,054	--	--
	Woodstove: Catalytic, Certified	9,173	12,840	9,037	12,622	136	218	--	--
	Woodstove: Non-Catalytic, Certified	13,986	19,534	13,984	19,532	2	2	--	--
	Wood Pellet/Corn Stove	1,225	3,371	--	--	--	--	1,225	3,371
	Fireplace: Regular	4,147	5,636	3,712	5,185	435	451	--	--
	Fireplace: Insert, Uncertified	7,385	10,308	7,361	10,281	--	--	25	27
	Fireplace: Insert, Non-Catalytic, Certified	2,428	3,391	2,428	3,391	--	--	--	--
	Fireplace: Insert, Catalytic, Certified	1,595	2,228	1,595	2,228	--	--	--	--
	Boiler/Furnace: Indoor	16,961	23,537	16,447	22,972	--	--	514	565
	Boiler/Furnace: Outdoor	84,737	116,475	79,515	111,062	5,221	5,413	--	--
	Fire Pit/Ring/Chimenea	23,922	31,065	18,525	25,875	5,397	5,190	--	--
Total		208,756	287,684	192,158	268,395	14,834	15,325	1,764	3,964
Central Hardwoods	Woodstove: Conventional, Uncertified	51,625	72,157	51,194	71,505	431	652	--	--
	Woodstove: Catalytic, Certified	3,383	4,419	2,533	3,538	850	881	--	--
	Woodstove: Non-Catalytic, Certified	20,771	29,012	20,771	29,012	--	--	--	--
	Wood Pellet/Corn Stove	8,898	24,487	--	--	--	--	8,898	24,487
	Fireplace: Regular	16,353	22,801	16,172	22,588	108	133	73	80
	Fireplace: Insert, Uncertified	15,118	21,116	15,118	21,116	--	--	--	--
	Fireplace: Insert, Non-Catalytic, Certified	7,059	9,898	6,879	9,608	181	290	--	--
	Boiler/Furnace: Indoor	15,245	21,293	15,245	21,293	--	--	--	--
	Boiler/Furnace: Outdoor	79,924	107,553	70,032	97,817	9,892	9,736	--	--
	Fire Pit/Ring/Chimenea	33,687	43,263	28,241	39,445	5,447	3,818	--	--
Total		252,066	356,000	226,185	315,922	16,910	15,510	8,972	24,568



Survey Unit Where Consumed and Detailed Type of Burning Facility		Total Volume		Roundwood		Wood Residues or Scrap Lumber		Manufactured Logs or Pellets	
		(Cords)	(Dry Tons)	(Cords)	(Dry Tons)	(Cords)	(Dry Tons)	(Cords)	(Dry Tons)
Prairie	Woodstove: Conventional, Uncertified	40,614	57,073	38,258	53,437	2,356	3,636	--	--
	Woodstove: Catalytic, Certified	3,294	4,358	2,619	3,658	675	700	--	--
	Woodstove: Non-Catalytic, Certified	19,228	26,862	19,213	26,836	14	26	--	--
	Fireplace: Regular	8,222	11,510	8,020	11,202	170	274	31	34
	Fireplace: Insert, Uncertified	22,916	32,008	22,916	32,008	--	--	--	--
	Fireplace: Insert, Non-Catalytic, Certified	891	1,162	780	1,089	111	73	--	--
	Fireplace: Insert, Catalytic, Certified	1,013	1,415	1,013	1,415	--	--	--	--
	Boiler/Furnace: Indoor	14,366	20,095	14,224	19,867	142	228	--	--
	Boiler/Furnace: Outdoor	21,326	29,422	20,313	28,372	1,013	1,050	--	--
	Fire Pit/Ring/Chimenea	14,888	20,197	13,982	19,529	907	668	--	--
	Total	146,757	204,097	141,337	197,411	5,389	6,652	31	34
Metro	Woodstove: Conventional, Uncertified	6,744	9,429	6,706	9,367	39	62	--	--
	Woodstove: Catalytic, Certified	57,171	79,858	57,145	79,817	26	41	--	--
	Fireplace: Regular	58,739	77,651	47,852	66,837	10,191	10,049	696	765
	Fireplace: Insert, Uncertified	3,756	5,214	3,647	5,094	--	--	109	120
	Fireplace: Insert, Non-Catalytic, Certified	9,875	13,755	9,745	13,611	--	--	131	144
	Fireplace: Insert, Catalytic, Certified	3,447	4,815	3,447	4,815	--	--	--	--
	Fire Pit/Ring/Chimenea	77,365	97,628	59,698	83,383	17,613	14,186	54	59
	Total	217,098	288,349	188,240	262,923	27,869	24,338	990	1,088
All Units	Woodstove: Conventional, Uncertified	233,031	324,564	226,090	315,789	6,938	8,773	2	2
	Woodstove: Catalytic, Certified	81,520	113,352	79,802	111,463	1,718	1,889	--	--
	Woodstove: Non-Catalytic, Certified	73,448	102,597	73,415	102,542	33	55	--	--
	Wood Pellet/Corn Stove	10,509	28,921	--	--	--	--	10,509	28,921
	Fireplace: Regular	89,400	120,261	77,544	108,309	10,905	10,907	951	1,045
	Fireplace: Insert, Uncertified	53,164	74,155	52,962	73,974	68	35	133	146
	Fireplace: Insert, Non-Catalytic, Certified	22,576	31,455	22,138	30,921	308	390	131	144
	Fireplace: Insert, Catalytic, Certified	7,234	10,104	7,234	10,104	--	--	--	--
	Boiler/Furnace: Indoor	49,964	69,664	49,308	68,871	142	228	514	565
	Boiler/Furnace: Outdoor	199,238	271,959	183,112	255,760	16,127	16,199	--	--
	Fire Pit/Ring/Chimenea	158,811	204,271	128,638	179,674	30,119	24,538	54	59
	Total	978,895	1,351,299	900,243	1,257,407	66,357	63,010	12,295	30,882

**Table G: Residential Fuelwood Consumption in Secondary Residences Within Each Survey Unit by Wood Burners of Each Unit**

Primary Residence of Wood Burners	Location of secondary residence <sup>1</sup>										All Units	
	Aspen-Birch		Northern Pine		Central Hardwoods		Prairie		Metro			
	Number of Households	Volume (Cords)	Number of Households	Volume (Cords)	Number of Households	Volume (Cords)	Number of Households	Volume (Cords)	Number of Households	Volume (Cords)	Number of Households	Volume (Cords)
Aspen-Birch	22,380	21,318	393	196	--	--	393	283	--	--	23,166	21,797
Northern Pine	435	7	17,404	20,266	435	218	--	--	--	--	18,274	20,491
Central Hardwoods	2,576	3,864	5,153	3,392	36,068	31,506	1,288	602	--	--	45,085	39,364
Prairie	--	--	5,066	1,888	1,013	390	15,197	11,284	--	--	21,276	13,562
Metro	13,790	38,466	9,193	7,355	4,597	3,539	9,193	10,725	45,966	10,555	82,739	70,640
Total	39,181	63,655	37,209	33,097	42,113	35,653	26,071	22,894	45,966	10,555	190,540	165,854

<sup>1</sup> Includes secondary residences, recreational and business buildings, camping, and other places of consumption.

**Table H: Survey Units Where Residents of Each Unit Burned Wood**

Primary Residence of Wood Burners and Where Residents Burn Wood	Number of Households	Survey Unit Where Wood is Burned (Cords)				Consumption by Wood Burners of each Unit (Cords)	Average Volume (Cords per Household)
		Aspen-Birch	Northern Pine	Central Hardwoods	Prairie	Metro	
Aspen-Birch	Burn Outside of Unit	--	--	--	--	--	--
	Burn Within Unit	111,880	--	--	--	111,880	2.64
	Burn Within and Outside of Unit	--	196	--	283	479	0.61
	<b>Total</b>	111,880	196	--	283	112,359	2.6
Northern Pine	Burn Outside of Unit	--	--	--	--	--	--
	Burn Within Unit	--	194,555	--	--	194,555	3.76
	Burn Within and Outside of Unit	7	1,371	218	--	1,595	1.83
	<b>Total</b>	7	195,925	218	--	196,150	3.73
Central Hardwood	Burn Outside of Unit	--	--	--	--	--	--
	Burn Within Unit	--	--	242,331	--	242,331	1.92
	Burn Within and Outside of Unit	3,864	3,392	5,588	602	13,446	1.74
	<b>Total</b>	3,864	3,392	247,919	602	255,777	1.91
Prairie	Burn Outside of Unit	1,013	810	--	--	810	0.80
	Burn within Unit	--	--	--	125,409	125,409	1.96
	Burn Within and Outside of Unit	--	1,077	390	9,738	11,206	2.77
	<b>Total</b>	--	1,888	390	135,148	137,425	1.99
Metro	Burn Outside of Unit	38,052	4,597	--	--	42,649	3.09
	Burn Within Unit	--	--	--	--	207,352	0.73
	Burn Within and Outside of Unit	414	2,758	3,539	10,725	27,183	1.48
	<b>Total</b>	38,466	7,355	3,539	10,725	277,184	0.87
All Units	Burn Outside of Unit	14,803	5,407	--	--	43,458	2.93
	Burn Within Unit	569,234	194,555	242,331	125,409	881,527	1.55
	Burn Within and Outside of Unit	31,822	8,794	9,735	21,348	53,909	1.69
	<b>Total</b>	615,859	208,756	252,066	146,757	978,894	1.59

**Table I: Residential Fuelwood Consumption by Reason for Burning and When First Burned Wood**

Reason for Burning and When First Burned Wood		Number of Households	Volume (Cords)	Average (Cords per Household)
Pleasure	Last year	28,175	12,221	0.43
	2 years ago	12,715	7,676	0.60
	3 years ago	31,154	12,565	0.40
	4 years ago	3,421	1,612	0.47
	5 years ago	12,179	1,869	0.15
	More than 5 years ago	325,276	216,133	0.66
	Total	412,920	252,076	0.61
Primary Heat	Last year	10,718	45,369	4.23
	2 years ago	--	--	--
	3 years ago	1,448	6,371	4.40
	4 years ago	2,158	14,708	6.81
	5 years ago	1,406	9,348	6.65
	More than 5 years ago	63,996	371,638	5.81
	Total	79,726	447,434	5.61
Secondary Heat	Last year	2,191	2,876	1.31
	2 years ago	8,436	10,278	1.22
	3 years ago	2,509	8,004	3.19
	4 years ago	6,002	10,011	1.67
	5 years ago	1,406	1,252	0.89
	More than 5 years ago	102,669	246,963	2.41
	Total	123,213	279,384	2.27
All Reasons	Last year	41,084	60,466	1.47
	2 years ago	21,151	17,954	0.85
	3 years ago	35,111	26,940	0.77
	4 years ago	11,581	26,331	2.27
	5 years ago	14,991	12,469	0.83
	More than 5 years ago	491,941	834,734	1.70
	Total	615,860	978,895	1.59

**Table J: Residential Fuelwood Consumption by Type of Fuelwood\***

Survey Unit Where Consumed and Type of Roundwood Burned		Number of Wood-Burning Facilities	Type of Fuelwood			Total Volume (Cords)	Average (Cords per Facility)
			Roundwood (Cords)	Wood Residues and Scrap Lumber (Cords)	Manufactured Logs or Wood Pellets (Cords)		
Aspen-Birch	Roundwood	61,677	140,972	--	--	140,972	2.29
	Wood Residues	3,534	--	78	--	78	0.02
	Manufactured Logs	1,178	--	--	29	29	0.02
	Combination	12,449	11,352	1,279	510	13,140	1.06
	Total	78,838	152,323	1,357	538	154,218	1.96
Northern Pine	Roundwood	75,596	175,345	--	--	175,345	2.32
	Wood residues	2,611	--	6,418	--	6,418	2.46
	Manufactured Logs	1,740	--	--	1,739	1,739	1
	Combination	14,260	16,813	8,416	25	25,253	1.77
	Total	94,207	192,158	14,834	1,764	208,756	2.22
Central Hardwoods	Roundwood	128,417	189,902	--	--	189,902	1.48
	Wood Residues	6,441	--	337	--	337	0.05
	Manufactured Logs	9,017	--	--	4,696	4,696	0.52
	Combination	39,932	36,282	16,573	4,275	57,131	1.43
	Total	183,807	226,185	16,910	8,972	252,066	1.37
Prairie	Roundwood	73,411	119,439	--	--	119,439	1.63
	Wood Residues	5,066	--	1,086	--	1,086	0.21
	Manufactured Logs	--	--	--	--	--	--
	Combination	17,498	21,898	4,303	31	26,233	1.5
	Total	95,975	141,337	5,389	31	146,757	1.53
Metro	Roundwood	220,637	124,848	--	--	124,848	0.57
	Wood Residues	9,193	--	431	--	431	0.05
	Manufactured Logs	13,790	--	--	185	185	0.01
	Combination	133,301	63,392	27,437	805	91,634	0.69
	Total	376,921	188,240	27,869	990	217,098	0.58
All Units	Roundwood	559,738	750,506	--	--	750,506	1.34
	Wood Residues	26,845	--	8,350	--	8,350	0.31
	Manufactured Logs	25,725	--	--	6,649	6,649	0.26
	Combination	217,440	149,737	58,008	5,646	213,390	0.98
	Total	829,748	900,243	66,357	12,295	978,895	1.18

\*Most of this volume is derived from dead and cull trees, not trees from growing stock.

**Table K: Residential Fuelwood Consumption by Type of Fuelwood, Survey Unit, and Detailed Type of Burning Facility\***

Survey Unit Where Consumed and Detailed Type of Burning Facility		Total Volume (Cords)	Roundwood (Cords)	Wood Residues or Scrap Lumber (Cords)	Manufactured Logs or Pellets (Cords)
Aspen-Birch	Woodstove: Conventional, Uncertified	90,851	90,379	469	2
	Woodstove: Catalytic, Certified	8,499	8,468	31	--
	Woodstove: Non-Catalytic, Certified	19,463	19,446	17	--
	Wood Pellet/Corn Stove	385	--	--	385
	Fireplace: Regular	1,938	1,787	--	151
	Fireplace: Insert, Uncertified	3,989	3,921	68	--
	Fireplace: Insert, Non-Catalytic, Certified	2,323	2,307	17	--
	Fireplace: Insert, Catalytic, Certified	1,178	1,178	--	--
	Boiler/Furnace: Indoor	3,392	3,392	--	--
	Boiler/Furnace: Outdoor	13,251	13,251	--	--
	Fire Pit/Ring/Chimenea	8,948	8,193	755	--
	Total	154,218	152,323	1,357	538
Northern Pine	Woodstove: Conventional, Uncertified	43,196	39,554	3,643	--
	Woodstove: Catalytic, Certified	9,173	9,037	136	--
	Woodstove: Non-Catalytic, Certified	13,986	13,984	2	--
	Wood Pellet/Corn Stove	1,225	--	--	1,225
	Fireplace: Regular	4,147	3,712	435	--
	Fireplace: Insert, Uncertified	7,385	7,361	--	25
	Fireplace: Insert, Non-Catalytic, Certified	2,428	2,428	--	--
	Fireplace: Insert, Catalytic, Certified	1,595	1,595	--	--
	Boiler/Furnace: Indoor	16,961	16,447	--	514
	Boiler/Furnace: Outdoor	84,737	79,515	5,221	--
	Fire Pit/Ring/Chimenea	23,922	18,525	5,397	--
	Total	208,756	192,158	14,834	1,764
Central Hardwoods	Woodstove: Conventional, Uncertified	51,625	51,194	431	--
	Woodstove: Catalytic, Certified	3,383	2,533	850	--
	Woodstove: Non-Catalytic, Certified	20,771	20,771	--	--
	Wood Pellet/Corn Stove	8,898	--	--	8,898
	Fireplace: Regular	16,353	16,172	108	73
	Fireplace: Insert, Uncertified	15,118	15,118	--	--
	Fireplace: Insert, Non-Catalytic, Certified	7,059	6,879	181	--
	Boiler/Furnace: Indoor	15,245	15,245	--	--
	Boiler/Furnace: Outdoor	79,924	70,032	9,892	--
	Fire Pit/Ring/Chimenea	33,687	28,241	5,447	--
	Total	252,066	226,185	16,910	8,972

Survey Unit Where Consumed and Detailed Type of Burning Facility		Total Volume (Cords)	Roundwood (Cords)	Wood Residues or Scrap Lumber (Cords)	Manufactured Logs or Pellets** (Cords)
Prairie	Woodstove: Conventional, Uncertified	40,614	38,258	2,356	--
	Woodstove: Catalytic, Certified	3,294	2,619	675	--
	Woodstove: Non-Catalytic, Certified	19,228	19,213	14	--
	Fireplace: Regular	8,222	8,020	170	31
	Fireplace: Insert, Uncertified	22,916	22,916	--	--
	Fireplace: Insert, Non-Catalytic, Certified	891	780	111	--
	Fireplace: Insert, Catalytic, Certified	1,013	1,013	--	--
	Boiler/Furnace: Indoor	14,366	14,224	142	--
	Boiler/Furnace: Outdoor	21,326	20,313	1,013	--
	Fire Pit/Ring/Chimenea	14,888	13,982	907	--
	Total	146,757	141,337	5,389	31
Metro	Woodstove: Conventional, Uncertified	6,744	6,706	39	--
	Woodstove: Catalytic, Certified	57,171	57,145	26	--
	Fireplace: Regular	58,739	47,852	10,191	696
	Fireplace: Insert, Uncertified	3,756	3,647	--	109
	Fireplace: Insert, Non-Catalytic, Certified	9,875	9,745	--	131
	Fireplace: Insert, Catalytic, Certified	3,447	3,447	--	--
	Fire Pit/Ring/Chimenea	77,365	59,698	17,613	54
	Total	217,098	188,240	27,869	990
All Units	Woodstove: Conventional, Uncertified	233,031	226,090	6,938	2
	Woodstove: Catalytic, Certified	81,520	79,802	1,718	--
	Woodstove: Non-Catalytic, Certified	73,448	73,415	33	--
	Wood Pellet/Corn Stove	10,509	--	--	10,509
	Fireplace: Regular	89,400	77,544	10,905	951
	Fireplace: Insert, Uncertified	53,164	52,962	68	133
	Fireplace: Insert, Non-Catalytic, Certified	22,576	22,138	308	131
	Fireplace: Insert, Catalytic, Certified	7,234	7,234	--	--
	Boiler/Furnace: Indoor	49,964	49,308	142	514
	Boiler/Furnace: Outdoor	199,238	183,112	16,127	--
	Fire Pit/Ring/Chimenea	158,811	128,638	30,119	54
	Total	978,895	900,243	66,357	12,295

\*Most of this volume is derived from dead and cull trees, not trees from growing stock.

\*\*If material burned takes place in a pellet stove, the material is pellets. If burned in a fireplace, the material is manufactured logs.

**Table L: Residential Fuelwood Consumption of Roundwood by Species Group and Survey Unit\***

Species Group	All Units (Cords)	Survey Unit where Consumed (cords)				
		Aspen- Birch	Northern Pine	Central Hardwoods	Prairie	Metro
Softwoods						
Cedar	6,034	1,257	12	1,032	2,114	1,619
Tamarack	782	226	522	34	--	--
Spruce-fir	1,830	736	64	34	536	460
Pine	55,660	10,516	25,847	7,809	2,916	8,572
Total	64,306	12,735	26,445	8,909	5,566	10,651
Hardwoods						
Maple	92,701	12,377	13,097	22,108	19,638	25,481
Birch	87,420	42,339	19,309	12,033	4,365	9,374
Ash	157,611	37,538	12,752	26,296	42,223	38,802
Aspen	108,092	32,967	36,829	28,546	7,149	2,601
Oak	275,167	9,977	77,604	92,925	22,674	71,987
Basswood	19,649	4,031	1,395	8,484	4,075	1,664
Elm	85,169	336	4,549	22,572	31,574	26,138
Other Hardwoods	10,127	24	177	4,313	4,071	1,542
Total	835,936	139,589	165,712	217,277	135,769	177,589
All Species	900,242	152,324	192,157	226,186	141,335	188,240

\*Most of this volume is derived from dead and cull trees, not trees from growing stock.



**Table M: Residential Fuelwood Consumption by Method of Procurement and Survey Unit**

Survey Unit Where Consumed and Procurement Method		Roundwood Procurement Method			Total Roundwood Volume (Cords)	Total Other Fuelwood Types <sup>2</sup> (Cords)	Total Fuelwood (Cords)
		Volume Cut (Cords)	Volume Purchased (Cords)	Volume Other <sup>1</sup> (Cords)			
Aspen-Birch	Cut	42,666	--	2,984	45,650	578	46,228
	Purchased <sup>1</sup>	--	72,786	769	73,556	701	74,257
	Cut and Purchased <sup>1</sup>	9,500	16,432	7,185	33,117	615	33,733
	Total	52,166	89,218	10,939	152,323	1,895	154,218
Northern Pine	Cut	118,496	--	4,251	122,747	3,755	126,502
	Purchased <sup>1</sup>	--	15,701	562	16,264	8,701	24,964
	Cut and Purchased <sup>1</sup>	21,713	25,140	6,294	53,147	4,142	57,289
	Total	140,209	40,841	11,108	192,158	16,598	208,756
Central Hardwoods	Cut	148,846	--	11,757	160,603	7,722	168,325
	Purchased <sup>1</sup>	--	16,200	4,232	20,432	10,084	30,517
	Cut and Purchased <sup>1</sup>	12,021	19,249	13,879	45,149	8,075	53,224
	Total	160,867	35,449	29,868	226,185	25,881	252,066
Prairie	Cut	115,374	--	1,499	116,873	2,100	118,973
	Purchased <sup>1</sup>	--	8,624	507	9,131	1,327	10,458
	Cut and Purchased <sup>1</sup>	1,646	1,646	12,041	15,334	1,993	17,327
	Total	117,020	10,271	14,047	141,337	5,420	146,757
Metro	Cut	95,930	--	5,865	101,795	2,920	104,715
	Purchased <sup>1</sup>	--	35,192	7,521	42,713	8,885	51,598
	Cut and Purchased <sup>1</sup>	4,317	22,104	17,310	43,732	17,053	60,785
	Total	100,248	57,296	30,696	188,240	28,858	217,098
All units	Cut	521,312	--	26,357	547,668	17,075	564,743
	Purchased <sup>1</sup>	--	148,504	13,591	162,095	29,699	191,794
	Cut and Purchased <sup>1</sup>	49,198	84,572	56,710	190,480	31,879	222,358
	Total	570,510	233,076	96,658	900,243	78,652	978,895

<sup>1</sup> Includes gift wood, free wood, and leftover wood.<sup>2</sup> Includes wood residues, scrap lumber, manufactured logs and pellets.

**Table N: Residential Fuelwood Consumption of Purchased Fuelwood by Survey Unit and Size of Fuelwood**

Survey Unit Where Consumed and Size of Wood Purchased		Number of Wood-Burning Facilities	Volume (Cords)	Average (Cords per Facility)
Aspen-Birch	16 inches	10,094	8,738	0.87
	24 inches	785.2721	1,178	1.50
	72 inches	785.2721	220.8578	0.28
	100 inches	9,466	31,871	3.37
	Mixed slabs and endings	392.636	98.15901	0.25
	Mixed roundwood	8,916	40,339	4.52
	Tree length	785.2721	6,478	8.25
	Roundwood and Residues	392.636	392.636	1.00
	Total	31,616	89,316	2.83
Northern Pine	12 inches	2,176	803	0.37
	16 inches	6,527	11,024	1.69
	24 inches	870.2101	1240.049	1.43
	100 inches	3,046	10,171	3.34
	Mixed slabs and endings	5,902	7,714	1.31
	Mixed roundwood	3,046	5,112	1.68
	Tree length	1,305	10,225	7.83
	Roundwood and Residues	2,176	3,250	1.49
	Total	25,047	49,539	1.98
Central Hardwoods	12 inches	6,441	1,231	0.19
	16 inches	11,037	11,465	1.04
	24 inches	1,288	1	0.00
	100 inches	1,288	4,830	3.75
	Mixed slabs and endings	1,288	1,787	1.39
	Mixed roundwood	3,864	6,183	1.60
	Roundwood and Residues	12,881	11,171	0.87
	Total	38,088	36,668	0.96
Prairie	12 inches	1,013	4,559	4.50
	16 inches	2,026	317	0.16
	24 inches	2,026	1,646	0.81
	Mixed slabs and endings	2,026	537	0.27
	Mixed roundwood	3,432	1,975	0.58
	Roundwood and Residues	1,013	1,268	1.25
	Total	11,537	10,301	0.89

Survey Unit Where Consumed and Size of Wood Purchased		Number of Wood-Burning Facilities	Volume (Cords)	Average (Cords per Facility)
Metro	12 inches	22,983	2,464	0.11
	16 inches	64,352	17,322	0.27
	Mixed slabs and endings	18,386	3,751	0.20
	Mixed roundwood	22,983	10,285	0.45
	Tree length	9,193	33,096	3.60
	Roundwood and Residues	18,386	3,652	0.20
	Total	156,284	70,569	0.45
All units	12 inches	32,612	9,057	0.28
	16 inches	94,036	48,866	0.52
	24 inches	4,970	4,065	0.82
	72 inches	785,2721	220,8578	0.28
	100 inches	13,800	46,872	3.40
	Mixed slabs and endings	27,995	13,887	0.50
	Mixed roundwood	42,241	63,894	1.51
	Tree length	11,284	49,799	4.41
	Roundwood and Residues	34,849	19,733	0.57
	Total	262,572	256,394	0.98

**Table O: Residential Fuelwood Consumption by Survey Unit and Place of Consumption**

Survey Unit Where Consumed and Place of Consumption		Number of Wood-Burning Facilities	Primary Residence (Cords)	Secondary Residence (Cords)	Other Buildings <sup>1</sup> (Cords)	Total Fuelwood (Cords)	Average (Cords per Facility)
Aspen-Birch	Primary Residence	31,018	69,667	--	--	69,667	2.25
	Secondary Residence	6,167	--	2,219	--	2,219	0.36
	Other Buildings <sup>1</sup>	12,057	--	--	45,047	45,047	3.74
	Combination	29,596	20,895	11,008	5,381	37,284	1.26
	Total	78,838	90,562	13,228	50,428	154,218	1.96
Northern Pine	Primary Residence	46,991	156,736	--	--	156,736	3.34
	Secondary Residence	6,772	--	6,623	--	6,623	0.98
	Other Buildings <sup>1</sup>	5,757	--	--	12,673	12,673	2.20
	Combination	34,687	18,923	4,847	8,953	32,724	0.94
	Total	94,207	175,659	11,470	21,626	208,756	2.22
Central Hardwoods	Primary Residence	108,203	186,349	--	--	186,349	1.72
	Secondary Residence	3,864	--	3,301	--	3,301	0.85
	Other Buildings <sup>1</sup>	6,441	--	--	14,577	14,577	2.26
	Combination	65,299	30,064	6,185	11,590	47,839	0.73
	Total	183,807	216,413	9,486	26,167	252,066	1.37
Prairie	Primary Residence	53,694	90,777	--	--	90,777	1.69
	Secondary Residence	393	--	283	--	283	0.72
	Other Buildings <sup>1</sup>	4,052	--	--	6,975	6,975	1.72
	Combination	37,835	33,086	9,193	6,443	48,723	1.29
	Total	95,974	123,864	9,476	13,418	146,757	1.53
Metro	Primary Residence	266,603	179,530	--	--	179,530	0.67
	Secondary Residence	4,597	--	766	--	766	0.17
	Other Buildings <sup>1</sup>	4,597	--	--	41	41	0.01
	Combination	101,125	27,013	--	9,748	36,761	0.36
	Total	376,921	206,543	766	9,789	217,098	0.58
All units	Primary Residence	506,510	683,059	--	--	683,059	1.35
	Secondary Residence	21,793	--	13,192	--	13,192	0.61
	Other Buildings <sup>1</sup>	32,903	--	--	79,314	79,314	2.41
	Combination	268,541	129,981	31,234	42,115	203,330	0.76
	Total	829,747	813,040	44,426	121,429	978,895	1.18

<sup>1</sup> Include: garages, business and recreational buildings.

**Table P: Residential Fuelwood Production by Homeowners and Loggers, Survey Unit, and Source of Material**

Survey Unit	All Sources cords	Forest Land (cords)			Non-Forest Land (cords)			
		Standing Live Trees	Logging Waste	Dead Trees	Windbreaks and Fencerows	Pasture and Cropland	Cities and Towns	Yard Trees
Aspen-Birch	100,875	62,311	3,273	26,672	1,021	790	760	6,048
Northern Pine	245,895	58,417	27,829	130,747	787	11,519	4,536	12,060
Central Hardwoods	419,255	67,019	79,718	185,858	14,107	15,400	20,007	37,147
Prairie	195,491	8,326	4,805	120,265	12,062	29,993	5,561	14,479
Metro	72,571	8	--	11,785	460	--	16,387	43,932
All Units	1,034,087	196,080	115,625	475,327	28,436	57,702	47,251	113,666

**Table Q: Residential Fuelwood Production by Homeowners, Loggers, Species Group, and Source of Material**

Ownership Class	All Sources cords	Forest Land (cords)			Non-Forest Land (cords)			
		Standing Live Trees	Logging Waste	Dead Trees	Windbreaks and Fencerows	Pasture and Cropland	Cities and Towns	Yard Trees
Softwoods								
Cedar	3,247	927	81	1,879	69	--	268	24
Tamarack	14,528	2,045	646	11,838	--	--	--	--
Spruce-fir	2,560	469	--	1,617	94	32	143	205
Pine	53,269	5,101	9,670	28,784	776	1,955	1,706	5,278
Total	73,604	8,542	10,396	44,117	939	1,987	2,116	5,507
Hardwoods								
Maple	120,703	31,151	13,506	52,375	353	2,663	7,151	13,502
Birch	77,138	31,030	6,167	29,143	678	2,224	1,834	6,061
Ash	195,778	27,106	8,726	86,616	14,293	26,489	9,716	22,834
Cottonwood	8,547	313	--	1,454	547	2,214	738	3,281
Aspen	115,731	31,887	21,376	44,990	1,167	4,930	1,416	9,966
Oak	304,146	57,535	45,530	153,127	4,154	8,743	13,328	21,730
Basswood	32,116	6,261	6,931	10,248	38	502	1,975	6,161
Elm	99,036	1,507	2,640	51,570	6,092	5,965	6,859	24,403
Other Hardwoods	7,288	747	354	1,687	175	1,986	2,118	221
Total	960,482	187,538	105,229	431,209	27,497	55,715	45,135	108,159

**Table R: Residential Fuelwood Production by Homeowners, Loggers, Ownership Class, and Source of Material**

Ownership Class	All Sources cords	Forest Land (cords)			Non-Forest Land (cords)			
		Standing Live Trees	Logging Waste	Dead Trees	Windbreaks and Fencerows	Pasture and Cropland	Cities and Towns	Yard Trees
National Forest	6,578	5,767	303	507	--	--	--	--
Other Federal	48	18	--	29	--	--	--	--
State	88,052	46,293	36,745	5,014	--	--	--	--
County	55,162	37,862	6,186	11,114	--	--	--	--
Municipal	6,748	--	81	2,616	--	--	3,931	121
Forest Industry	7,340	2,019	1,368	3,952	--	--	--	--
Private	870,159	114,422	70,942	452,095	28,171	57,453	42,120	104,957
All ownerships	1,034,087	206,381	115,625	475,327	28,171	57,453	46,051	105,078

**Table S: Residential Fuelwood Production by Homeowners, Loggers, Species Group, and Ownership Class**

Species Group	All Ownerships cords	Ownership Class (cords)						
		National Forest	Other Federal	State	County	Municipal	Forest Industry	Private
Softwoods								
Cedar	3,247	--	--	61	--	50	18	3,119
Tamarack	14,528	--	--	3,056	1,111	--	--	10,361
Spruce-fir	2,560	--	--	--	--	50	--	2,509
Pine	53,269	52	22	2,811	2,684	121	2,514	45,065
Total	73,604	52	22	5,927	3,795	221	2,532	61,055
Hardwoods								
Maple	120,703	1,749	4	9,601	11,429	1,011	603	96,305
Birch	77,138	1,962	16	6,997	11,631	162	1,679	54,691
Ash	195,778	1,361	1	12,656	7,481	384	280	173,615
Cottonwood	8,547	--	--	--	--	725	--	7,823
Aspen	115,731	1,144	0	10,781	4,860	1,197	212	97,537
Oak	304,146	282	5	36,381	13,773	1,413	1,579	250,713
Basswood	32,116	26	0	5,274	158	100	0	26,557
Elm	99,036	1	1	434	2,033	1,536	453	94,578
Other Hardwoods	7,288	0	0	0	0	0	0	7,285
Total	960,482	6,525	26	82,125	51,367	6,528	4,807	809,104
All Species	1,034,087	6,578	48	88,052	55,162	6,748	7,340	870,159

0= Less than ½ cord

**Table T: Residential Fuelwood Production by Homeowners, Loggers, Species Group, and Survey Unit**


Species Group	All Units cords	Survey Unit (cords)				
		Aspen-Birch	Northern Pine	Central Hardwoods	Prairie	Metro
Softwoods						
Cedar	3,247	1,564	85	525	904	170
Tamarack	14,528	892	13,572	--	65	--
Spruce-fir	2,560	1,500	3	--	914	143
Pine	53,269	3,980	31,535	12,906	3,316	1,532
Total	73,604	7,936	45,195	13,431	5,199	1,845
Hardwoods						
Maple	120,703	17,041	14,164	48,477	26,079	14,941
Birch	77,138	29,675	29,081	13,384	2,034	2,964
Ash	195,778	16,556	19,041	71,174	75,264	13,743
Cottonwood	8,547	--	--	4,434	4,100	13
Aspen	115,731	21,704	46,549	39,108	7,842	528
Oak	304,146	6,556	86,242	169,184	26,752	15,412
Basswood	32,116	355	3,223	24,317	3,726	494
Elm	99,036	1,042	2,359	34,666	40,369	20,601
Other Hardwoods	7,288	9	41	1,079	4,126	2,032
Total	960,482	92,938	200,700	405,823	190,292	70,728
All Species	1,034,087	100,875	245,895	419,255	195,491	72,571

**Table U: Residential Fuelwood Production by Homeowners, Loggers, Ownership Class, and Survey Unit**

Ownership Class		All Units cords	Survey Unit (cords)				
			Aspen-Birch	Northern Pine	Central Hardwoods	Prairie	Metro
Households	National Forest	776	5	764	7	--	--
	Other Federal	48	41	--	7	--	--
	State	9,109	5	7,926	1,178	--	--
	County	27,403	2,282	11,639	1,514	3,120	8,848
	Municipal	6,184	654	322	4,040	896	272
	Forest Industry	3,467	1,128	825	1,514	--	--
	Private	776,063	54,360	171,456	298,351	189,358	62,538
	Total	823,050	58,475	192,932	306,611	193,374	71,658
Loggers	National Forest	5,802	4,726	1,076	--	--	--
	State	78,943	12,346	13,894	52,582	121	--
	County	27,758	13,581	14,113	64	--	--
	Municipal	564	--	--	56	--	508
	Forest Industry	3,873	129	3,744	--	--	--
	Private	94,097	11,617	20,138	59,942	1,995	405
	Total	211,037	42,399	52,965	112,644	2,116	913
Total Harvest	National Forest	6,577	4,731	1,839	7	--	--
	Other Federal	48	41	--	7	--	--
	State	88,052	12,351	21,820	53,760	121	--
	County	55,160	15,863	25,751	1,578	3,120	8,848
	Municipal	6,748	654	322	4,096	896	780
	Forest Industry	7,340	1,257	4,569	1,514	--	--
	Private	870,159	65,977	191,593	358,293	191,353	62,943
	Total	1,034,087	100,875	245,895	419,255	195,491	72,571

# MINNESOTA RESIDENTIAL FUELWOOD ASSESSMENT 2007-2008

Minnesota Department of Natural Resources  
Minnesota Pollution Control Agency  
USDA, Forest Service, Northern Research Station  
Hearth, Patio and Barbecue Association

	BURN SEASON (YEAR)	STATE ID	POP UNIT	COUNTY (FIP)	SURVEY # IN COUNTY

County where you reside \_\_\_\_\_

*The above table is for office use only*

1. Did you burn wood, corn, or pellets between April 2007 and March 2008? Yes No
2. If you burned wood, corn, or pellets in the past but no longer do, why did you stop?  
\_\_\_\_\_
3. Do you plan on burning wood, corn, or pellets next year? Yes No
4. Do you plan on installing wood, corn, or pellet burning equipment within one year? Yes No
5. Do you have wood, corn, or pellet burning equipment (including fire pits/chimenea)? Yes No

If you answered "NO" to question 5, then go to question 20.

6. When did you start burning wood, corn, or pellets (year)? \_\_\_\_\_
7. What type and how many units of wood, corn, or pellets burning equipment do you have?

Equip- ment Code #	Type Of Wood Burning Equipment (do not include gas burning equipment)	Quan- tity	Equip- ment Age(s)	Does your wood- burning equipment have glass in the doors? (yes or no)	Brand And Model (if known)
1	Woodstoves: Uncertified, Conventional				
2	Woodstoves: Catalytic with bypass lever, EPA-Certified				
3	Woodstoves: Non-Catalytic, EPA-Certified				
4	Woodstoves: Wood Pellet				
5	Stoves: Corn/Non-Wood Pellet				
6 *	Fireplaces: Regular No Inserts				
7 *	Fireplaces: Inserts, Uncertified, Conventional				
8 *	Fireplaces: Inserts - Non- Catalytic, EPA-Certified				
9 *	Fireplaces: Inserts – Catalytic with bypass lever, EPA-Certified				
10 *	Fireplaces: Pellet Insert				
11	Boilers/Furnaces: Indoor				
12	Boilers/Furnaces: Outdoor				
13	Fire Pits/Rings/Chimenea				

\*: If your fireplace door is hinged on the sides, it is an insert. If it is a bi or tri-folding door, is screened, or has no door, it is fireplace.

8. Which of the following describes your primary motivation for burning? (please circle one)  
economics      pleasure      convenience      sustainability of fuel      government incentive  
other (please specify): \_\_\_\_\_



# MINNESOTA

## RESIDENTIAL FUELWOOD ASSESSMENT 2007-2008

9. What type and how much fuel did you burn between April 2007 and March 2008?

\* Use the Equipment Code Number from Question 7.

\*\* Use the Measure Code Number from below and use the second set of columns for additional pieces of equipment.

Type of Fuel	Equipment Code #*	Measure Code #**	Amount Burned	Equipment Code #*	Measure Code #**	Amount Burned
Round wood or logs						
Split wood						
Slabs						
Wood pellets						
Corn/non-wood pellets						
Wax fireplace logs (ie: Duraflame or Pine Mountain)						
Densified logs (ie: Pres-to-Logs)						
Crates/pallets						
Lumber						
Sawdust						
Other (please specify):						

**\*\*Measurement Code Number choices:**

**VEHICLE LOAD**

1. ¾ ton pick up.
2. ½ ton pick up.
3. Small pickup truck  
(Nissan, Toyota, Ranger, S-10, etc.)
4. Full size car trunk
5. Small size car trunk
6. Suburban (Carryall)
7. Full size van
8. Small size van
9. Small hatchback
10. Small station wagon
11. Station wagon

**WEIGHT**

12. Pounds of green wood
13. Pounds of dry wood
14. Tons of green wood
15. Tons of dry wood

**TREES**

23. 5 inch trees
24. 10 inch trees
25. 15 inch trees
26. 20 inch trees
27. 25 inch trees
28. 30 inch trees
29. 40 inch trees

**BUNDLES**

22. Bundles

**OTHER**

66. Pallets
67. Board feet
68. Other Specify.

**VOLUME**

16. Cubic feet (Length x Width x Height) in feet
17. Cords: 4'x 8'x 12" (1/4 std. cord)
18. Cords: 4'x 8'x 16" (1/3 std. cord)
19. Cords: 4'x 8'x 18"
20. Cords: 4'x 8'x 24" (1/2 std. cord)
21. Cords: 4'x 8'x 4' (1 std. cord)

**PELLETS/CORN**

71. Tons
70. Bags: weight per bag/lbs

**PIECES**

30. Pieces length in inches

10. List your purposes for burning wood, corn or pellets and percent burned for each:

Purpose	Equipment Code #*	Percent	Purpose	Equipment Code #*	Percent
Primary source of heat			Supplemental source of heat		
Pleasure only			Other (please specify)		
Camping					

11. If your use is supplemental, what is your primary source of heat? \_\_\_\_\_

12. Where did you burn and what percent was burned at each location?

Location	Equipment Code #*	Percent	County	Equipment Code #*	Percent	County
Primary residence						
Secondary residence						
Business building						
Recreational building						
Other (please specify):						

\*Use Equipment Code Numbers from question 7 for questions number 10 and 12.

# MINNESOTA RESIDENTIAL FUELWOOD ASSESSMENT 2007-2008

13. Please check the months you had a fire at each location between April 2007 and March 2008?

Location	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March
Primary residence												
Secondary residence												
Business building												
Recreational building												
Other (please specify):												

14. Between October 2007 and March 2008, when did you burn? Check all that apply:  
Weekdays \_\_\_\_\_ Weekends \_\_\_\_\_ Holidays \_\_\_\_\_
15. Between April 2007 and September 2007, when did you burn? Check all that apply:  
Weekdays \_\_\_\_\_ Weekends \_\_\_\_\_ Holidays \_\_\_\_\_
16. If you burned fuelwood, what percent was burned of each species?

HARDWOODS									SOFTWOODS			
Oak	Birch	Ash	Elm	Maple	Aspen	Bass-wood	Other:	Other:	Pine	Cedar	Other:	Other:

17. What percent of the fuelwood burned between April 2007 and March 2008 was purchased or obtained from another source? \_\_\_\_\_
18. Of the fuelwood purchased or obtained from another source, what percent was purchased or obtained from: Loggers \_\_\_\_\_ Firewood processors \_\_\_\_\_ Others (please specify) \_\_\_\_\_

Were any of the above DNR approved vendors? Yes No Don't know

19. If you purchased or obtained fuelwood, what was its length?

LENGTH	√	LENGTH	√
12 inches		Random slabs	
16 inches		Random endings	
24 inches		Mixed slabs and endings	
48 inches		Random round wood	
72 inches		Mixed round wood	
100 inches		Tree length	

20. Did you or a member of your household harvest fuelwood between April 2007 and March 2008? Yes No

If you answered "NO" to question 20, then go to the end of the survey and follow the instructions to return the completed form. Thank you.

# MINNESOTA RESIDENTIAL FUELWOOD ASSESSMENT 2007-2008

21. What percent of the fuelwood burned between April 2007 and March 2008 was harvested by members of your household? \_\_\_\_\_
22. How much fuelwood did members of your household harvest between April 2007 and March 2008? Use the Measure Code Number from question 10: \_\_\_\_ Amount: \_\_\_\_\_
23. What percent of the fuelwood harvested by members of your household came from the following sources:

Source	Percent	Source	Percent
Live trees in forest/woodland		Rural/agricultural land clearing	
Dead and down trees in forest/woodland		Rural trees in yard	
Logging residue (tops/slash)		Trees inside city/town limits	
Trees in fence rows/windbreaks		Other (please specify):	

24. What percent of the fuelwood harvested came from the following locations:

Location	Percent	Location	Percent
Private land		State land	
County land		National forest land	
Municipal land		Other federal land	
Land owned by forest industry		Don't know	

25. Counties where members of your household harvested fuelwood:

County name: 1: \_\_\_\_\_ Percent from county: 1: \_\_\_\_\_

2: \_\_\_\_\_ 2: \_\_\_\_\_

3: \_\_\_\_\_ 3: \_\_\_\_\_

4: \_\_\_\_\_ 4: \_\_\_\_\_

26. What percent of the fuelwood harvested was of each species:

HARDWOODS								SOFTWOODS			
Oak	Birch	Ash	Elm	Maple	Aspen	Bass-wood	Other:	Pine	Cedar	Other:	Other:

**THANK YOU FOR YOUR PARTICIPATION**

Please return your completed questionnaire in the enclosed postage-paid envelope to:

Minnesota Department of Natural Resource  
Division of Forestry  
1201 East Highway 2  
Grand Rapids, MN 55744

**Thank you for responding by June 2, 2008**