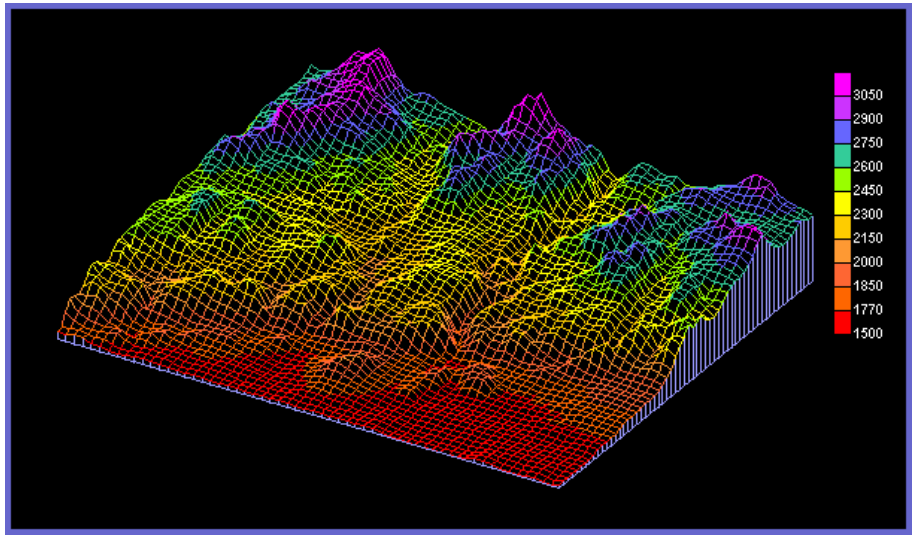
Background

- 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

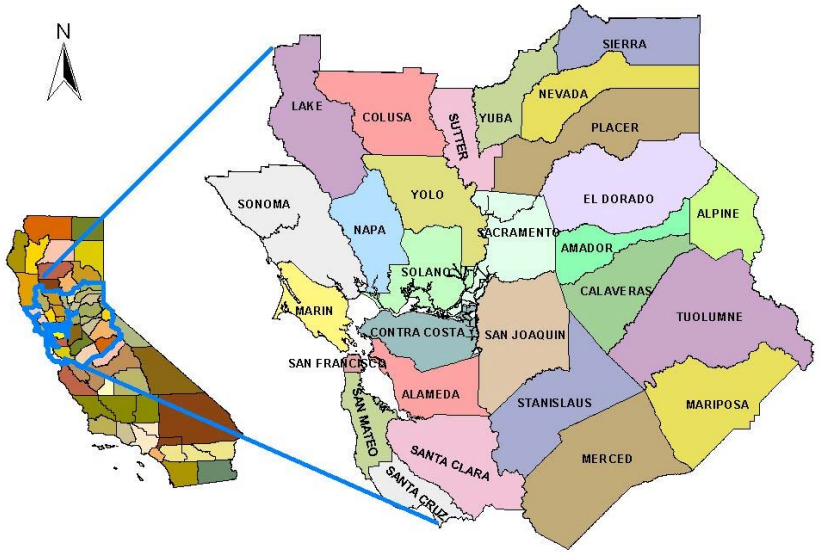
Why spatial data require special analytic techniques, distinct from standard statistical analysis?

- 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



The Sacramento Valley, the San Joaquin Valley and the San Francisco Bay Area

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

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

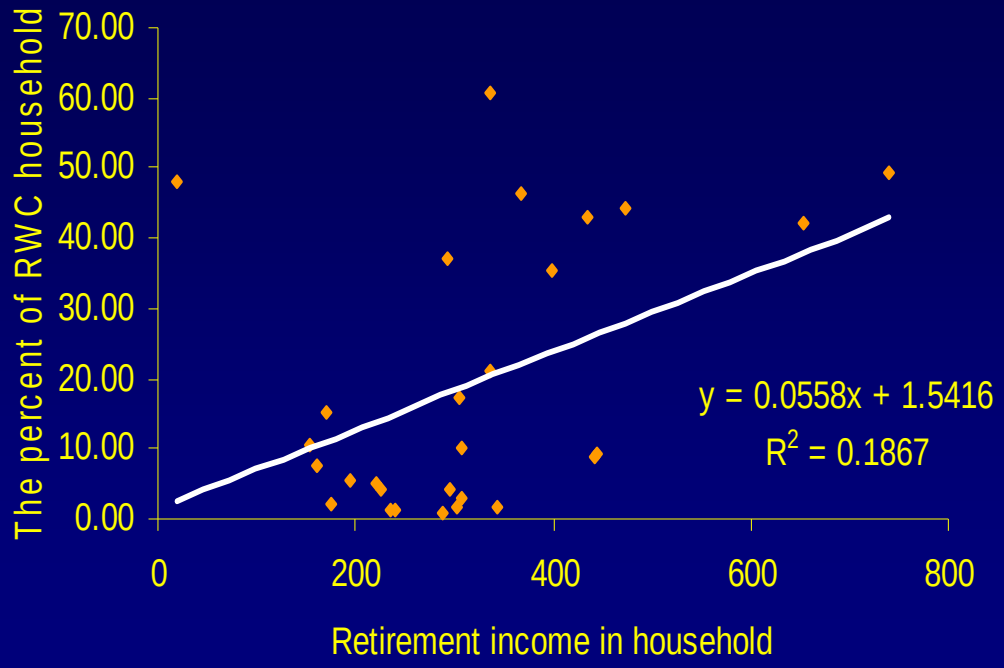
Statistic Analysis: Stepwise variable selection

- 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

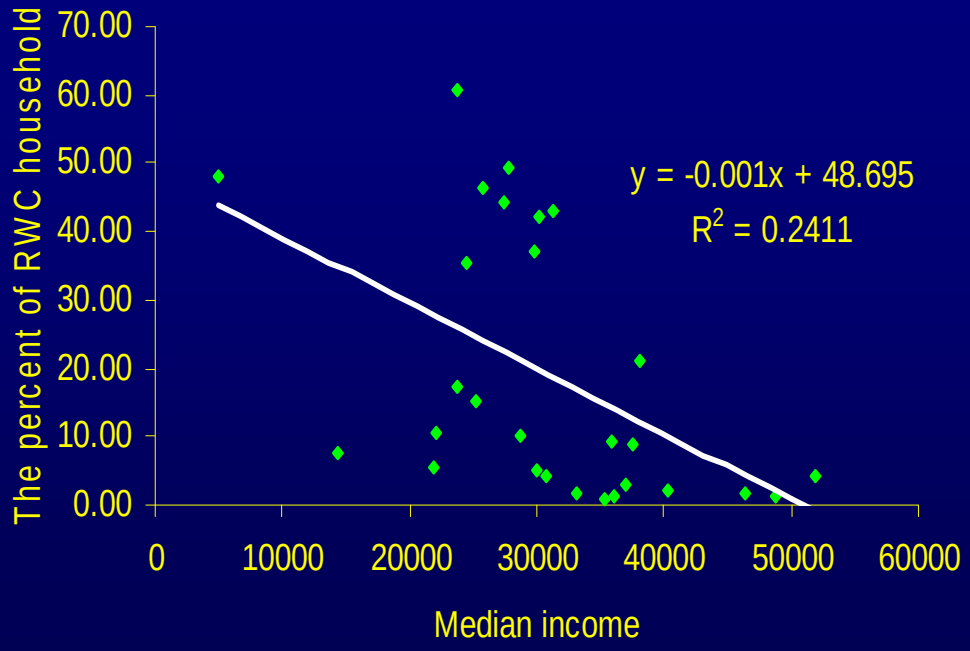
  -DEM, distance to forest, temperature, urban/non-urban, *et al*

Demographic data only		+ Forest Accessibility		+DEM	
Vars	Adjut. R^2	Vars	Adjut. R^2	Vars	Adjut. R^2
URS	0.386	FORACC	0.564	DEM	0.645
RETI_INC	0.547	URS	0.755	URS	0.782
OCCUPIED	0.614	OCCUPIED	0.793	RETI_INC	0.808
FOR_DIST	0.651	DETACHED	0.812	FORACC	0.824
MON_12	0.688	AVE_RNT	0.828	OCCUPIED	0.833
APPL_TYP2	0.707	AGE35_54	0.843	FARM_INC	0.846
DETACHED	0.722	MON_2	0.847	AGEGT55	0.854
-	-	MON_12	0.852	AGE35_54	0.857
-	-	-	-	OWNR_OCC	0.863



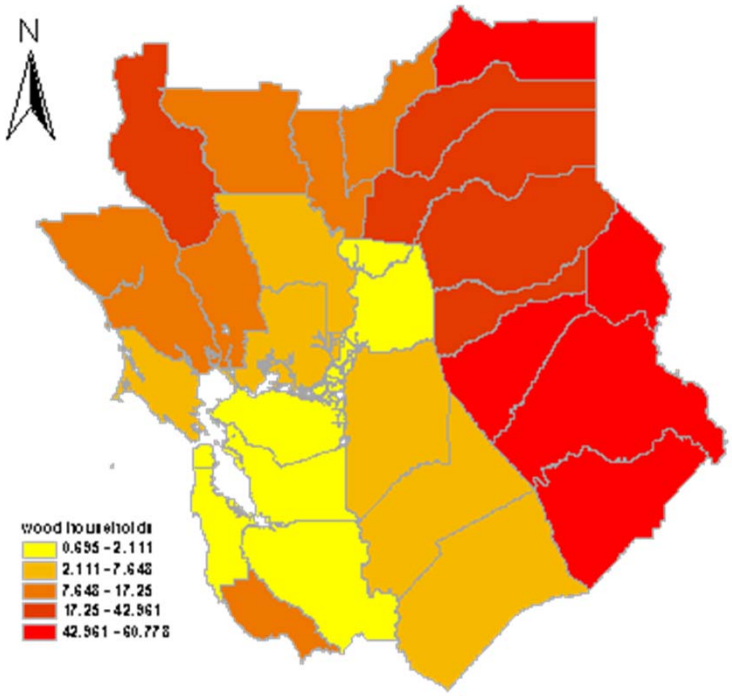
Retired income

- Positive impact
- R^2=0.1867
- r = 0.4321
- moderate positive correlation



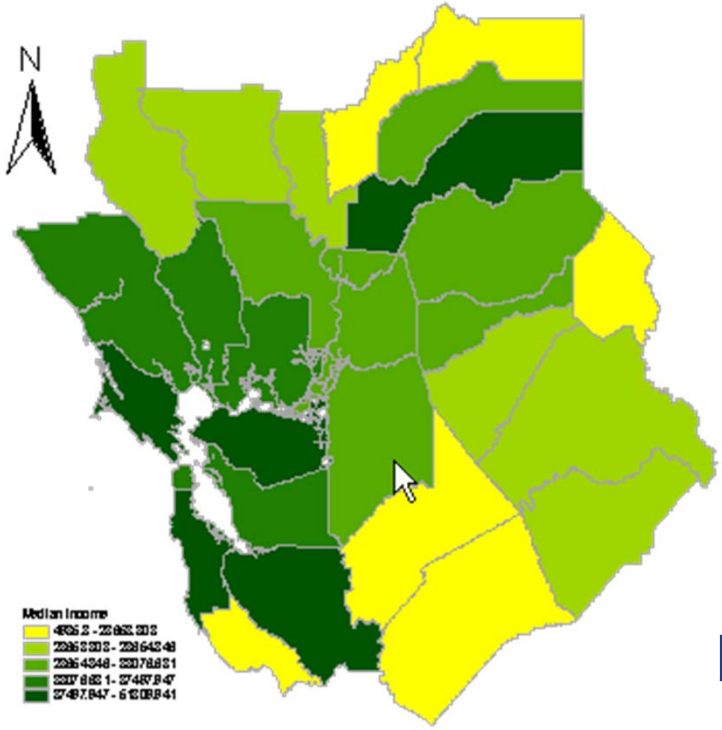
Median income

- Negative impact
- R^2=0.2411
- r = -0.4910
- moderate negative correlation

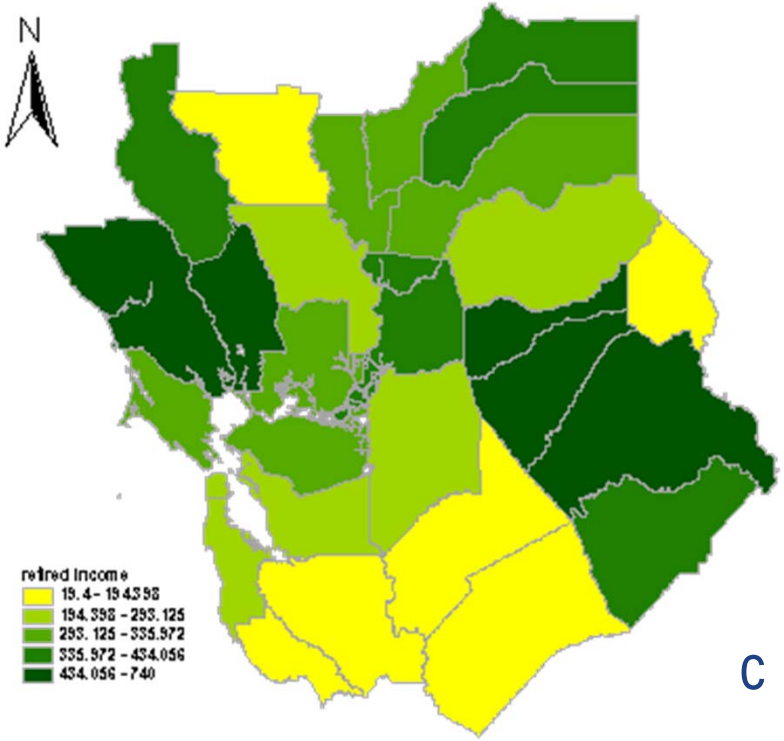


a

The spatial pattern of median household income(b) retirement income(c) compared with the RWC percent(a).

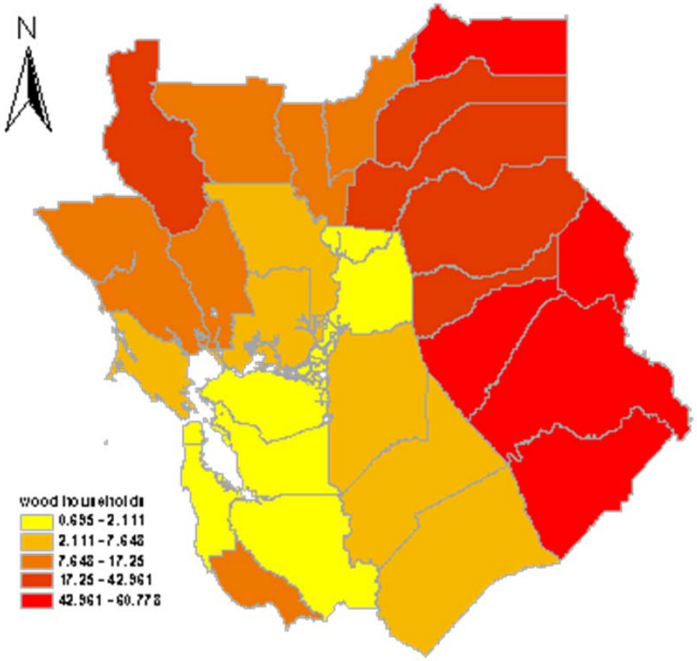


b



c

Spatial dependence



Wood burning household

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

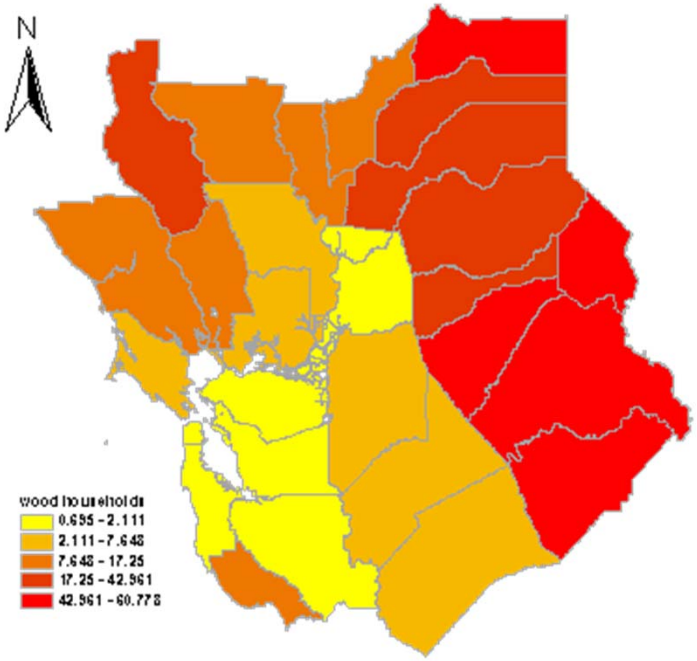
The assumption of equal probability of each area receiving an event cannot be sustained.

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

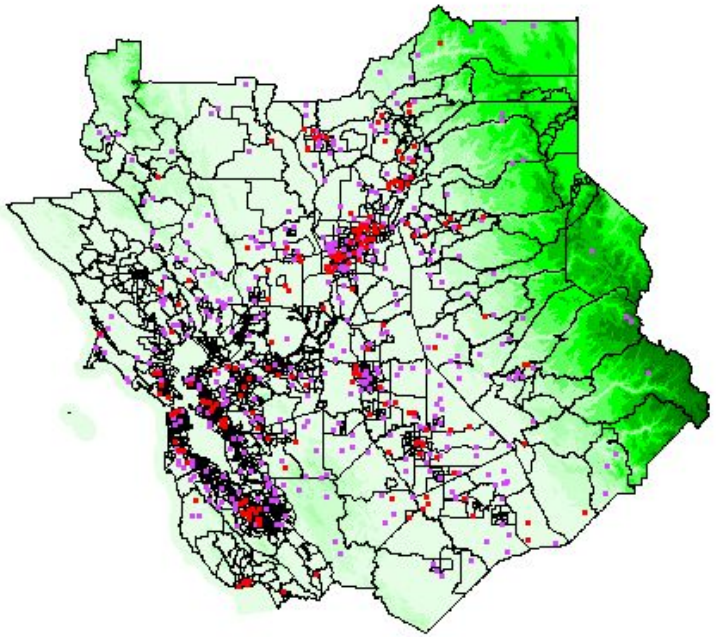
The assumption that event placements are independent of each other cannot be sustained.

First-order or second order variation?

Spatial dependence

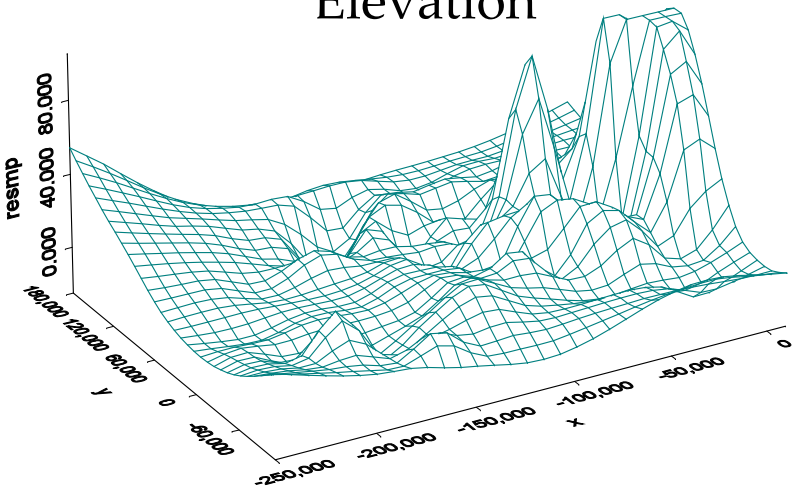


Wood burning household



Elevation

Using Median Polish to remove the trend.



After removing trend, the median income is positively related to RWC!