Background

- **Education**
  - Ph.D in Environmental Science at UC Berkeley,
  - M.S. in GIS and B.S. in Geography at Nanjing U. in China.

- **Research interests**
  Study environmental system using GIS, remote sensing and spatial modeling. My current research focuses on assessing riverine carbon export at land-water interface.

- **Teaching**
  - GEO-SCI 468/668: GIS and Spatial Analysis
  - GEO-SCI 426/626: Remote Sensing and Image Interpretation
  - GEO-SCI 636: Advanced Remote Sensing
  - GEO-SCI 678: Spatial Data Analysis
Why spatial data require special analytic techniques, distinct from standard statistical analysis?

- Conventional statistical analysis assumes **random & independent**.

- Tobler’s (1970) First Law of Geography: “everything is related to everything else, but near things are more related than distant things”

- The nonrandom distribution of phenomena in space has various consequences for conventional statistical analysis: bias toward prevalent values in parameter estimates, redundant observation
Factors driving Residential Wood Burning

- **PM2.5**: fine particles of less than 2.5 mm in diameter.
- Residential wood combustion (RWC): dominant source to PM2.5 emission.
- Linear relationship between RWC and corresponding PM2.5 emission

(Burnet et al. 1986, Radke et al., 2002)

The Sacramento Valley, the San Joaquin Valley and the San Francisco Bay Area
Statistic Analysis: Stepwise variable selection

- Dependent variable: the percent of the households using wood as primary heating source of total households
- Independent variables
  - Demographic data
    - income, ethnicity, education, age, *et al*
  - Environmental data
    - DEM, distance to forest, temperature, urban/non-urban, *et al*

<table>
<thead>
<tr>
<th>Demographic data only</th>
<th>+ Forest Accessibility</th>
<th>+DEM</th>
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<tbody>
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<td>Vars Adj. $R^2$</td>
<td>Vars Adj. $R^2$</td>
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Retired income
- Positive impact
- $R^2 = 0.1867$
- $r = 0.4321$
- moderate positive correlation

Median income
- Negative impact
- $R^2 = 0.2411$
- $r = -0.4910$
- moderate negative correlation
The spatial pattern of median household income (b) retirement income (c) compared with the RWC percent (a).
Spatial dependence

- **First-order effect**: variation in the mean value of the process in space, or intensity

  *The assumption of equal probability of each area receiving an event cannot be sustained.*

- **Second-order effect**: interaction between events, spatial correlation/dependence

  *The assumption that event placements are independent of each other cannot be sustained.*

First-order or second order variation?
Using Median Polish to remove the trend.
After removing trend, the median income is positively related to RWC!