Emission Inventory Oriented RWC Survey

Minnesota PCA & USDA Forest Service -

"Two Agencies are better than One"

Authors

- **Chun Yi Wu -**

  Minnesota Pollution Control Agency
- **Ronald Piva -**

  USDA, Forest Service-FIA
- **David R. Broderick, James E. Houck**

  OMNI Environmental Services, Inc
- **John Crouch -**

  HPBA - Sacramento Office

  crouch@hpba.org

Answering 2 questions with 1 survey

- Minnesota PCA – More wood burned than in surrounding states?
- Small budget,
- USDA Forest Service – Updates Res Fuel Use Survey, app every 10 years
- history & tools but No budget
- HPBA interested in supporting quality survey efforts

Solution

- Minn PCA provided budget
- USDA created & executed Survey
  - **1408 HH's** surveyed by mail or phone
  - State divided up into 5 regions – based on
    - Type of trees
    - Urban/Rural
  - Survey questions reflected historic ties to earlier surveys, but also reflected EI interests
  - USDA kept surveying until they had "enough"

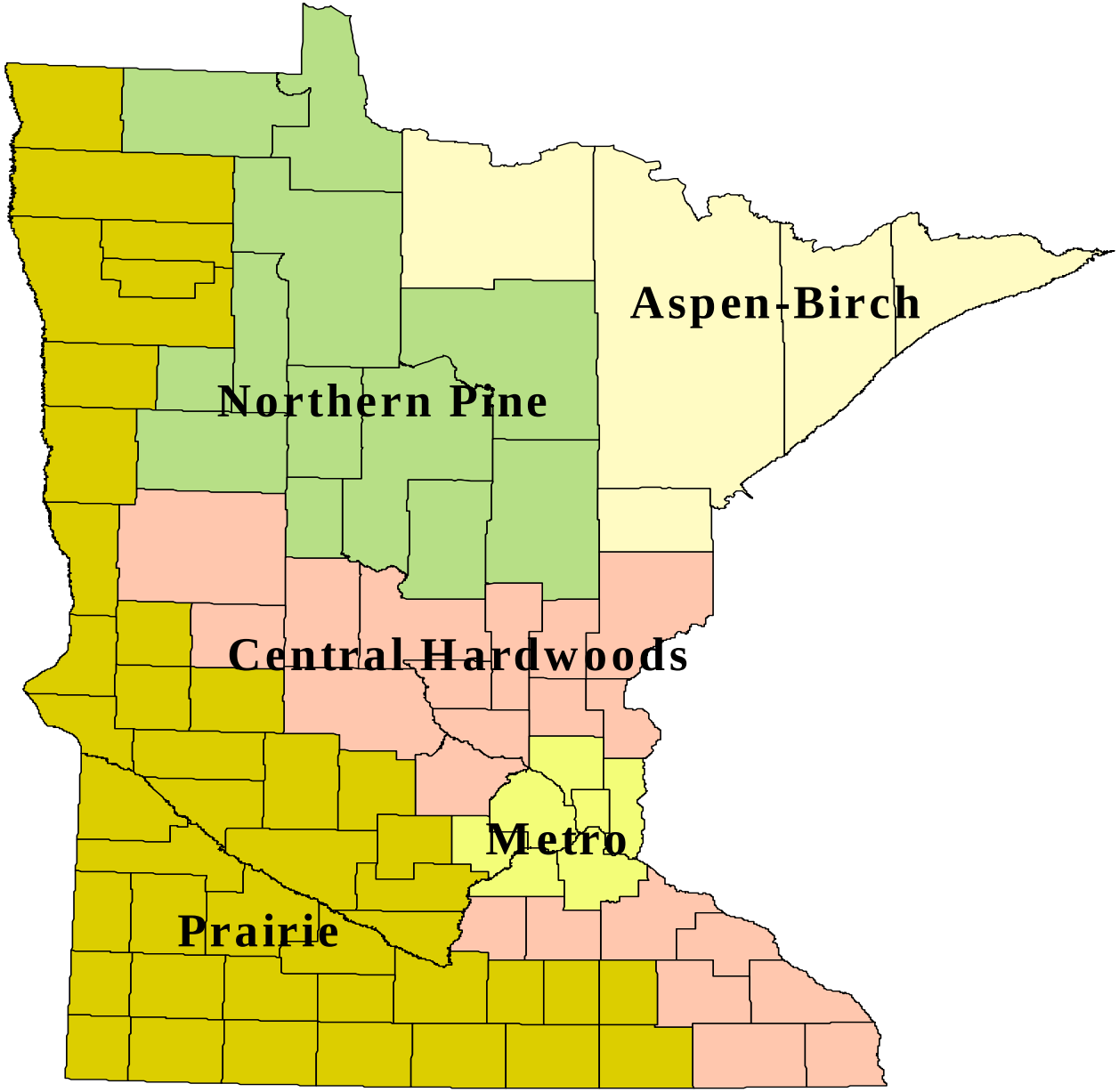
Aspen-Birch
Northern Pine
Central Hardwoods
Metro
Prairie

Table 1-- HH's Sampled by Unit

Survey Unit	Number of Households Responded	# Respondents with RWC Appliances	Total Number of Households in 2002[5]	Population in 2002[5]
Aspen-Birch	301	105	108,747	262,653
Central Hardwoods	348	75	375,520	1,008,558
Metro	**252**	**73**	**1,053,853**	**2,708,916**
Northern Pine	306	124	112,973	282,585
Prairie	257	50	302,543	770,949
Total	**1,464**	**427**	**1,953,636**	**5,033,661**

Table 2 – HH's Burning Wood by Unit

Survey Unit	# HH's With RWC Appliances	% Total HH's with RWC Units	# HH's Reporting Burning	% Total HH's Burning Wood	Cords Burned
Aspen-Birch	37,900	34.8	32,500	29.9	109,100
Central Hardwoods	80,900	21.5	65,800	17.5	150,900
Metro	**305,300**	**29.2**	**225,800**	**21.4**	**184,200**
Northern Pine	45,800	40.5	36,900	32.7	142,800
Prairie	58,900	19.5	42,400	14.0	79,500
Total	**528,800**	**27.1**	**403,500**	**20.7**	**666,500**

Collaboration---- PCA $ + USDA History = PCA access to TREND Data

If PCA had not keep questions relevant to historic surveys – 1 Data point

If USDA had not thought about EI issues – results useless to PCA

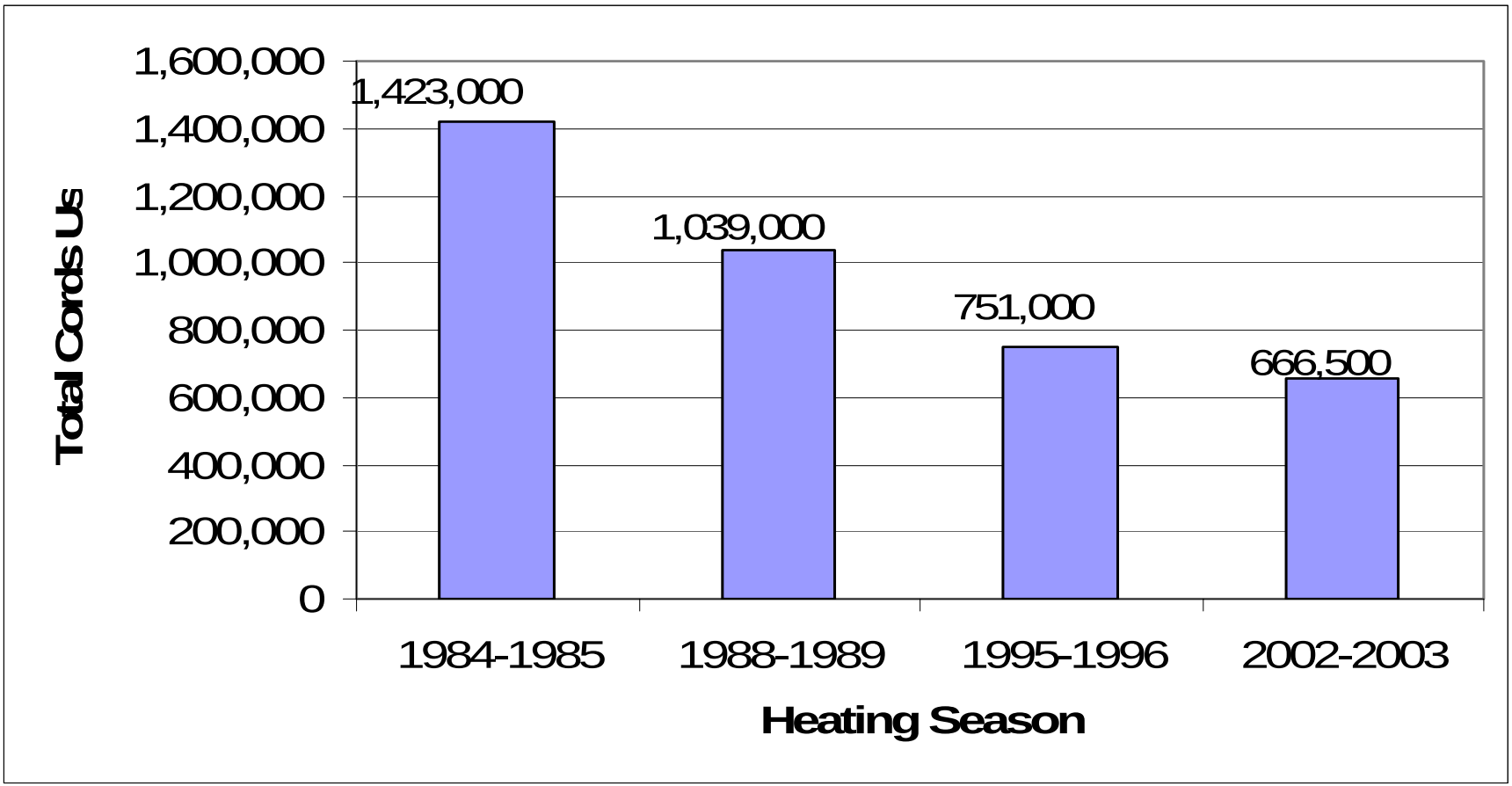

Table 3 Ownership & Use by Appliance Type

Appliance Type	# Appliances Owned	% of Total Owned	# Appliances Used	% Used
Conventional Woodstove	82,000	11.6	64,000	78.0
Certified Catalytic Woodstove	12,700	1.8	12,000	94.3
Certified Non-Catalytic Woodstove	23,700	3.4	22,200	93.9
Conventional Insert	58,800	8.3	56,200	95.6
Certified Catalytic Insert*	361	0.1	361	100
Certified Non-Catalytic Insert*	7,420	1.1	7,420	100
Wood-burning Furnace	46,000	6.5	43,300	94.1
Wood-burning Boiler	15,600	2.2	14,200	90.8
Fireplace	422,100	59.9	308,100	**73.0**
Firepit	35,800	5.1	35,100	98
Total	**704,700**	**100**	563,000	**79.9**

Table 4 Ownership and Use by Appliance Group

Appliance Group	# Owned	% Total Owned	# Used	% Used
All Woodstove (Conventional, Certified Catalytic, and Certified Non-Catalytic)*	118,400	16.8	98,200	82.9
All Inserts (Conventional, Certified Catalytic, and Certified Non-Catalytic)*	66,600	9.5	64,000	96.1
All Central Heating (Furnace and Boiler)	61,700	8.8	57,500	93.2
All Uncontrolled Appliances (Fireplace and Firepit)	458,000	65.0	343,200	74.9
Total	**704,700**	**100**	**563,000**	**79.9**

total # space heaters (all WS & Inserts) = 185,000, or 26.2% of # owned.
Of 185,000 space heaters, 162,200 were used, or 87.6%.

Table 6-- Burning Purpose by Appliance Group

Appliance Group	Did Not Burn	Primary Heat	Supplemental Heat	Pleasure Only
All Wood Heaters , Certified, (Conventional WS & Inserts)	13.1%	18.4%	46.7%	21.7%
All Central Heating (Furnaces and Boilers)	11.8%	63.8%	24.3%	0.0%
All Uncontrolled Appliances (Fireplaces and Firepits)	37.4%	0.1%	9.7%	52.7%
Total	**29.5%**	**9.9%**	**19.7%**	**40.9%**

Only surveys with only 1 appliance type used, question not asked on individual appliance level, table approximately 70% of the surveys.

Table 7 -- Amount of Wood Burned by Appliance Type (EI #)

Appliance Type	Ave Cords / Year / Appliance	Total Cords Burned per Year	Total Tons Wood Burned	% of Total Wood
Conventional Woodstove	1.29	82,600	116,500	12.4
Certified Catalytic Woodstove	1.17	14,100	19,800	2.1
Certified Non-Catalytic Woodstove	1.53	34,100	48,100	5.1
Conventional Insert**	1.37	77,100	108,700	11.5
Certified Catalytic Insert**	0.50	181	255	0.03
Certified Non-Catalytic Insert	1.23	9,200	12,900	1.4
Wood-burning Furnace	3.54	153,500	216,400	23.0
Wood-burning Boiler	7.57	107,600	151,700	16.1
Fireplace	0.54	166,300	234,500	25.0
Firepit	0.62	21,700	30,600	3.3
Total	**1.18**	**666,300**	**939,500**	**100**

1.41 short tons/cord conversion, dry basis

Table 8 - Wood Burned by Appliance Group

Appliance Group	Ave Cords per Year/ Appliance	Cords Burned / Year	Total Mass of Wood Burned	% of Wood Burned
All Woodstove (Conventional, Certified Catalytic, and Certified Non-Catalytic)*	1.33	130,900	184,600	19.6
All Inserts (Conventional, Certified Catalytic, and Certified Non-Catalytic)*	1.35	86,400	121,800	13.0
All Central Heating (Furnace and Boiler)	4.54	261,100	368,200	39.2
All Uncontrolled Appliances (Fireplace and Firepit)	0.55	188,000	265,100	28.2
Total	**1.18**	**666,300**	**939,500**	**100**

Other issues

- conversion factor of 1.41 short tons/cord- based on specific mixture of species used *as obtained from the questionnaire*
- Survey asked “Pick-up Truck loads” – USDA has paper on conversion to cords
- 31,794 households (10.3% of FP users) use **manufactured wax/sawdust logs** – Emission factors very distinct from wood

Working with Forest Service

- Ron Piva rpiva@fs.fed.us

  Forest Inventory & Analysis –

  Forest Research Stations

“Try to update every 10 years”

“Limited by budget”

Conclusions

- Carefully designed RWC surveys yield superior results for EI planning
- Collaboration with USDA leveraged PCA $'s **&** linked to existing Wood Trends Data
- Differences in usage within this 1 state demonstrate value of local scale surveys
- Wood use declining, Furnaces % High

[*Opinion]* – Emission Factors not as solid