

***Department of Environmental Quality
Residential Wood Combustion Survey:
Results Report***

Survey Conducted March, 2009

**Draft Report for the
Oregon Department of Environmental Quality**

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This report is a summary of a telephone survey of Oregonians' behaviors associated with residential wood burning. The Portland State University Survey Research Lab (SRL) conducted the survey between March 5th and March 14th, 2009. The SRL simultaneously conducted a random statewide survey and oversamples of four specific Oregon communities (Klamath Falls, Lakeview, Medford, and the Burns/Hines/Paiute Tribe boundary area). A total of 1,298 respondents completed the survey, with 1,036 respondents from throughout the state and 262 respondents from the oversamples.

I. METHODOLOGY

A. Survey Programming, Interviewer Training and Data Collection Oversight

Before conducting the survey, the SRL assisted DEQ in developing and finalizing the questions. The survey included items regarding both indoor and outdoor residential wood combustion behavior and demographics. The finalized survey instrument was then programmed in Voxco Virtual Call Center (VCC)¹ software. Live pilot testing was conducted with 10 respondents to ensure the appropriate wording of questions, the correct functioning of all skip patterns, and data accuracy and reliability.

The SRL uses Computer Assisted Telephone Interviewing (CATI), is equipped with 10 CATI call stations, and is part of the extensive PSU Local Area Network (LAN) with high-speed access to the Internet. The SRL stations are fully computerized using Voxco software, as well as a range of software for word processing, database management, spreadsheet preparation, graphics presentations, and statistical analysis. The SRL data and software are stored on secure servers set aside for the sole purpose of conducting confidential surveys and securely storing the gathered data.

A total of 16 interviewers were trained on conducting the survey. The project training included DEQ staff, the SRL Research Assistant, the SRL Interview Coordinators, and all scheduled interviewers. DEQ staff gave an overview of the background and purpose of the survey to provide the interviewers with the context within which the survey was being conducted. This was followed by a round-table review of the entire survey in order to review the survey items, discuss idiosyncratic issues related to the population being surveyed, and clarify the investigator's data needs. Interviewers also had the opportunity to ask the client specific questions about the meaning of the items. Finally, interviewers participated in on-line practice of the survey before going live.

Before calling began, phone numbers were ordered from Marketing Systems Group (MSG)². The random statewide survey of Oregon residents was divided into five state regions (Northwest, Southwest, Central, Northeast, and Southeast). Table 1 lists the counties that were included in each region and Figure 1 displays a map of the regional counties and the locations of the oversample communities.

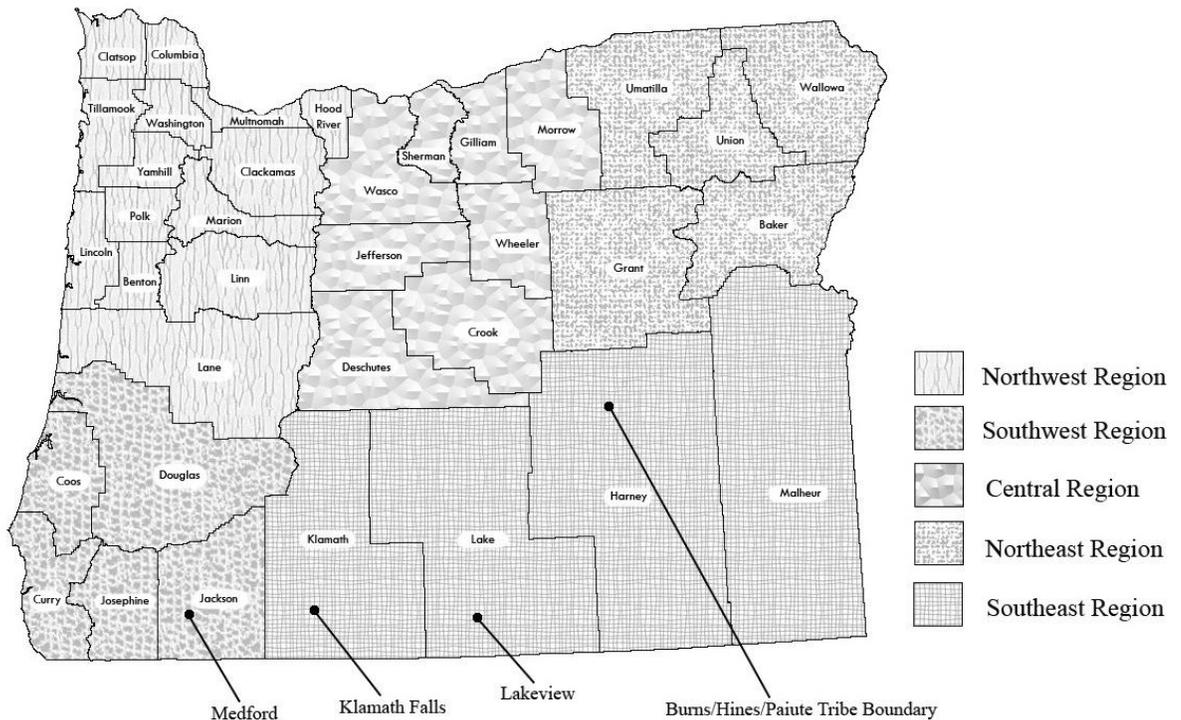
¹ <http://www.voxco.com>

² <http://www.m-s-g.com>

Table 1: Regions and Counties

Northwest Region	Southwest Region	Central Region	Northeast Region	Southeast Region
Benton	Coos	Crook	Baker	Harney
Clackamas	Curry	Deschutes	Grant	Klamath
Clatsop	Douglas	Gilliam	Umatilla	Lake
Columbia	Jackson	Jefferson	Union	Malheur
Hood River	Josephine	Morrow	Wallowa	
Lane		Sherman		
Lincoln		Wasco		
Linn		Wheeler		
Marion				
Multnomah				
Polk				
Tillamook				
Washington				
Yamhill				

Figure 1: Map of Oregon Region Counties and Oversample Communities



The sample was proportionally distributed based on the population across each census tract within each region. Additionally, the sample was split between 70% randomly selected directory listed numbers and 30% randomly generated numbers. This approach replicates the proportion of listed to unlisted numbers that currently exists within Oregon; with a slightly larger proportion of listed numbers to maximize the response rate (randomly generated numbers include more invalid numbers than do listed numbers). Once the sample was received, numbers were randomly selected for calling by the CATI software. For the oversample, the sample was divided into four communities: the towns of Medford, Lakeview, and Klamath Falls, and the Burns/Hines/Paiute Tribe boundary area. Due to the targeted nature of these oversamples, the numbers were all directory listed.

Calls were made during afternoon and evening hours, Monday through Sunday. Interview Coordinators provided on-site monitoring and supervision during all calling hours to ensure the highest quality data collection, as well as accurate data entry. For quality assurance purposes, the interview coordinators frequently monitored interviewers, with the level of monitoring varying depending upon the individual needs of each interviewer. The interview monitoring was live and involved the coordinator patching into the telephone conversation to listen to the interviewer conducting the survey, as well as viewing interviewer's input of the data being collected. The CATI software allowed the Coordinators to pull up the live interview on their computer screen to view the real-time typing, away from the interviewer's view for reduced distraction. Additional quality assurance checks were conducted repeatedly throughout survey calling, with a higher frequency at the beginning of calling. These included the Research Assistant reviewing the collected data and the Interview Coordinators continuously monitoring the data collection process. Any issues that came up during the survey were quickly resolved with the DEQ staff.

During the two-week data collection period, the Research Assistant submitted periodic status reports to the project team at DEQ that itemized the status of all the telephone numbers in the sample. The numbers were divided into two groups, active and resolved, and these two groups were further subdivided into call disposition codes. The final counts for the resolved and active disposition codes are presented in Table 2.

Table 2: Resolved and Active Disposition Codes

Resolved Number Disposition Codes	Survey	
	Count	Percent
Completed Interviews	1,298	37.6%
Fax Machine	133	3.8%
Non-working, disconnected number	1,575	45.6%
Non-residential	204	5.9%
Language/Disability barrier	81	2.3%
No one in Household 18 years of age or older	2	0.1%
Cell Phone Refusal	1	<0.1%
Group Home	9	0.3%
Pay Phone	0	<0.1%
Suspend without callback	39	1.1%
Refusal - Never callback	114	3.3%
Total Resolved Numbers =	3,456	100.0%
Active Number Disposition Codes	Survey	
	Count	Percent
Answering machine	1,621	43.5%
Busy	99	2.7%
No answer	372	10.0%
Specific English callback	74	2.0%
Suspend with English callback	1	<0.1%
Generic English callback	627	16.8%
Refusal	93	2.5%
Immediate Hang Up - timed callback	519	13.9%
Not yet Called	322	8.6%
Total Active Numbers =	3,728	100.0%
TOTAL SAMPLE	7,184	100.0%

The average length of completed surveys was 7.52 minutes and an average of 1.72 calls was made per number to complete a survey.

B. Sampling Plan and Sample Management

To ensure that there would be enough surveys to draw statistically meaningful conclusions across levels of the variables of interest for the statewide survey, a power analysis was conducted. In order for a statistical test to be valid, the sample sizes must be large enough to detect group differences. A reasonable level of probability (significance level) of 5% (i.e., $p < .05$) was selected. Given that preliminary evidence about Residential Wood Combustion was not available, a conventionally acceptable medium effect size of .30 was used (Cohen, 1988³). Additionally, the desired level of power was set at .80 (Cohen, 1988). Based on this information, a sample size of 176 surveys per group was found to be adequate for comparing across regions. This resulted in a goal of 880 completed surveys for the random statewide survey.

To ensure that the sample would be representative of each individual community population required some estimates and assumptions. The estimated sample size is based on: (1) the level of accuracy a researcher desires to have in the results (i.e., an estimate of the *sampling error*); (2) the *confidence* a researcher would like to have that the data gathered from the sample is representative of the entire population; and (3) *how varied* the population is thought to be related to a characteristic of interest, gathered by a two-answer question in the survey (e.g., a yes/no item) (Kraemer & Thiemann, 1987⁴; Dillman, 2000⁵; Fowler, 1993⁶). The commonly accepted value for *sampling error* is plus or minus 5 percent (denoted $\pm 5\%$). A typical *confidence interval* used in survey research is 95%. The *maximum variation* in a yes/no item is 50/50; whereas less variation would be 80/20 or 90/10.

For the community oversamples, a lower expected amount of variation (i.e., 80/20) was used to calculate the sample size for a sampling error of plus or minus 10 percent. A total sample size of at least 61 respondents in each community was needed to be 95% confident that the overall results are those we would expect to find within that specific community. Rounding up slightly, a goal of 65 surveys per community was set (for a total of 260 surveys from the oversamples).

Table 3 summarizes the goals and the actual number of completed surveys for the five statewide regions and the four community oversamples. In all areas, the goals were successfully reached and in some cases exceeded due to unexpectedly high response rates⁷.

³ Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

⁴ Kraemer, H.S. & Thiemann, S. (1987). *How many subjects?* Newbury Park, CA: Sage.

⁵ Dillman, D.A. (2000). *Mail and internet surveys: The tailored design method*. NY: Wiley.

⁶ Fowler, F.J., Jr. (1993). *Survey research methods* (2nd ed.). Newbury Park, CA: Sage.

⁷ The sample originally included 1,311 respondents. However, ten records were removed because the respondents did not know their county location so that their region could not be determined. An additional three records were removed because one respondent initiated the survey and a second respondent completed the survey, resulting in potentially invalid data.

Table 3: Survey Goals and Actual Frequencies

Statewide Region	Goal	Actual
Northwest	176	204
Southwest	176	212
Central	176	198
Southeast	176	209
Northeast	176	213
Total	880	1,036
Community Oversamples	Goal	Actual
Klamath Falls	65	65
Lakeview	65	66
Medford	65	65
Burns/Hines/Paiute Tribe Boundary	65	66
Total	260	262
Total	1,140	1,298

C. Response and Refusal Rates

The response rate for this survey was calculated two different ways. It was first calculated using all eligible numbers in the denominator. That included all of the numbers within the resolved and active disposition codes listed in Table 2 *except* for numbers classified as fax machine, non-working, non-residential, group home, no one in the household 18 years of age or older, or not yet called. Numbers classified as pay phone would also have been excluded from that response rate calculation, but for this survey there were not any numbers coded in that category. This calculation resulted in a response rate of 26.3%. The second approach to calculating the response rate was based on only resolved numbers. This rate represents the proportion of all resolved numbers that are actually completed surveys. This alternate calculation resulted in a response rate of 37.6%.

The refusal rate included any numbers classified as suspended without callback, general refusal, or hanging up. These counts were considered relative to the total number of used sample such that the denominator did not include any numbers that had not been called at least once. This calculation resulted in a refusal rate of 15.5%.

Table 4 summarizes the response and refusal rates for the five regions and four community oversamples. The community oversamples had slightly higher response rates based on the resolved number calculations. However, the response rate based on eligible numbers and their refusal rates were fairly comparable to the rates from respondents in the five regions.

Table 4: Response Rates and Refusal Rates

	Response Rate-Eligible Numbers	Response Rate-Resolved Numbers	Refusal Rate
Northwest	25.8%	33.2%	13.7%
Southwest	25.9%	35.4%	15.2%
Central	24.2%	33.6%	14.8%
Southeast	28.0%	40.0%	12.7%
Northeast	28.0%	32.9%	18.1%
Klamath Falls	29.8%	55.6%	18.3%
Lakeview	27.4%	58.4%	19.1%
Medford	17.7%	46.8%	16.6%
Burns/Hines/Paiute Tribe Boundary	37.3%	57.4%	18.1%
Total	26.3%	37.6%	15.5%

D. Sampling Error

When estimating the sample size needed for a survey, one of the criteria included is the sampling error (also known as margin of error), which is the level of accuracy we would like to have in the results. Once the survey is completed, the *actual* sampling error can be calculated. To determine the actual sampling error, the number of respondents reporting that they burned wood in fireplaces was used as a basis of that calculation. The responses showed an even lower variation (ranging from 90/10 to 95/5) than was initially expected. Therefore, using these calculated variations in combination with a confidence interval of 95% and the achieved sample sizes, sampling error was calculated. All of the calculated sampling errors were lower (i.e., better) than the initial goal of $\pm 10\%$ (Table 5).

Table 5: Sampling Errors

	Population	Sample Size	Sampling Error
Klamath Falls	19,662	65	6.47%
Lakeview	2,345	66	4.05%
Medford	71,168	65	7.02%
Burns/Hines/Paiute Tribe Boundary	4,729	66	4.97%

Additionally, sampling error was calculated for the overall survey, combining the five regions and the four community oversamples. For this calculation, we used a confidence interval of 95%, maximum variation (50/50), and the sample sizes achieved. This approach resulted in a sampling error of 2.72%, which is better than a reasonable sampling error of 5%.

E. Respondent Demographic Characteristics

Once the primary survey questions were completed, respondents were asked a series of demographic characteristics items. The demographic characteristics of the 1,298 respondents combined and split by type of sample are presented in Table 6.

Table 6: Demographic Characteristics of Respondents

Demographic	Full Sample (n=1,298)		Statewide Regions (n=1,036)		Oversamples (n=262)	
	Percent	Count	Percent	Count	Percent	Count
Own or Rent Home						
Own	83.9%	1,089	85.4%	885	77.9%	204
Rent	15.6%	203	14.2%	147	21.4%	56
Don't Know	0.2%	3	0.2%	2	0.4%	1
Refused	0.2%	3	0.2%	2	0.4%	1
Type of Building Lived In						
Single Family House	79.7%	1,034	79.4%	823	80.5%	211
Duplex or Multiplex	3.1%	40	2.6%	27	5.0%	13
Apartment or Condominium	5.2%	67	5.1%	53	5.3%	14
Mobile Home	11.9%	155	12.7%	132	8.8%	23
Other	0.2%	2	0.1%	1	0.4%	1
2008 Annual Household Income						
Less than \$30,000	27.7%	359	25.8%	267	35.1%	92
\$30,000 to less than \$50,000	20.6%	267	20.3%	210	21.8%	57
\$50,000 to less than \$70,000	13.6%	177	14.1%	146	11.8%	31
\$70,000 to less than \$90,000	9.5%	123	10.3%	107	6.1%	16
\$90,000 to less than \$150,000	9.5%	123	9.7%	100	8.8%	23
\$150,000 or more	3.5%	45	3.7%	38	2.7%	7
Don't Know	3.5%	45	3.3%	34	4.2%	11
Refused	12.2%	159	12.9%	134	9.5%	25

Additionally, respondents ranged in age from 18 to 96 years, with an average of 58.88 ($SD = 15.66$) years⁸. Respondents from the statewide regional sample were similar in age ($M = 58.84$) to respondents from the oversample communities ($M = 59.03$).

⁸ Average age is based on a sample of 1,267 respondents. Two respondents did not know their age and twenty-nine respondents refused to provide their age.

As seen in Table 7, in the statewide regional survey, at least one respondent was included from every county in Oregon. Additionally, only two counties (Deschutes and Klamath) represented more than 10% of the responses.

Table 7: County Location

County	Full Sample (n=1,298)		Statewide Regions (n=1,036)	
	Percent	Count	Percent	Count
Baker	2.6%	34	3.3%	34
Benton	0.7%	9	0.9%	9
Clackamas	2.3%	30	2.9%	30
Clatsop	0.2%	2	0.2%	2
Columbia	0.3%	4	0.4%	4
Coos	2.8%	36	3.5%	36
Crook	1.4%	18	1.7%	18
Curry	1.2%	16	1.5%	16
Deschutes	8.8%	114	11.0%	114
Douglas	3.7%	48	4.6%	48
Gilliam	0.2%	2	0.2%	2
Grant	1.8%	24	2.3%	24
Harney	5.6%	73	0.6%	6
Jackson	10.5%	136	6.9%	71
Jefferson	1.5%	20	1.9%	20
Josephine	3.2%	41	4.0%	41
Klamath	14.0%	182	11.4%	118
Lake	6.2%	80	1.4%	14
Lane	2.5%	33	3.2%	33
Lincoln	0.2%	3	0.3%	3
Linn	0.4%	5	0.5%	5
Malheur	5.5%	71	6.9%	71
Marion	1.5%	20	1.9%	20
Morrow	0.8%	10	1.0%	10
Multnomah	3.8%	49	4.7%	49
Polk	0.5%	6	0.6%	6
Sherman	0.2%	2	0.2%	2
Tillamook	0.2%	3	0.3%	3
Umatilla	6.4%	83	8.0%	83
Union	3.8%	49	4.7%	49
Wallowa	1.8%	23	2.2%	23
Wasco	2.2%	29	2.8%	29
Washington	2.5%	32	3.1%	32
Wheeler	0.2%	3	0.3%	3
Yamhill	0.6%	8	0.8%	8

II. SURVEY CONTENT

A. Executive Summary

- The most common source of main household heating was electricity (35.8%), followed by natural gas (32.8%). Respondents in the Northwest, Southeast, Northeast, Klamath Falls, and Medford areas were slightly more likely to use natural gas than electricity and respondents in the Lakeview area were most likely to use oil. The most common source of backup household heating was electricity (41.1%), followed by wood (36.3%).
- About 47.5% of respondent households had at least one wood burning device. Respondents most commonly owned woodstoves (22.1%) followed by fireplaces (17.1%), fireplaces with inserts (8.4%), pellet stoves (3.9%), and central furnaces (0.6%).
- About 34.7% of respondent households burned wood in at least one wood burning device. Respondents most commonly burned wood in woodstoves (19.1%) followed by fireplaces (7.9%), fireplaces with inserts (6.0%), pellet stoves (3.3%), and central furnaces (0.4%). Respondents in the Northwest region were an exception: they were more likely to own and use a fireplace relative to other devices. However, relative to other regions, they also were the most likely to own a fireplace but not actually use it to burn.
- A majority of respondents reported that their fireplaces with inserts (49.6%) and woodstoves (56.5%) were certified. There were a few exceptions: in the Central Region and Lakeview area, respondents reported more non-certified inserts than certified, and in the Medford area, respondents reported more non-certified woodstoves than certified.
- Respondents in the Southeast and Northeast regions of the state reported burning the most cords of wood on average, particularly using a central furnace.
- A majority of respondents (ranging from 75% to 86%) reported that their indoor burning behavior for each of the five device types was typical of their yearly behavior. Of those respondents who said their behavior was not typical, they most often reported that their burning was a lot less or somewhat less.
- Respondents burned more than 50 species of wood in their devices, but the most common was Fir, followed by Lodgepole Pine. The types of wood most commonly burned varied by region and area.
- A majority (63.6%) of respondents reported that outdoor burning does not occur at their home. Respondents reported slightly more outdoor burning in the Southeast and Northeast Regions and in the Burns/Hines/Paiute oversample area. Outdoor burners reported most commonly using a ground fire pit (71.6%) or a burn barrel (44.1%). Additionally, they were most likely to report burning brush (71.2%) in a pile outdoors. Outdoor burning occurred most often in the spring (69.7%) and fall (66.7%) and most commonly on weekday or weekend mornings.

B. Main Source of Heating

Respondents were first asked about the main and backup sources of heating utilized in their home. Responses summarized across all respondents and for each specific region or area can be seen in Tables 8 and 9 and Figures 2 and 3.

Table 8: Household Main Source of Heating (n = 1,298)

	Wood	Natural Gas	Oil	Electricity	Liquefied Petroleum Gases	Other	Don't Know
Northwest Region	9.3%	48.5%	5.4%	33.3%	0.5%	2.5%	0.5%
Southwest Region	17.9%	26.9%	3.8%	46.7%	3.3%	0.9%	0.5%
Central Region	14.6%	28.3%	5.6%	48.0%	3.0%	0.5%	0.0%
Southeast Region	19.6%	34.4%	9.1%	29.2%	5.3%	1.9%	0.5%
Northeast Region	23.0%	32.4%	10.8%	28.2%	4.7%	0.9%	0.0%
Klamath Falls	1.5%	60.0%	1.5%	21.5%	0.0%	15.4%	0.0%
Lakeview	34.8%	1.5%	37.9%	21.2%	1.5%	3.0%	0.0%
Medford	0.0%	49.2%	4.6%	44.6%	0.0%	0.0%	1.5%
Burns Hines Paiute	27.3%	1.5%	22.7%	37.9%	7.6%	3.0%	0.0%
Statewide Total	16.8%	32.8%	8.9%	35.8%	3.2%	2.2%	0.3%

Figure 2: Household Main Source of Heating for Statewide Totals

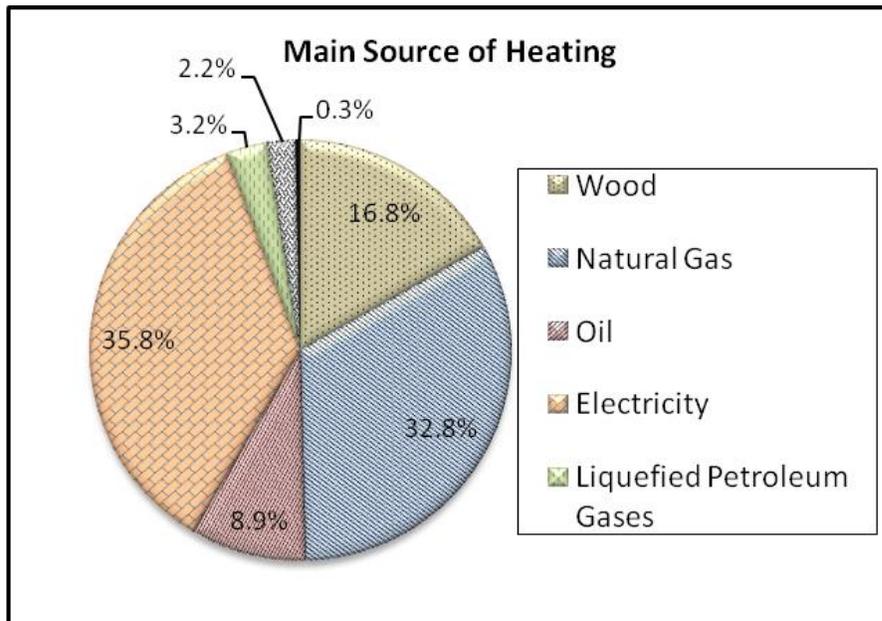
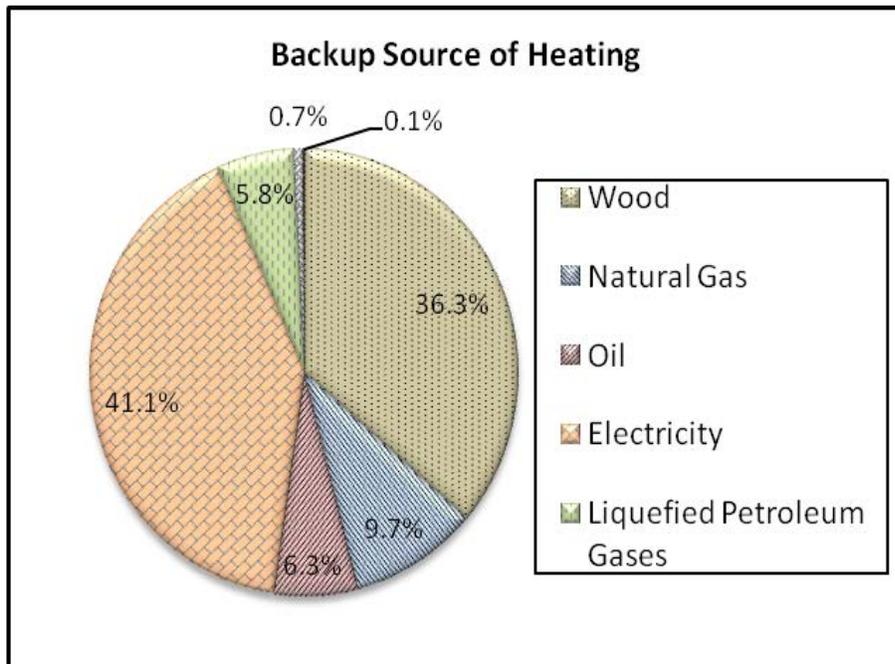


Table 9: Household Backup Source of Heating (n = 703)

	Wood	Natural Gas	Oil	Electricity	Liquefied Petroleum Gases	Other	Don't Know
Northwest Region	45.5%	11.8%	0.9%	36.4%	4.5%	0.9%	0.0%
Southwest Region	42.2%	8.8%	1.0%	37.3%	8.8%	2.0%	0.0%
Central Region	30.5%	17.1%	1.0%	41.0%	10.5%	0.0%	0.0%
Southeast Region	36.4%	6.4%	6.4%	44.5%	5.5%	0.0%	0.9%
Northeast Region	35.5%	10.5%	9.7%	36.3%	6.5%	1.6%	0.0%
Klamath Falls	31.0%	6.9%	3.4%	58.6%	0.0%	0.0%	0.0%
Lakeview	21.3%	2.1%	23.4%	51.1%	2.1%	0.0%	0.0%
Medford	46.7%	16.7%	0.0%	36.7%	0.0%	0.0%	0.0%
Burns Hines Paiute	28.3%	0.0%	21.7%	47.8%	2.2%	0.0%	0.0%
Statewide Total	36.3%	9.7%	6.3%	41.1%	5.8%	0.7%	0.1%

Figure 3: Household Backup Source of Heating for Statewide Totals



C. Respondents Who Own a Woodburning Device vs. Respondents Who Burn Wood in the Device

Respondents were next asked if they owned specific wood-burning devices. Device owners were then asked if they had burned in these devices within the last 12 months. Table 10 shows the number and percent of respondents who reported owning a device and who reported burning in the device for all five potential devices in the five statewide regions. Figure 4 illustrates the percentages of all respondents who reported owning devices and burning wood in the devices. Additionally, Tables 11a, 11b, and 11c includes responses from the oversample communities and information regarding the certification and catalytic status of fireplace insert and woodstove devices.

Table 10: Respondents who Own vs. Respondents Who Burn using all potential devices (n = 1,298)

Region	Fireplace		Fireplace Insert		Woodstove		Pellet Stoves		Central Furnace	
	Own	Burn	Own	Burn	Own	Burn	Own	Burn	Own	Burn
Northwest	31.4%	15.7%	5.9%	4.9%	12.7%	9.3%	3.9%	3.9%	0.0%	0.0%
Southwest	16.0%	9.0%	6.6%	5.7%	22.6%	20.8%	4.7%	4.7%	0.0%	0.0%
Central	11.6%	6.6%	4.5%	2.5%	23.7%	21.7%	5.1%	4.0%	1.0%	0.5%
Southeast	14.4%	6.7%	12.4%	8.1%	23.4%	20.6%	5.7%	4.3%	1.4%	1.4%
Northeast	13.1%	4.2%	8.9%	6.6%	31.5%	26.8%	2.3%	1.9%	0.9%	0.5%

Figure 4: Percent of Respondents who Own vs. Burn for Statewide Totals (n = 1,298)

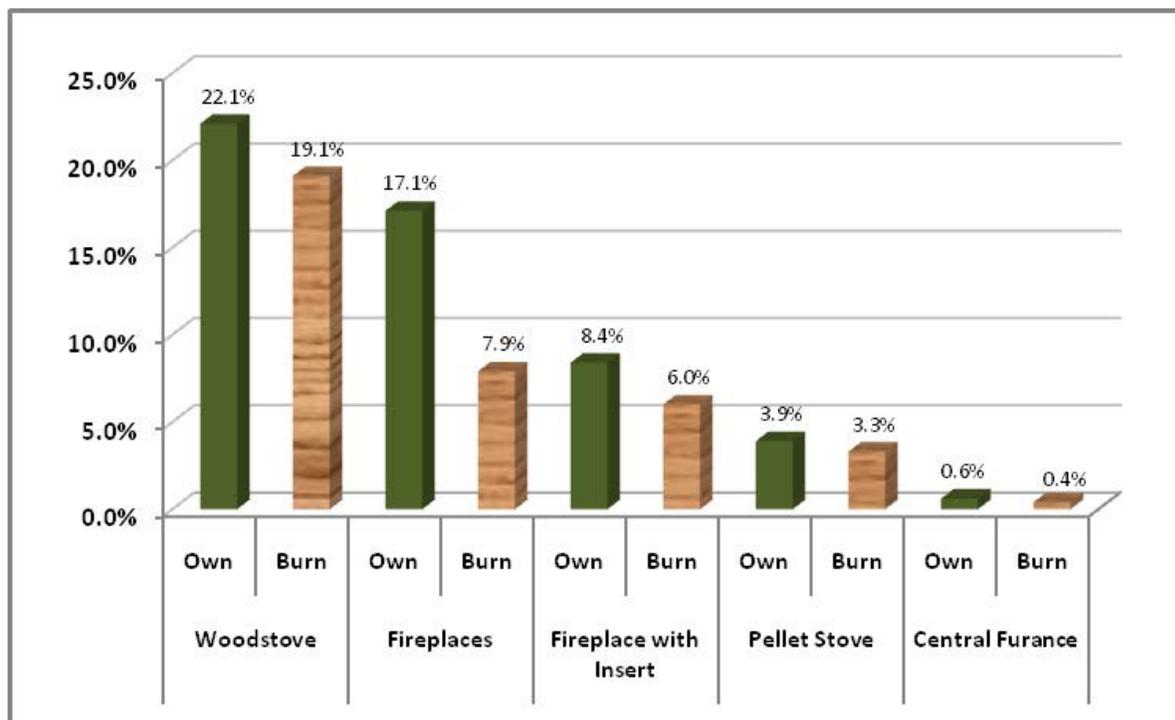


Table 11a: Respondents who Own vs. Respondents Who Burn using a Fireplace, Pellet Stove, or Central Furnace (n = 1,298)

	Fireplace		Pellet Stove		Central Furnace	
	Own	Burn	Own	Burn	Own	Burn
Northwest Region	31.4%	15.7%	3.9%	3.9%	0.0%	0.0%
Southwest Region	16.0%	9.0%	4.7%	4.7%	0.0%	0.0%
Central Region	11.6%	6.6%	5.1%	4.0%	1.0%	0.5%
Southeast Region	14.4%	6.7%	5.7%	4.3%	1.4%	1.4%
Northeast Region	13.1%	4.2%	2.3%	1.9%	0.9%	0.5%
Klamath Falls	23.1%	7.7%	4.6%	1.5%	0.0%	0.0%
Lakeview	13.6%	3.0%	0.0%	0.0%	1.5%	0.0%
Medford	20.0%	9.2%	1.5%	1.5%	0.0%	0.0%
Burns Hines Paiute	9.1%	4.5%	3.0%	3.0%	0.0%	0.0%
Statewide Total	17.1%	7.9%	3.9%	3.3%	0.6%	0.4%

**Table 11b: Respondents who Own vs. Respondents Who Burn using a Fireplace Insert
(n = 1,298)**

	Total Inserts		Insert Not Certified		Insert Certified Non-Catalytic		Insert Certified Catalytic		Insert Non-Classifiable	
	Own	Burn	Own	Burn	Own	Burn	Own	Burn	Own	Burn
Northwest Region	5.9%	4.9%	2.0%	2.0%	1.5%	1.5%	0.5%	0.5%	2.0%	1.0%
Southwest Region	6.6%	5.7%	1.9%	1.4%	0.9%	0.9%	0.5%	0.5%	3.3%	2.8%
Central Region	4.5%	2.5%	2.0%	1.0%	1.5%	1.0%	0.0%	0.0%	1.0%	0.5%
Southeast Region	12.4%	8.1%	3.3%	1.4%	3.8%	3.3%	1.4%	1.4%	3.8%	1.9%
Northeast Region	8.9%	6.6%	1.9%	1.4%	1.9%	1.4%	1.4%	1.4%	3.8%	2.3%
Klamath Falls	6.2%	6.2%	1.5%	1.5%	0.0%	0.0%	3.1%	3.1%	1.5%	1.5%
Lakeview	19.7%	16.7%	10.6%	7.6%	6.1%	6.1%	0.0%	0.0%	3.0%	3.0%
Medford	9.2%	3.1%	1.5%	1.5%	3.1%	0.0%	3.1%	1.5%	1.5%	0.0%
Burns Hines Paiute	9.1%	4.5%	1.5%	0.0%	3.0%	1.5%	1.5%	1.5%	3.0%	1.5%
Statewide Total	8.4%	6.0%	2.5%	1.7%	2.2%	1.7%	1.0%	0.9%	2.7%	1.7%

**Table 11c: Respondents who Own vs. Respondents Who Burn using a Woodstove
(n = 1,298)**

	Total Woodstoves		Woodstove Not Certified		Woodstove Certified Non-Catalytic		Woodstove Certified Catalytic		Woodstove Non-Classifiable	
	Own	Burn	Own	Burn	Own	Burn	Own	Burn	Own	Burn
Northwest Region	12.7%	9.3%	3.9%	2.5%	2.0%	1.5%	3.9%	3.4%	2.9%	2.0%
Southwest Region	22.6%	20.8%	4.7%	4.7%	6.1%	5.2%	5.7%	5.7%	6.1%	5.2%
Central Region	23.7%	21.7%	7.1%	6.6%	5.6%	5.6%	7.1%	6.1%	4.0%	3.5%
Southeast Region	23.4%	20.6%	6.2%	5.3%	6.7%	6.7%	5.7%	4.8%	4.8%	3.8%
Northeast Region	31.5%	26.8%	8.5%	5.6%	5.2%	5.2%	11.3%	10.3%	6.6%	5.6%
Klamath Falls	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Lakeview	33.3%	28.8%	9.1%	6.1%	7.6%	6.1%	10.6%	10.6%	6.1%	6.1%
Medford	6.2%	1.5%	4.6%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	1.5%
Burns Hines Paiute	36.4%	33.3%	6.1%	6.1%	9.1%	7.6%	6.1%	6.1%	15.2%	13.6%
Statewide Total	22.1%	19.1%	5.9%	4.5%	4.9%	4.5%	6.2%	5.7%	5.1%	4.3%

D. Certification of Inserts and Woodstoves

Respondents were also asked whether each fireplace insert and woodstove was certified by either the DEQ or the EPA and what year it was purchased or installed. If a respondent did not know whether a device was certified and the device was purchased in 1986 or later, the device was coded as certified. Figures 5 and 6 display the certification results for all respondents for both fireplace inserts and woodstoves. Figures 7 and 8 display the certification results by region and Figures 9 and 10 display the certification results by oversample area.

Figure 5: Statewide Percentages for Insert Certification

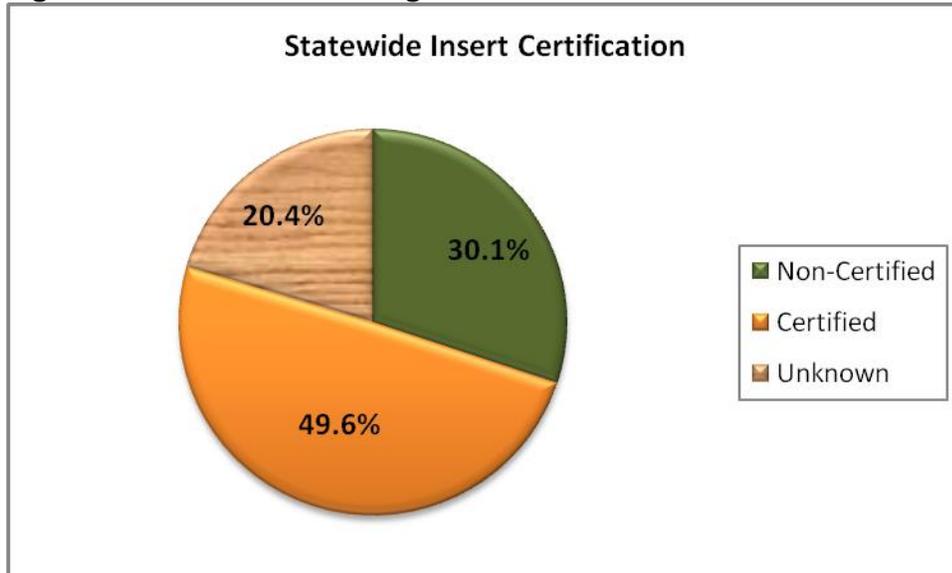


Figure 6: Statewide Percentages for Woodstove Certification



Figure 7: Insert Certification by Region

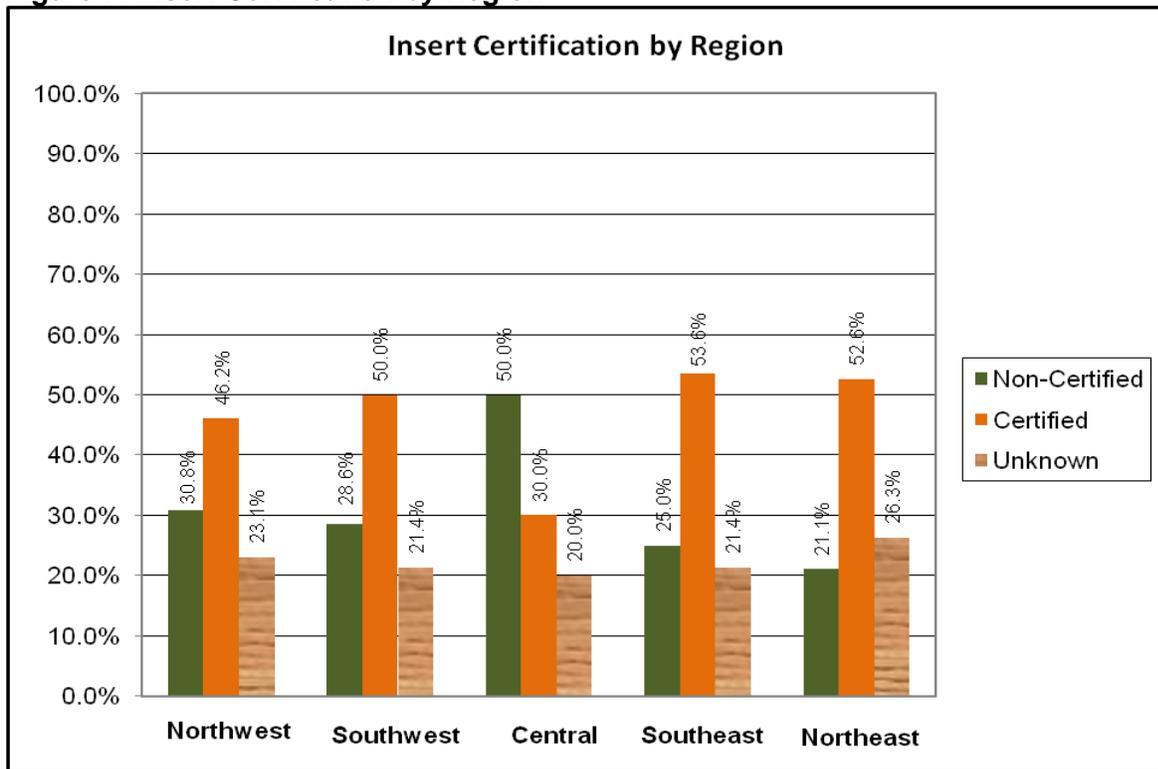


Figure 8: Woodstove Certification by Region

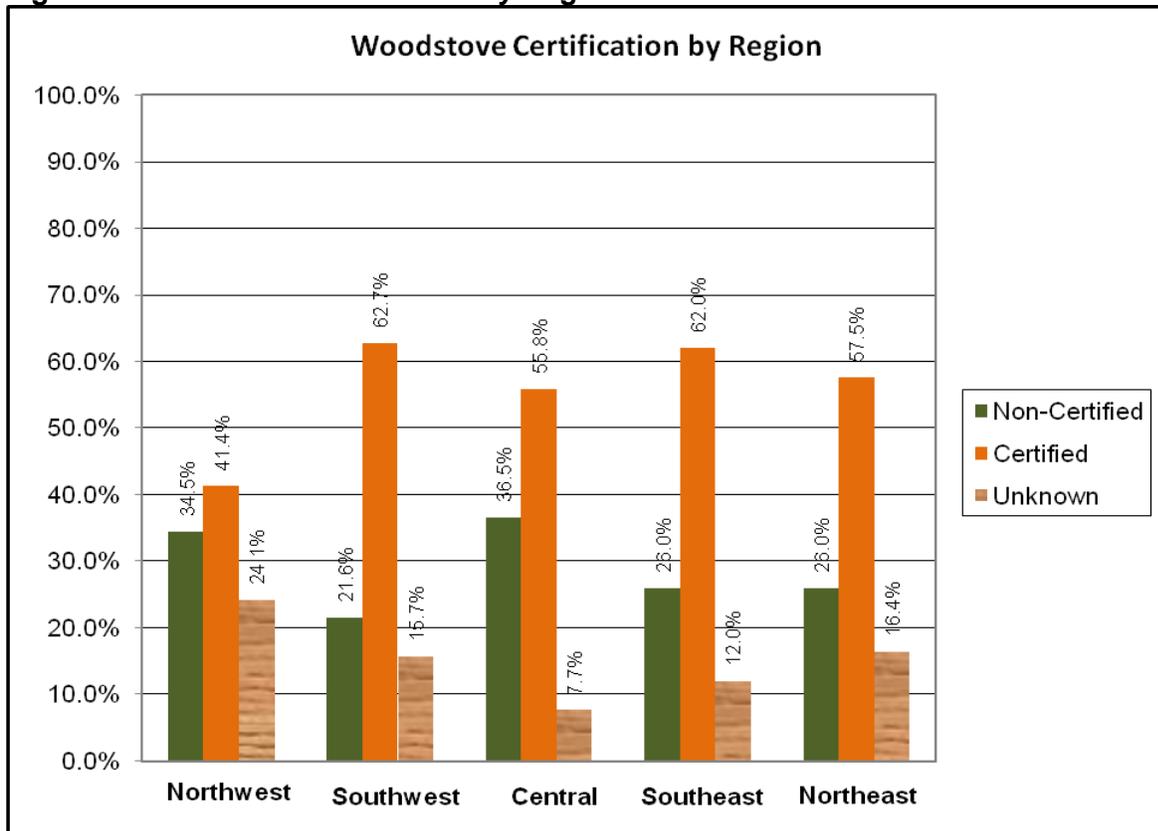


Figure 9: Insert Certification by Oversample Area

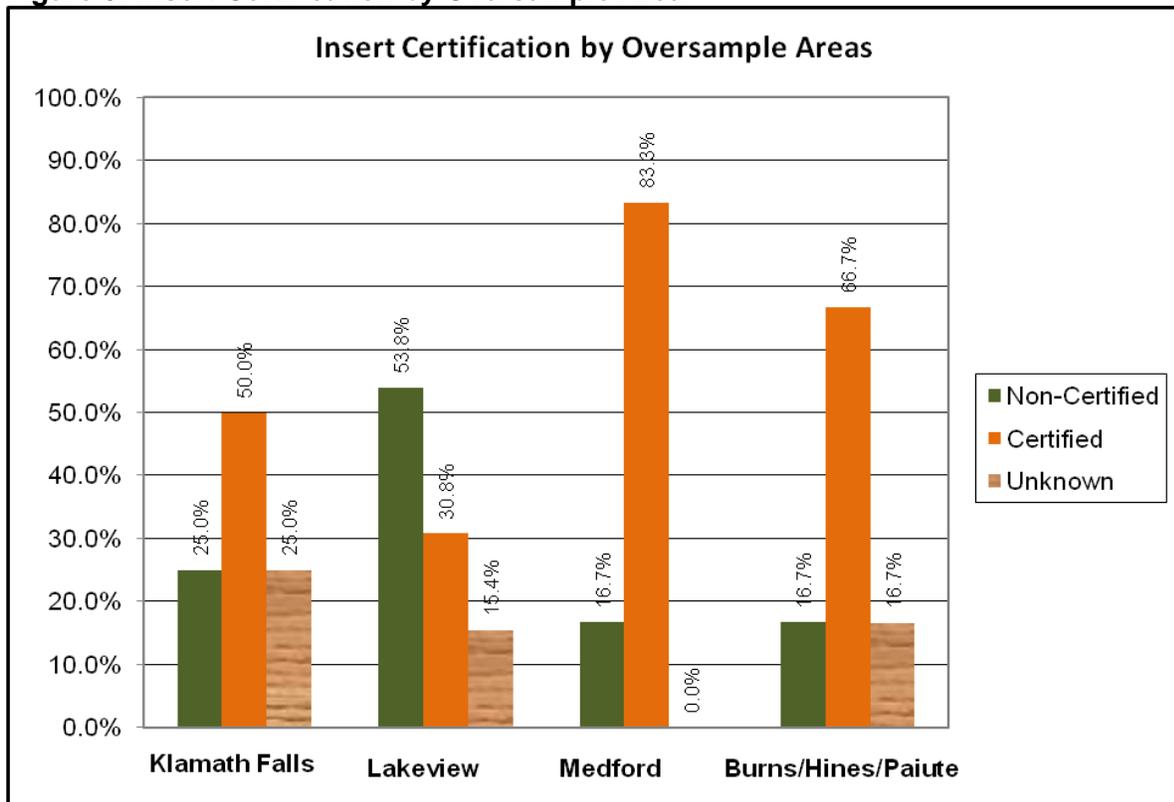
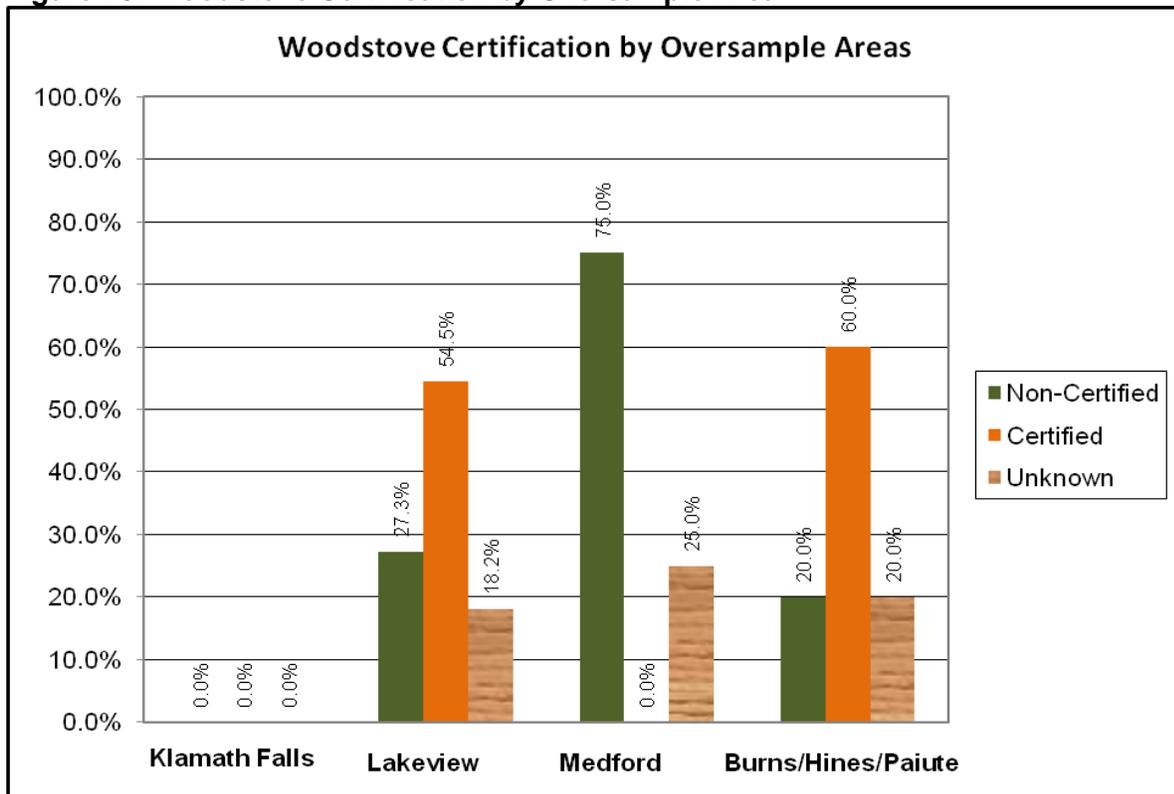


Figure 10: Woodstove Certification by Oversample Area



E. Volume of Wood Burned

In addition to being asked if they burned wood in the devices, respondents were also asked about the type of wood and amount of wood they burned within the last 12 months. For each device by fuel type (i.e. cord, Presto firelog, pellet bag), the total volume of fuel was summed across the total number of devices they had. For example, a respondent who burned two cords of wood in their first fireplace, and one cord in their second fireplace, burned a total of three cords of wood. Tables 12a, 12b, and 12c show the total fuel volume and total number of devices across all respondents for each region and area and across all survey respondents. Total fuel volume and total device count were then used to calculate the average amount of fuel burned for each device by fuel type. Figure 5 displays the average volume for each device for each of the five statewide regions.

Table 12a: Estimated Average Annual Volume Wood Burned per Heating Device

Region and Device Type	Total Fuel Volume	Type/Unit	Total Device Count	Average Volume (per device) ⁹
Northwest Region				
Fireplace	15.5	Cord	22	0.7
	197.0	Presto Firelog	12	16.4
Insert	13.8	Cord	9	1.5
	18.0	Presto Firelog	1	18.0
	-	Pellet Tons	-	-
Woodstove	35.0	Cord	19	1.8
	3.0	Presto Firelog	1	3.0
Pellet Stove	18.6	Pellet Tons	9	2.1
Central Furnace	-	Cord	-	-
Southwest Region				
Fireplace	25.2	Cord	19	1.3
	-	Presto Firelog	-	-
Insert	16.5	Cord	10	1.7
	-	Presto Firelog	-	-
	1.5	Pellet Tons	2	0.8
Woodstove	106.0	Cord	46	2.3
	-	Presto Firelog	-	-
Pellet Stove	13.5	Pellet Tons	10	1.4
Central Furnace	-	Cord	-	-
Central Region				
Fireplace	12.1	Cord	11	1.1
	73.0	Presto Firelog	3	24.3
Insert	7.0	Cord	5	1.4
	-	Presto Firelog	-	-
	-	Pellet Tons	-	-
Woodstove	121.2	Cord	46	2.6
	20.0	Presto Firelog	1	20.0
Pellet Stove	10.8	Pellet Tons	9	1.2
Central Furnace	2.0	Cord	1	2.0

⁹ Average Fuel Volume per Device = Total Fuel Volume / Total Device Count.

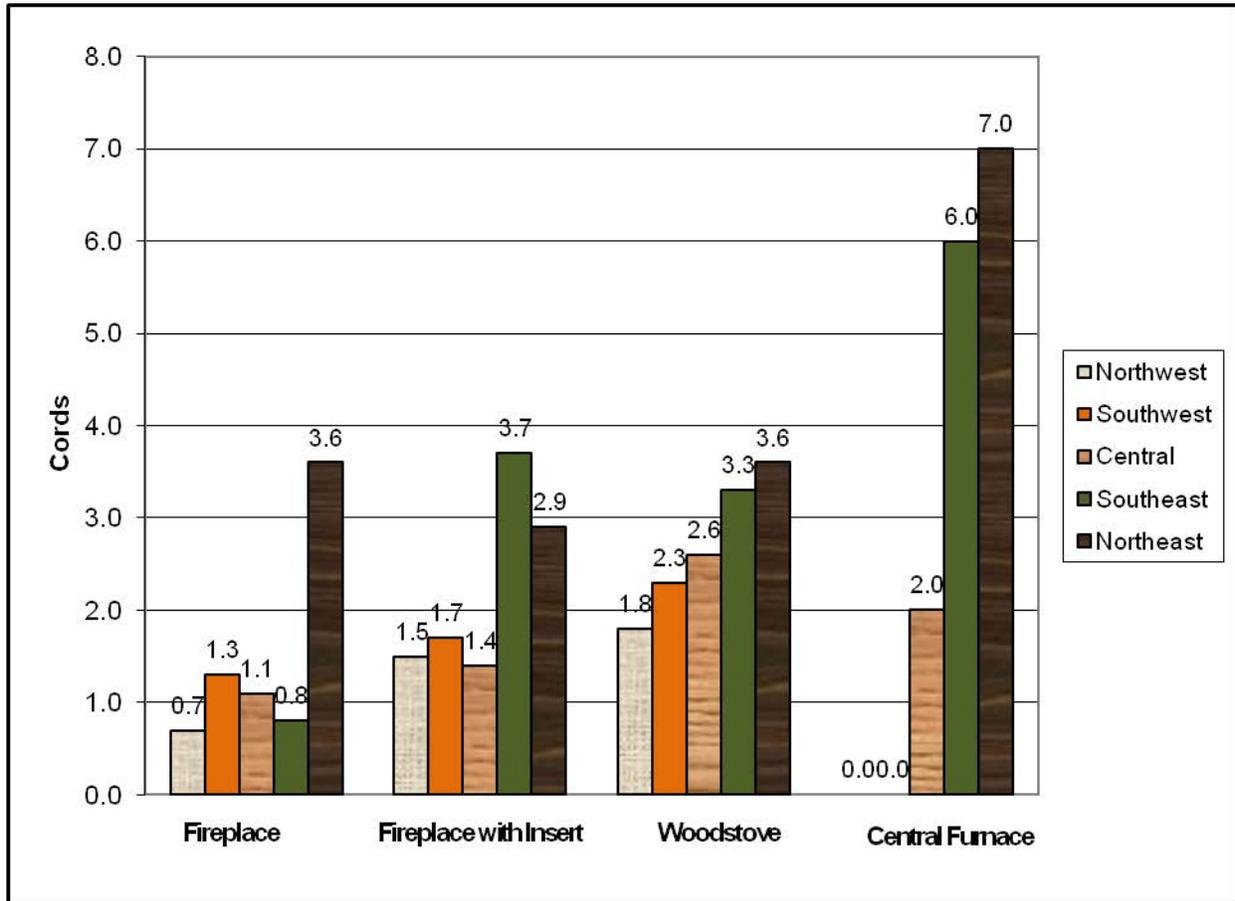
Table 12b: Estimated Average Annual Volume Wood Burned per Heating Device

Region and Device Type	Total Fuel Volume	Type/Unit	Device Count	Average Volume (per device)
Southeast Region				
Fireplace	11.1	Cord	14	0.8
	-	Presto Firelog	-	-
Insert	55.0	Cord	15	3.7
	-	Presto Firelog	-	-
	4.2	Pellet Tons	3	1.4
Woodstove	142.4	Cord	43	3.3
	25.0	Presto Firelog	1	25.0
Pellet Stove	18.4	Pellet Tons	9	2.0
Central Furnace	18.0	Cord	3	6.0
Northeast Region				
Fireplace	29.0	Cord	8	3.6
	20.0	Presto Firelog	1	20.0
Insert	38.3	Cord	13	2.9
	-	Presto Firelog	-	-
	2.0	Pellet Tons	1	2.0
Woodstove	224.0	Cord	62	3.6
	-	Presto Firelog	-	-
Pellet Stove	5.5	Pellet Tons	4	1.4
Central Furnace	7.0	Cord	1	7.0
Statewide (Regions and Oversamples)				
Fireplace	125.4	Cord	90	1.4
	322.0	Presto Firelog	18	17.9
Insert	192.2	Cord	70	2.7
	18.0	Presto Firelog	1	18.0
	7.8	Pellet Tons	7	1.1
Woodstove	765.8	Cord	259	3.0
	48.0	Presto Firelog	3	16.0
Pellet Stove	70.9	Pellet Tons	45	1.6
Central Furnace	27.0	Cord	5	5.4

Table 12c: Estimated Average Annual Volume Wood Burned per Heating Device

Region and Device Type	Total Fuel Volume	Type/Unit	Device Count	Average Volume (per device)
Klamath Falls				
Fireplace	5.5	Cord	7	0.8
	-	Presto Firelog	-	-
Insert	7.1	Cord	3	2.4
	-	Presto Firelog	-	-
	0.1	Pellet Tons	1	0.1
Woodstove	-	Cord	-	-
	-	Presto Firelog	-	-
Pellet Stove	0.4	Pellet Tons	1	0.4
Central Furnace	-	Cord	-	-
Lakeview				
Fireplace	10.0	Cord	2	5.0
	-	Presto Firelog	-	-
Insert	39.5	Cord	11	3.6
	-	Presto Firelog	-	-
	-	Pellet Tons	-	-
Woodstove	71.5	Cord	19	3.8
	-	Presto Firelog	-	-
Pellet Stove	-	Pellet Tons	-	-
Central Furnace	-	Cord	-	-
Medford				
Fireplace	1.0	Cord	5	0.2
	20.0	Presto Firelog	1	20.0
Insert	8.5	Cord	2	4.3
	-	Presto Firelog	-	-
	-	Pellet Tons	-	-
Woodstove	0.01	Cord	1	0.01
	-	Presto Firelog	-	-
Pellet Stove	1.0	Pellet Tons	1	1.0
Central Furnace	-	Cord	-	-
Burns Hines Paiute				
Fireplace	16.0	Cord	2	8.0
	12.0	Presto Firelog	1	12.0
Insert	6.5	Cord	2	3.3
	-	Presto Firelog	-	-
	-	Pellet Tons	-	-
Woodstove	65.8	Cord	23	2.9
	-	Presto Firelog	-	-
Pellet Stove	2.7	Pellet Tons	2	1.4
Central Furnace	-	Cord	-	-

Figure 11: Average Volume of Wood Cords Burned per Device and Region



The average volume of cordwood burned was also calculated for each device type in each statewide region (see Table 13). The total housing units for each county were used to determine regional housing unit figures. The percent of wood burners per region was then used to estimate the population of woodburning housing units in each region. The average volume of cords per device was then used to calculate total cords and average cords burned per device in each region.

Table 13: Statewide Average Volume of Cordwood Burned per Device

Region and Device Type	2008 Total HU ¹⁰	Percent Woodburning HU ¹¹	Total Woodburning HU ¹²	Average Volume Cords per Device ¹³	Total Cords ¹⁴
Fireplace					
Northwest	1,177,015	15.7%	184,791	0.7	129,354
Southwest	208,765	9.0%	18,789	1.3	24,426
Central	118,861	6.6%	7,845	1.1	8,630
Southeast	48,891	6.7%	3,276	0.8	2,621
Northeast	55,255	4.2%	2,321	3.6	8,356
Total			217,022		173,387
Average Cords per Fireplace ¹⁵					0.8
Woodstove					
Northwest	1,177,015	9.3%	109,462	1.8	197,032
Southwest	208,765	20.8%	43,423	2.3	99,873
Central	118,861	21.7%	25,793	2.6	67,062
Southeast	48,891	20.6%	10,072	3.3	33,238
Northeast	55,255	26.8%	14,808	3.6	53,309
Total			203,558		450,514
Average Cords per Woodstove					2.2
Insert					
Northwest	1,177,015	4.9%	57,674	1.5	86,511
Southwest	208,765	5.7%	11,900	1.7	20,230
Central	118,861	2.5%	2,972	1.4	4,161
Southeast	48,891	8.1%	3,960	3.7	14,652
Northeast	55,255	6.6%	3,647	2.9	10,576
Total			80,153		136,130
Average Cords per Fireplace Insert					1.7
Central Furnace					
Northwest	1,177,015	-	-	-	-
Southwest	208,765	-	-	-	-
Central	118,861	0.5%	594	2.0	1,188
Southeast	48,891	1.4%	684	6.0	4,104
Northeast	55,255	0.5%	276	7.0	1,932
Total			1,554		7,224
Average Cords per Central Furnace					4.6

¹⁰ 2008 Housing Unit (HU) estimates from U.S. Census Bureau.

¹¹ Percentages from Tables 3a, 3b, and 3c.

¹² Total Woodburning HU = 2008 Total HU * Percent Woodburning HU.

¹³ Averages from Tables 5a and 5b.

¹⁴ Total Cords = Total Woodburning HU * Average Volume Cords per Device.

¹⁵ Average Cords = Total Cords Fuel Volume / Total Woodburning HU.

F. Typicality of Wood Burning

Respondents who reported having a fireplace, fireplace with insert, woodstove, pellet stove, or central furnace were asked if the amount of wood they burned in the last 12 months was typical of how much wood they burn every year. For those who said this was not typically how much wood they burned, they were then asked if the amount was a lot more, somewhat more, somewhat less, or a lot less than they typically burn. Tables 14a and 14b indicate the degree to which respondent behavior was typical.

Table 14a: Typicality of Wood Burning

Device Type	Yes, Typical	No, Not Typical	Don't Know /Refused
Fireplace	84.8%	12.0%	3.2%
Fireplace Insert	86.2%	11.0%	2.8%
Woodstove	81.5%	13.9%	4.6%
Pellet Stove	84.0%	14.0%	2.0%
Central Furnace	75.0%	25.0%	-

Table 14b: Non-Typical Wood Burning

Device Type	A Lot More	Somewhat More	Somewhat Less	A Lot Less	Don't Know /Refused
Fireplace	15.4%	11.5%	30.8%	34.6%	7.7%
Fireplace Insert	16.7%	16.7%	25.0%	41.7%	-
Woodstove	23.1%	30.8%	23.1%	20.5%	2.6%
Pellet Stove	14.3%	28.6%	-	42.9%	14.3%
Central Furnace	-	-	50.0%	50.0%	-

G. Type of Wood Burned

The 416 respondents who said that they burned wood in at least one of the five types of devices were next asked if they burned several varieties of commonly used wood. Respondents who burned a particular variety of wood were then asked how much of that variety they burn in a typical year. Table 15a shows the number and percent of respondents who reported burning each wood variety.

Table 15a: Type of Wood Burned (n = 416)

	Fir	Lodgepole Pine	Ponderosa or Yellow Pine	Oak	Maple	Cedar	Madrone or Tamrack	Alder	Other Varieties
Northwest Region	44.3%	1.6%	4.9%	29.5%	23%	23.0%	1.6%	31.1%	6.3%
Southwest Region	47.3%	2.7%	5.4%	45.9%	6.8%	17.6%	62.2%	12.2%	3.7%
Central Region	21.7%	50.0%	21.7%	20%	3.3%	6.7%	11.7%	0.0%	8.7%
Southeast Region	11.3%	54.9%	15.5%	5.6%	0.0%	5.6%	4.2%	1.4%	10.3%
Northeast Region	59.2%	32.9%	18.4%	6.6%	3.9%	1.3%	63.2%	1.3%	8.9%
Klamath Falls	25.0%	62.5%	12.5%	0.0%	0.0%	37.5%	12.5%	0.0%	0.2%
Lakeview	23.3%	76.7%	23.3%	0.0%	0.0%	20.0%	0.0%	0.0%	3.4%
Medford	33.3%	0.0%	0.0%	44.4%	0.0%	11.1%	22.2%	0.0%	1.0%
Burns Hines Paiute	11.1%	37.0%	44.4%	0.0%	0.0%	7.4%	7.4%	0.0%	4.6%
Statewide Total	34.4%	32.5%	15.6%	18.5%	5.8%	11.5%	26.5%	7.2%	46.4%

Respondents could also report any other varieties of wood burned. Tables 15b and 15c show the different types of wood burned and the number of respondents reporting them for each statewide region and each community oversample.

Table 15b: Other Types and Frequency of Wood Burned in Regions

Northwest	Southwest	Central	Southeast	Northeast
Apple (1)	Apple (1)	Cherrywood (1)	Apple (1)	Apple (1)
Ash (2)	Apricot (1)	Cottonwood (1)	Aspen (2)	Birch (1)
Birch (1)	Fruit Wood (1)	Duraflame Logs (1)	Box Elder (1)	Black Locust (1)
Black Hawthorne (1)	Hemlock (1)	Elm (1)	Cottonwood (2)	Black Pine (1)
Cedar (1)	Juniper (1)	Firelogs (1)	Elm (4)	Cedar (1)
Cherry (4)	Myrtlewood (5)	Jack Pine (1)	Hybrid Poplar (1)	Cottonwood (3)
Duraflame Logs (1)	Oregon Grape (1)	Juniper (24)	Jack Pine (1)	Elm (1)
European Cherry Plum (1)	Poplar (1)	Locust (2)	Juniper (27)	Hawthorne (1)
Filbert (1)	Scrap Wood (1)	Osage (1)	Locust (1)	Juniper (8)
German Pine Trees (1)	Sycamore (1)	Poplar (1)	Pine (1)	Larch (1)
Grocery Store Bundle (1)		Pressed Logs (1)	Russian Olive (2)	Locust (8)
Hemlock (1)		Walnut (1)		Pine (1)
Italian Prune (1)				Red Fir (1)
Locust (1)				Scrap Wood (1)
Mountain/Sour Cherry (1)				Spruce (4)
Plum (1)				White Fir (1)
Poplar (1)				White Pine (2)
Scrap Wood (2)				Willow (1)
Spruce (1)				
Western Choke Cherry (1)				
Willow (1)				

Table 15c: Other Types and Frequency of Wood Burned in Community Oversamples

Klamath Falls	Lakeview	Medford	Burns Hines Paiute
Juniper (1)	Juniper (12)	Applewood (1)	Aspen (1)
	White Fir (1)	Oak (1)	Elm (2)
		Pine (1)	Juniper (16)
		Scrap Wood (1)	

H. Outdoor Wood Burning

At the end of the survey and prior to providing demographic information, respondents were asked whether outdoor burning occurred at their home. Table 16 shows the frequency and percent of responses.

Table 16: Degree of Outdoor Burning by Region/Area and Statewide (n = 1,298)

	Yes, Burned Outdoors	No, Did Not Burn Outdoors	Don't Know/ Refused
Northwest Region	28.4%	71.1%	0.5%
Southwest Region	37.7%	62.3%	-
Central Region	41.4%	58.6%	-
Southeast Region	48.3%	51.7%	-
Northeast Region	46.0%	54.0%	-
Klamath Falls	12.3%	87.7%	-
Lakeview	15.2%	84.8%	-
Medford	4.6%	95.4%	-
Burns Hines Paiute	48.5%	51.5%	-
Statewide Total	36.4%	63.6%	0.1%

The 472 respondents who reported burning outdoors were then asked about how they burned outdoors. The summary of responses can be seen in Table 17.

Table 17: Type of Device Used Statewide (n = 472)

	Used Device	Did Not Use Device
Hydronic Heater	-	100.0%
Burn Barrel	44.1%	55.9%
Chimnea	5.5%	94.5%
Ground Firepit	71.6%	28.4%
Other	2.8%	97.2%

Respondents were also asked if they had burned specific types of materials outdoors in a pile within the last 12 months. Responses are summarized in Table 18.

Table 18: Types of Materials Burned Statewide (n = 472)

	Burned Material	Did Not Burn Material	Don't Know/ Refused
Brush	71.2%	28.8%	-
Leaves	23.5%	76.1%	0.4%
Cardboard or Paper	18.2%	81.8%	-
Grass Clippings	7.2%	92.6%	0.2%
Plastics	1.7%	98.3%	-
Tires	0.4%	99.6%	-
Other Materials	6.8%	93.2%	-

Respondents were then asked if their outdoor burning behavior in the last 12 months was typical of how much wood and other materials they burn every year. Of the 472 respondents who reported that they burned outdoors, a majority ($n = 417$, 88.3%) reported that this was typically how much they burned. A smaller percentage reported that it was not typical ($n = 47$, 10.0%). Of those respondents reporting that the behavior was not typical, a majority said they were burning a lot more ($n = 19$, 40.4%) or somewhat more ($n = 12$, 25.5%) outdoors. Several respondents also indicated they were burning a lot less ($n = 10$, 21.3%) or somewhat less ($n = 6$, 12.8%).

Respondents were then asked whether they burned in each of the four seasons. Results are summarized in Table 19.

Table 19: Seasonal Outdoor Burning (n = 472)

	Yes, Burned Outdoors in Season	No, Did Not Burn Outdoors in Season	Don't Know/ Refused
Fall	66.7%	32.2%	1.1%
Winter	40.9%	58.9%	0.2%
Spring	69.7%	29.7%	0.6%
Summer	24.6%	75.2%	0.2%

Respondents who reported burning in each season then reported the extent they burned during different times of the day on weekdays and weekends. Results are summarized in Table 20.

Table 20: Time of Day of Seasonal Outdoor Burning

	Weekday Mornings	Weekday Afternoons	Weekday Evenings	Weekend Mornings	Weekend Afternoons	Weekend Evenings
Fall	42.9%	21.0%	12.7%	45.7%	27.9%	19.4%
Winter	39.9%	26.4%	10.4%	43.0%	29.5%	16.6%
Spring	42.2%	22.5%	11.9%	40.4%	29.8%	16.1%
Summer	33.6%	19.0%	26.7%	26.7%	18.1%	43.1%