

# Purple America

**KEVIN WAYNE**

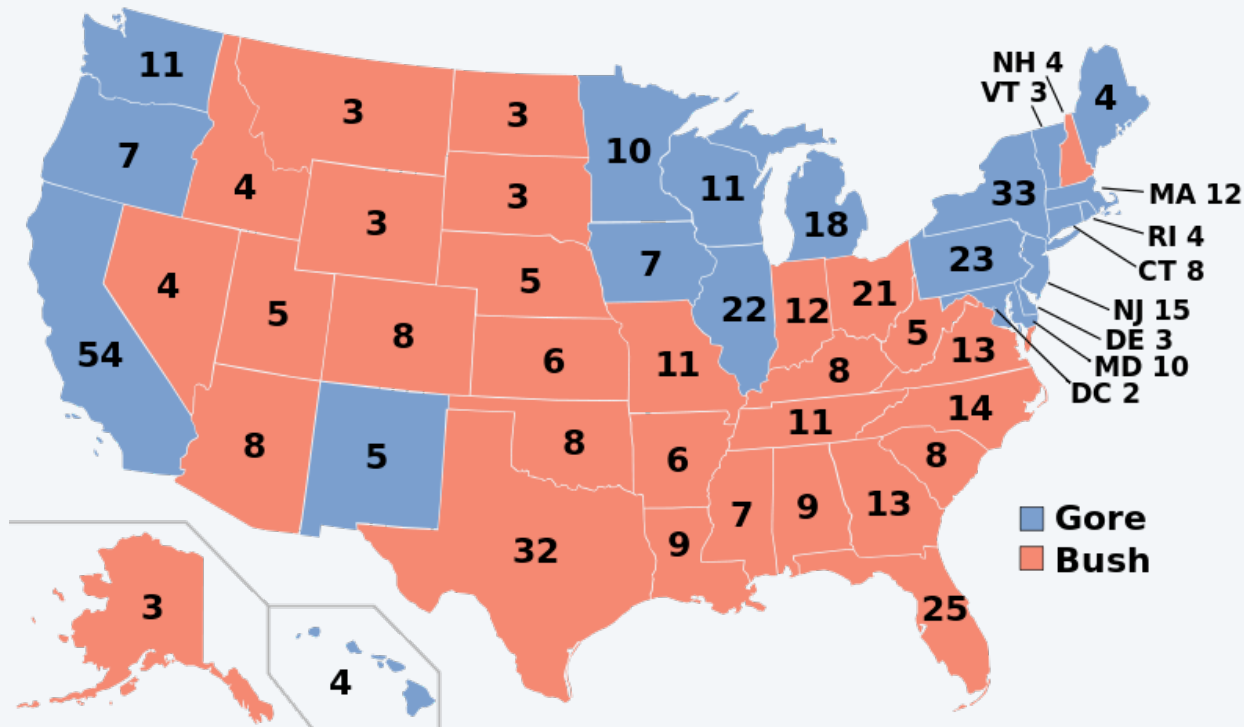


**PRINCETON  
UNIVERSITY**

# Red states, blue states

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**Goal.** Write program to visualize presidential election results.



Tim Russert  
Meet the Press  
(2000)

intended: late CS 1

concepts: data visualization, OOP, map data type

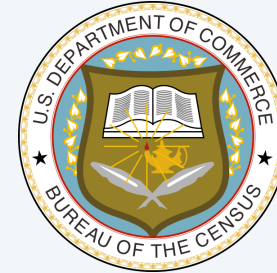
requirements: filled-polygon primitive

## Step 0. Collect the data (optional)

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**Geometric data.** [www.census.gov/tiger/boundary](http://www.census.gov/tiger/boundary)

- Text files encode geographic information.
- Format useful for programmers.



**Election returns.** [www.uselectionatlas.org](http://www.uselectionatlas.org)

- Web site displays election results.
- Screen scrape to extract raw data.



irony

# Step 1. Process the geometric data

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State names and boundary points.

% more USA.txt

Alabama

498

-88.200027 34.995548

-88.202919 35.007942

⋮

Georgia

1363

-84.321953 34.988327

-84.129639 34.987423

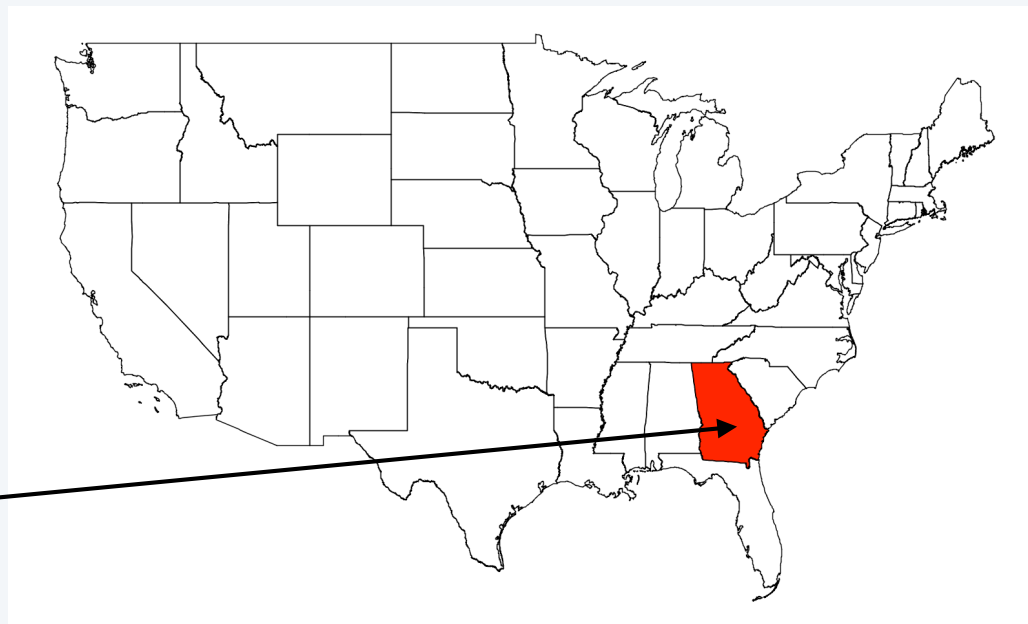
-84.005501 34.987251

⋮

-84.621552 34.988251

**1363 points**  
**(longitude, latitude)**

⋮





## Step 2. Process the election return data

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Votes for Romney, Obama, and other, by state.

% more USA2012.txt

Alabama,1255925,795696,22717

Alaska,164676,122640,13179

Arizona,1233654,1025232,47673

Arkansas,647744,394409,27315

⋮

Georgia,2078688,1773827,55854

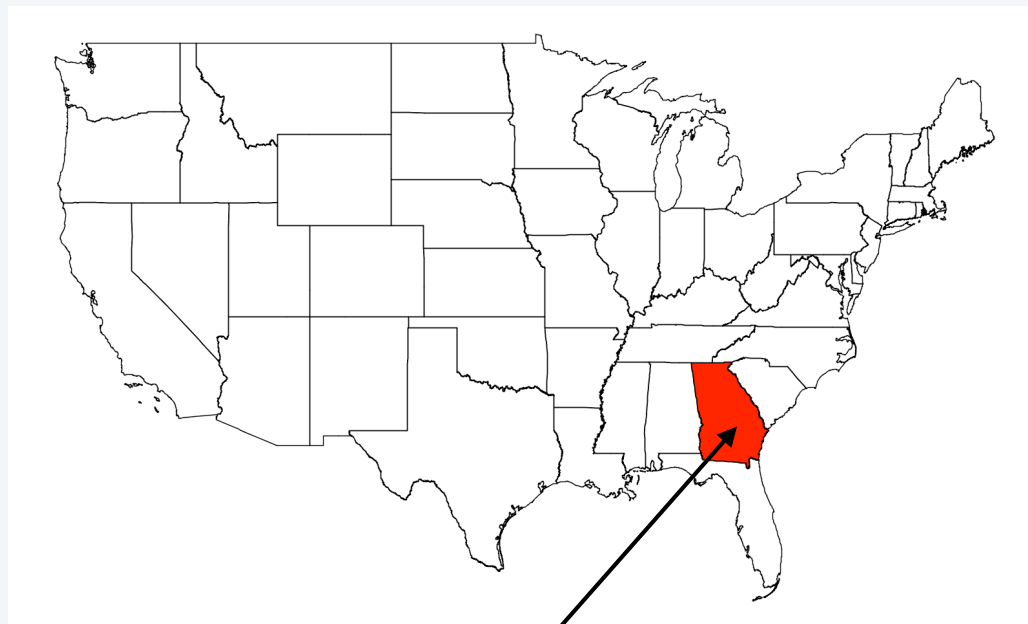
⋮

Washington,1290670,1755396,99892

West Virginia,417655,238269,14743

Wisconsin,1407966,1620985,39483

Wyoming,170962,69286,8813



2,078,688 Romney

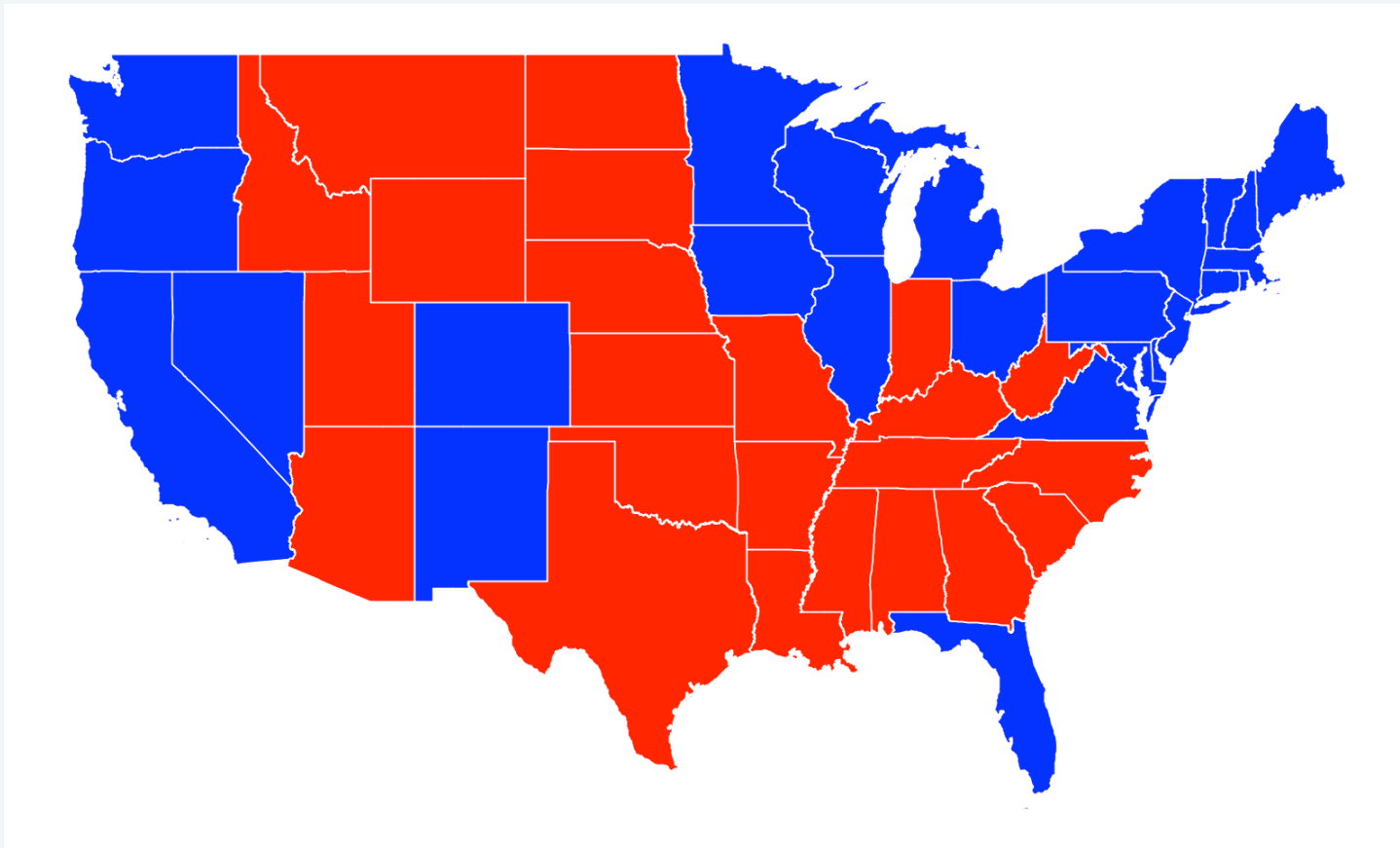
1,773,827 Obama

55,854 Other

## Step 3. Plot the results

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Red states, blue states. Pretty picture.



Visualization bug. Misleading and polarizing picture.

# Purple America

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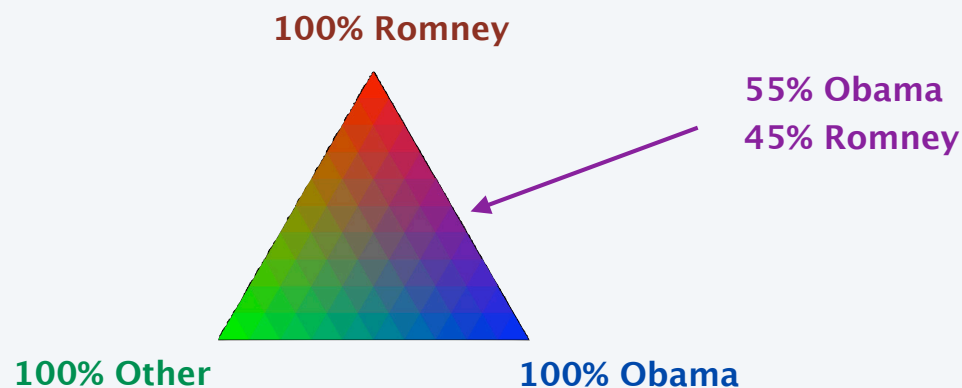
**Key idea.** Assign color based on number of votes.

- $a_1$  = Romney votes.
- $a_2$  = Other votes.
- $a_3$  = Obama votes.



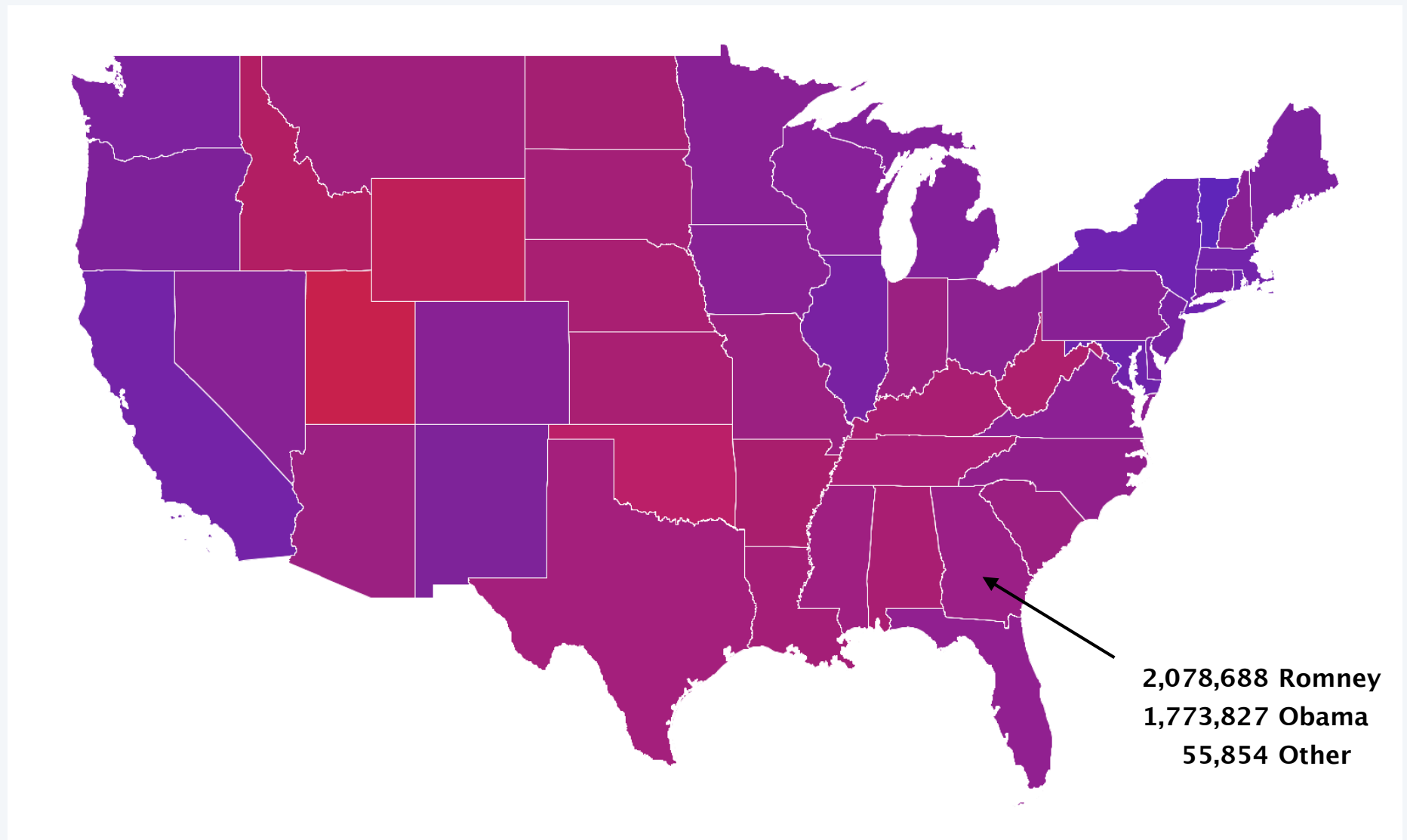
**Bob Vanderbei**  
Princeton University

$$(R, G, B) = \left( \frac{a_1}{a_1 + a_2 + a_3}, \frac{a_2}{a_1 + a_2 + a_3}, \frac{a_3}{a_1 + a_2 + a_3} \right)$$



# Purple America

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# More data

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Geometric data by county. County names and boundary points.

% more GA.txt

Rabun

162

-83.483398 34.993198

-83.108665 35.000683

⋮

Fulton

149

-84.418999 34.073200

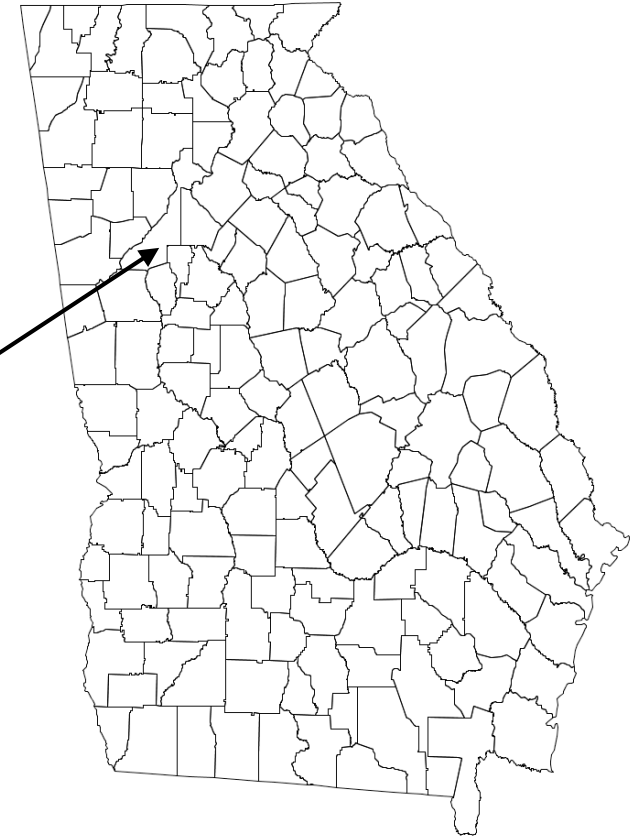
-84.418503 34.108799

-84.414597 34.110100

⋮

-84.418404 34.052898

149 points  
(longitude, latitude)



# Thirst for more data

---

Election results by county. County names and votes for each candidate.

% more GA2012.txt

Appling,5233,1758,102

Atkinson,1938,930,39

Bacon,3093,791,52

Baker,785,794,12

Baldwin,7589,8483,198

Banks,5354,780,70,

Barrow,18725,6028,517,

:

Fulton,137124,255470,5752

:

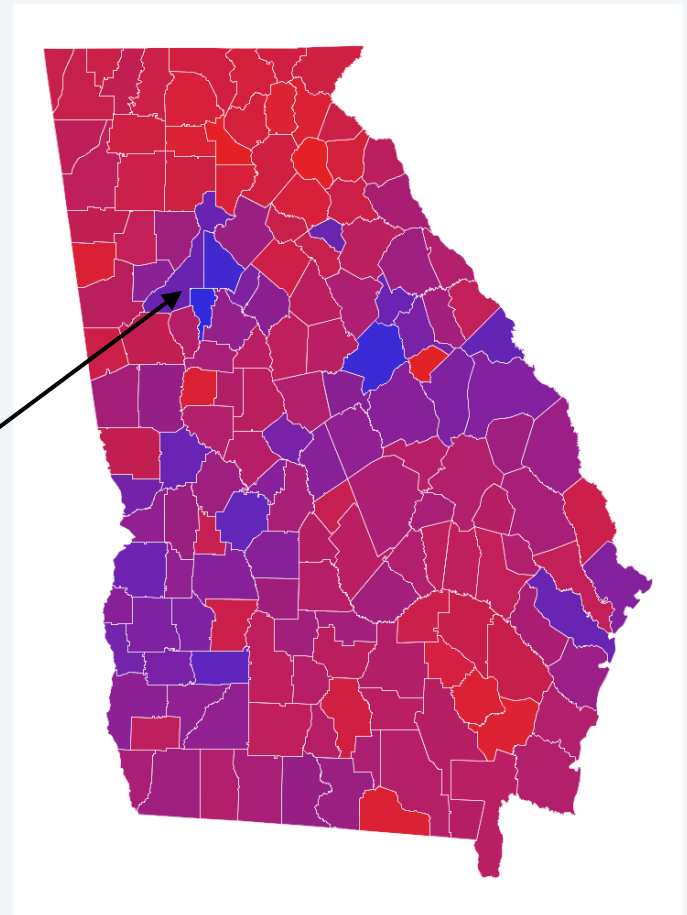
Wilkinson,2246,2181,29

Worth,5869,2487,80

137,124 Romney

255,470 Obama

5,752 Other



# Thirst for more data

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Election results by county. County names and votes for each candidate.

% more GA1968.txt

Appling,795,760,2678,

Atkinson,288,686,1554,

Bacon,586,279,1935,

Baker,99,548,1067,

Baldwin,2318,2109,2678,

Banks,398,296,1434,

Barrow,1372,1070,2731,

:

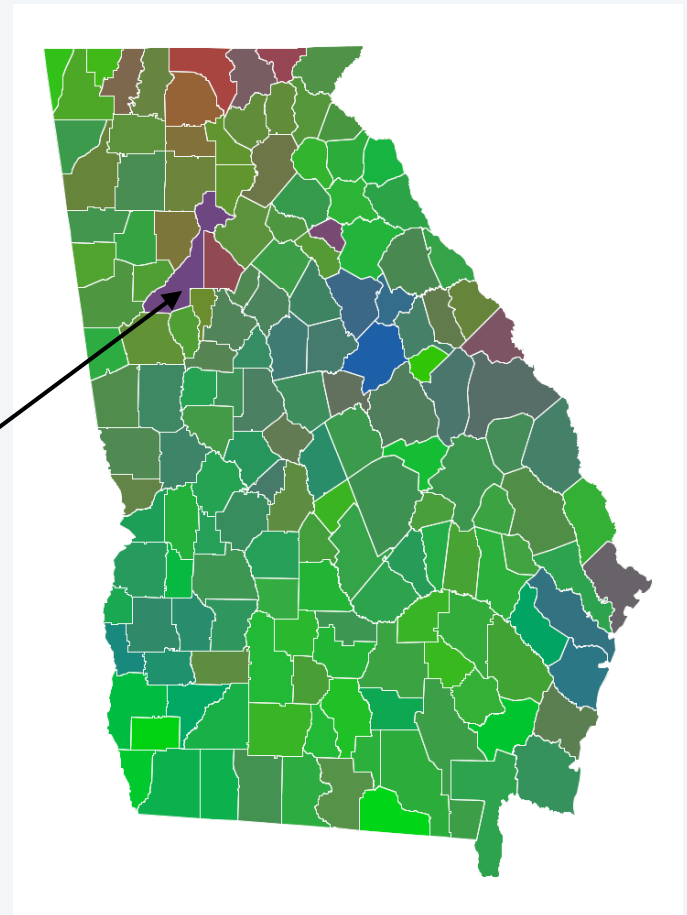
64,153 Nixon  
77,847 Humphrey  
36,995 Wallace

Fulton,64153,77847,36995,

:

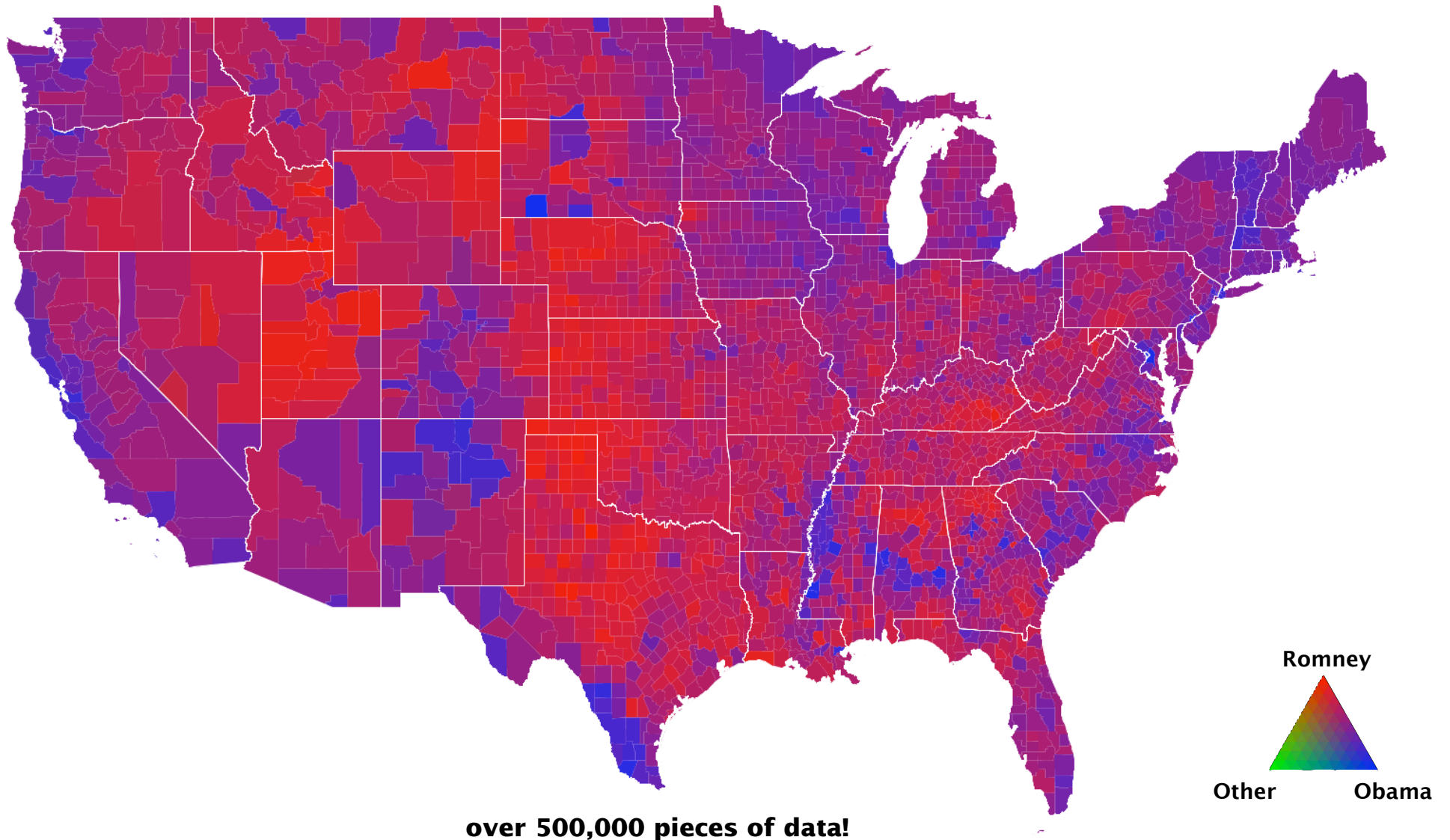
Wilkinson,685,829,1870,

Worth,603,719,3049,



# Purple America: 2012 Presidential Election

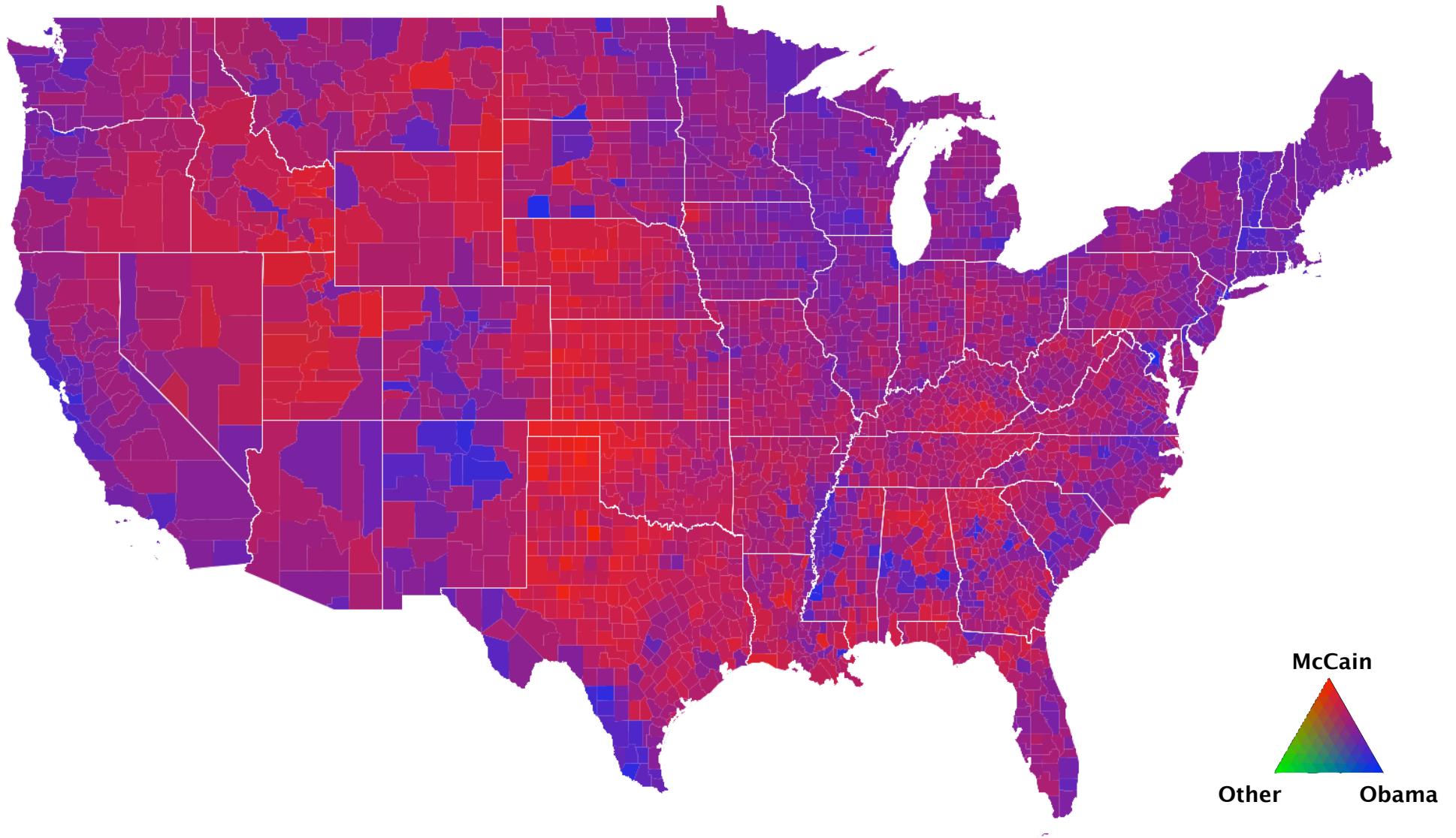
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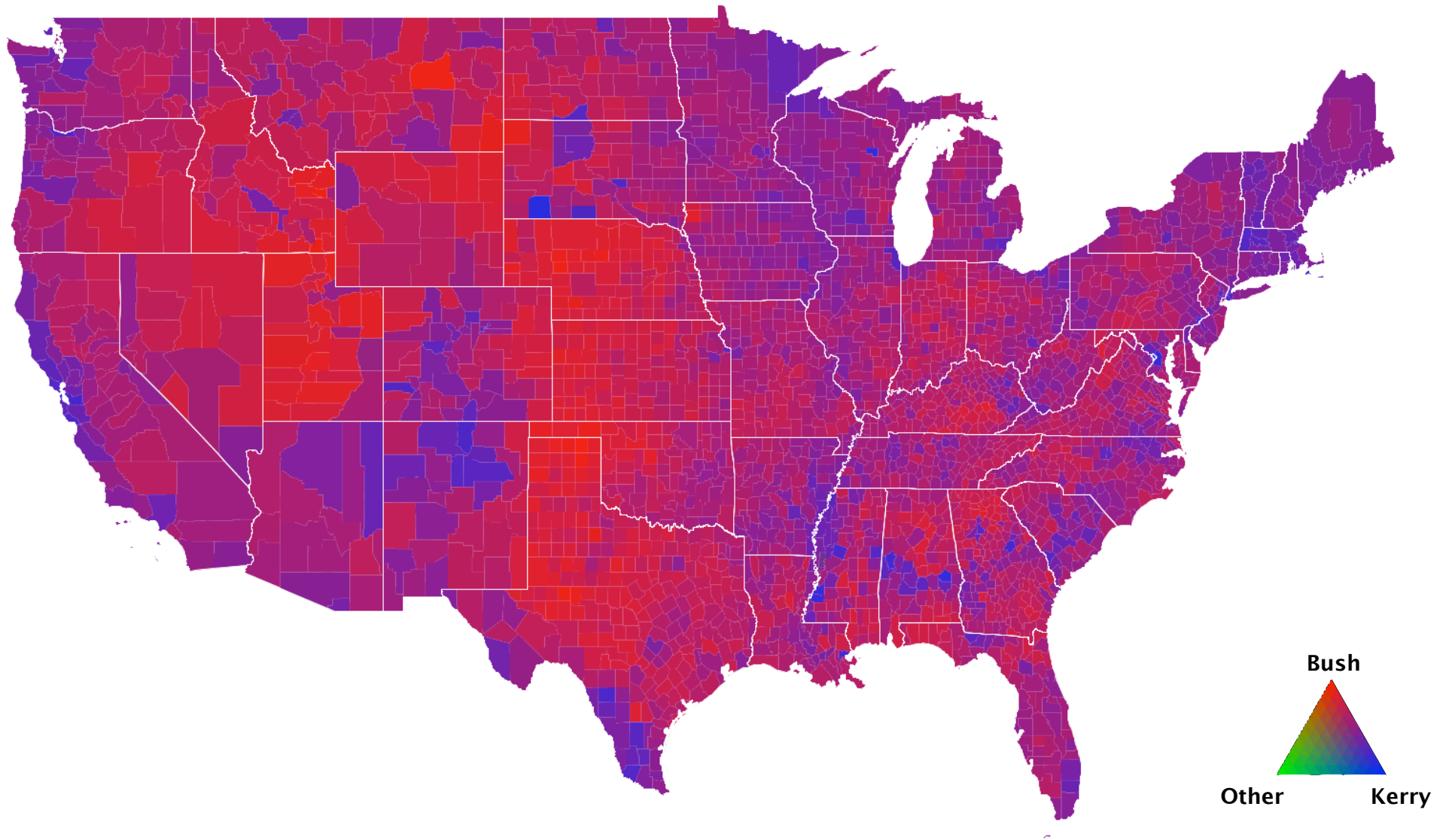
# Purple America: 2008 Presidential Election

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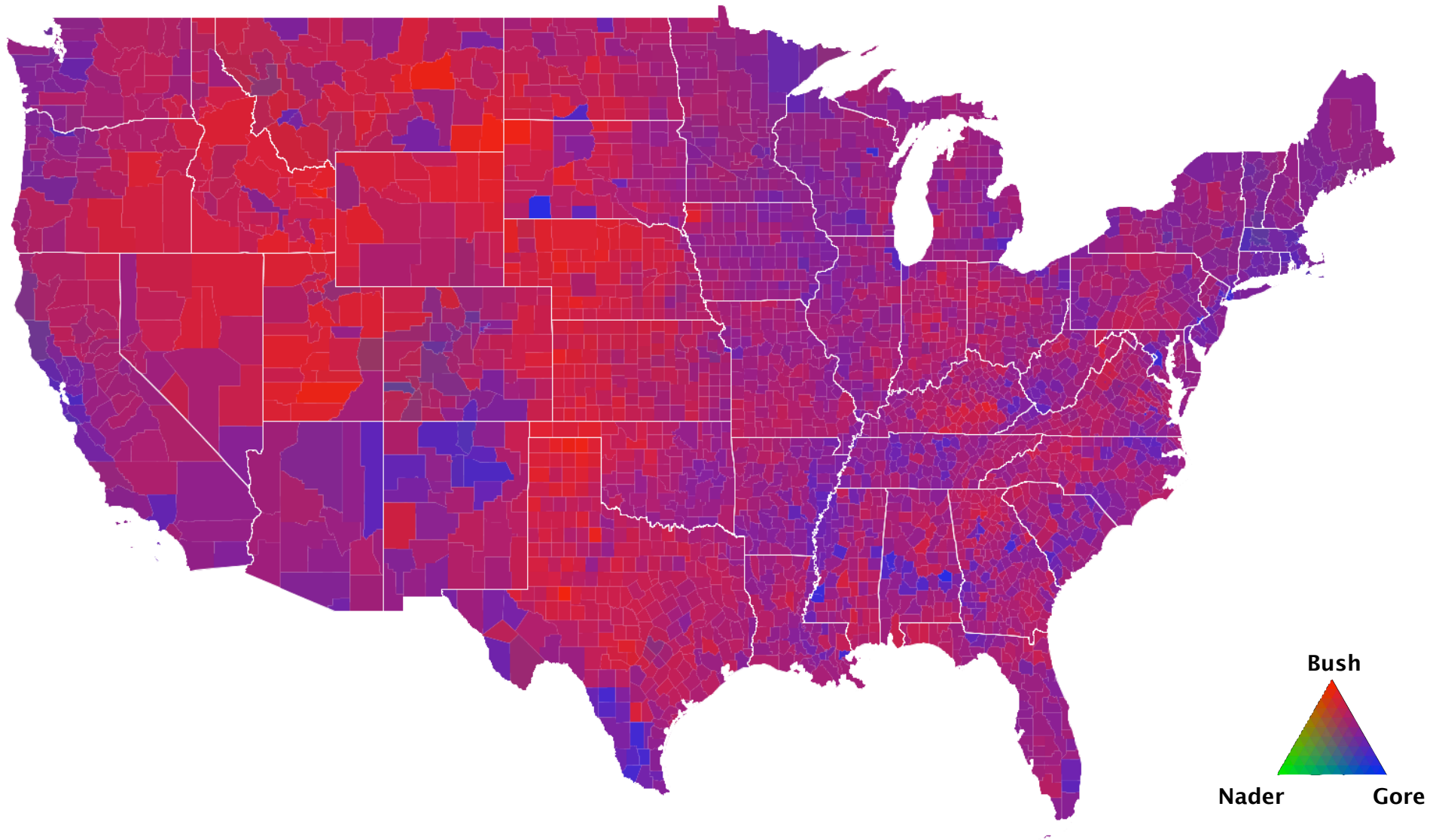
# Purple America: 2004 Presidential Election

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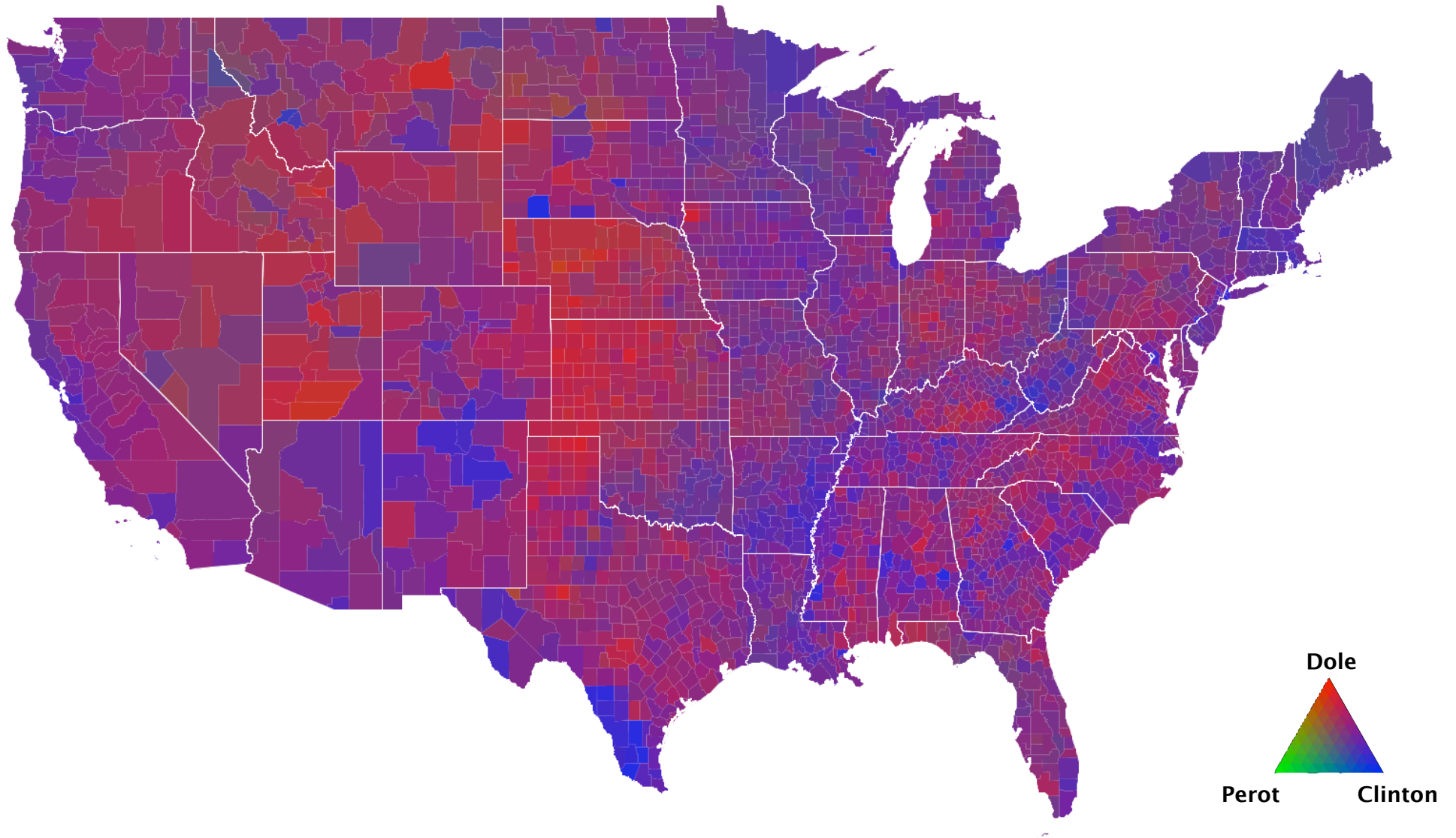
# Purple America: 2000 Presidential Election

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# Purple America: 1996 Presidential Election

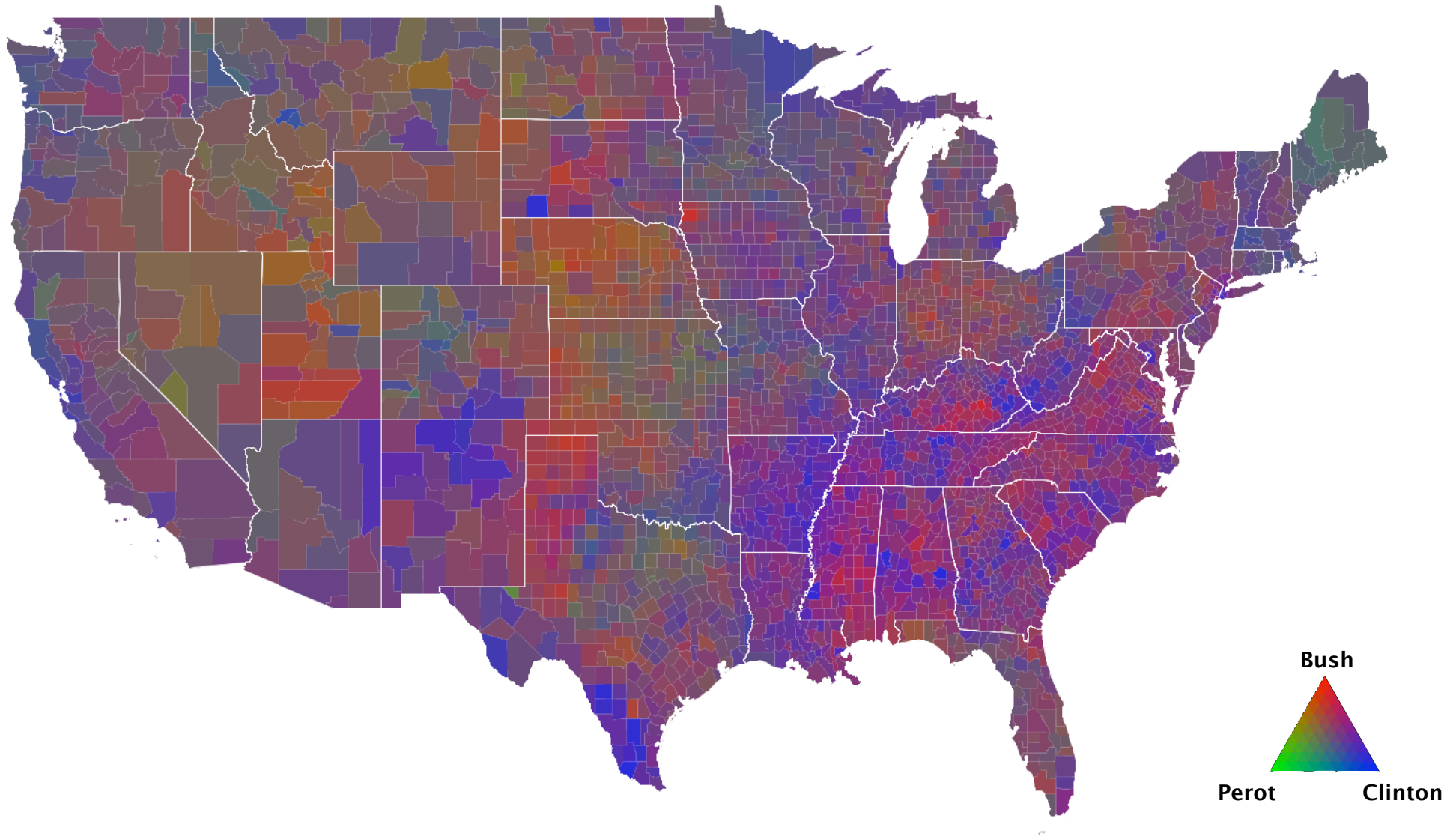
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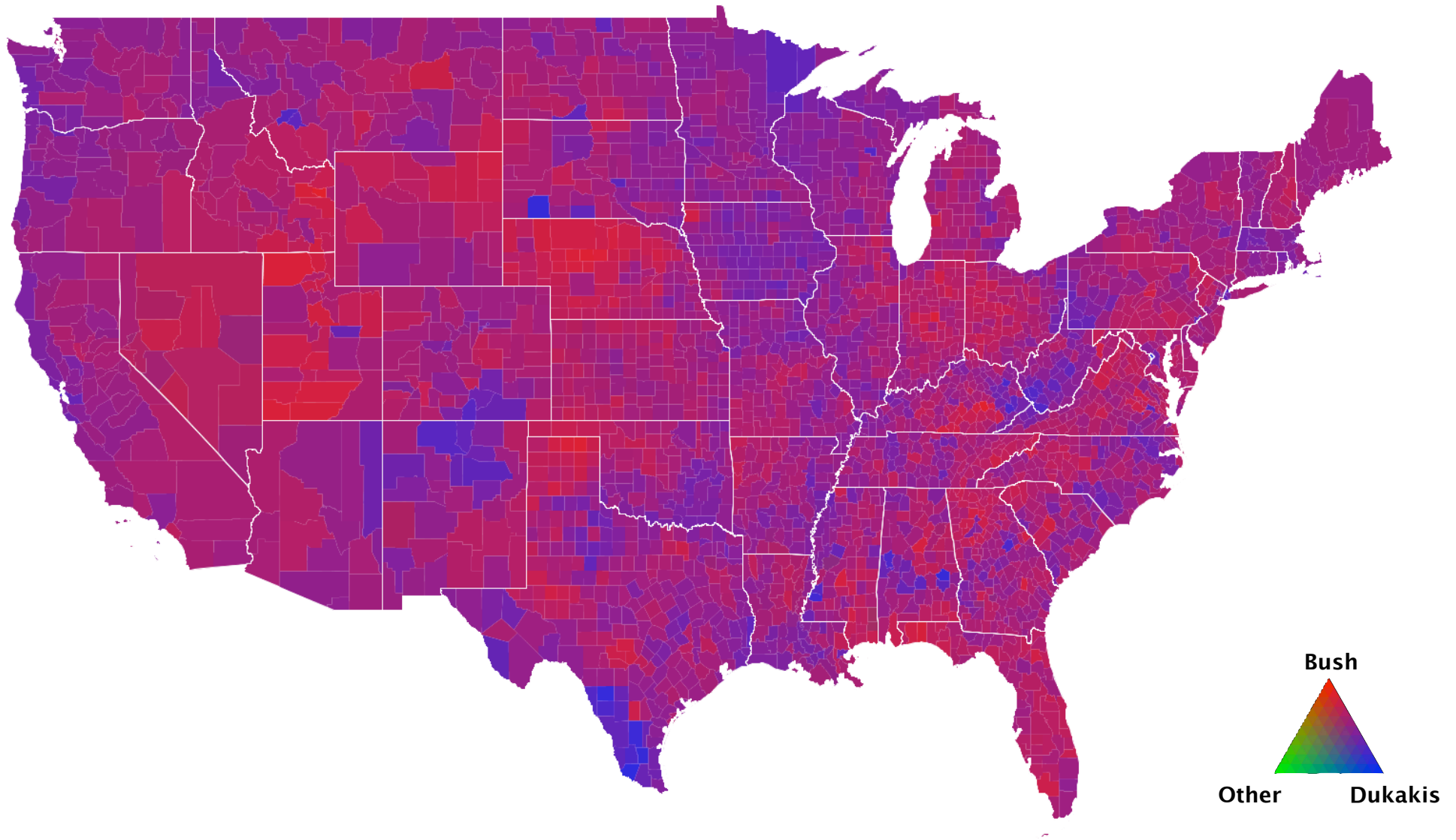
# Purple America: 1992 Presidential Election

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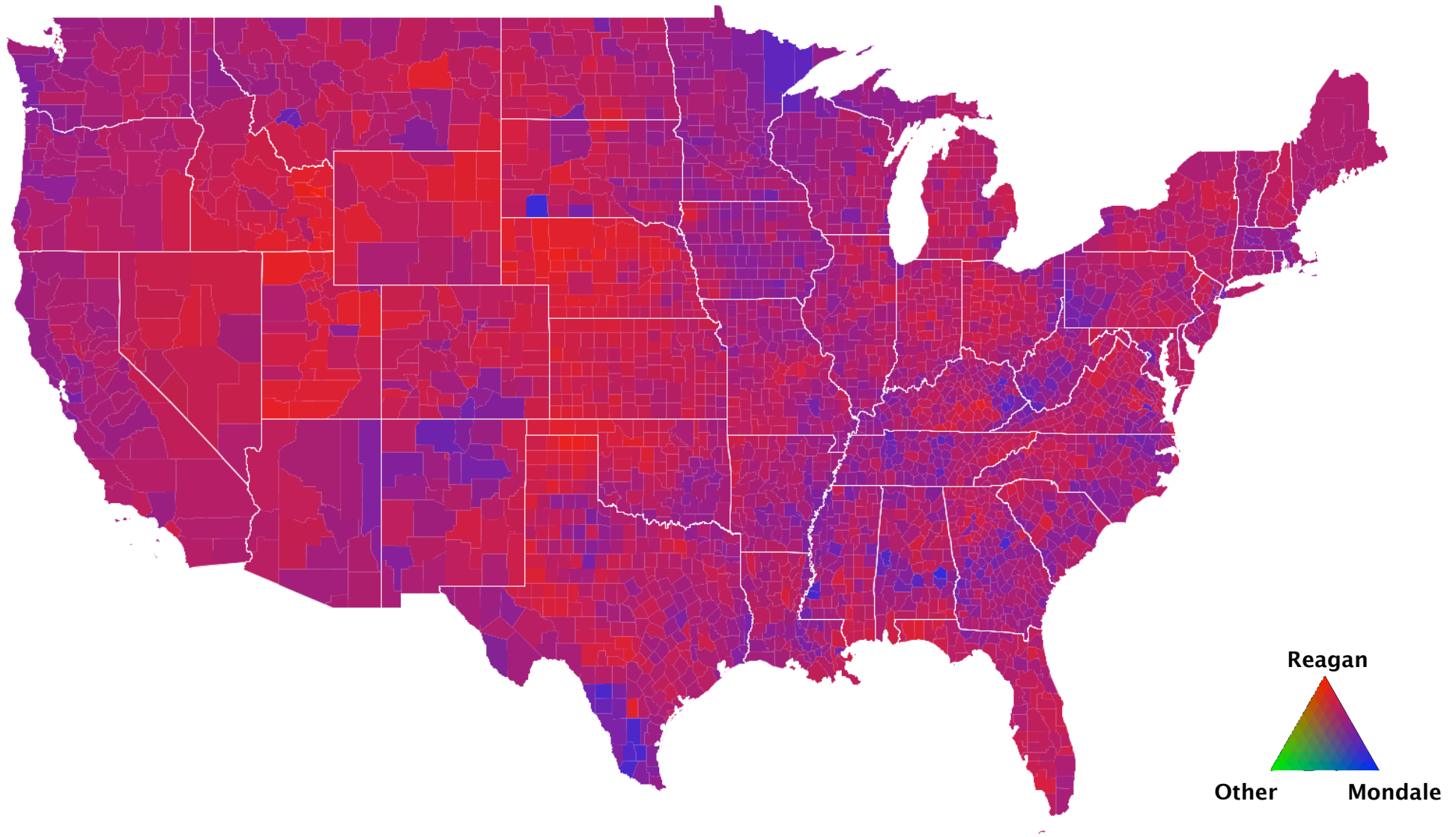
# Purple America: 1988 Presidential Election

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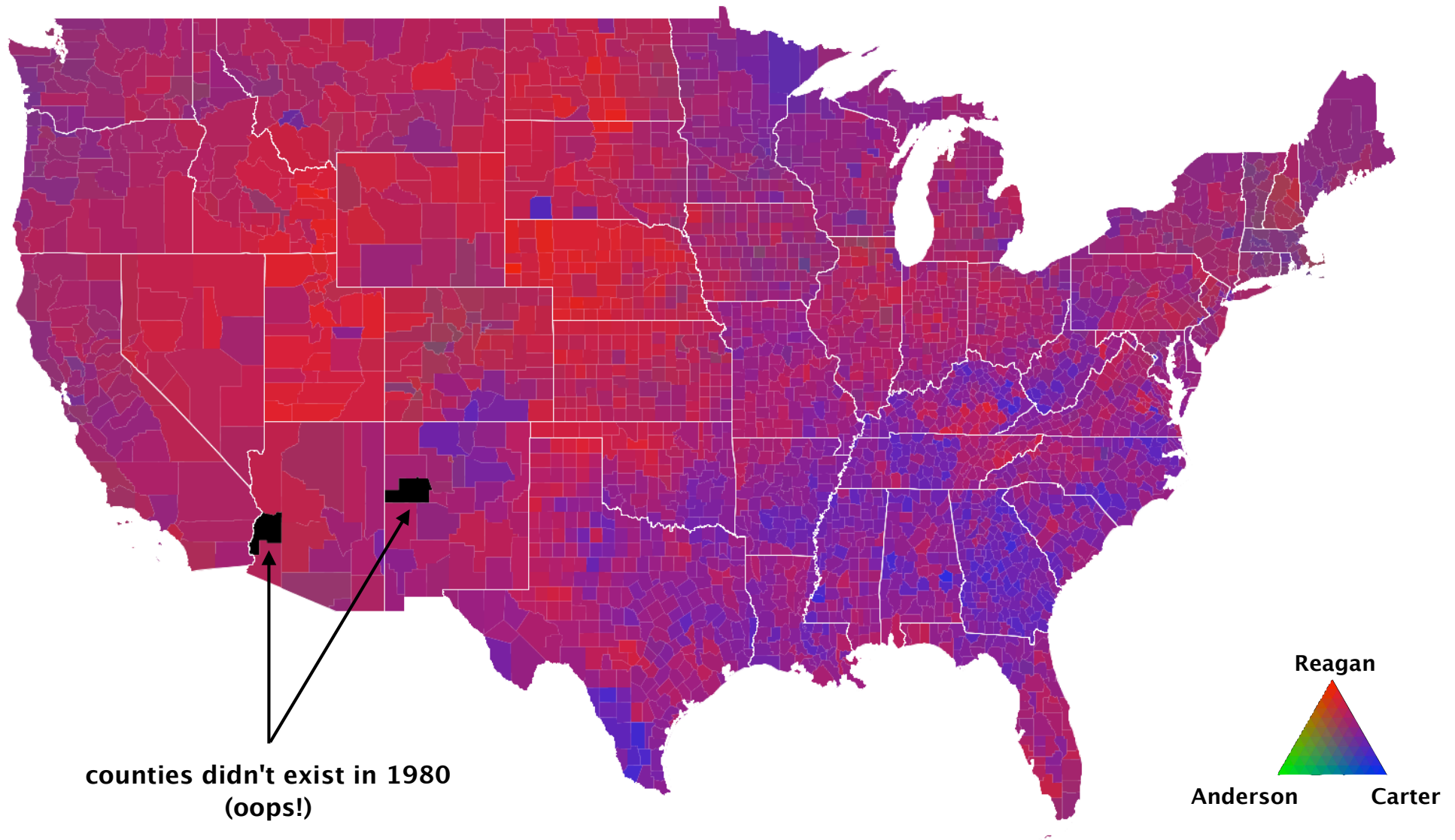
# Purple America: 1984 Presidential Election

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# Purple America: 1980 Presidential Election

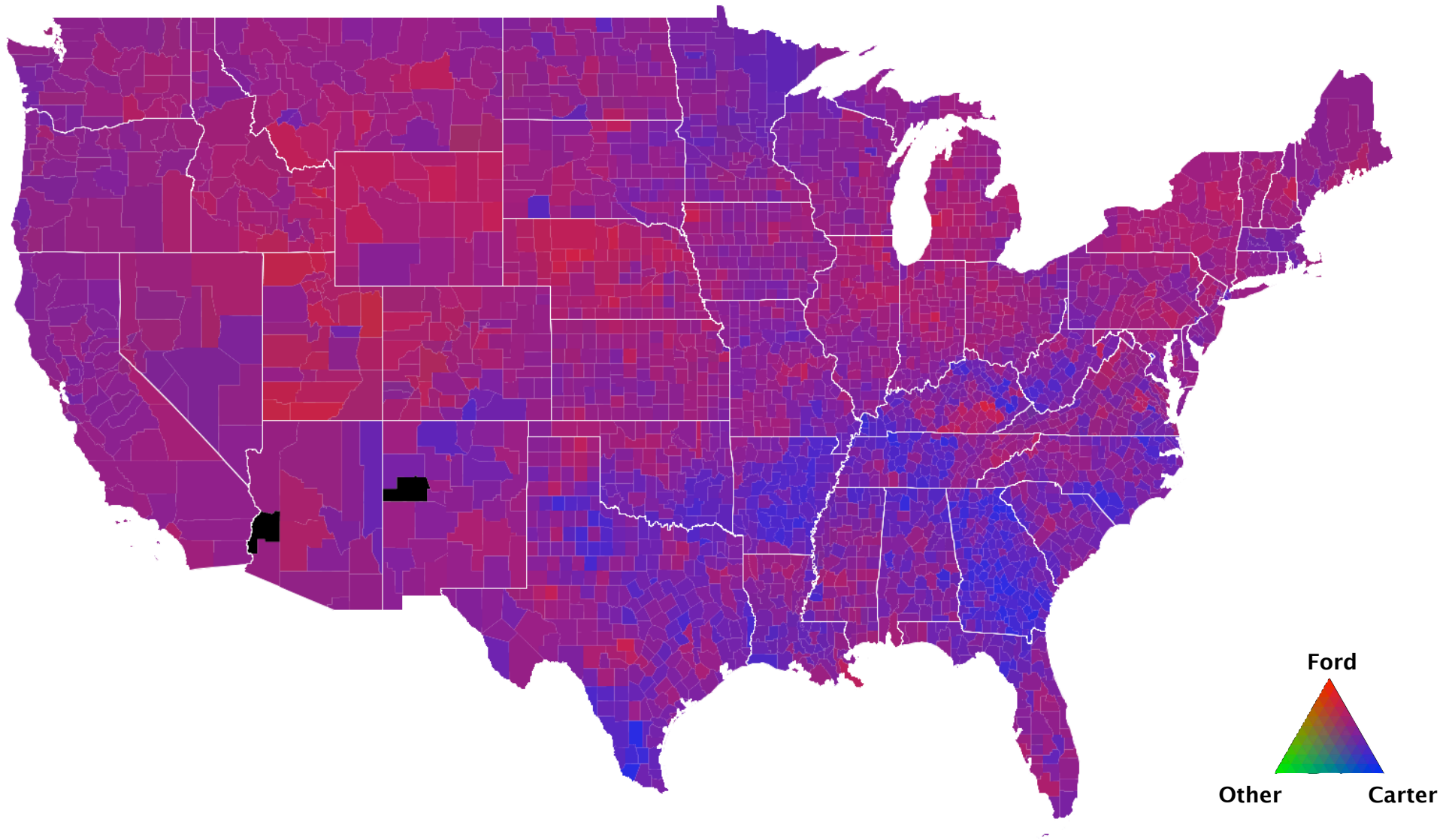
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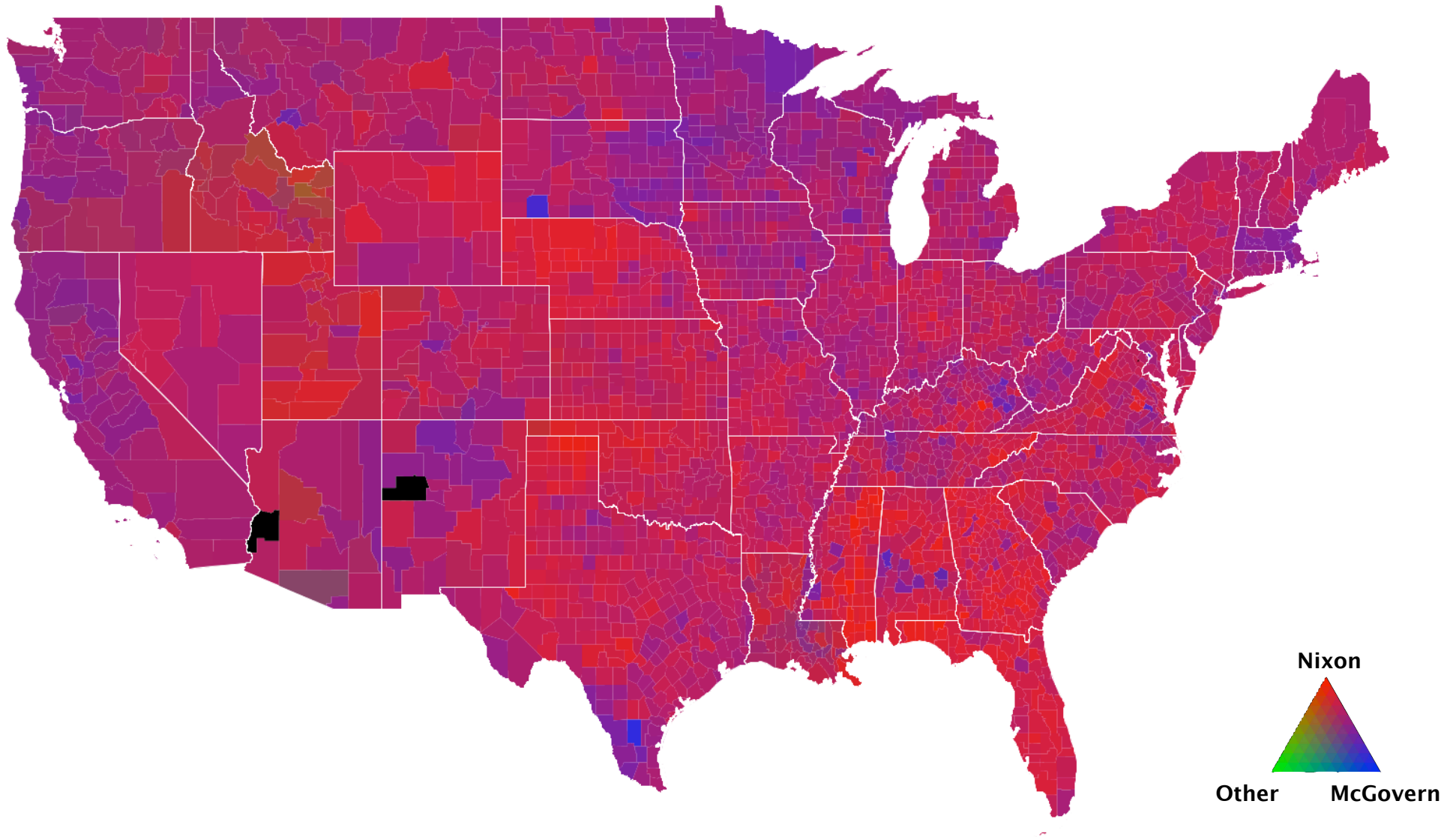
# Purple America: 1976 Presidential Election

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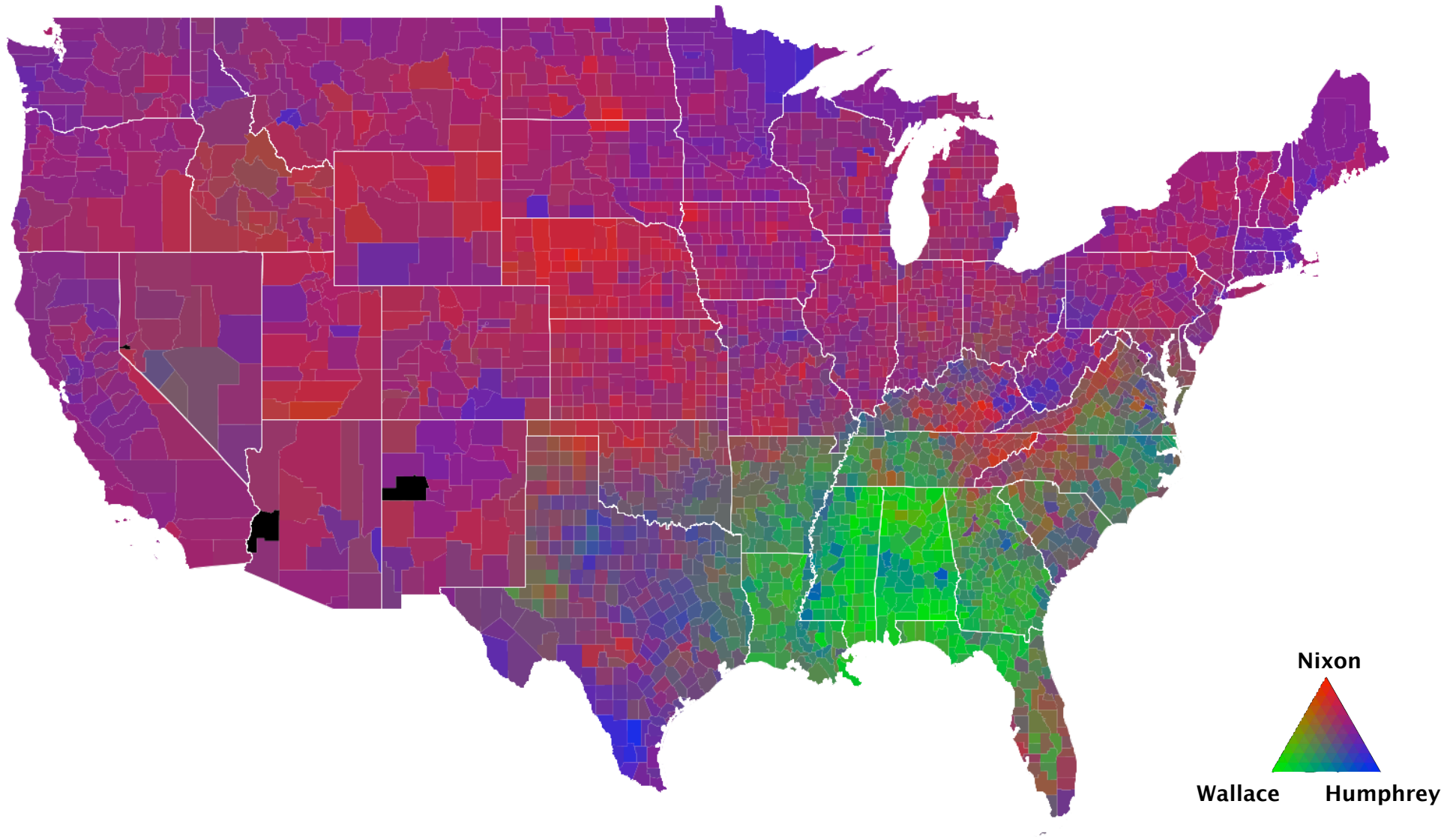
# Purple America: 1972 Presidential Election

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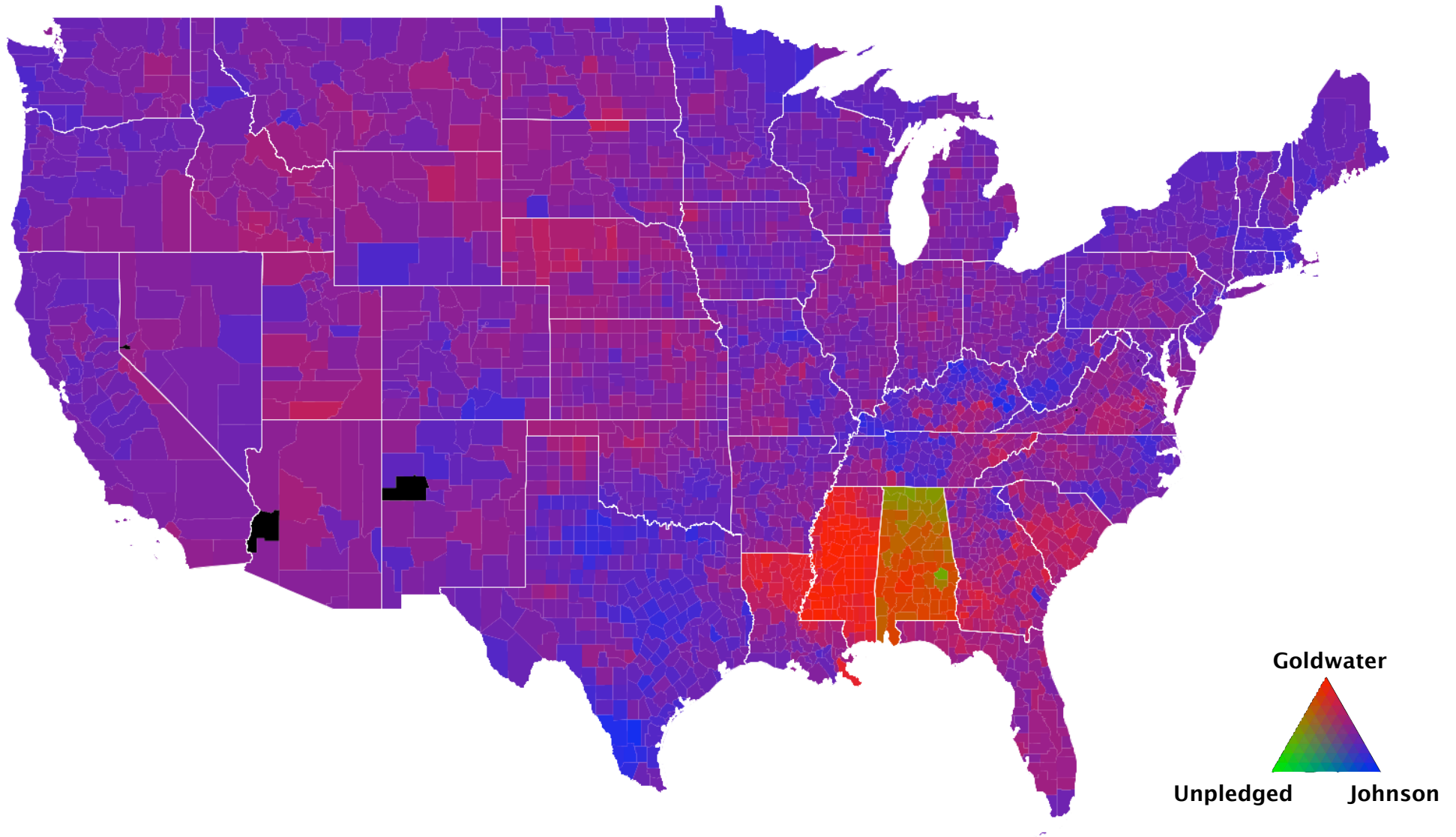
# Purple America: 1968 Presidential Election

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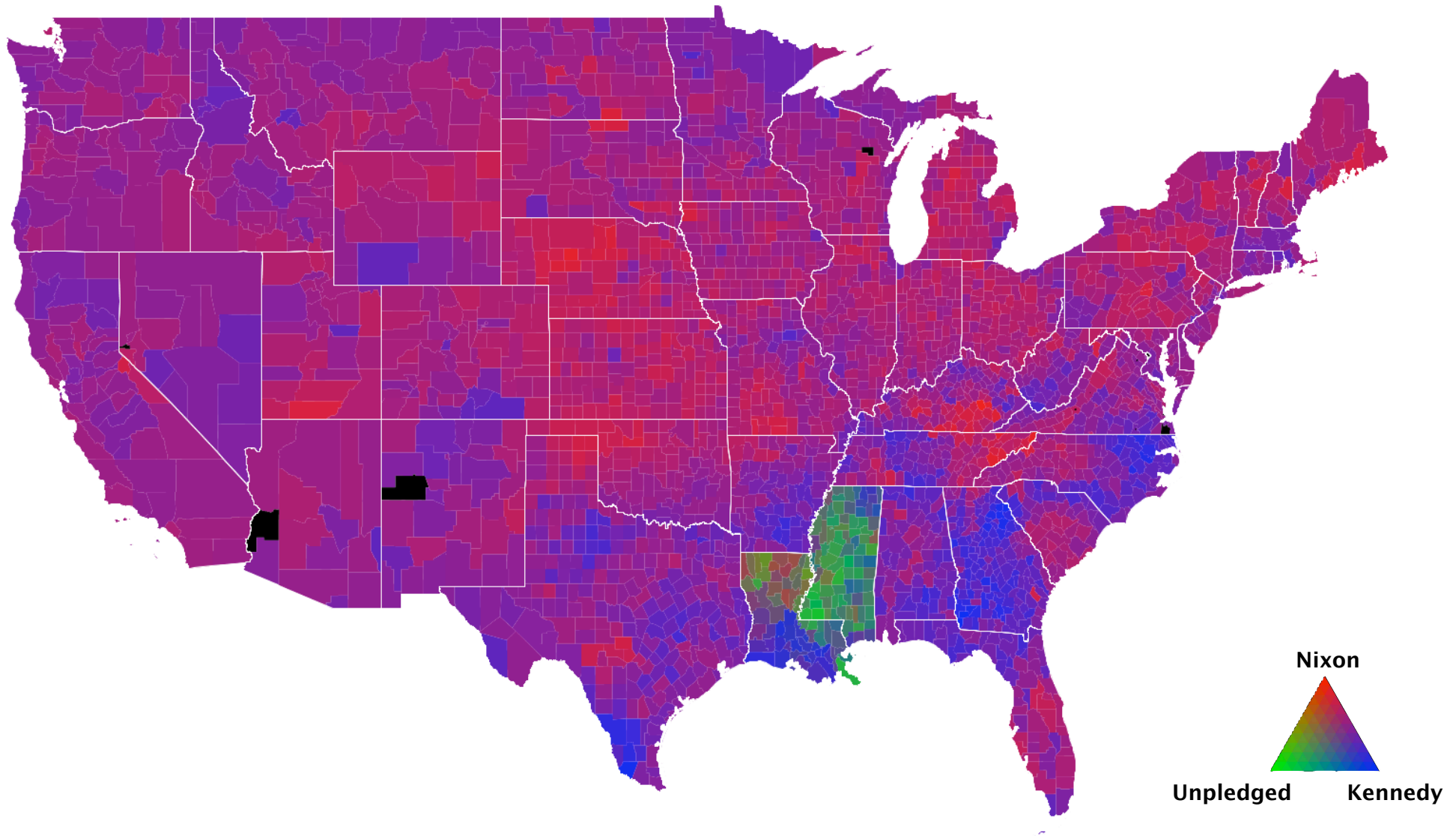
# Purple America: 1964 Presidential Election

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# Purple America: 1960 Presidential Election

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# Why nifty?

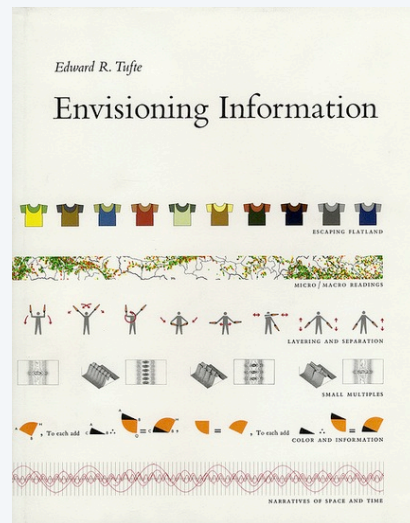
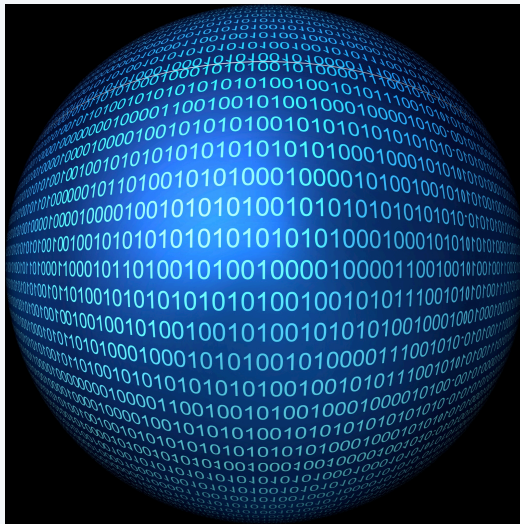
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Real data: Motivates and excites students.

Data visualization: Communicates data in clear and engaging manner.

History: Captures changing colors of America.

Open ended...

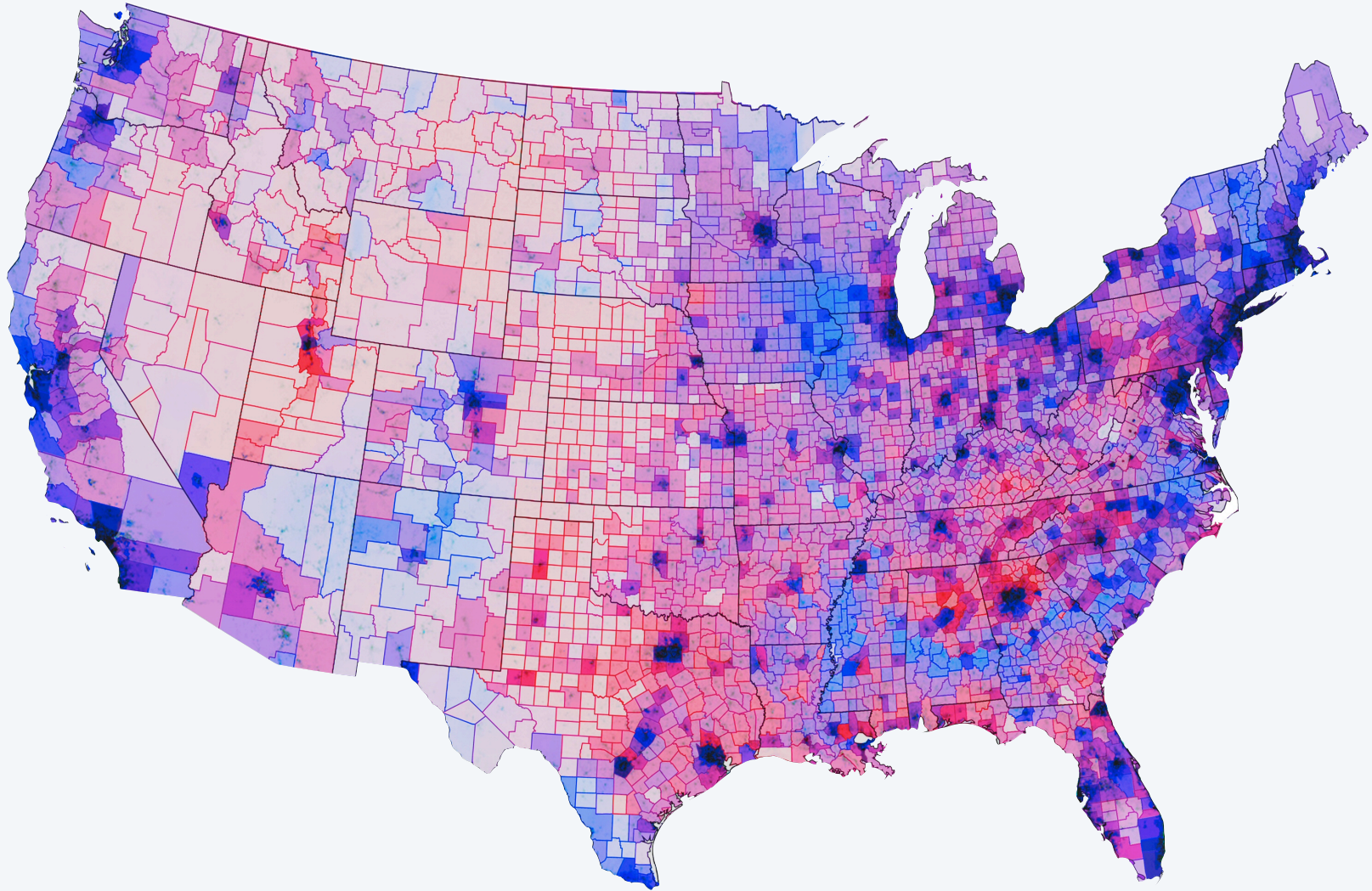


# Opportunities for creativity, enrichment, and inspiration

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Colors. Explore different color palettes.

How? Lookup table.

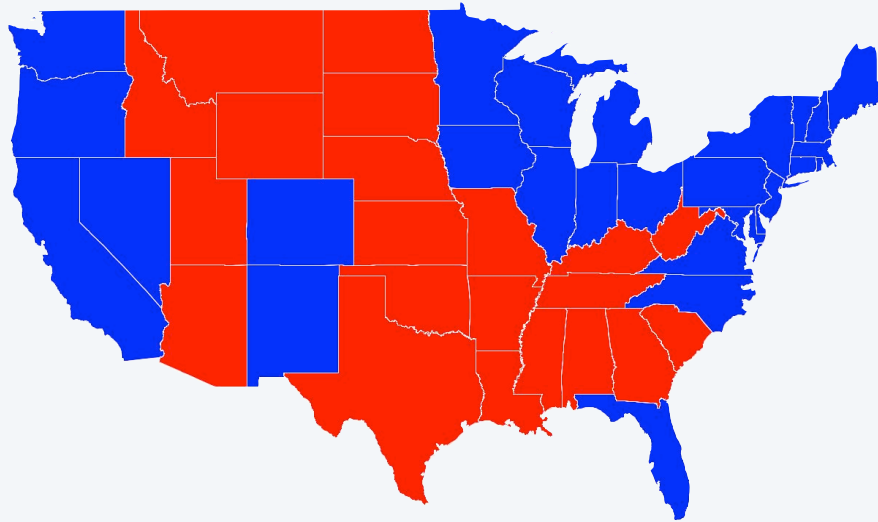


## Opportunities for creativity, enrichment, and inspiration

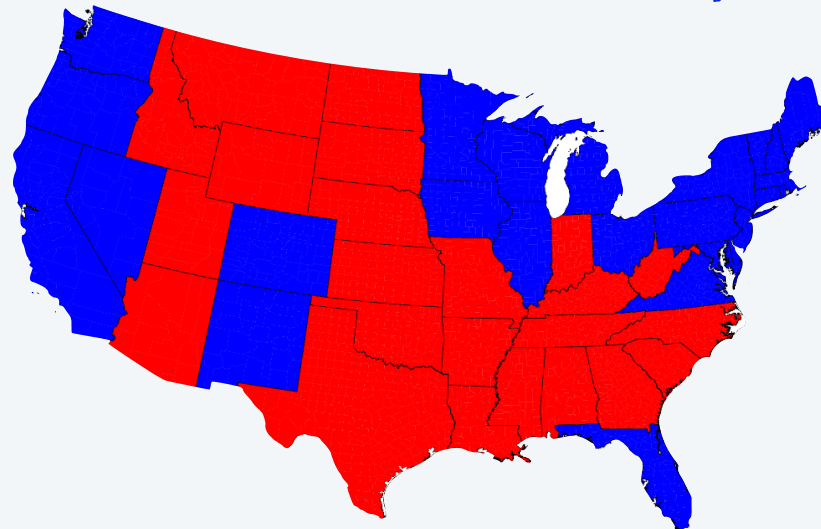
**Map projections.** Mercator, azimuthal, Albers, Gall-Peters, ...

How? Spherical geometry.

**unprojected**



## Mercator projection

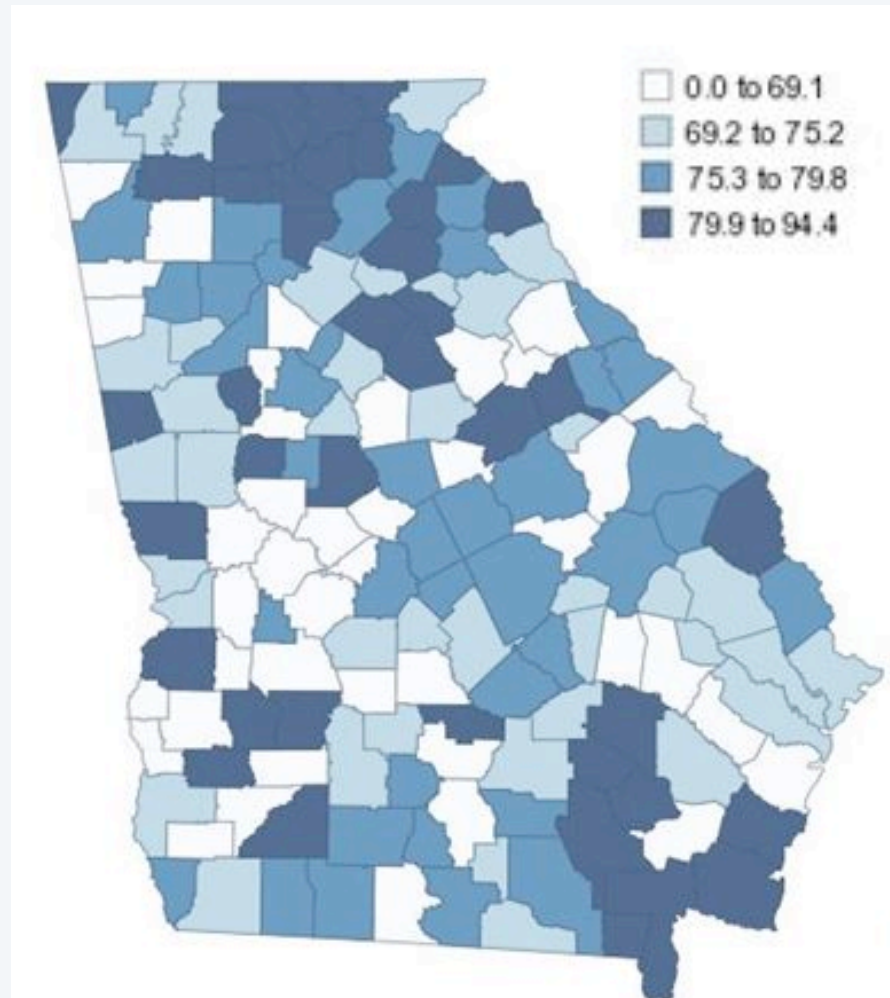




# Opportunities for creativity, enrichment, and inspiration

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Use different data sets. High-school graduation rates by county.  
How? Screen-scrape (and scrub) data.

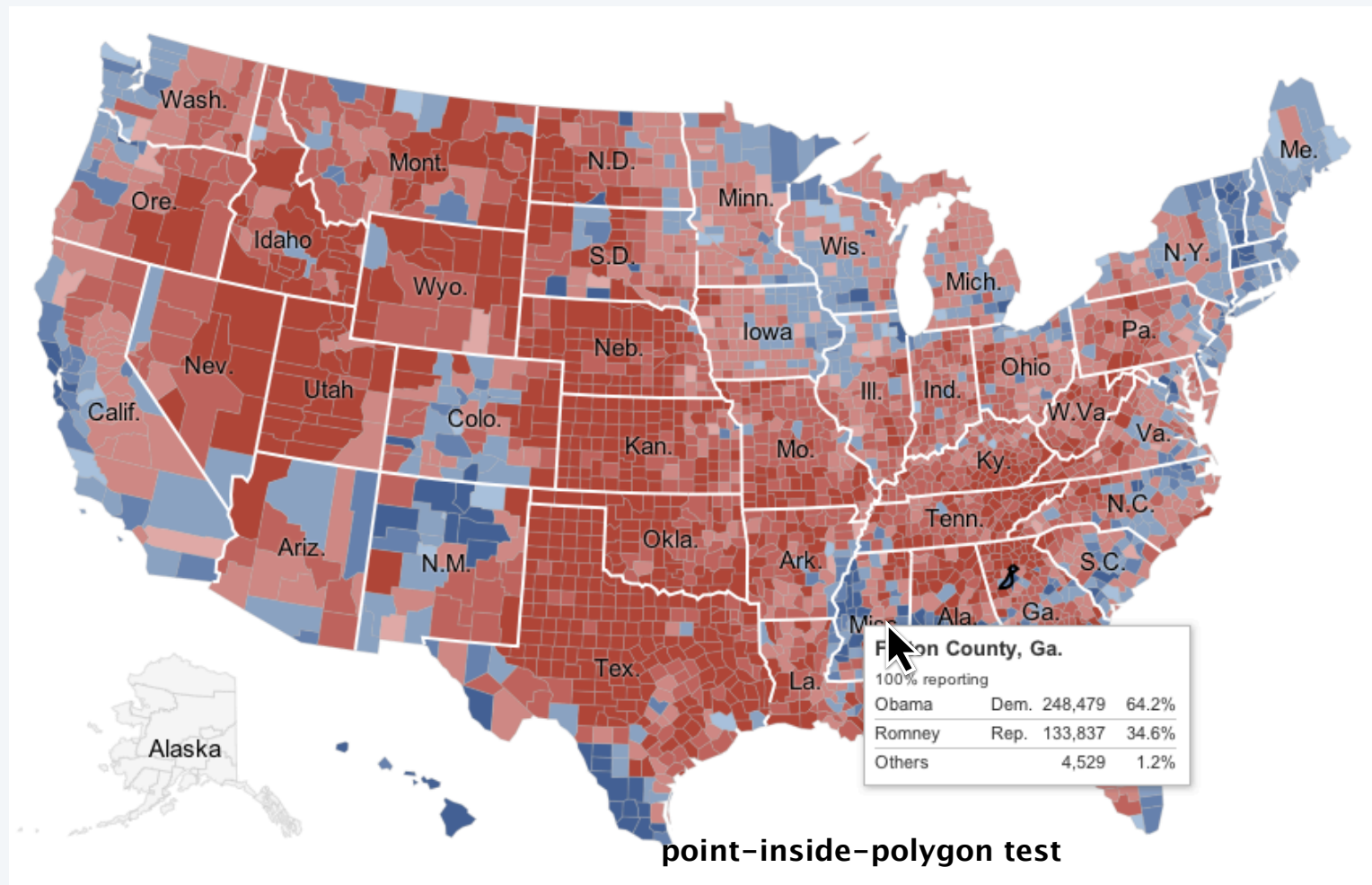


# Opportunities for creativity, enrichment, and inspiration

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Add a GUI. As user hovers over county, display election results.

How? Point-inside-polygon, GUI widgets.



<http://elections.nytimes.com/2012/results/president>