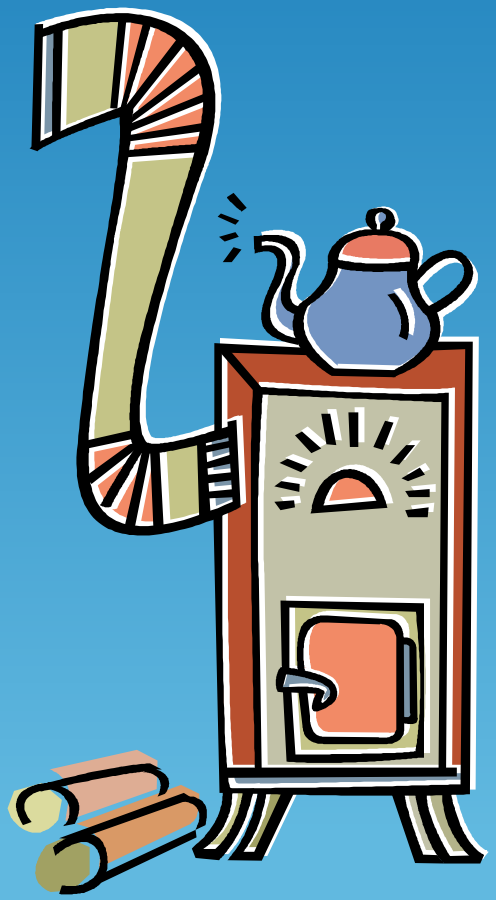
Report on the 2011 Tacoma burning activity survey (aka log-your-log)



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Objectives

- How does burning activity relate to ambient temperature?
  - Fraction burning?
  - Number of logs burned?
  - Differences between device types?
  - Differences between low and moderate frequency burners?
- Are there temporal (diurnal) patterns?
  - Adding or starting?

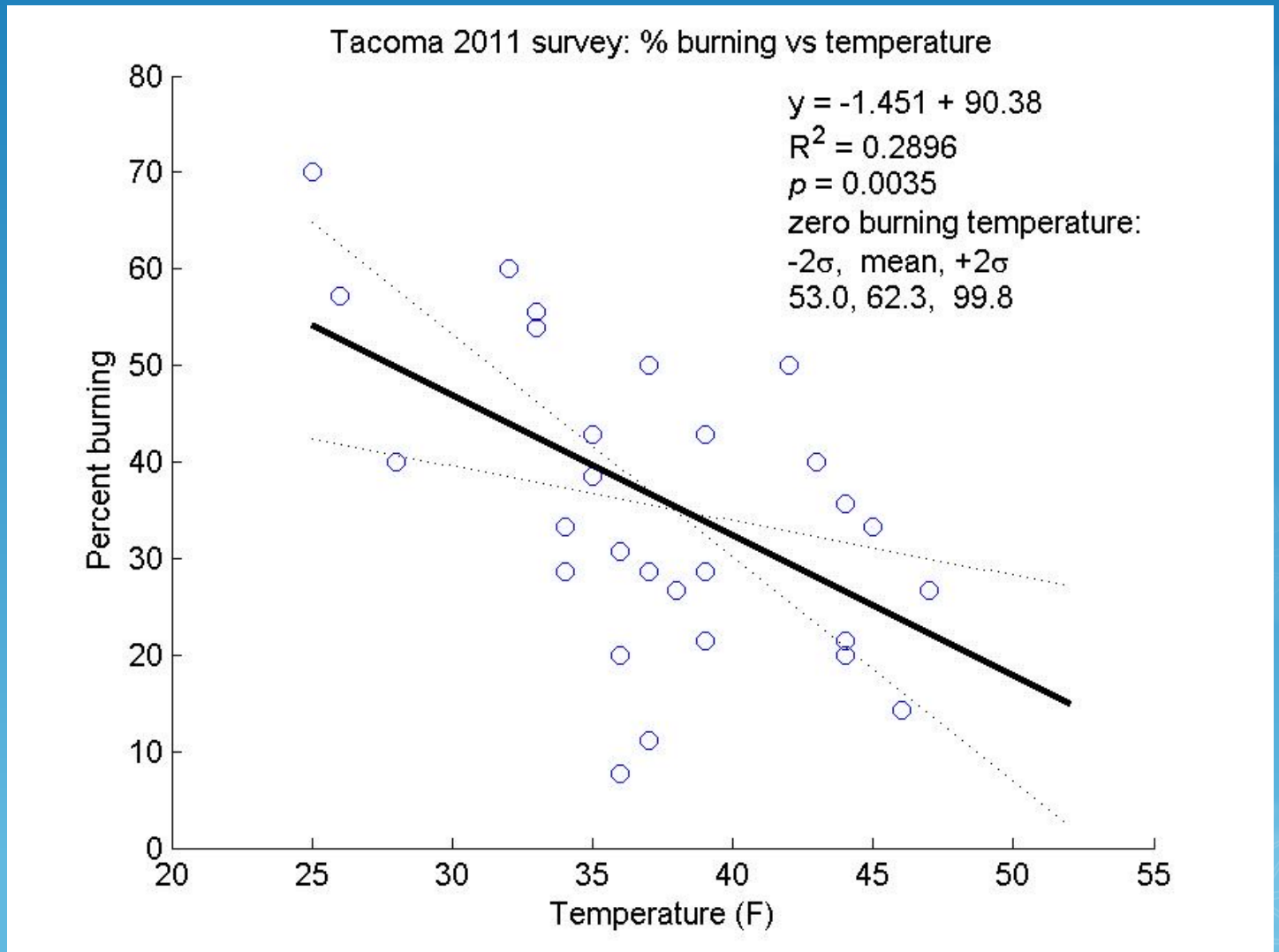
Overview

- 25 enrolled
  - 11 fireplace
  - 10 woodstoves
  - 4 inserts
- Surveyed from Jan 24 – Mar 1
- Nominally burned either 2-3 times/month (low frequency) or 4-20 times/month (moderate frequency)
- Recorded start time and logs added for 4 weeks (low frequency) or 2 weeks (moderate frequency)

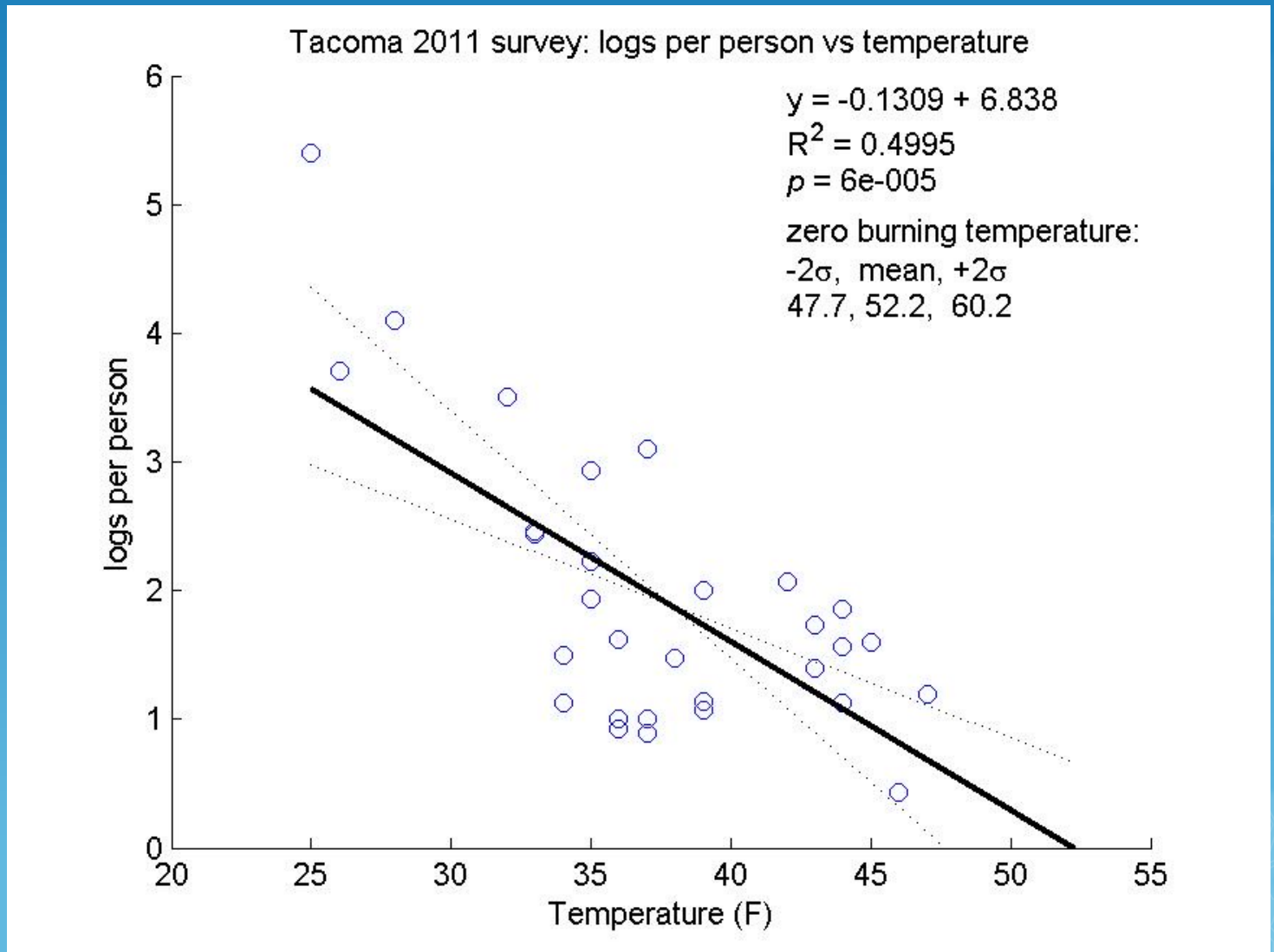
Basic results

- 5 people had no activity during their survey period (0%)
- 3 people had 100% activity
- Removed these people as they aren't low or moderate and would skew results
- 17 maximum surveyed on any one day
- Ambient temperatures were 25 - 47 F
- Will analyze based on two metrics
  - % of homes which burn on a survey day
  - # of logs/home burned on a day

Aggregate percent burning is moderately-weakly correlated to temperate (but IS stat. sig.)



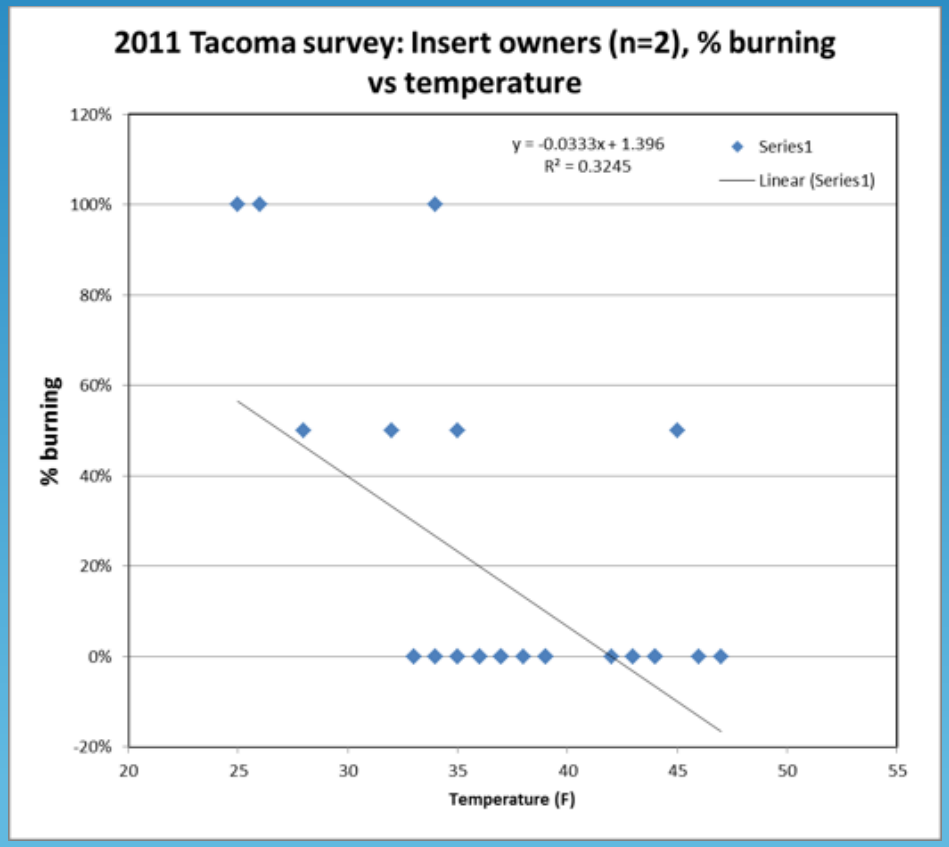
Aggregate number of logs burned per house is better correlated to temperature

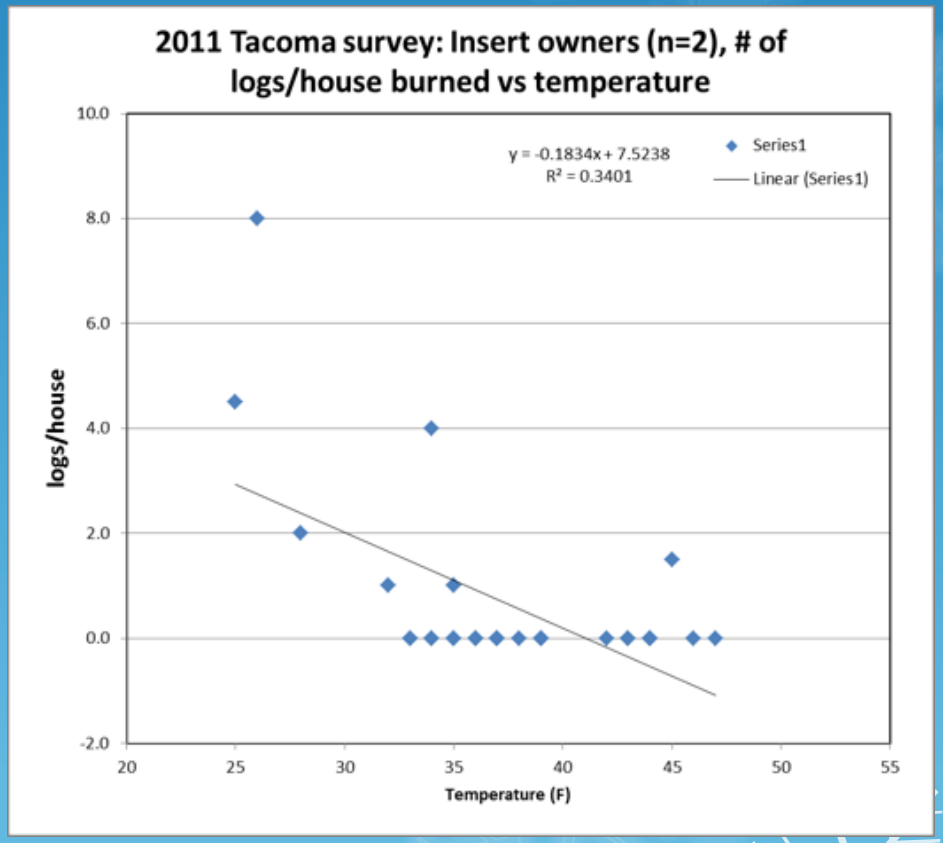


Aggregate conclusions

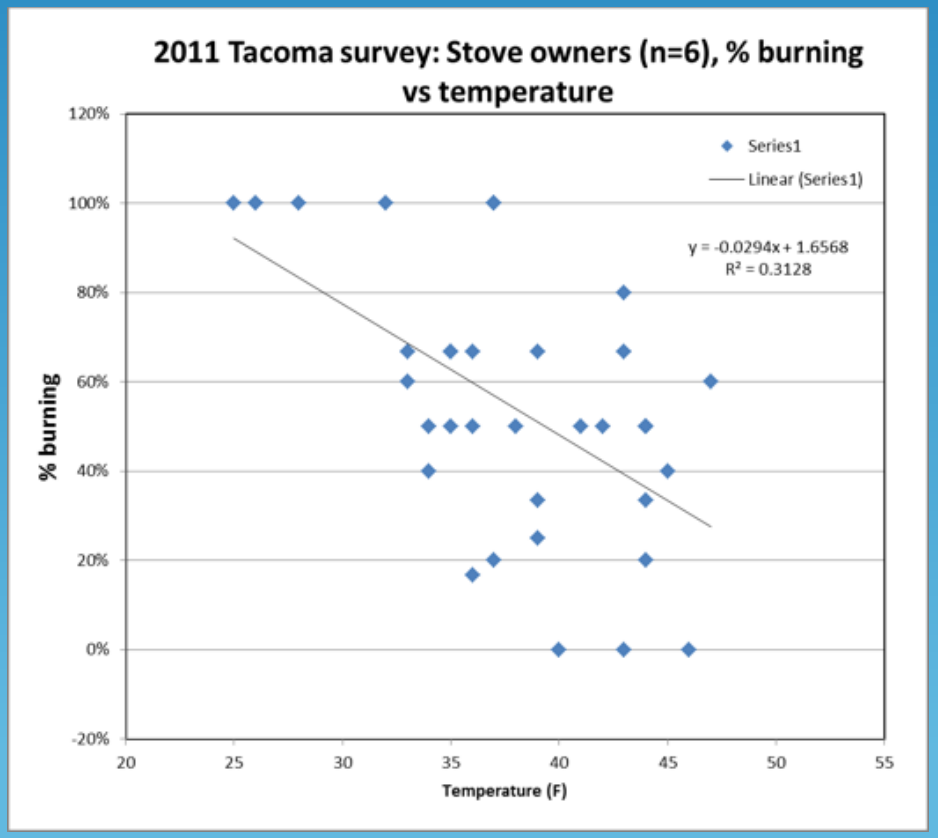
- Correlations support previous assertions that burning activity, among low and moderate burners, increases with temperature
- Rough agreement in rate of increase with temperature and observations
- Agreement in base (zero burning) temperature with observations and expectation of degree-days concept
- Individual behavior (yes/no) varies significantly from the aggregate
- But, fuel burned is much better related to temperature
- SO: an individual who burns (any amount in the winter) isn't that much more likely to burn when it's cold. But if they do burn, they are much more likely burn more wood as temperatures drop.

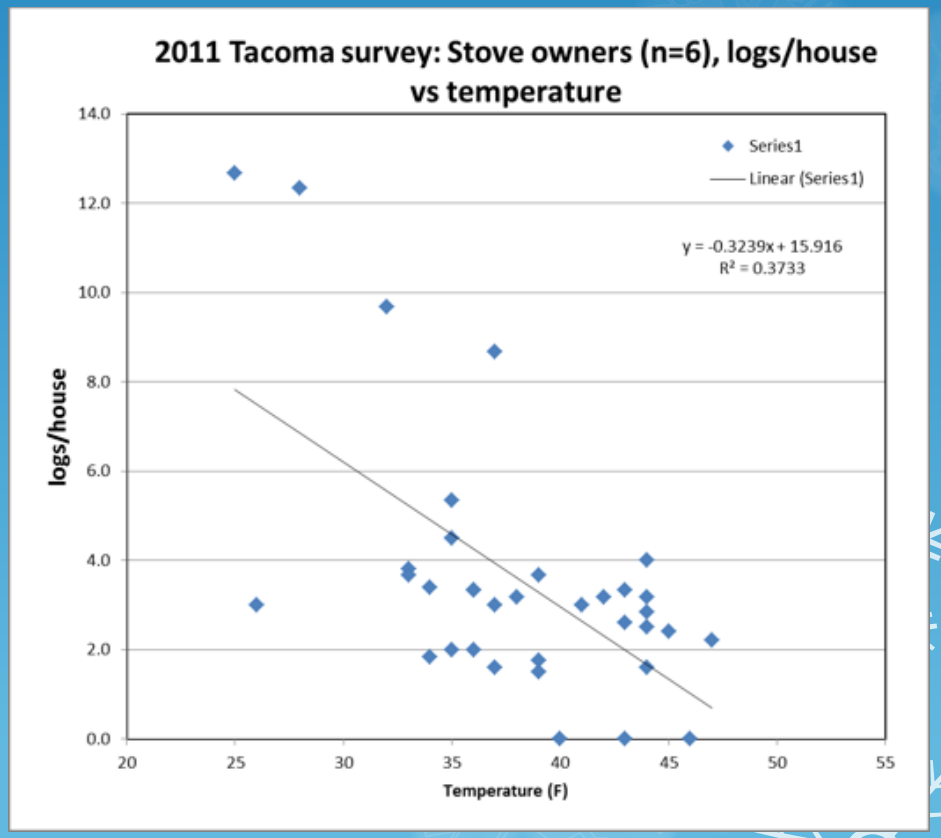
- Analysis broken down by device, here **inserts**:
- Same relationship with temperature as aggregate despite **very** small sample number (n=2)



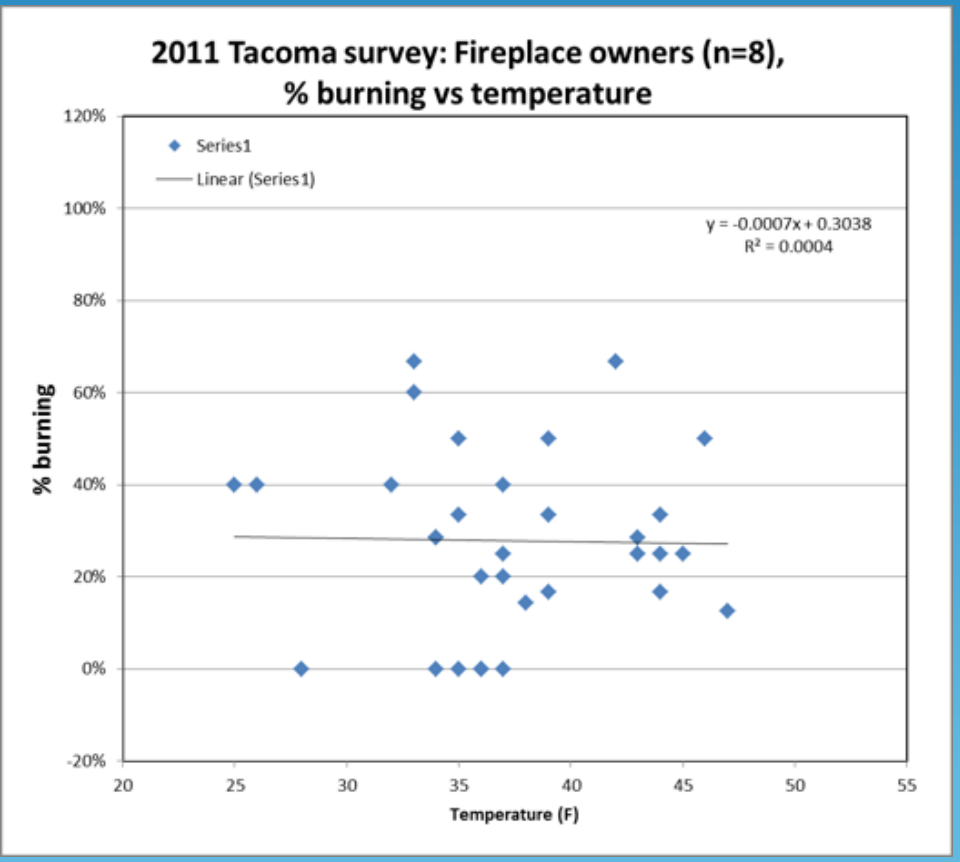


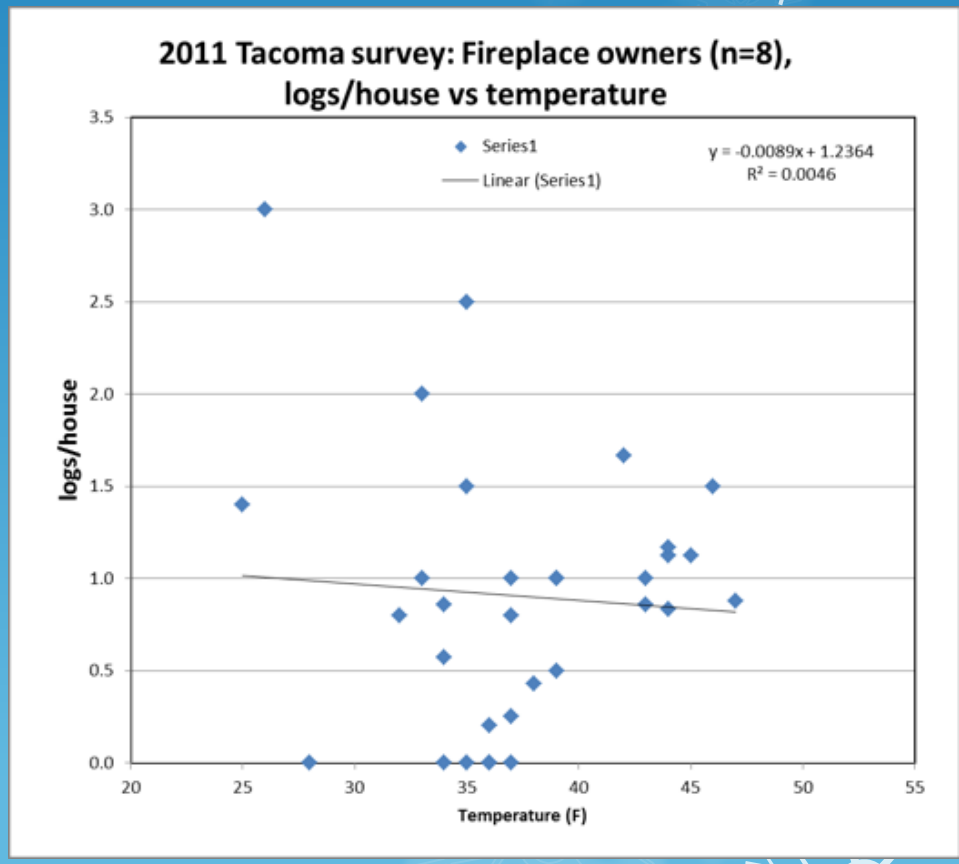
- Analysis broken down by device, here **woodstoves**
- Same relationship with temperature as aggregate despite small sample number (n=6)





- Analysis broken down by device, here **fireplaces**
- No observable relationship with temperature even with similar sample number (n=8)





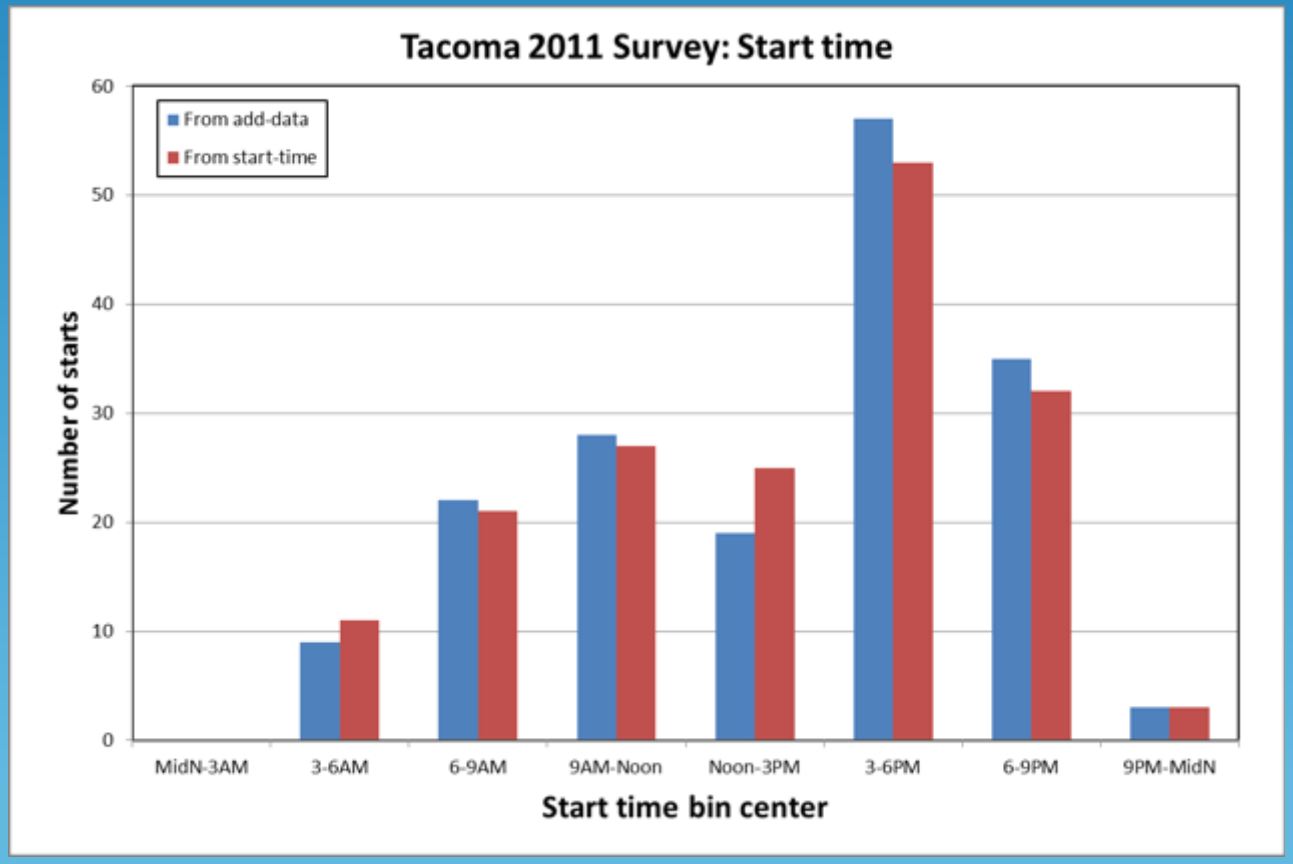
- Do fireplace users have different motives?
- Would it matter?

Breakdown conclusions

- Insert and woodstove use is consistent with aggregate
- Breakdown supports conclusion that aggregate result is robust
- Logs/house used (at a given temperature) appears to be greatest in woodstoves, followed by inserts, and lowest in fireplaces
- Fireplace use appears to have very different relationship to temperature
- So, why is fireplace use different than insert and woodstove use?
  - Sampled group not representative of population?
  - Fireplace owners have different motivation?
  - Evidence of fireplaces not being effective at heating?
  - Other?

Fire start time vs time of day

- Start-time data and add-time data were inconsistent
- Reconciled data appears consistent



Start time analysis and conclusions

- Many reported inconsistent start times
- Attempted to reconcile stated start time and first time wood added
- After reconciliation, good agreement between two methods
- Most cold starts occur from 3 - 9 PM
- Is it possible that the greater number of cold-starts at night is exacerbating the observed evening spike?

Overall conclusions

- Sample size is likely too small to draw any firm conclusions, nonetheless:
- Results support previous assertion that burning increases with lower temperature with a degree-day relationship
- Fireplace use does not appear to have an ambient temperature dependency. But, is this important for understanding or addressing nonattainment?
- Most fires are started 3-6PM
- Fuel burned follows temperature better than individual home activity
- Many individuals not able to accurately report (or characterize) their average use
- Would need to survey at least 200 houses, chosen randomly, to obtain reasonable confidence