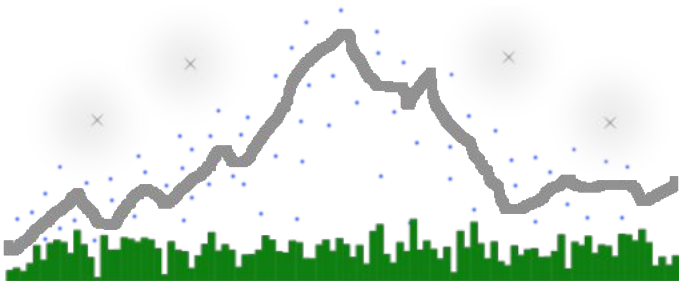# Mapping Precincts to Counties

Aligning Polygons with R's Geospatial Packages

Cascadia R Conference - June 3, 2017
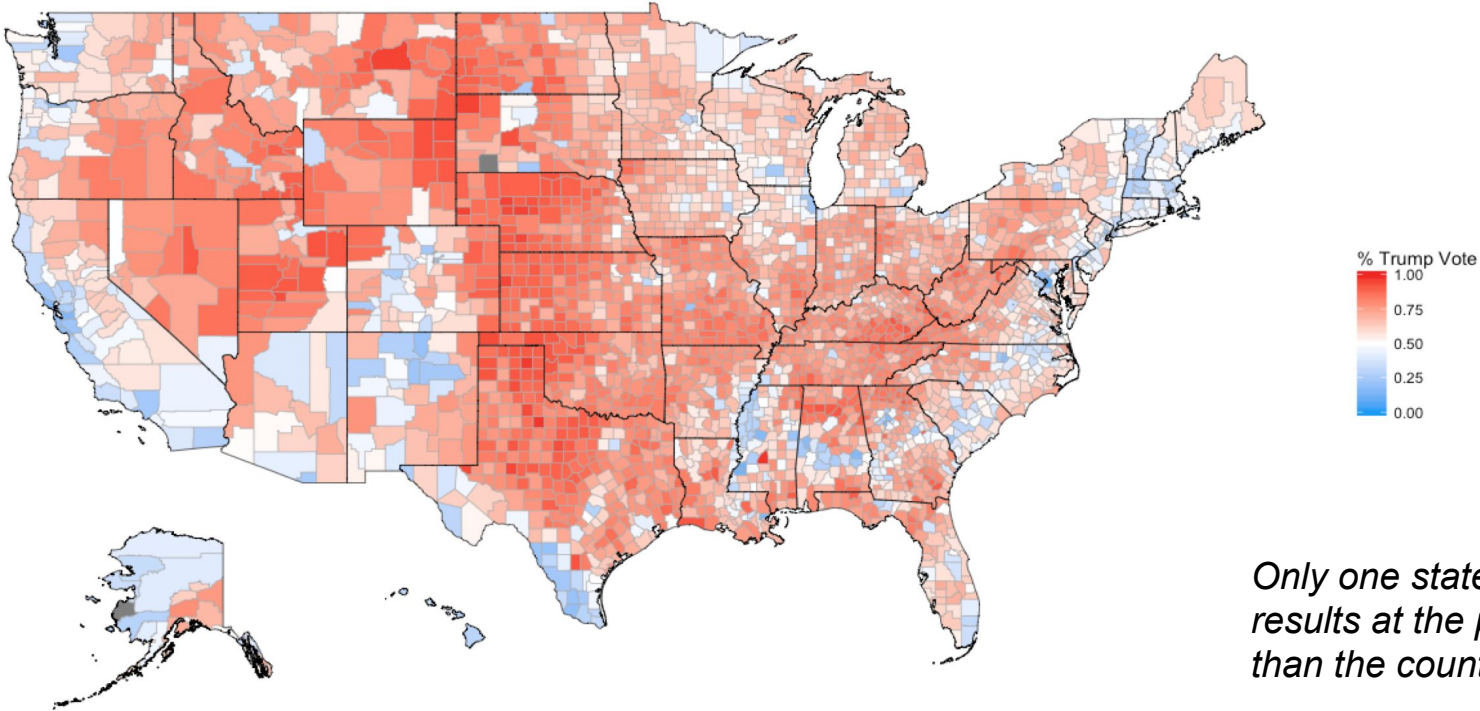
Scott Came
Principal
Cascadia Analytics LLC

The Challenge

#election-transparency

2016 Presidential Election Result
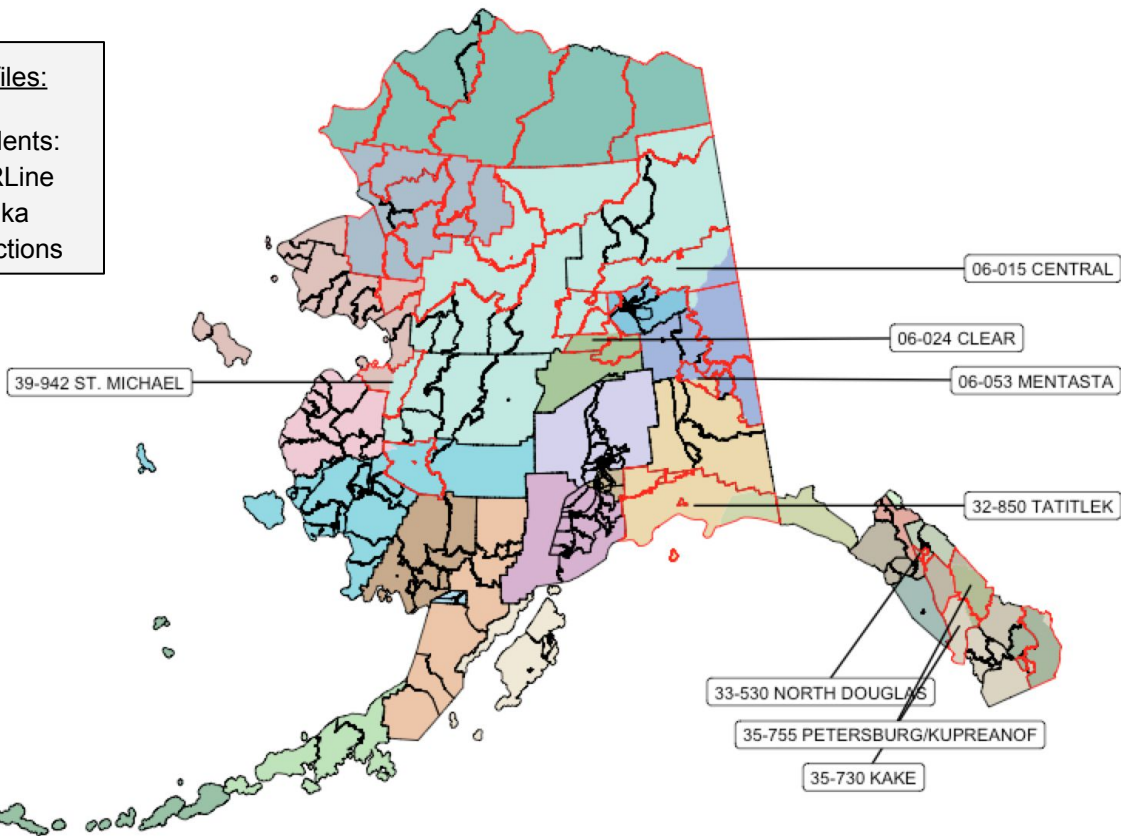

% Trump Vote
1.00
0.75
0.50
0.25
0.00

Only one state publishes results at the precinct, rather than the county, level...

The Solution

Polygon source shapefiles:

- County-equivalents: Census TIGERLine
- Precincts: Alaska Division of Elections

06-015 CENTRAL

06-024 CLEAR

39-942 ST. MICHAEL

06-053 MENTASTA

32-850 TATITLEK

33-530 NORTH DOUGLAS

35-755 PETERSBURG/KUPREANOF

35-730 KAKE

Red borders: > 5 sq mi outside assigned CE
Labeled precincts: > 10% of precinct area outside assigned CE
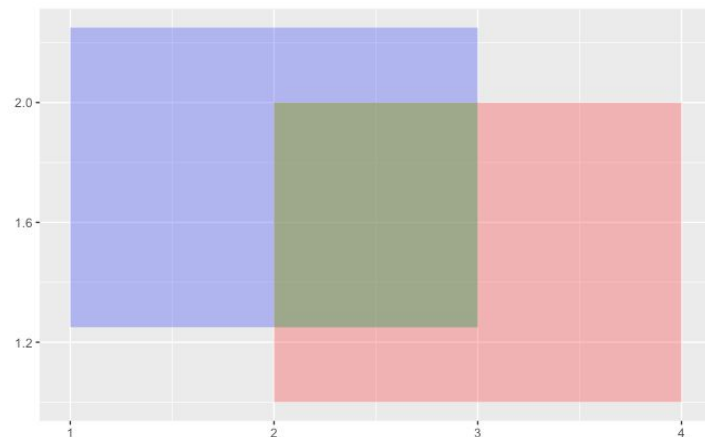
19 Boroughs
10 Census Areas

441 Election Precincts

Could we reliably assign precincts to "county equivalents" by overlaying polygons?

The Tools: `rgeos::gIntersection()` & `rgeos::gArea()`

```
1  library(tidyverse)
2  library(sp)
3  library(rgeos)
4
5  m <- matrix(c(1,1.25,1,2.25,3,2.25,3,1.25), nrow=4, byrow = TRUE)
6  sps <- SpatialPolygons(list(Polygons(list(Polygon(m)), 1)))
7  spsDf <- fortify(sps)
8
9  m2 <- matrix(c(2,1,2,2,4,2,4,1), nrow=4, byrow = TRUE)
10 sps2 <- SpatialPolygons(list(Polygons(list(Polygon(m2)), 1)))
11 sps2Df <- fortify(sps2)
12
13 i <- gIntersection(sps, sps2)
14 iDf <- fortify(i)
15
16 ggplot() +
17   geom_polygon(data=spsDf, aes(x=long, y=lat), fill='blue', alpha=.3) +
18   geom_polygon(data=sps2Df, aes(x=long, y=lat), fill='red', alpha=.3) +
19   geom_polygon(data=iDf, aes(x=long, y=lat), fill='green', alpha=.3) +
20   labs(x=NULL, y=NULL)
```

```
> gArea(i)
[1] 0.75
```
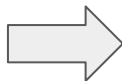
The process:

```
maxArea = 0

for each p in [Precincts]:
  for each c in [County Equivalents]:
    i = intersection(c, p)
    a = area(i)
    if (a > maxArea) then:
      maxArea = a
      assignTo(c, p)
  maxArea = 0
```
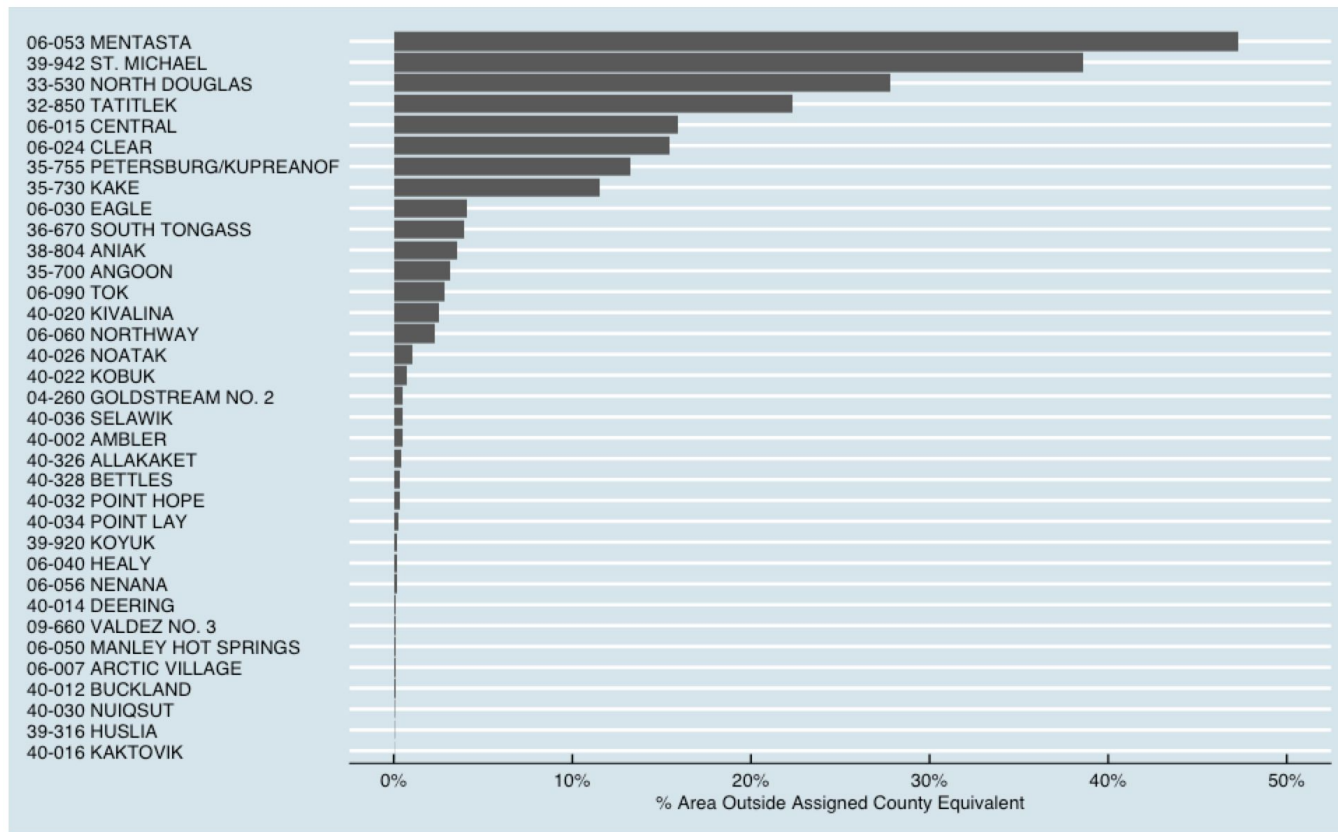
Testing the hypothesis...

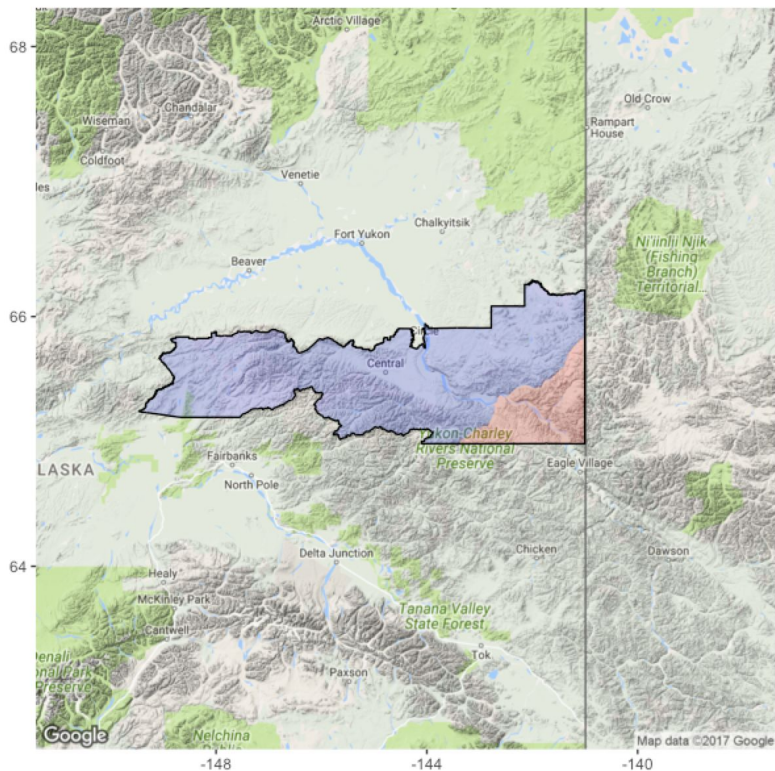35 / 441 Precincts have more than 5 square kilometers outside the assigned CE

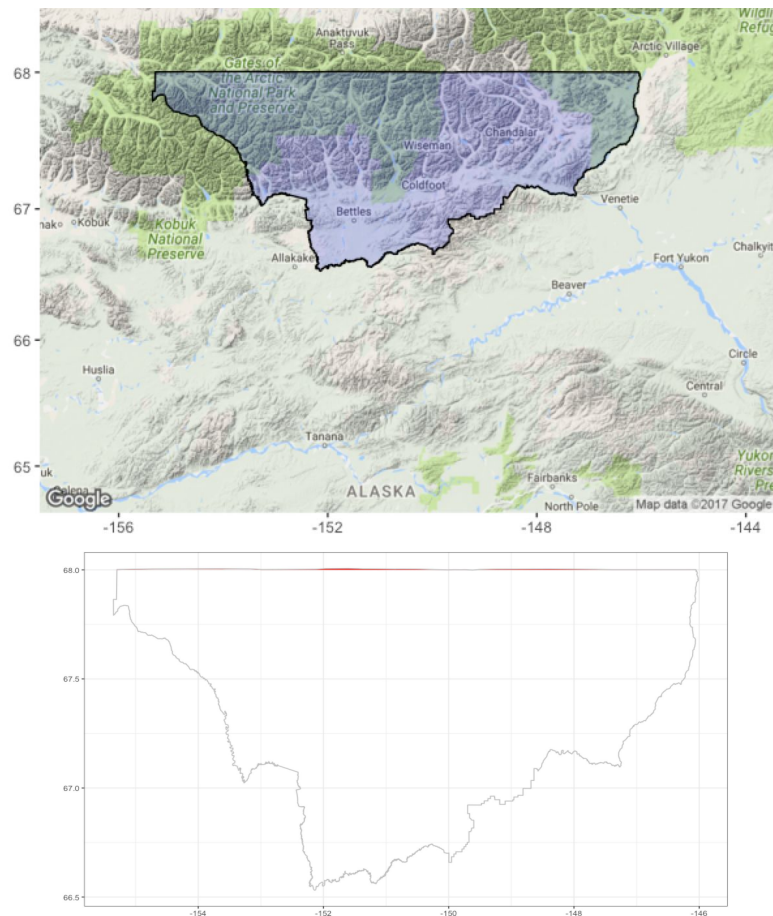8 Precincts have more than 10% area outside the assigned CE

Not perfect...but plenty good enough!

Two examples

Central (Precinct 06-015): 16% outside assigned CE
Natural / meaningful geographic partition (Kandik River)

Bettles (Precinct 40-328): .3% outside assigned CE
Mismatch due to resolution / mapping error

Resources

Notebook: https://rawgit.com/scottcame/elections-analyses/master/CascadiaR-notebook.nb.html
                                    https://github.com/scottcame/elections-analyses (PRs welcome!)

Data for Democracy: http://datafordemocracy.org/

D4D `uselections` package: https://github.com/Data4Democracy/election-transparency/tree/master/r-packages/uselections
                                    AK precinct mapping is in /R/util.R, function `getAlaskaPrecinctCountyMapping()`

D4D ET on data.world: https://data.world/data4democracy/election-transparency

Alaska Elections: http://www.elections.alaska.gov/

Precinct Shapefiles: http://elections.alaska.gov/Core/districtmaps.php

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           @scottcame / @cascadialytics   http://www.cascadia-analytics.com