

**DRAFT Technical  
Memorandum No. 1:  
MANE-VU Residential  
Wood Combustion EI  
Project: Sample Frame  
Development**

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## Technical Memorandum #1: Sample Frame Development

The purpose of this technical memorandum is to describe the construction of the sample frame for the residential wood combustion (RWC) survey of the MANE-VU region. Table 1 below shows the sample sizes within the sampling strata designed for this project. This memorandum describes how each census tract (and its associated housing units) was assigned to each cell in the table. The *sample frame* is simply Table 1 below populated with the number of single-family housing units or other housing units (multi-family or mobile home). The geographic zone strata refer to the annual heating-degree day (HDD) for each census tract.

**Table 1. Sample Sizes for This Project**

Geographic Zone	Urban		Suburban		Rural-Forested		Rural-Non-Forested	
	Single-Family	Other	Single-Family	Other	Single-Family	Other	Single-Family	Other
<i>High HDD</i>	61	61	61	61	61	61	61	61
<i>Low HDD</i>	61	61	61	61	61	61	61	61

Pechan followed the general steps below in constructing the sample frame:

1. *Assign geographic designations to each MANE-VU census tract:* Pechan used 2000 census data released by the U.S. Census Bureau starting in September 2002 on the number of total housing units within Census tracts classified as either: 1) inside urbanized area (urban); 2) inside urbanized cluster (suburban); or rural (BOC, 2002). Figures 1 through 5 show these designations for the MANE-VU region;
  
2. *Classify each census tract into either a high or low HDD zone:* Pechan assigned annual heating-degree days to each census tract in the MANE-VU region from data obtained from the National Climatic Data Center’s web-site. Figure 6 provides this information for the MANE-VU region which is HDD contours at intervals of 500 HDD. Pechan investigated different high/low HDD divisions between 5500 and 7000 HDD. The U.S. Department of Energy (1999) estimated that about 54% of national wood consumption occurred above 5500 HDD. At the same time, there was a need to assure that the number of single-family homes and census tracts were relatively equal between the two divisions (so that wood consumption could be characterized adequately). Table 2 below provides a summary of the number of single-family homes and census tracts at varying HDD levels.

**Table 2. MANE-VU Region HDD Intervals**

HDD Interval	Fraction of Census Tracts	Fraction of Single-Family Homes
< 5500	46	31
5500	15	18
6000	13	16
6500	13	16
≥ 7000	14	19

Note: totals may not add to 100 due to rounding.

An HDD division at  $\leq 5500$  will provide about a 60:40 split of census tracts (low:high) and a 49:51 split of single-family homes. Therefore, this value was selected as the cut-off between the low and high HDD

strata in the sample frame. Figure 7 is a layout of MANE-VU census tracts and the associated HDD designation (i.e. low or high).

3. *Assign rural census tracts into the appropriate forested or non-forested stratum:* As described in the Work Plan (Pechan, 2001), Pechan used a spatial coverage from the U.S. Geological Survey (USGS) North American Land Cover Characteristics (NALCC) data set (USGS, 1999) to classify the rural census tracts as either forested or non-forested. As shown in Table 3, the number of non-forested census tracts is very small. The census tracts were classified as forested if any portion of the census tract included one or more of the NALCC forest classifications (see Figure 8).

4. *Populate the sample frame with the number of single-family and other households in each cell:* Table 3 below provides the sample frame developed using the methods described above. It is now apparent that the number of households located in rural non-forested areas of the MANE-VU region is very small. Not only is the value of specifying a separate set of strata for non-forested areas questionable, but the small number of households in each cell would be difficult to survey (e.g. assuming a 20% response rate to the survey, about 300 households will need to be contacted in each cell to provide 61 completed surveys).

**Table 3. Initial Sample Frame (NALCC Data Set)**

Geographic Zone	Urban		Suburban		Rural-Forested		Rural-Non-Forested	
	Single-Family	Other	Single-Family	Other	Single-Family	Other	Single-Family	Other
High HDD (≥ 6000)	4,328,534	2,987,864	3,737,082	1,194,142	4,703,560	1,105,076	3,166	160
Low HDD (≤ 5500)	8,723,350	9,446,286	2,486,130	620,156	1,325,170	196,548	14,542	1,514

Pechan further investigated the issue of forested versus non-forested areas using another spatial data set from the USGS referred to as the Forest Fragmentation Index Map of North America (FFI; USGS, 2002b). An advantage of this data set over the NALCC is that it classifies land cover strictly on the basis of the amount of forest and not the type of land cover (e.g. cropland/woodland mosaic). Figure 9 shows the FFI cover for the MANE-VU Region. The USGS definitions for the different FFI categories are as follows (cells refer to the 1 kilometer x 1 kilometer pixels from the satellite image):

- Edge - most of the cells in the surrounding area are forested and this cell appears to be part of the outside edge of a forest patch;
- Undetermined - most of the cells in the surrounding area are forested but this cell could not be classified as to the type of fragmentation in the surrounding area;
- Perforated - most of the cells in the surrounding area are forested and this cell appears to be part of an inside edge of a forest patch. In other words, this cell is near a non-forest inclusion within a forest patch;
- Interior - all of the cells in the surrounding area are labeled as forest in the land-cover map;

- Patch - most of the cells in the surrounding area are not forested and this cell is part of a forest inclusion or patch of forest on a non-forest background;
- Transitional - about half of the cells in the surrounding area are forested and this cell may appear to be part of a patch, edge, or perforation depending on the local forest pattern; and
- Unlabeled land area - no definition given.

For the purposes of assigning forested and non-forested designations to MANE-VU census tracts, we considered the first 4 categories to be forested and the remaining categories to be non-forested. For each census tract, if the forested acreage was  $\geq 50\%$  of the area of the census tract, it was designated as forested. Figures 10 through 14 show the MANE-VU census tracts designated as being forested or non-forested rural tracts, suburban tracts, or urban tracts. The rural forested and non-forested designations take on more significance in the mid-Atlantic states (NJ, DE, and portions of MD and PA) as compared to the northeastern portion of the RPO. Table 4 presents the recommended sample frame constructed using the FFI data set.

**Table 4. Sample Frame Based on the FFI Data Set**

Geographic Zone	Urban		Suburban		Rural-Forested		Rural-Non-Forested	
	Single-Family	Other	Single-Family	Other	Single-Family	Other	Single-Family	Other
High HDD ( $\geq 6000$ )	4,328,534	2,987,864	3,737,082	1,194,142	4,500,382	1,051,904	474,964	86,894
Low HDD ( $\leq 5500$ )	8,723,350	9,446,286	2,486,130	620,156	729,522	89,900	675,842	114,448

## References

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