Wood Heat in the US

Understanding Use Through Mixed-Methods

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Introduction

- Part of an interdisciplinary team comprising members from Oregon State University and Aprovecho Research Center
  - Dr. Nordica MacCarty, Dr. Shaozeng Zhang, Sam Bentson, Jaden Berger, and Michael Laun
- DOE BETO project to understand real-world wood stove use and inform research and development

Motivation

- Modern wood stoves continue to emit higher levels of PM2.5 than acceptable or desirable

  - Anecdotes attribute much of this to user influence, often citing specific behaviors

Motivation

- Learning from users can inform the future design of cleaner-burning stoves and improve adoption rates

Specific Aims

- Inform an in-house stove testing protocol

- Inform research and development of a retrofit device

- Develop a set of design rules

US Stove 2469 E

Blaze King Princess

Research Problem

Real life is messy.

Mixed-Methods Needs Assessment

Survey Instrument

Semi-Structured Interviews

Sensor-Based Data Collection

Surveys
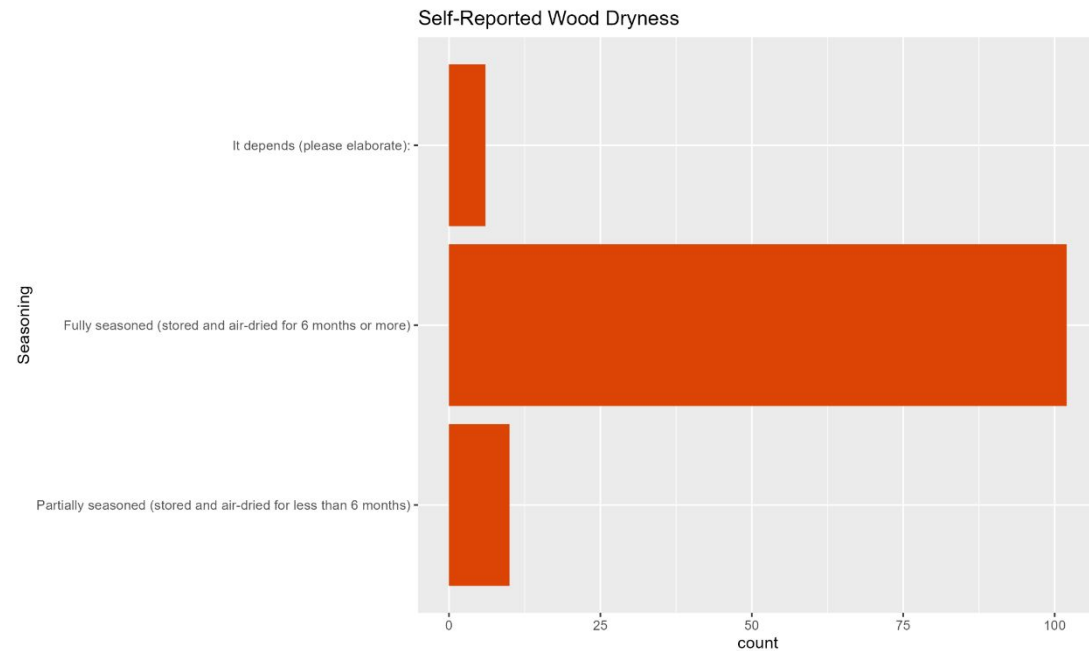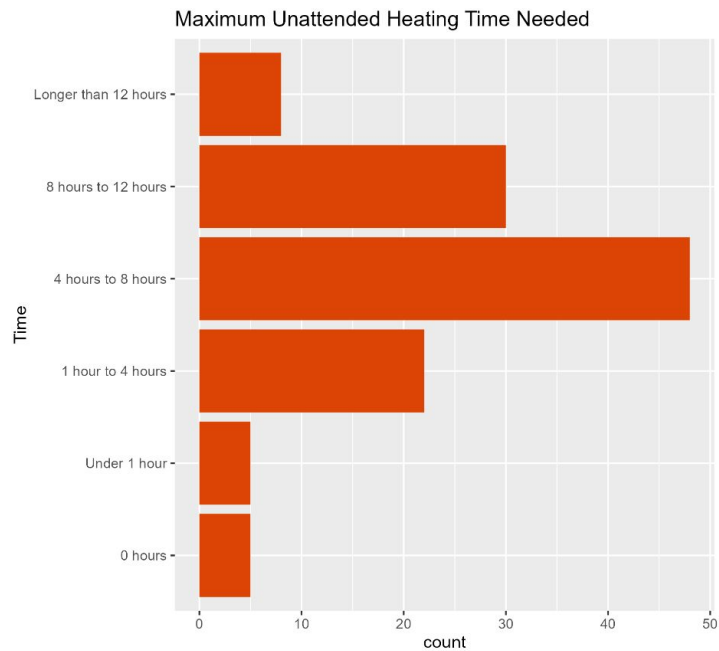
- Target respondents use wood as a primary source of heat

- Increase access to information about wood heat users

Art by Nina Zhang.

Preliminary Survey Data

Preliminary Survey Data

When do you add wood to your lit stove?

	Appliance		
	Free-standing	Insert	Furnace
Mainly when the fire is still strongly burning	6%	14%	NA
Mainly when small flames are visible	22%	27%	NA
Mainly when all brightly visible flames are gone	22%	9%	NA
Mainly when there are still enough coals for a hot restart	21%	23%	60%
Mainly after a certain amount of time	10%	NA	20%
Mainly after checking the stovetop or flue temperature	4%	NA	NA
None of the above (please elaborate):	14%	27%	20%

Cold Start Frequency During the Heating Season

	Appliance		
	Free-standing	Insert	Furnace
I do not (it stays on all through heating season)	14%	14%	NA
Everyday	39%	18%	20%
Every other day	6%	NA	20%
A few times a week	26%	36%	60%
Once every week or less often	14%	32%	NA

Semi-Structured Interviews

Coding Interviews for Themes

"Every time I turn the [electric] heaters on it just feels like money."

"As I'm getting a little older and the arthritis is getting worse, I appreciate the heat more. 70 degrees (F) from the wood stove feels better than 70 degrees from the heat pump."

"If the wind blew over 3 miles per hour and more than 5 snowflakes fell, we would lose power."

He thinks that madrone and maple are nice for burning, they burn hot and for a long time. In general, "fir is plentiful and cheap so that's what we go with."

Code Key
Affordability
Comfort Heat
Electric Power
Experiential Knowledge
Firestarters
Fuel Preference
Jobs to Be Done
Moving Heat
Noise Tolerance
Physicality
Self-sufficiency
Smoke
Startup Methods
Stove Operation
Weather
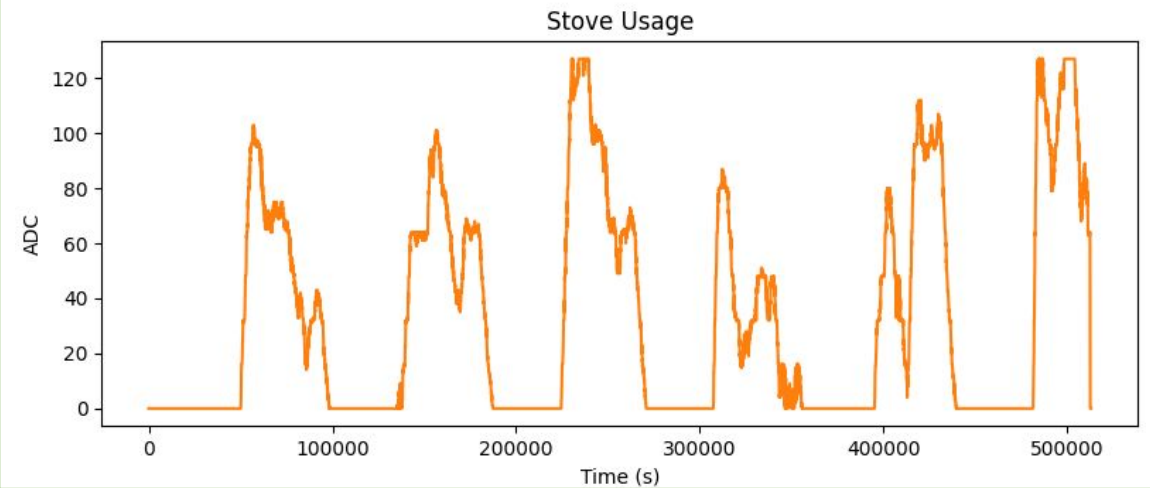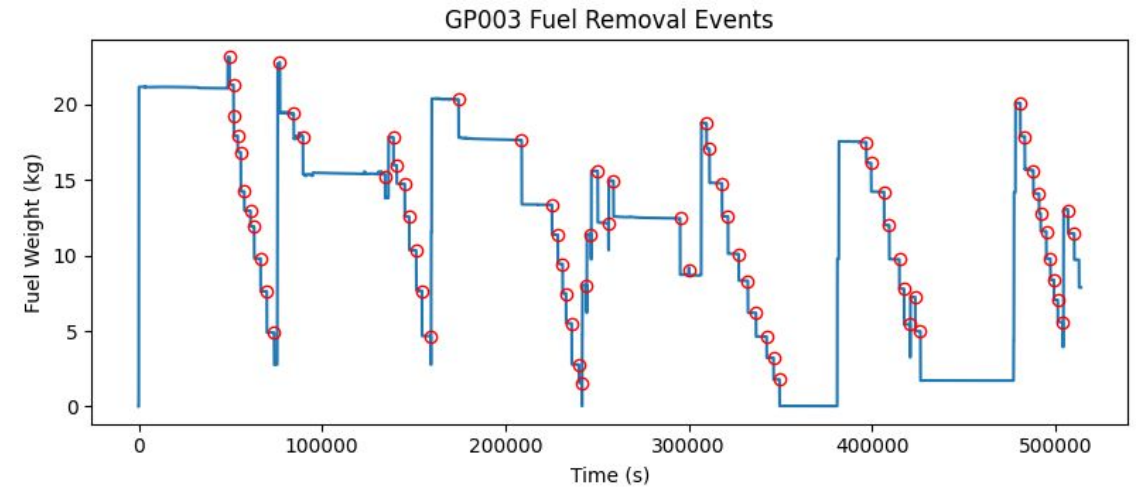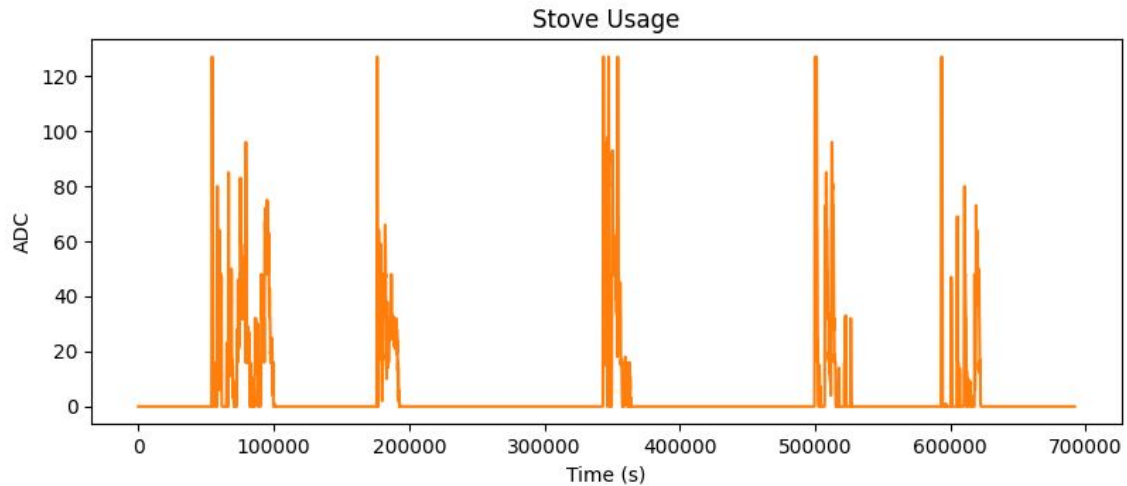Wood Condition
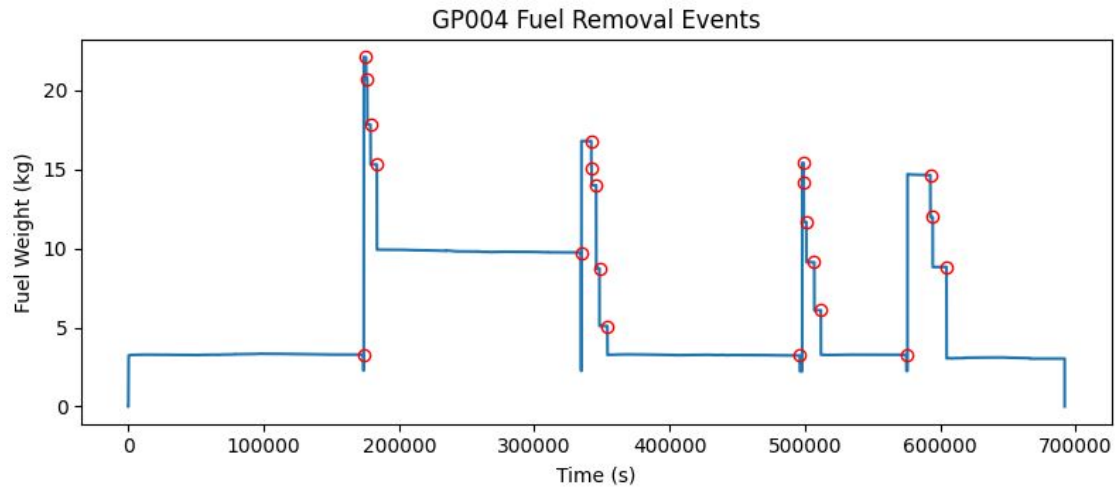
Sensor-Based Data Collection

EXACT Sensor

FUEL Sensor

https://www.climate-solutions.net/products/exact-stove-use-monitor
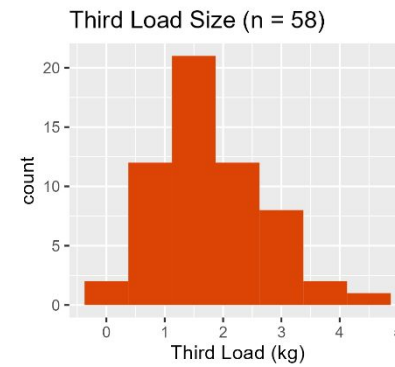
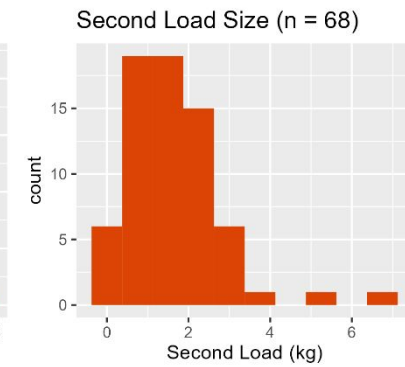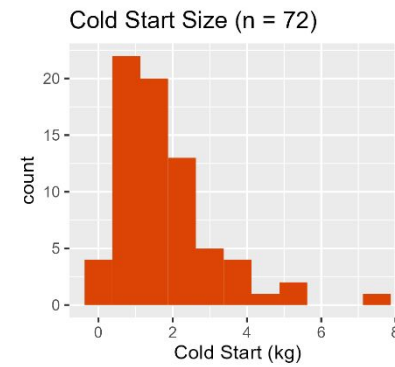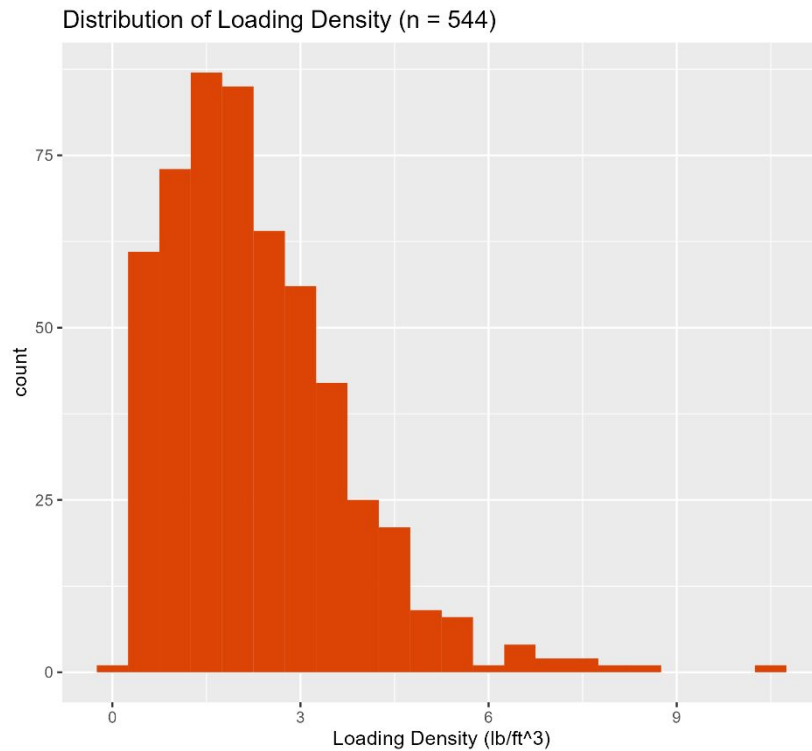https://www.climate-solutions.net/products/fuel

Sensor Data Plots

Sensor Data
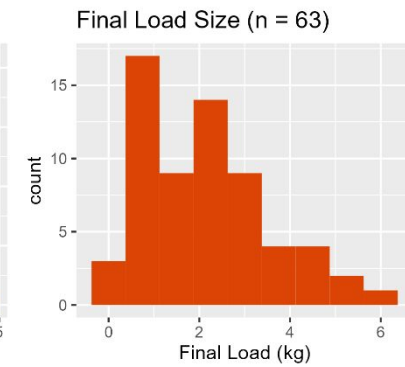
Conclusion and Next Steps

- A mixed-methods approach can give depth to and provide context for your data

- Tying it all together

- Use what we learned to inform the development of our retrofit device and engage in co-design with our research participants and users

Accessing the Survey

- Survey link:

  - http://bit.ly/3vXrITC

- QR code:

Contact Information
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