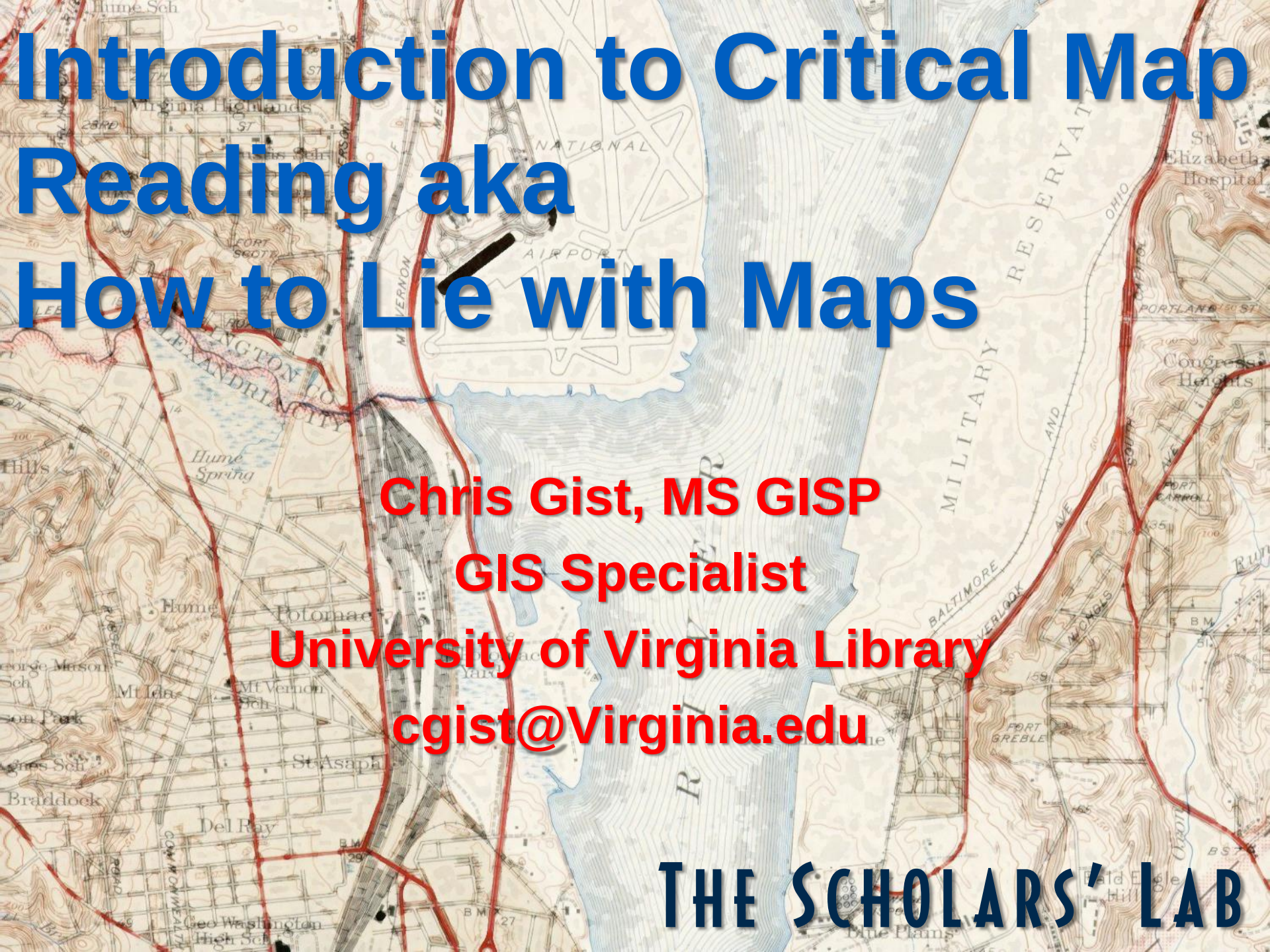


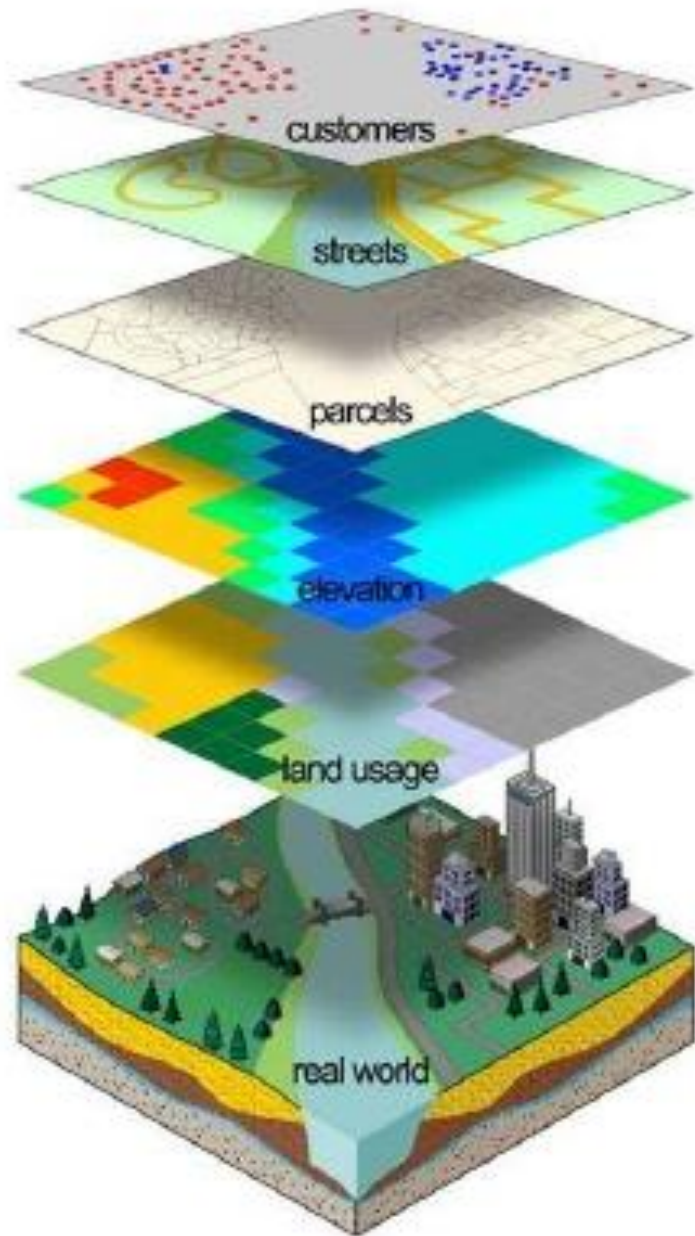


Introduction to Critical Map Reading aka How to Lie with Maps

**Chris Gist, MS GISP
GIS Specialist
University of Virginia Library
cgist@Virginia.edu**

THE SCHOLARS' LAB

What is GIS?



- A technology
Hardware, software & analysis tools
- An information handling strategy
- The objective: to improve overall decision making by visualizing data and seeing new patterns.

What makes data spatial?

Grid coordinates

Place name

Latitude / Longitude



**Government
Geographies**

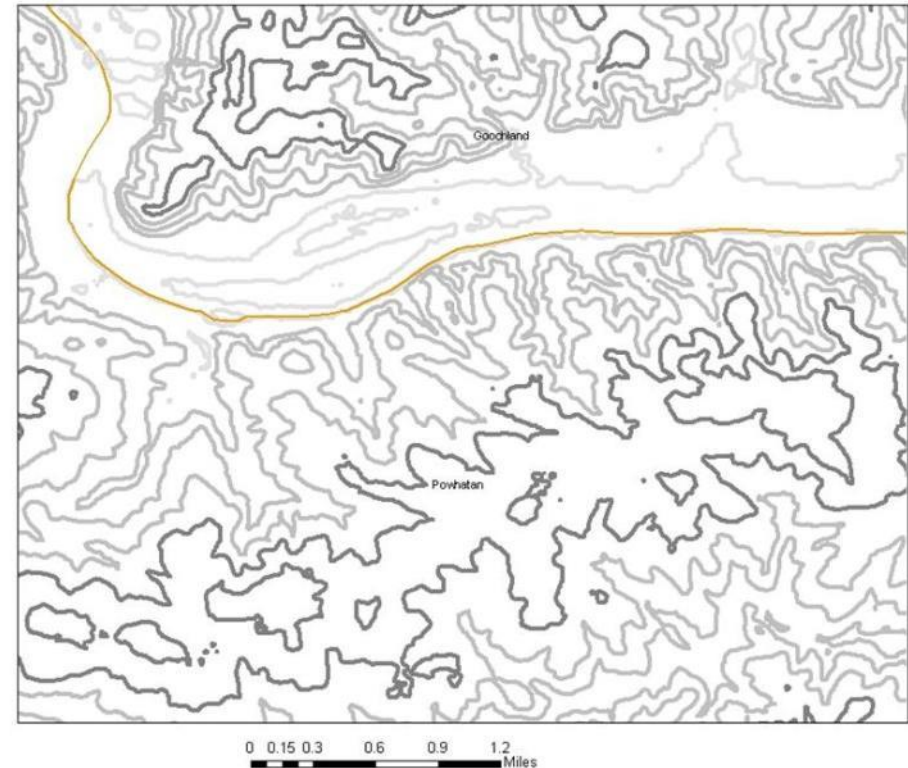
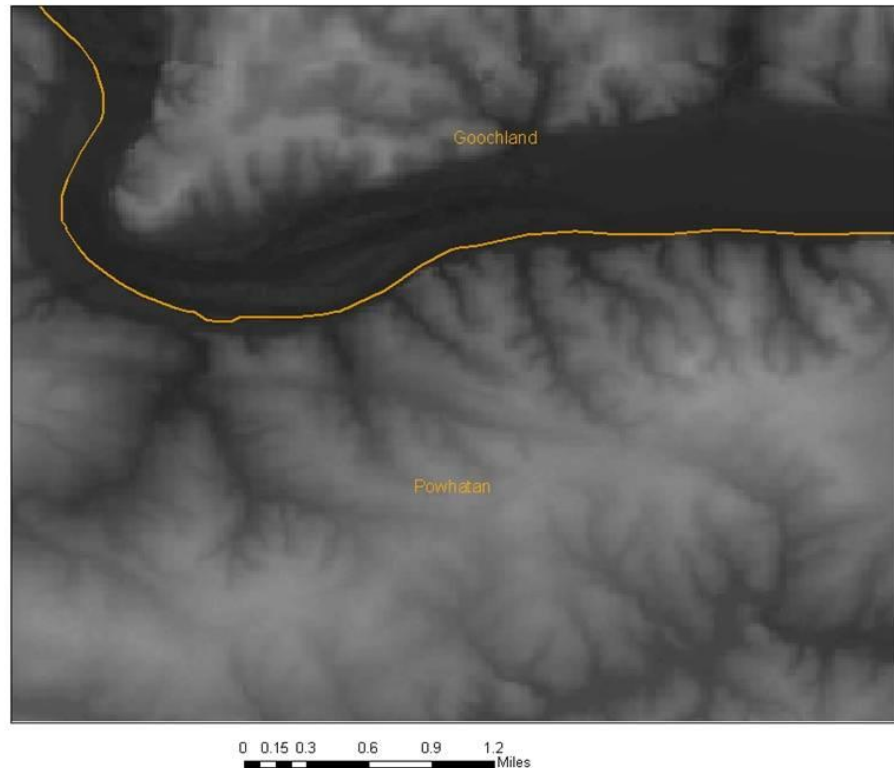
Real world objects

Distance & bearing

Types of Geographic Data

Raster

Vector



Date

- Lags between survey and production
- Cost of constant updates are still prohibitive
- Most GIS data has been produced within the last 20 years
- Historical data is not being created in significant amounts

Map Projection = 3D to 2D



Projection System

- Also known as “coordinate system”
- Dependent upon:
 - Local standards
 - Uses and needs
- Multiple data sources mean multiple projections



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THE WEST WING



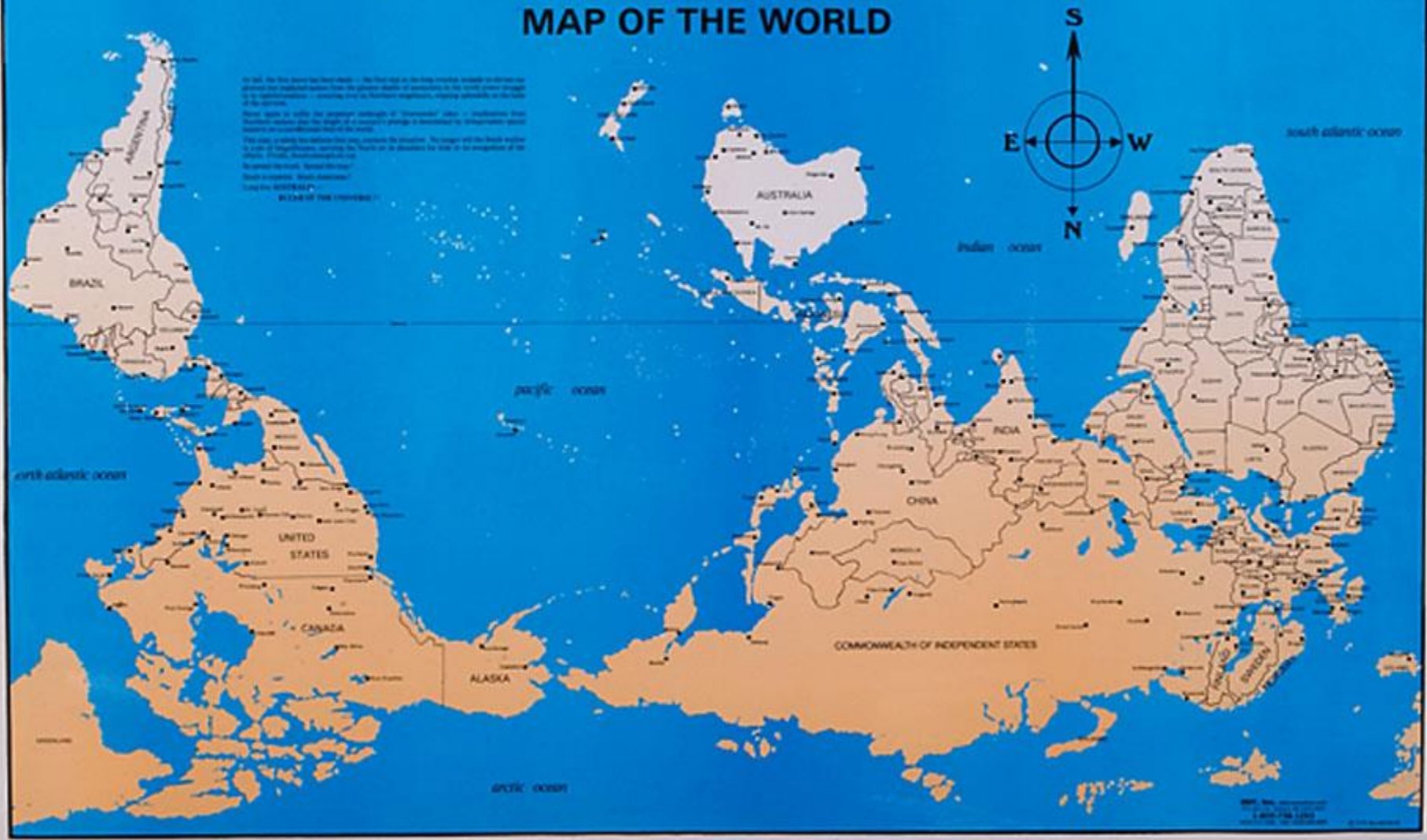
<http://www.youtube.com/watch?v=n8zBC2dvERM>

Aaron Sorkin

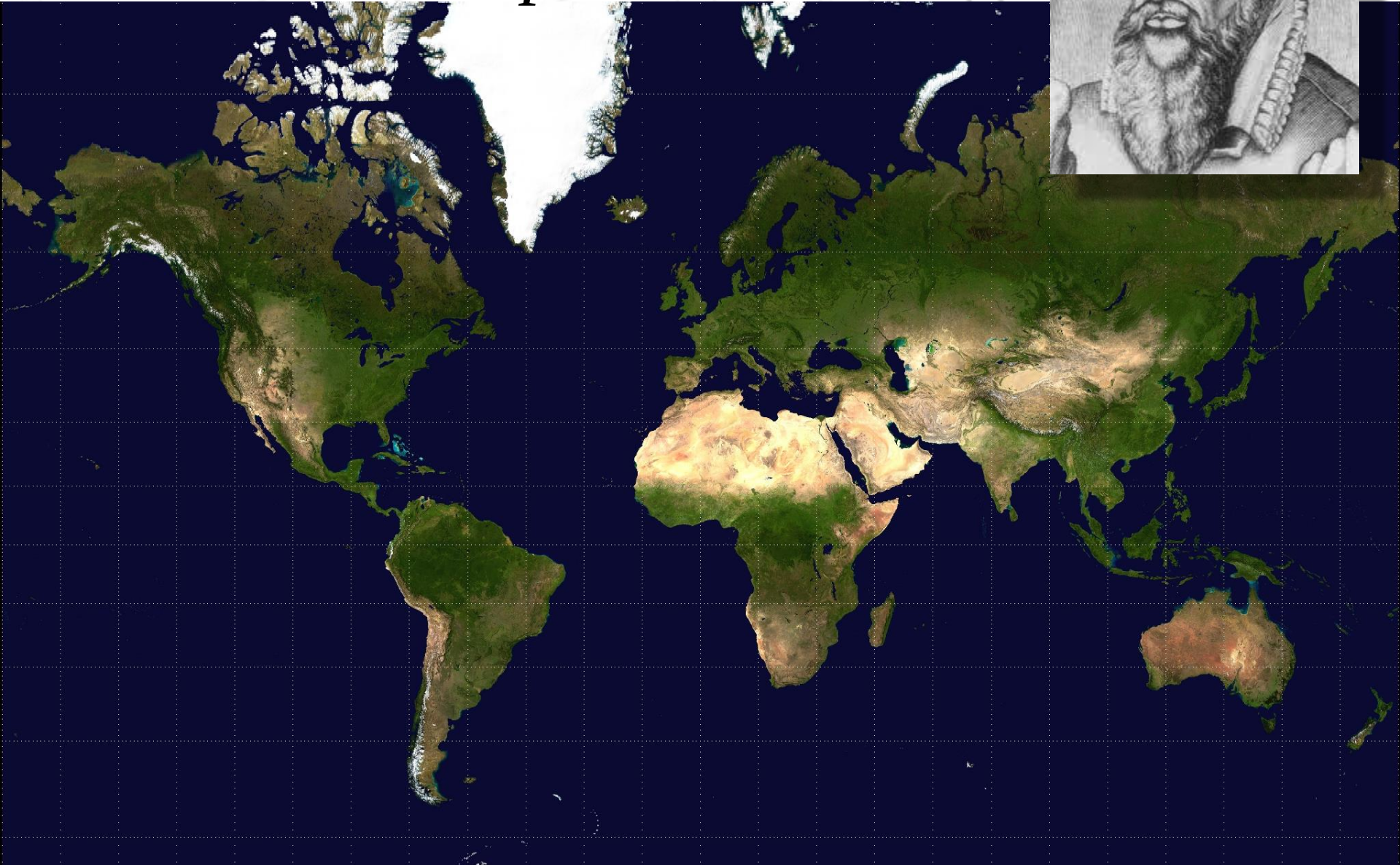
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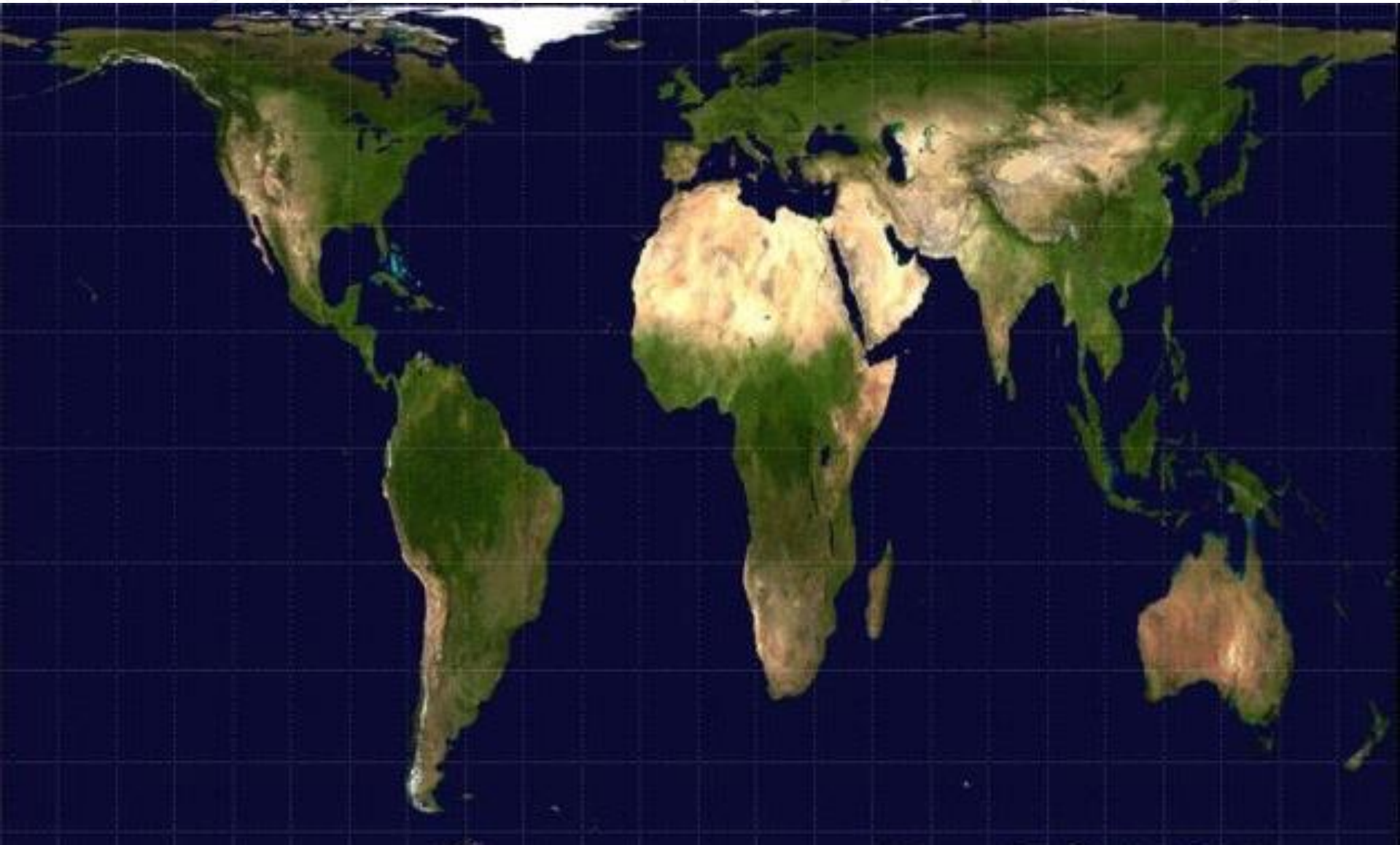
McARTHUR'S UNIVERSAL CORRECTIVE MAP OF THE WORLD



Mercator Projection Preserves Shape & Direction

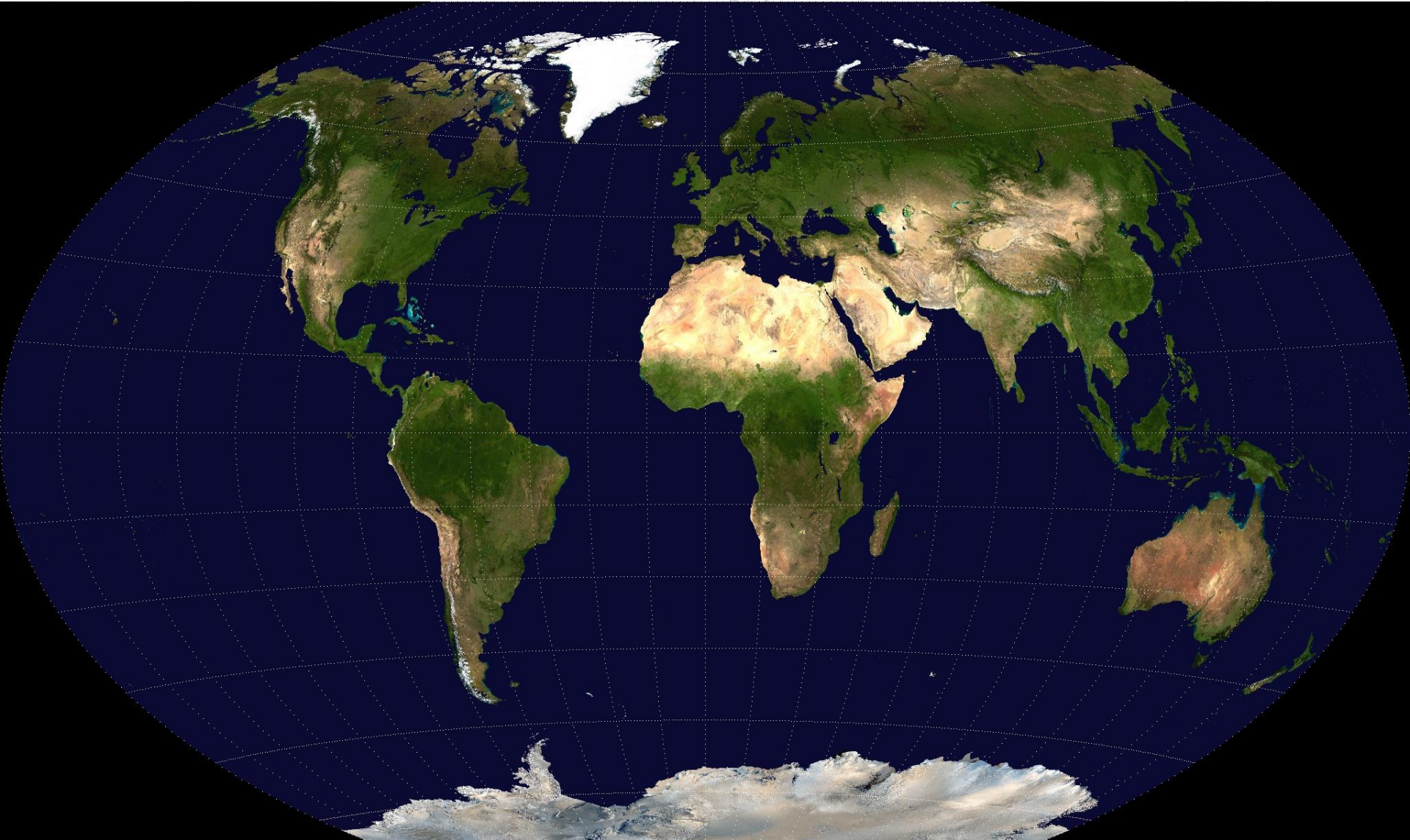


Peters Projection Preserves Area – Distorts Shape



Winkel Tripel Projection

Compromise Projection – Nat Geo



Dymaxion Projection Buckminster Fuller



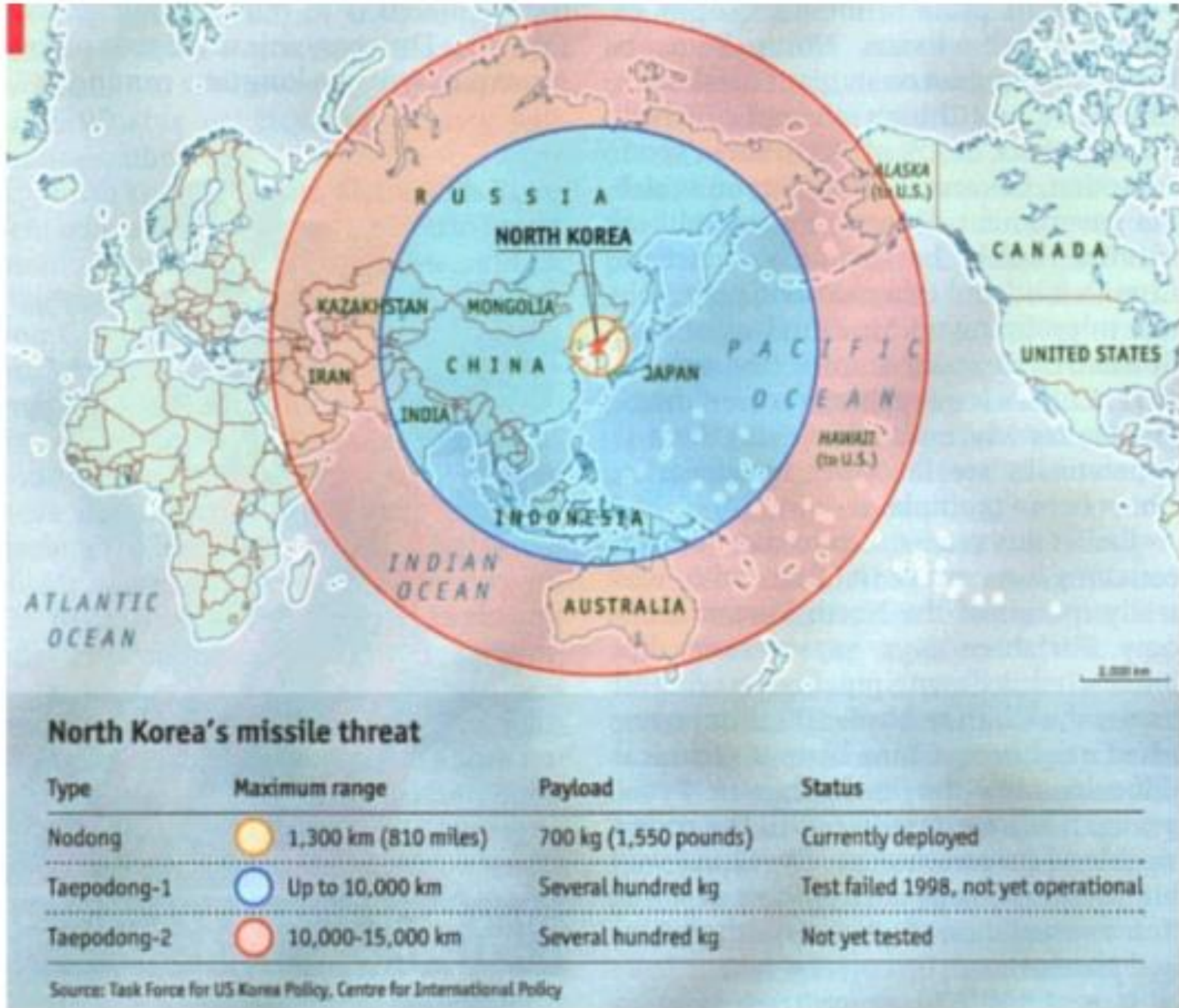
Projections

Summary

● = Yes
○ = Partly

Summary		Properties										Suitable for Mapping										General Use				
Projection	Type	Conformal						World						Topographic Maps												
		Equal area		Equidistant		True direction		Hemisphere		Continent/Ocean				Geological Maps												
										Region/Sea				Thematic Maps												
										Medium Scale				Presentations												
										Large Scale				Navigation												
														USGS Maps												
Globe	Sphere	●	●	●	●													●	●							
Mercator	Cylindrical	●			○			●										●	●		●	●				
Transverse Mercator	Cylindrical	●								●	●	●	●					●	●			●				
Oblique Mercator	Cylindrical	●								●	●	●	●					●				●				
Space Oblique Mercator	Cylindrical	●											●									●				
Miller Cylindrical	Cylindrical					●			●										●			●				
Robinson	Pseudocylindrical					●			●										●	●						
Sinusoidal Equal Area	Pseudocylindrical		●	○					●		●								●			●				
Orthographic	Azimuthal				○	●				○												●				
Stereographic	Azimuthal	●			○	●				●	●	●	●	●				●	●		●	●				
Gnomonic	Azimuthal				○	●						○								●	●					
Azimuthal Equidistant	Azimuthal			○	○					○	●	●	●		○			●				●				
Lambert Azimuthal Equal Area	Azimuthal		●		○					●	●	●	●						●	●		●				
Albers Equal Area Conic	Conic		●								●	●	●						●	●		●				
Lambert Conformal Conic	Conic	●			○						●	●	●	●				●	●		●	●				
Equidistant Conic (Simple Conic)	Conic			○							●	●														
Polyconic	Conic			○		●								○	○			●				●				
Bipolar Oblique Conic Conformal	Conic	●									●							●				●				

All above projections (except Robinson) are explained in detail in *Map Projections—A Working Manual*, John P. Snyder, Geological Survey Professional Paper 1395 (Washington: USGPO, 1987, 383 pp.)





North Korea's missile threat

Type	Maximum range	Payload	Status
Nodong	 1,300 km (810 miles)	700 kg (1,550 pounds)	Currently deployed
Taepodong-1	 Up to 10,000 km	Several hundred kg	Test failed 1998, not yet operational
Taepodong-2	 10,000-15,000 km	Several hundred kg	Not yet tested

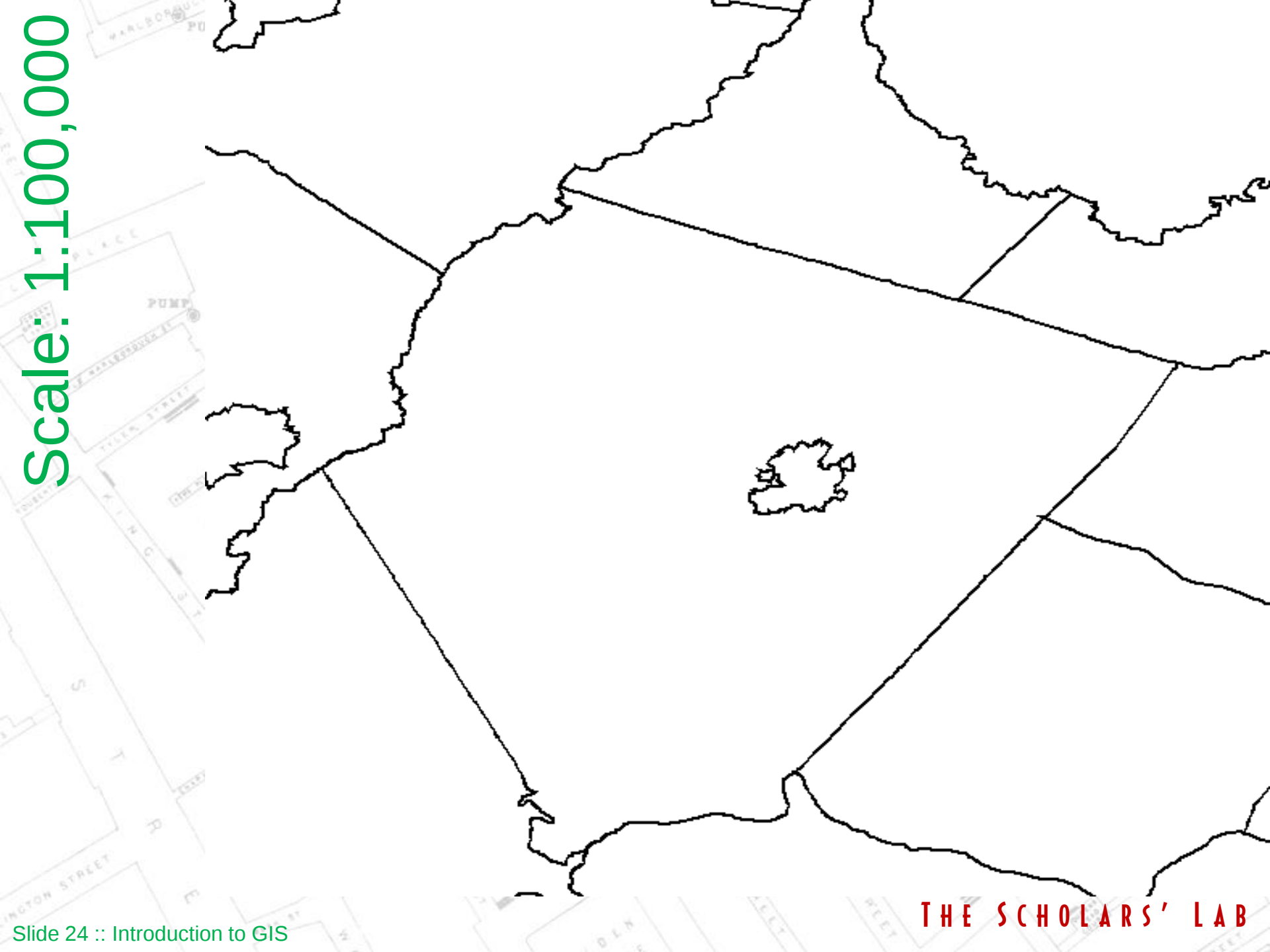
Source: Task Force for US Korea Policy, Centre for International Policy

Accuracy: Census Streets Data

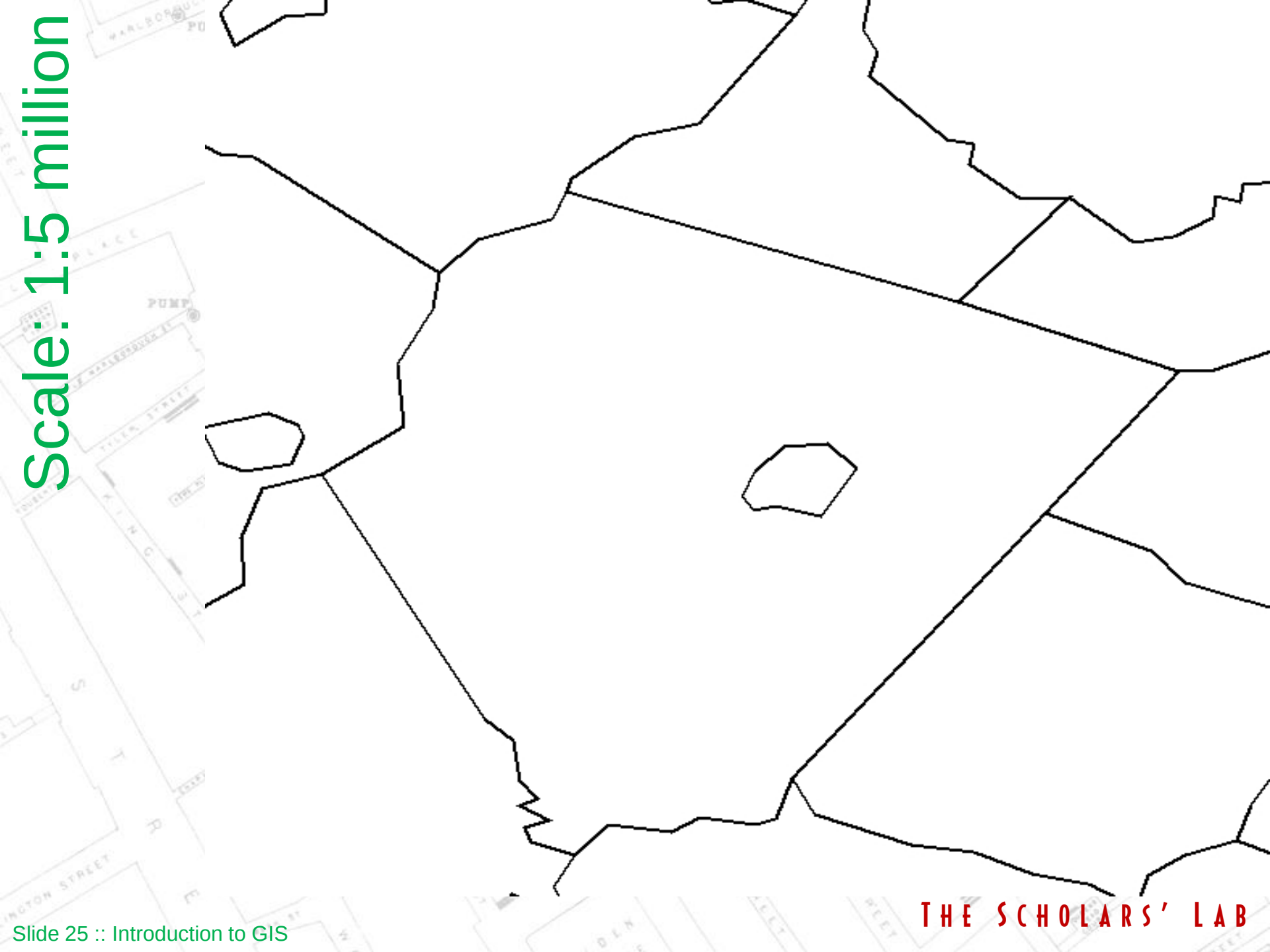


Accuracy: City Planning Data

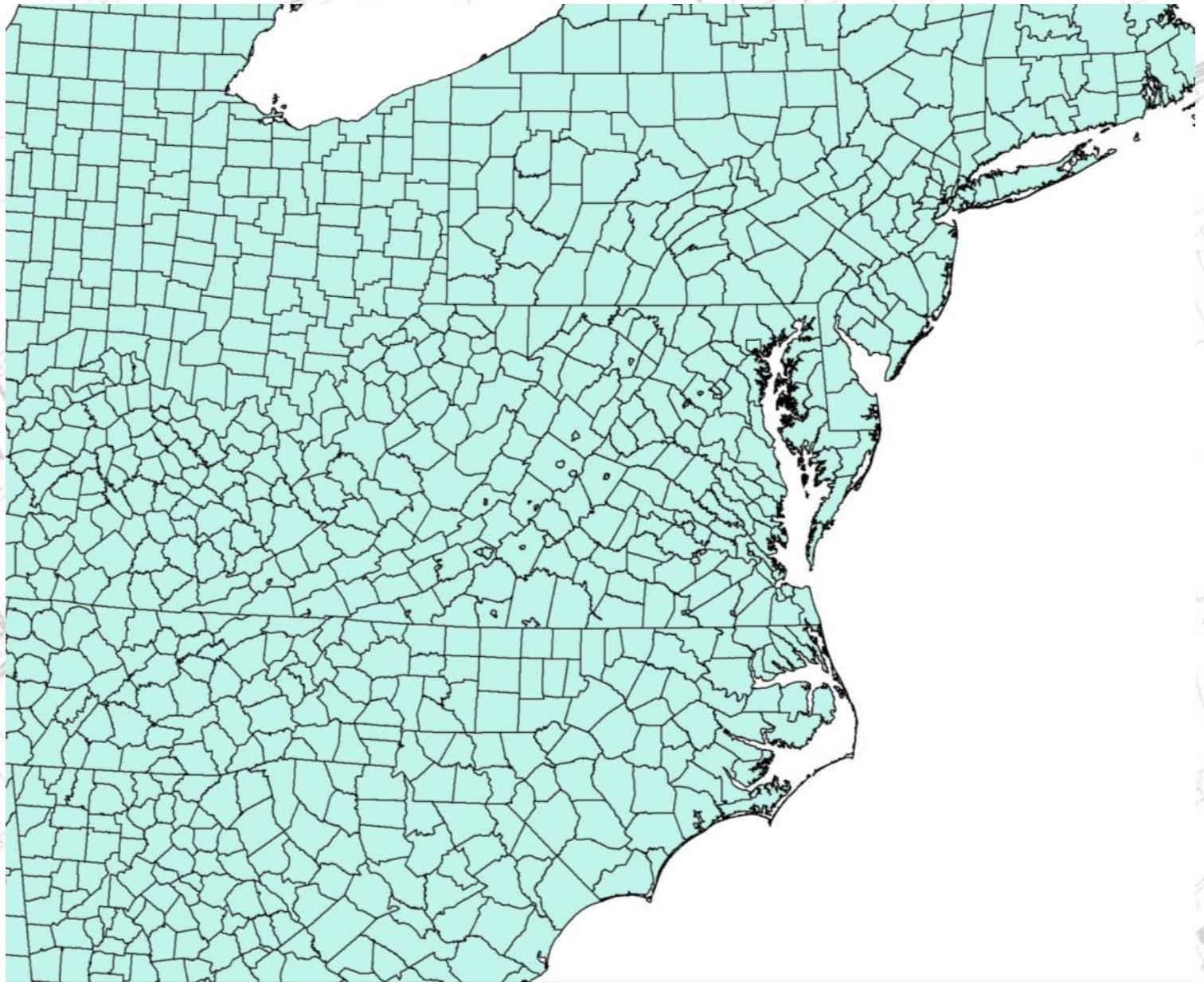


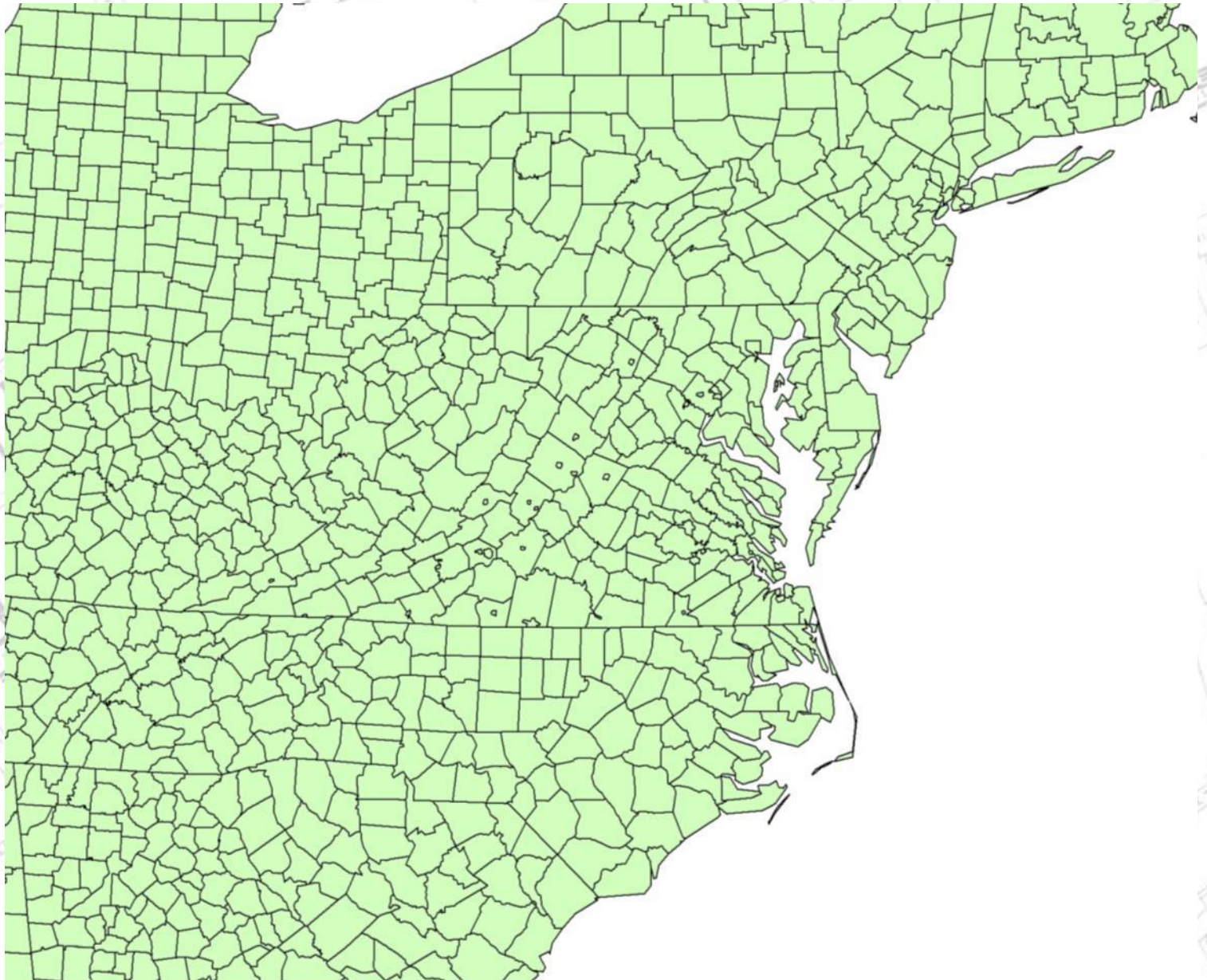


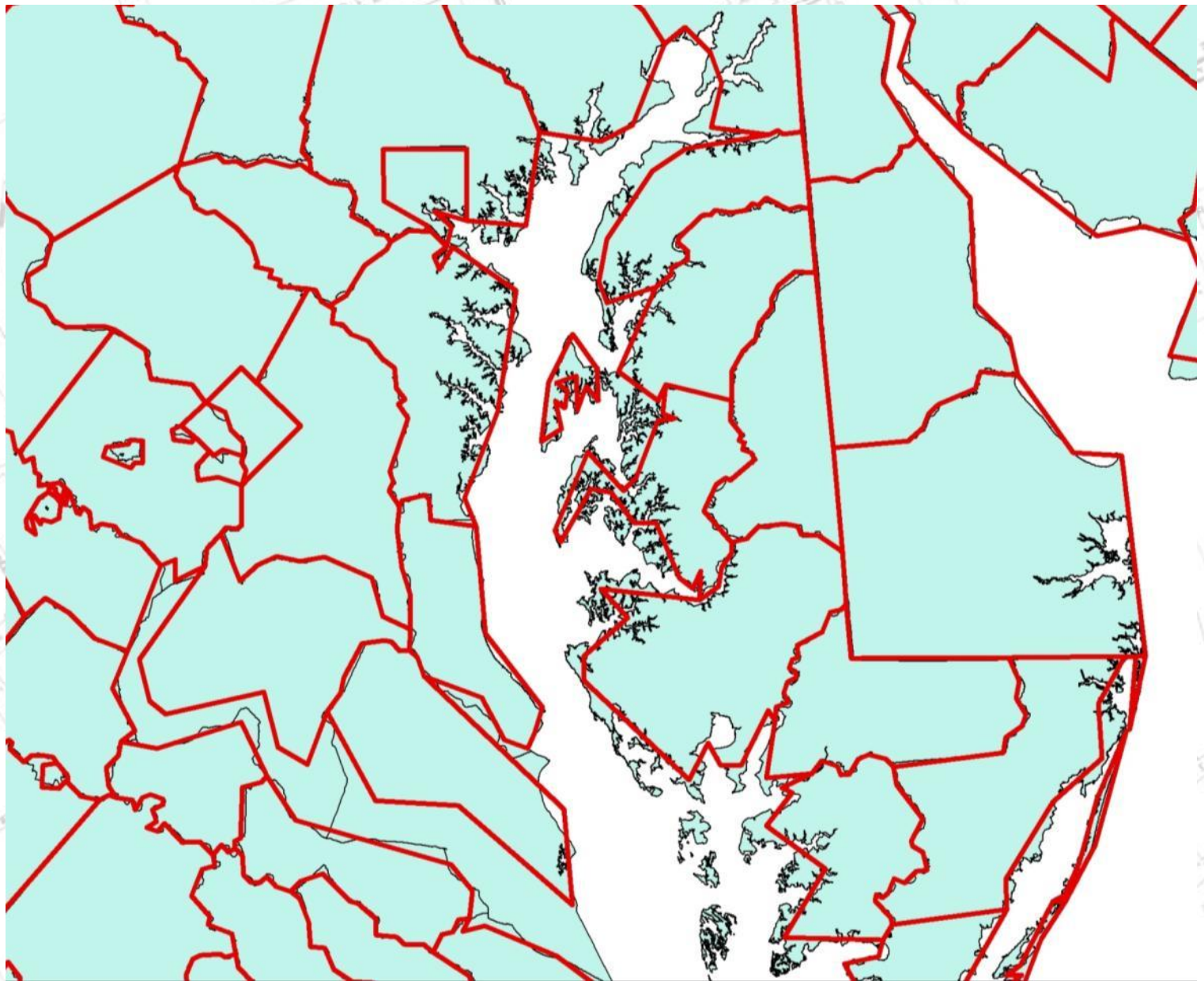
Scale: 1:100,000



Scale: 1:5 million



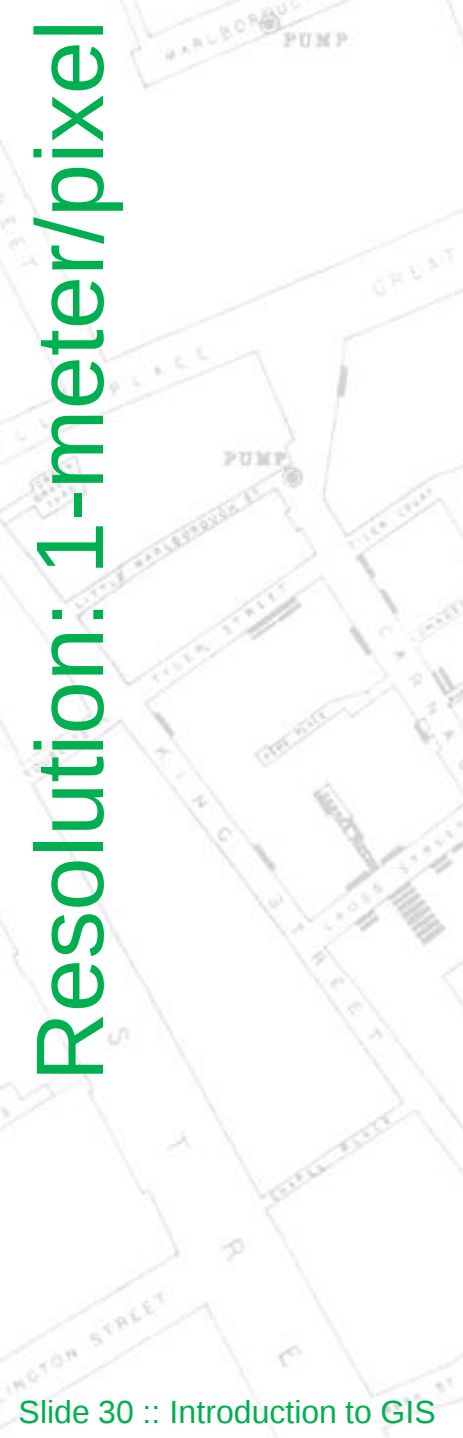




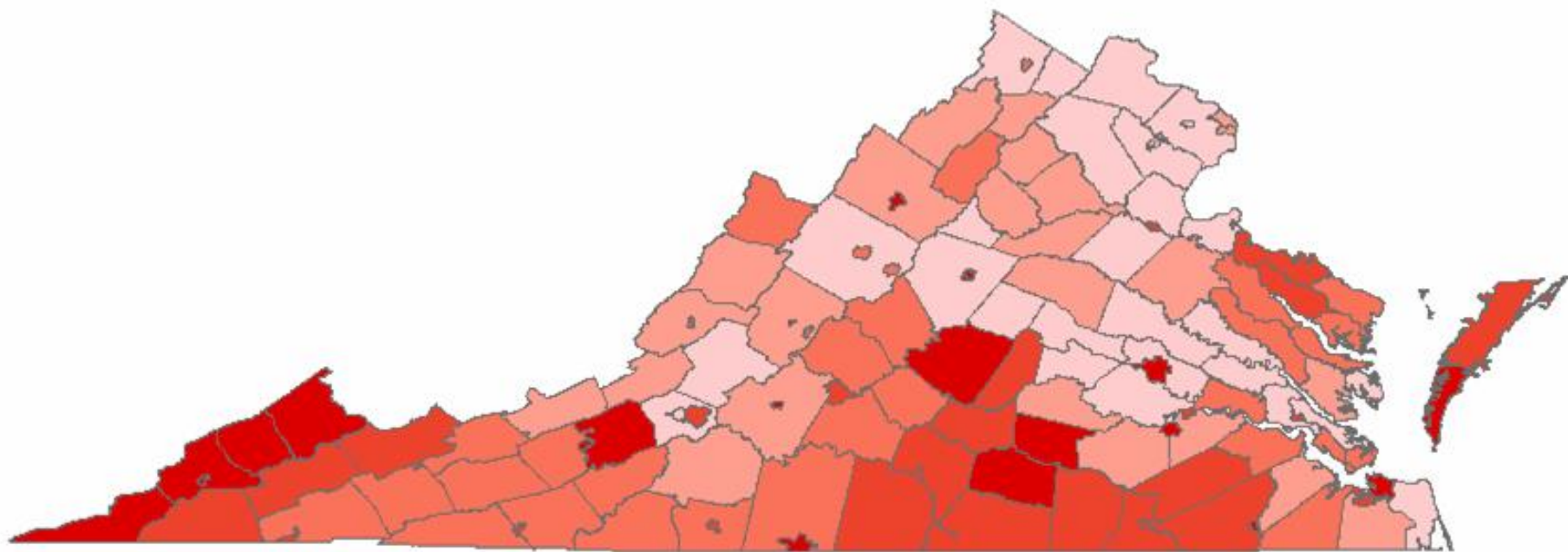
Resolution: 1-foot/pixel



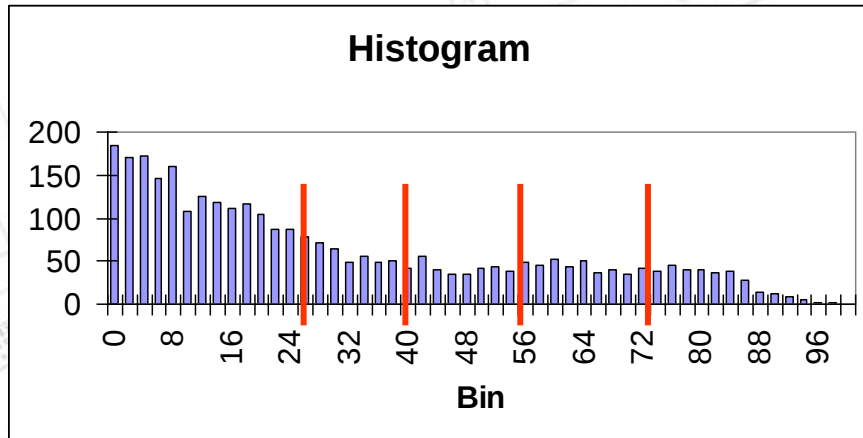
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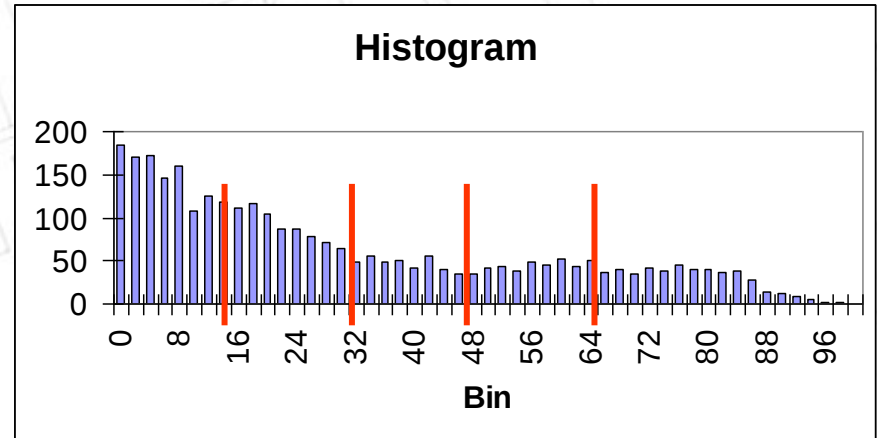




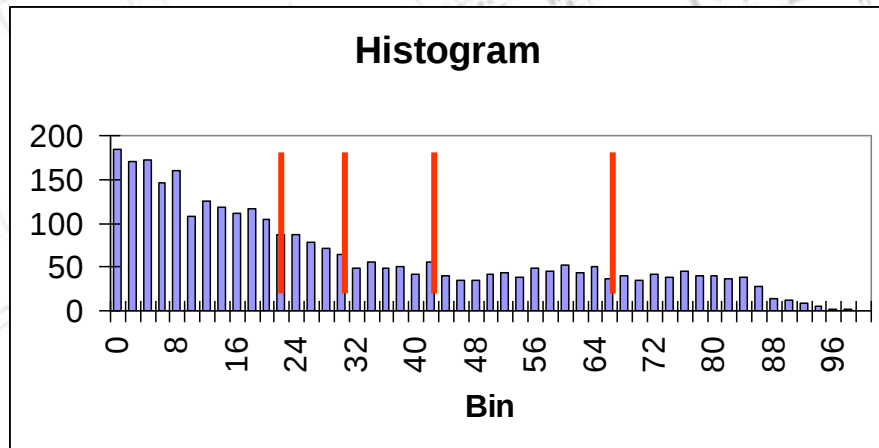
Playing with the numbers...



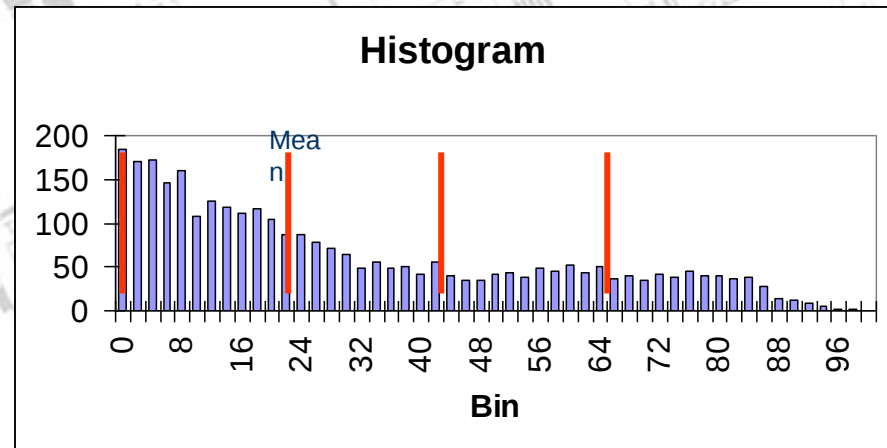
Natural breaks



Equal interval

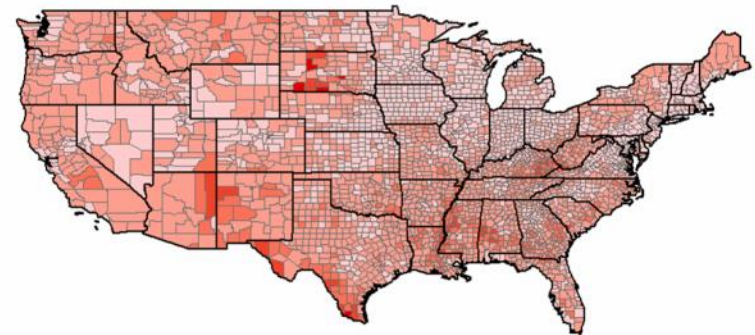
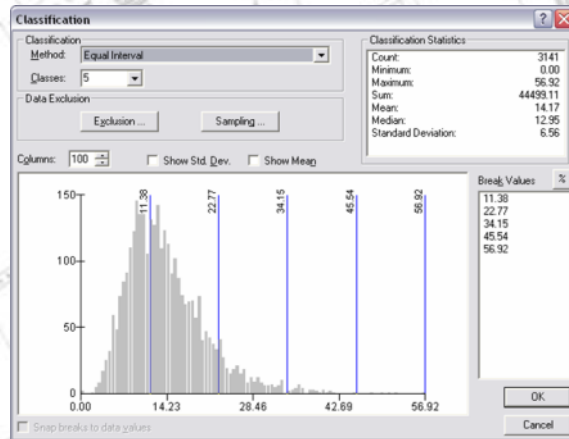
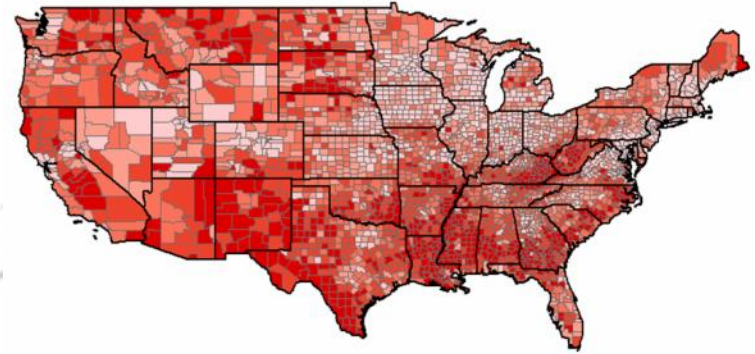
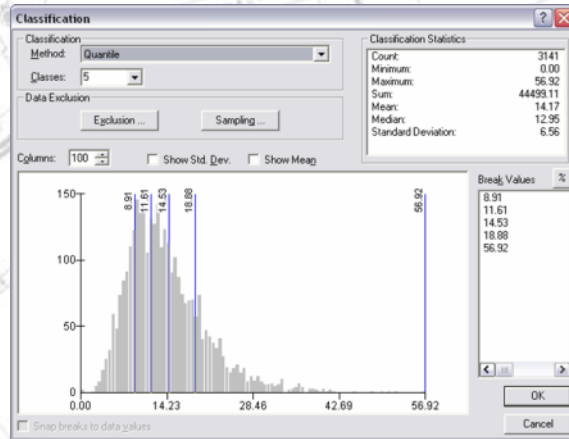
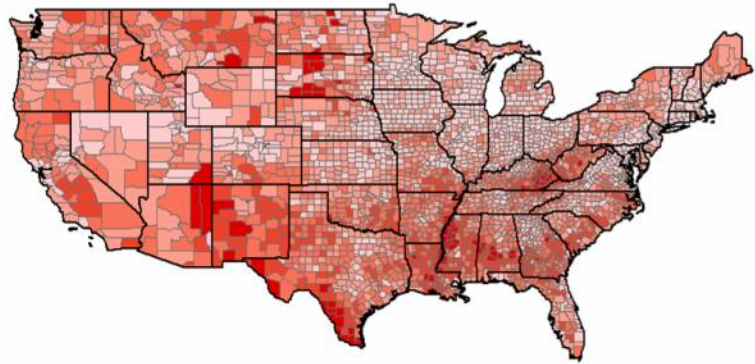
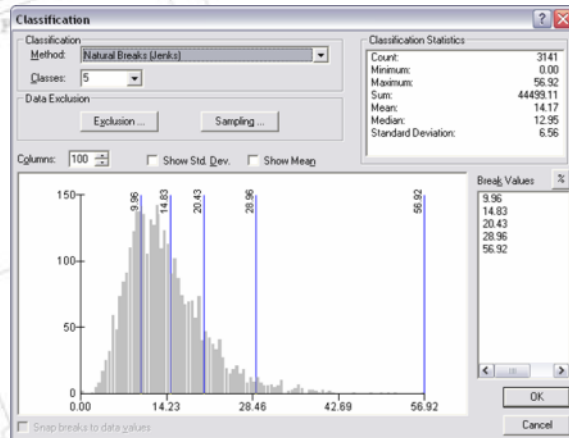


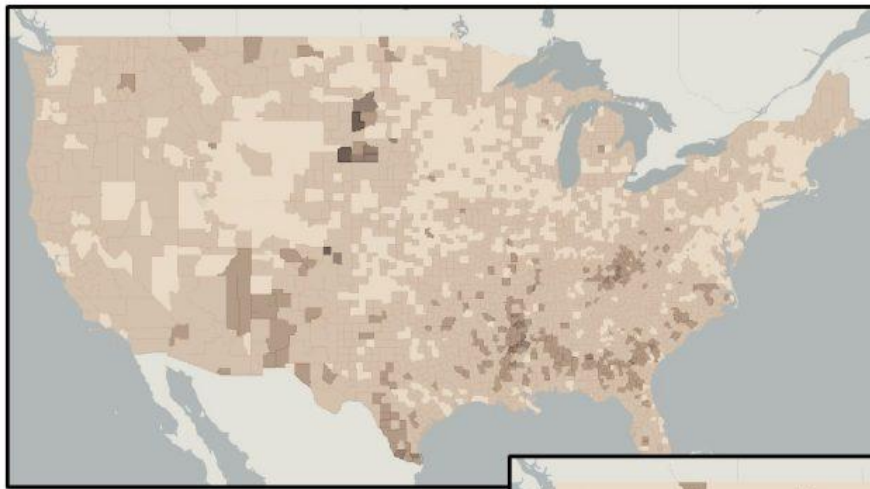
Quantile



Standard Deviation

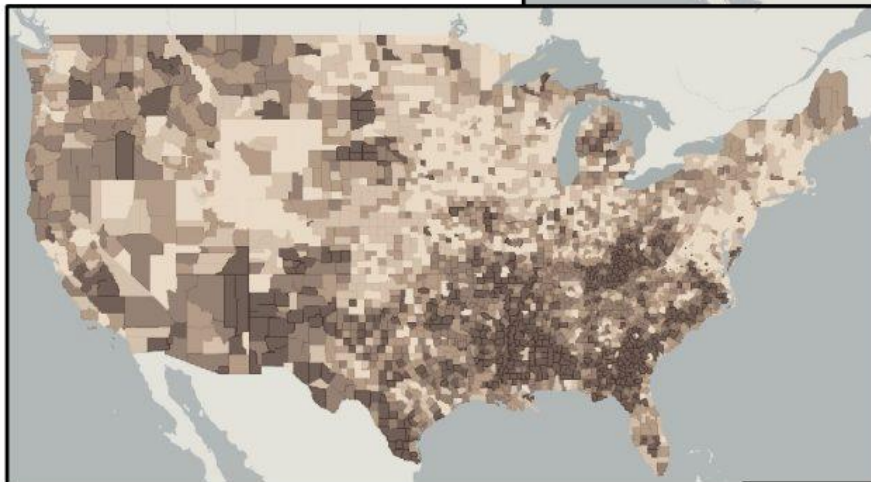
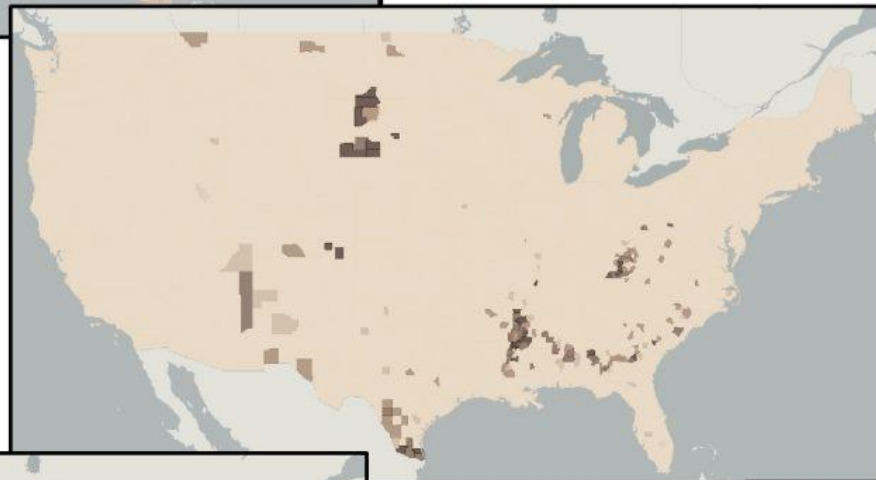
Playing with the numbers....





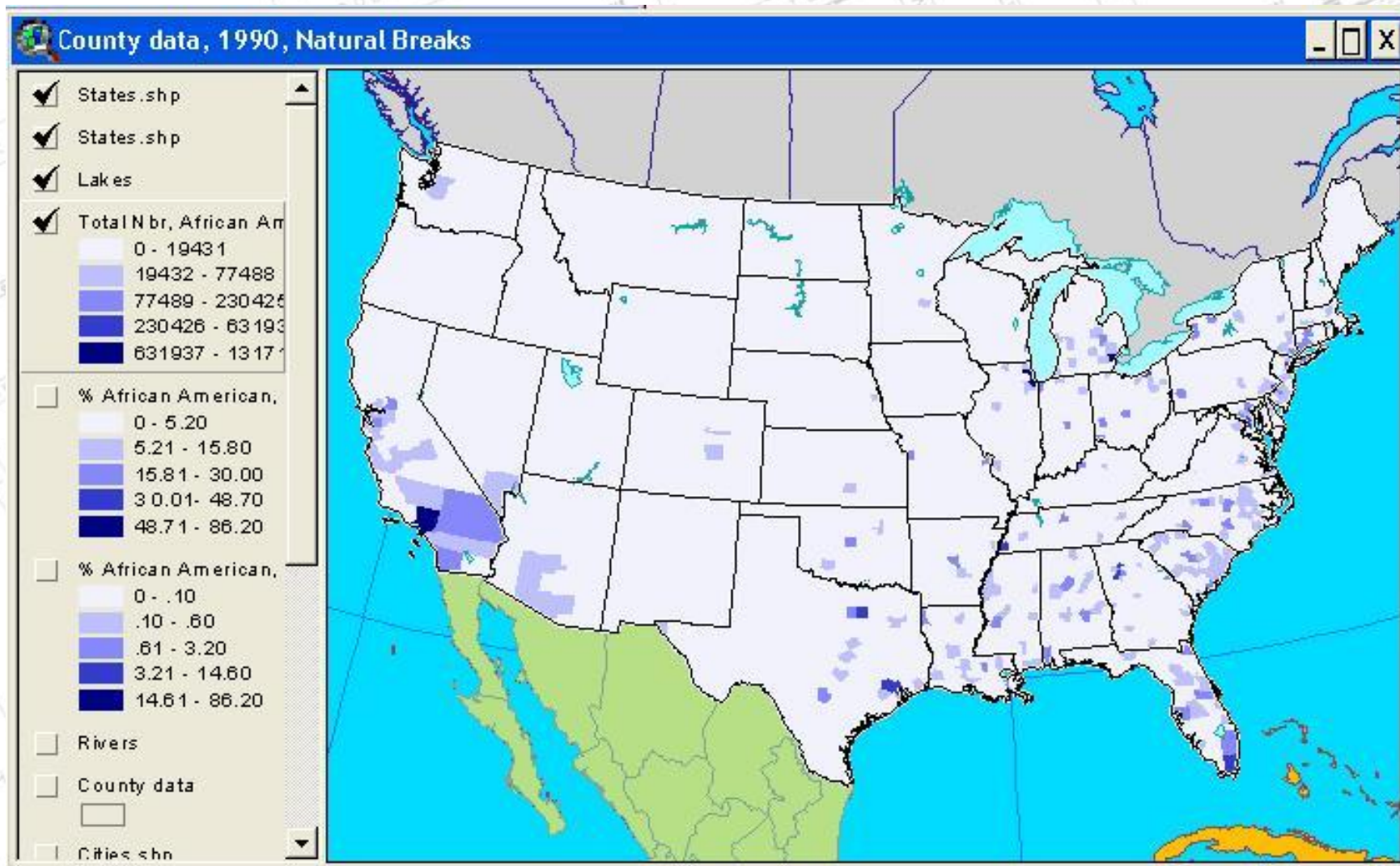
Equal
Interval

Natural
Breaks

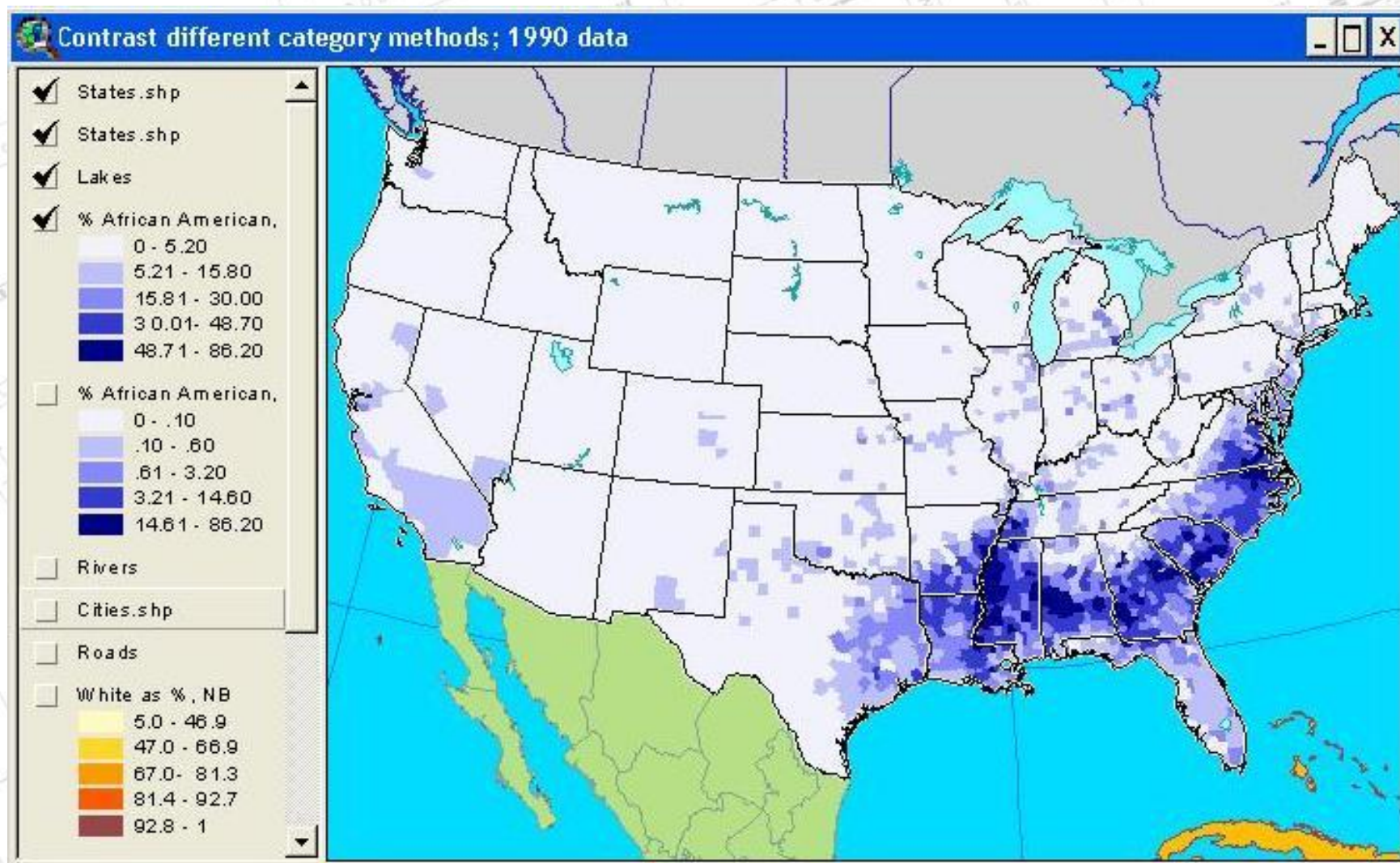


Quantile

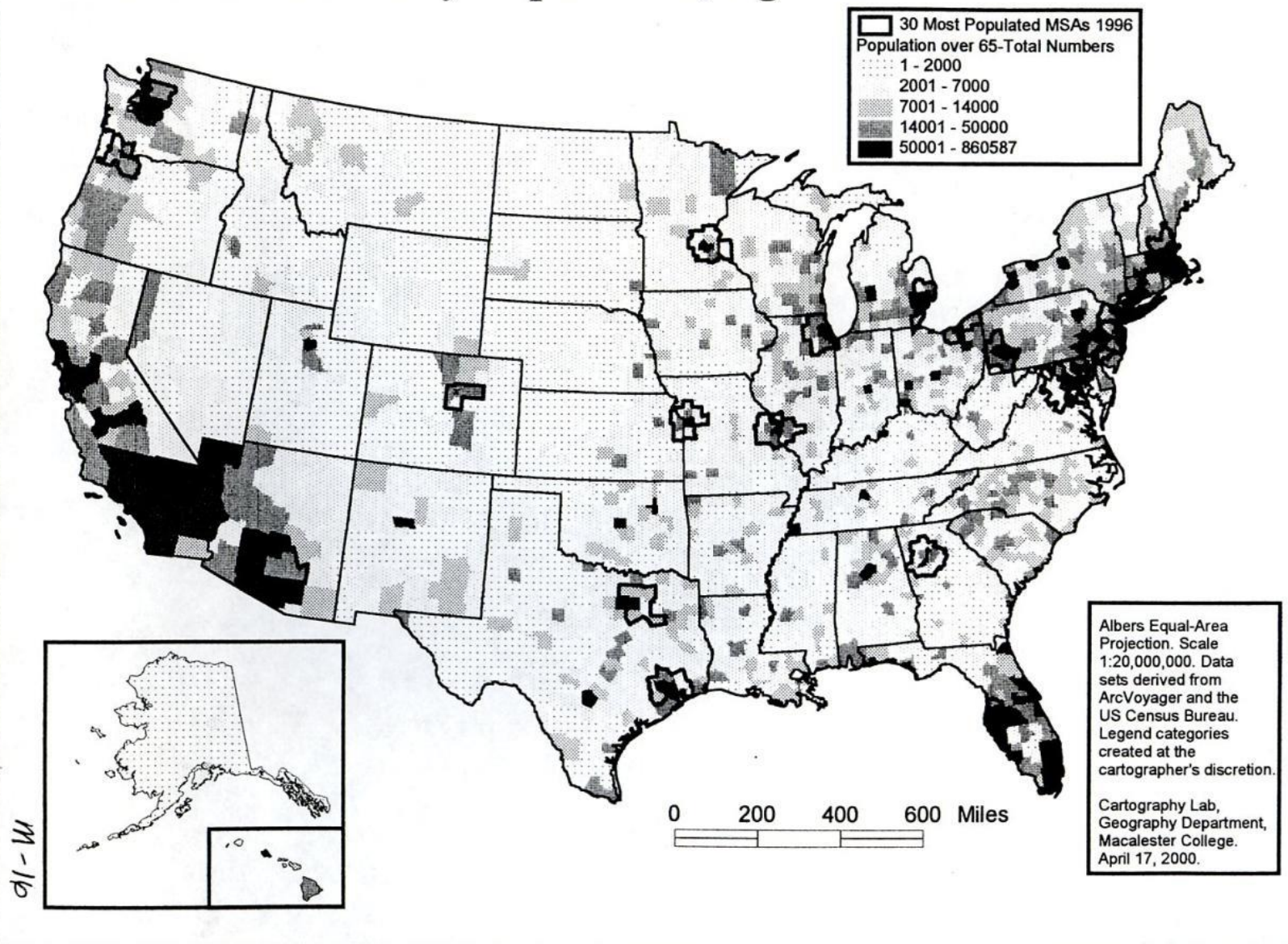
Normalization



Normalization

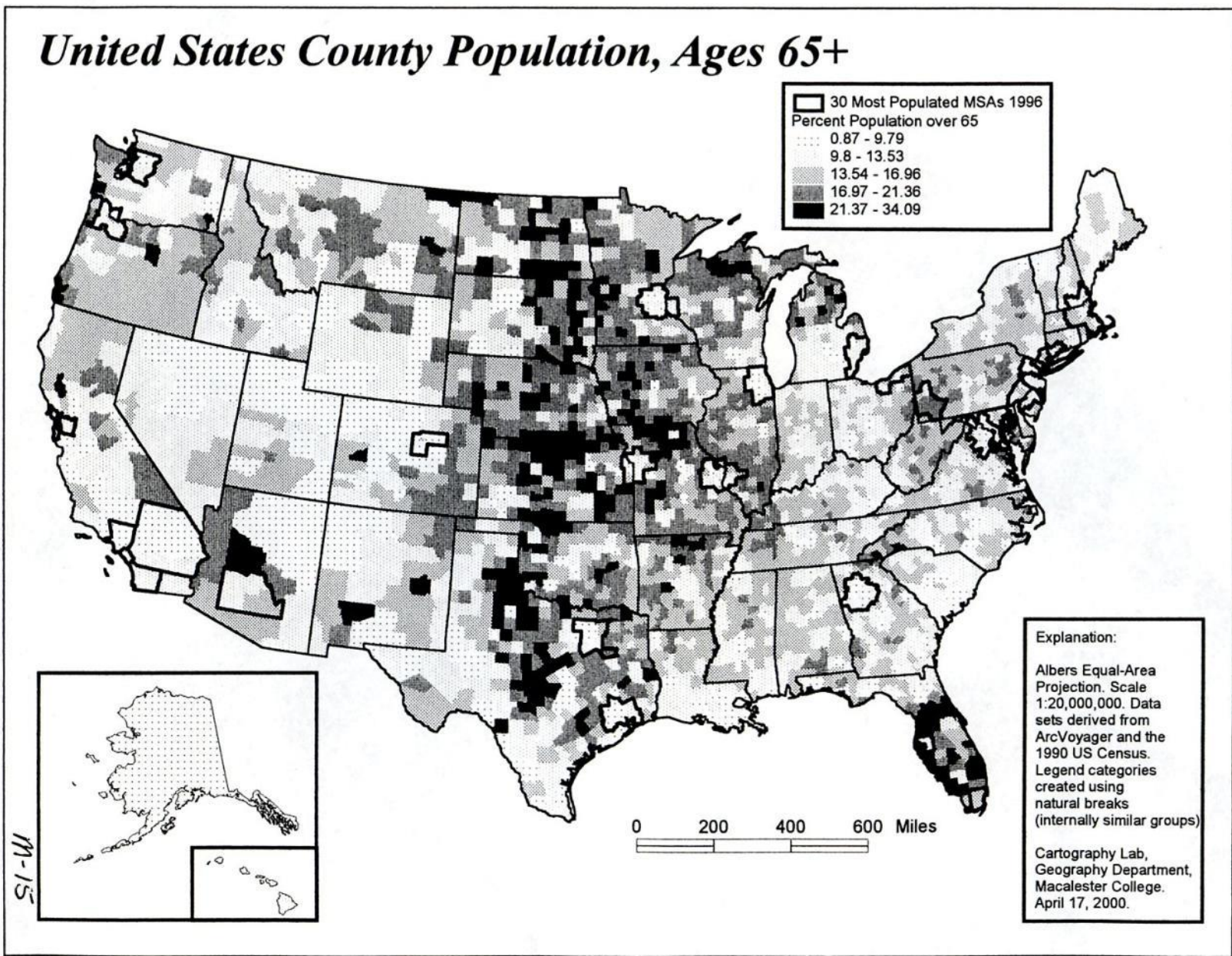


United States County Population, Ages 65+



Is this map telling the whole truth about elderly population in the U.S.?

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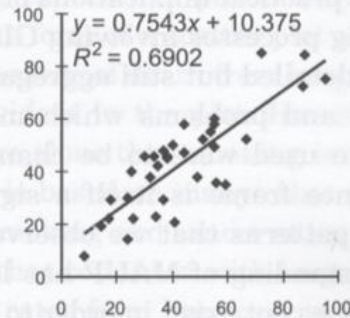
Modifiable Areal Unit Problem (MAUP)

Aggregation units are arbitrary with respect to the underlying data, yet the units used will affect statistics determined by those aggregations.

Independent variable Dependent variable

87	95	72	37	44	24
40	55	55	38	88	34
41	30	26	35	38	24
14	56	37	34	8	18
49	44	51	67	17	37
55	25	33	32	59	54

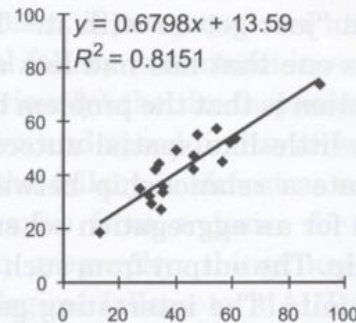
72	75	85	29	58	30
50	60	49	46	84	23
21	46	22	42	45	14
19	36	48	23	8	29
38	47	52	52	22	48
58	40	46	38	35	55



Aggregation scheme 1

91	54.5	34
47.5	46.5	61
35.5	30.5	31
35	35.5	13
46.5	59	27
40	32.5	56.5

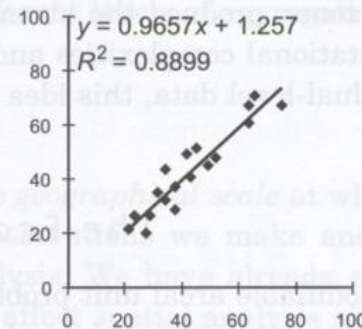
73.5	57	44
55	47.5	53.5
33.5	32	29.5
27.5	35.5	18.5
42.5	52	35
49	42	45



Aggregation scheme 2

63.5	75	63.5
27.5	43	31.5
52	34.5	42
49.5	34.5	38
45.5	21	45.5

61	67.5	67
20	41	35
43.5	49	45
28.5	26.5	51.5
26.5	71	26.5

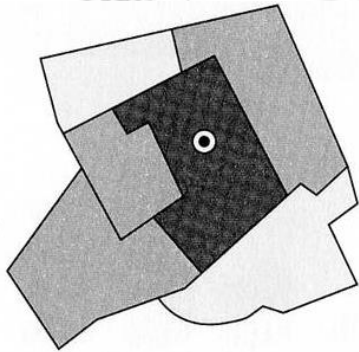




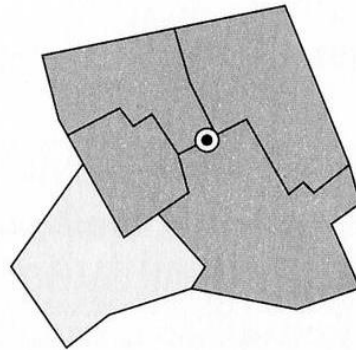
Snow's Map



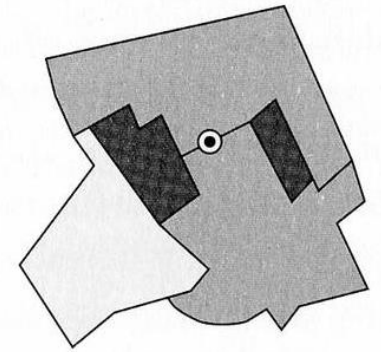
Modifiable Areal Unit Problem (MAUP)



In this aggregation of individual deaths into six areas, the greatest number is concentrated at the Broad Street pump.

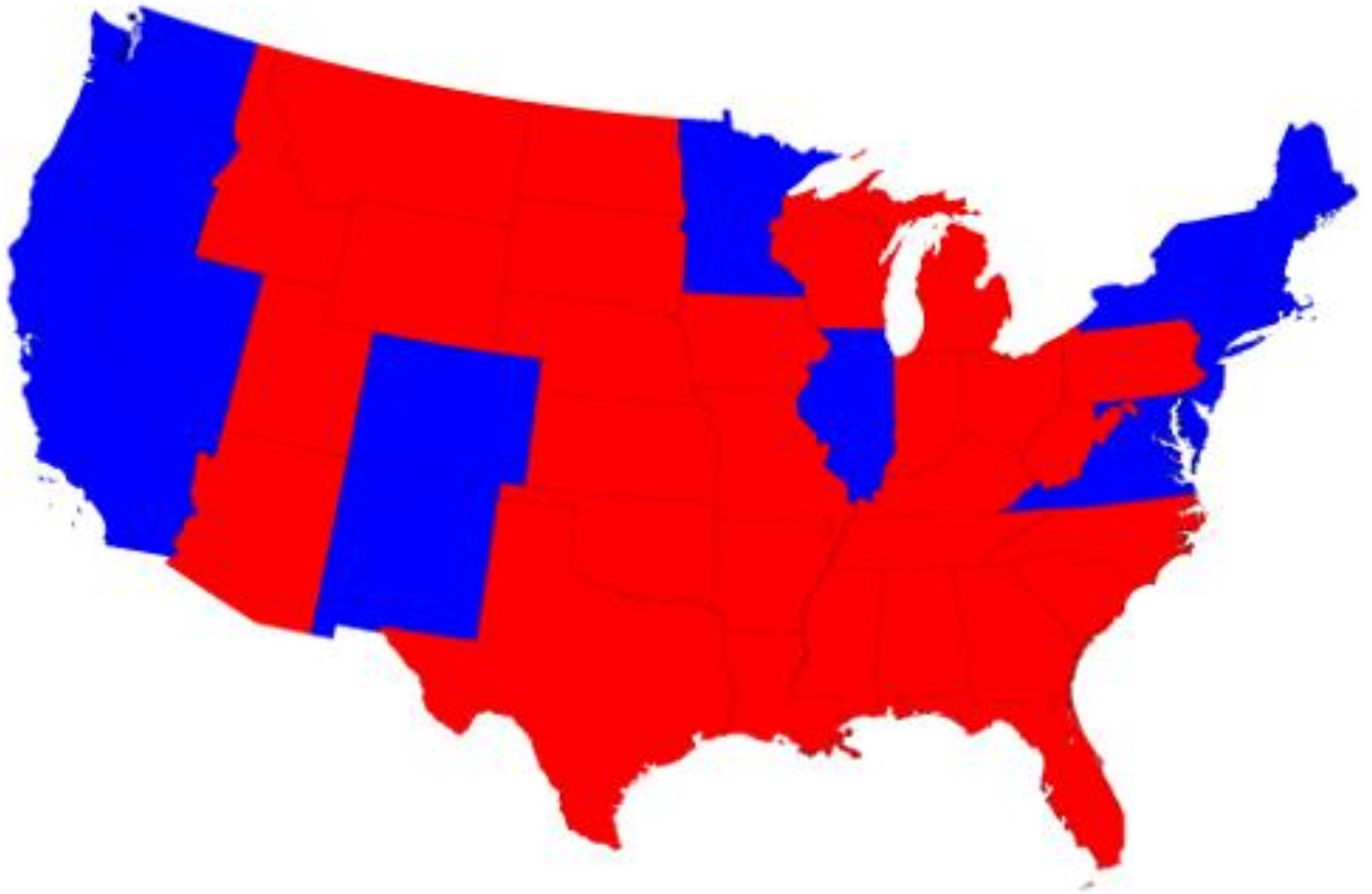


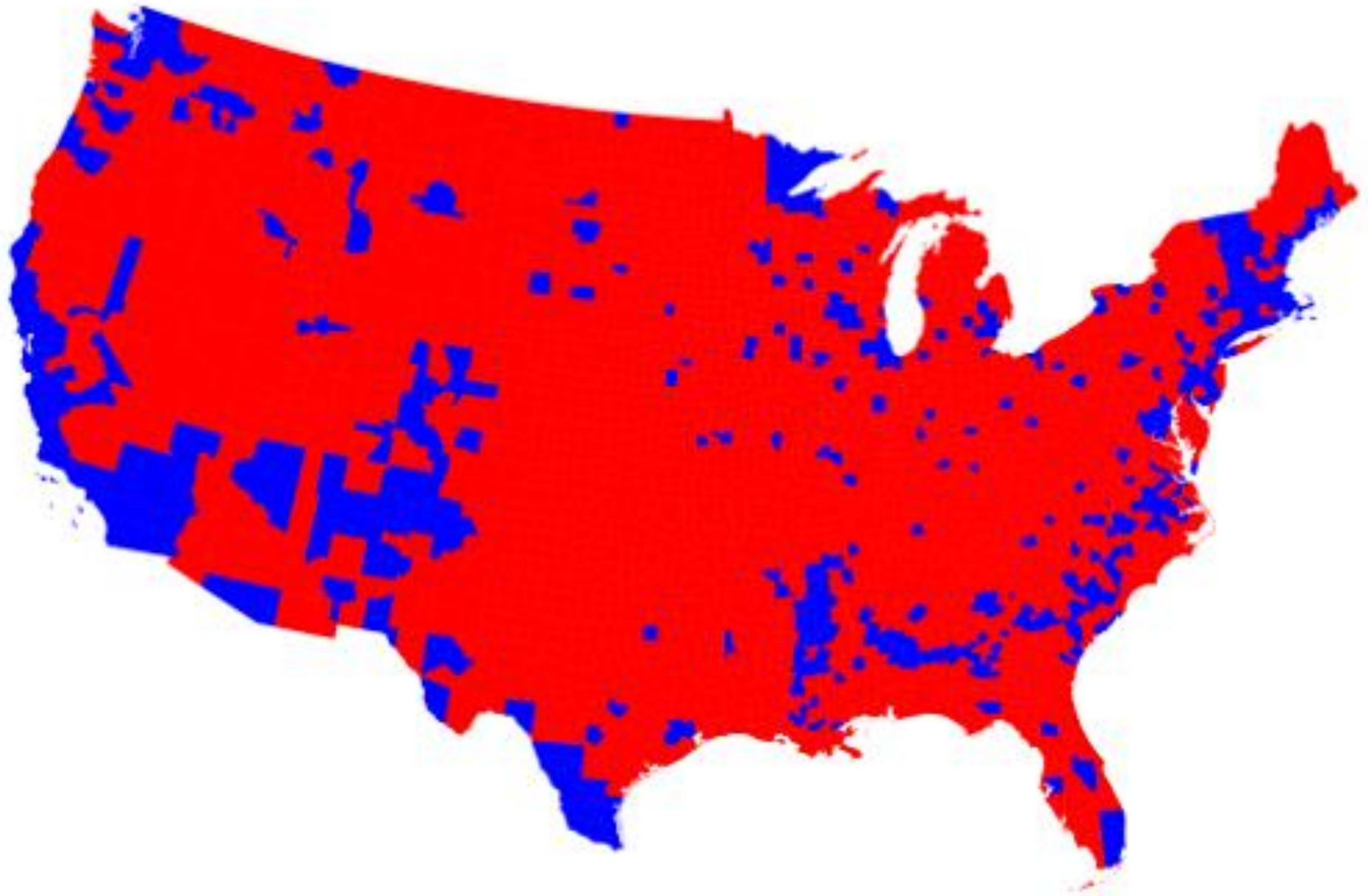
Using different geographic subdivisions, the cholera numbers are nearly the same in four of the five areas.

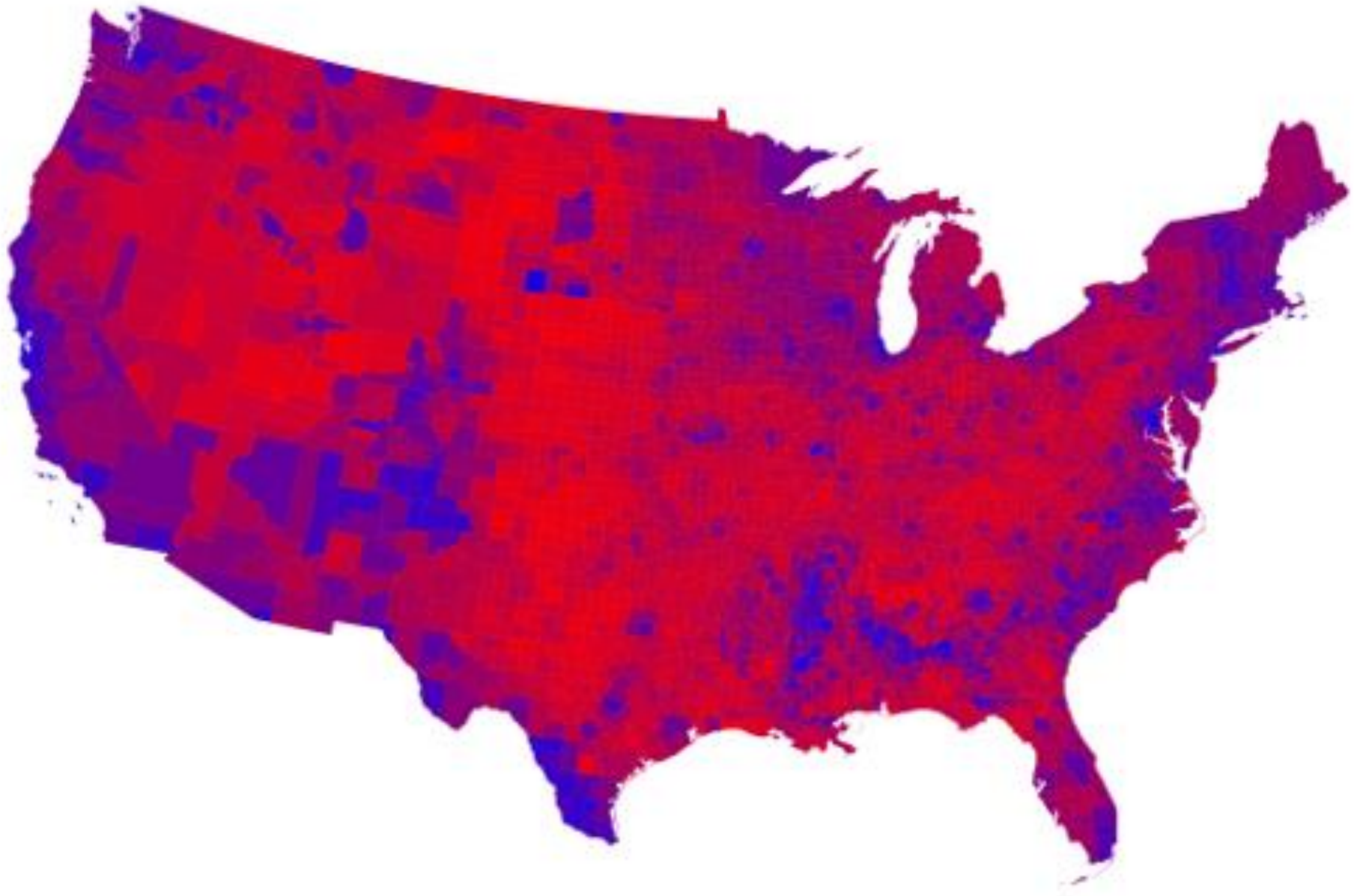


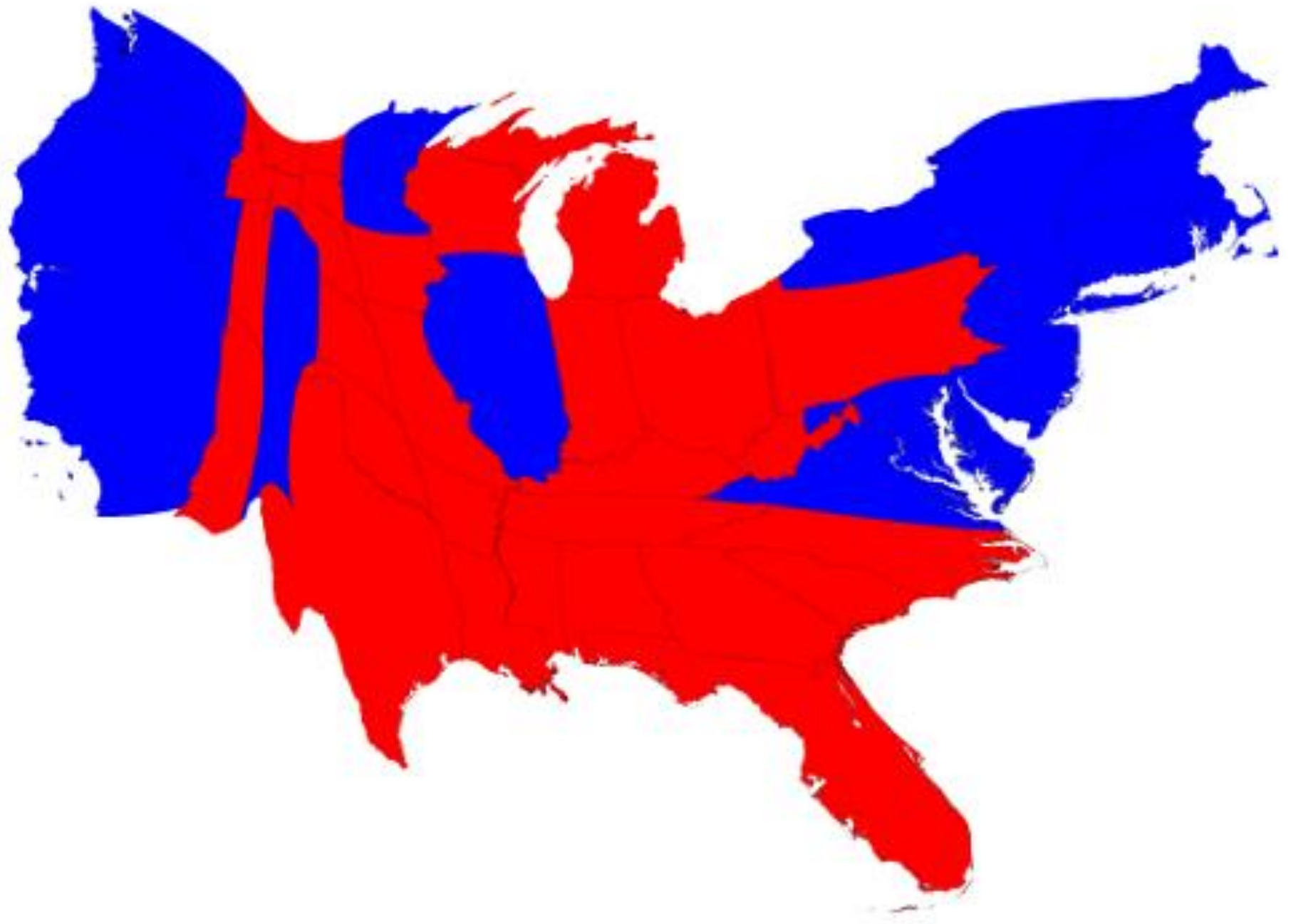
In this aggregation of the deaths, the two areas with the most deaths do not even include the infected pump!

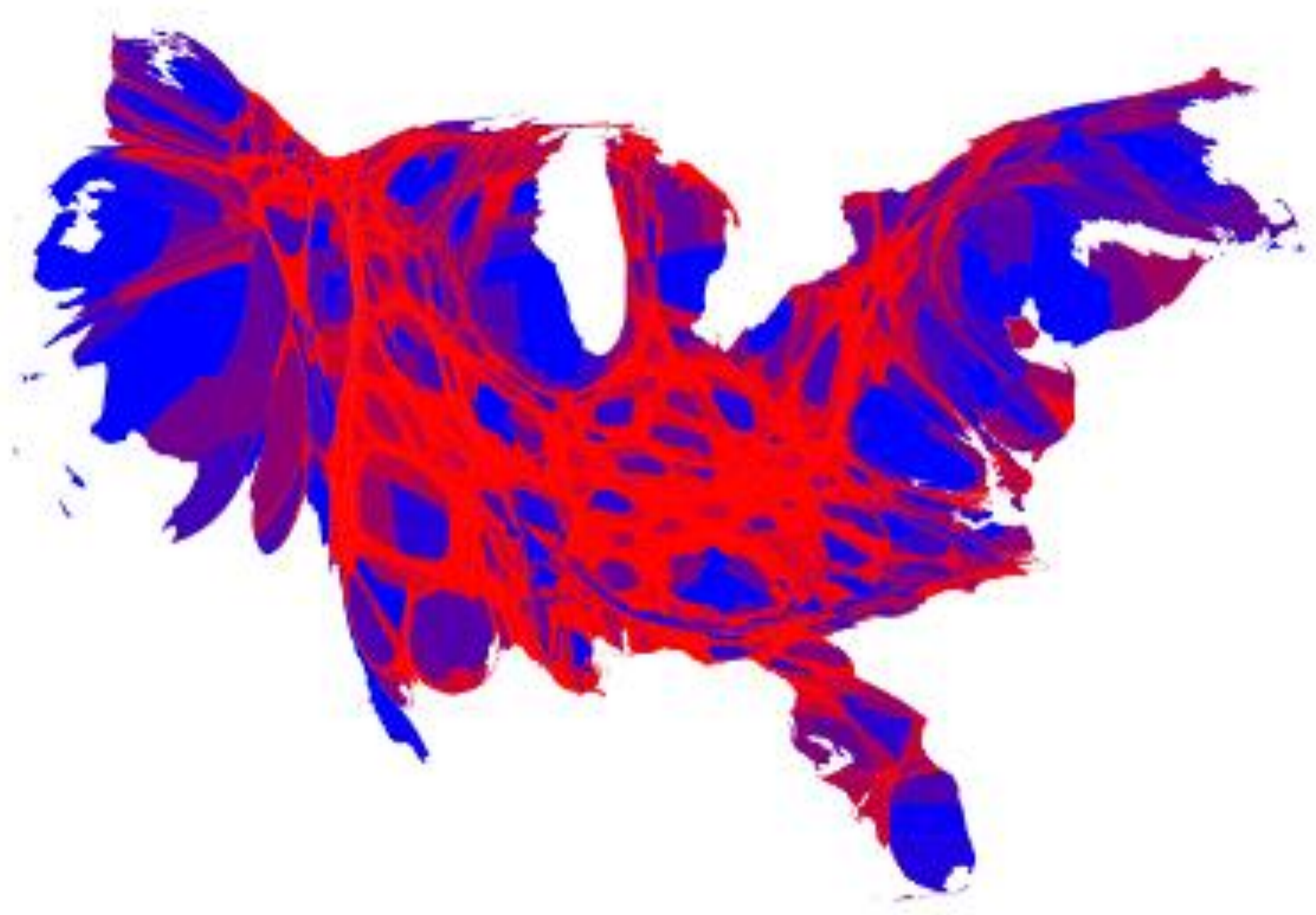
Tufte's example using Snow's cholera area of London

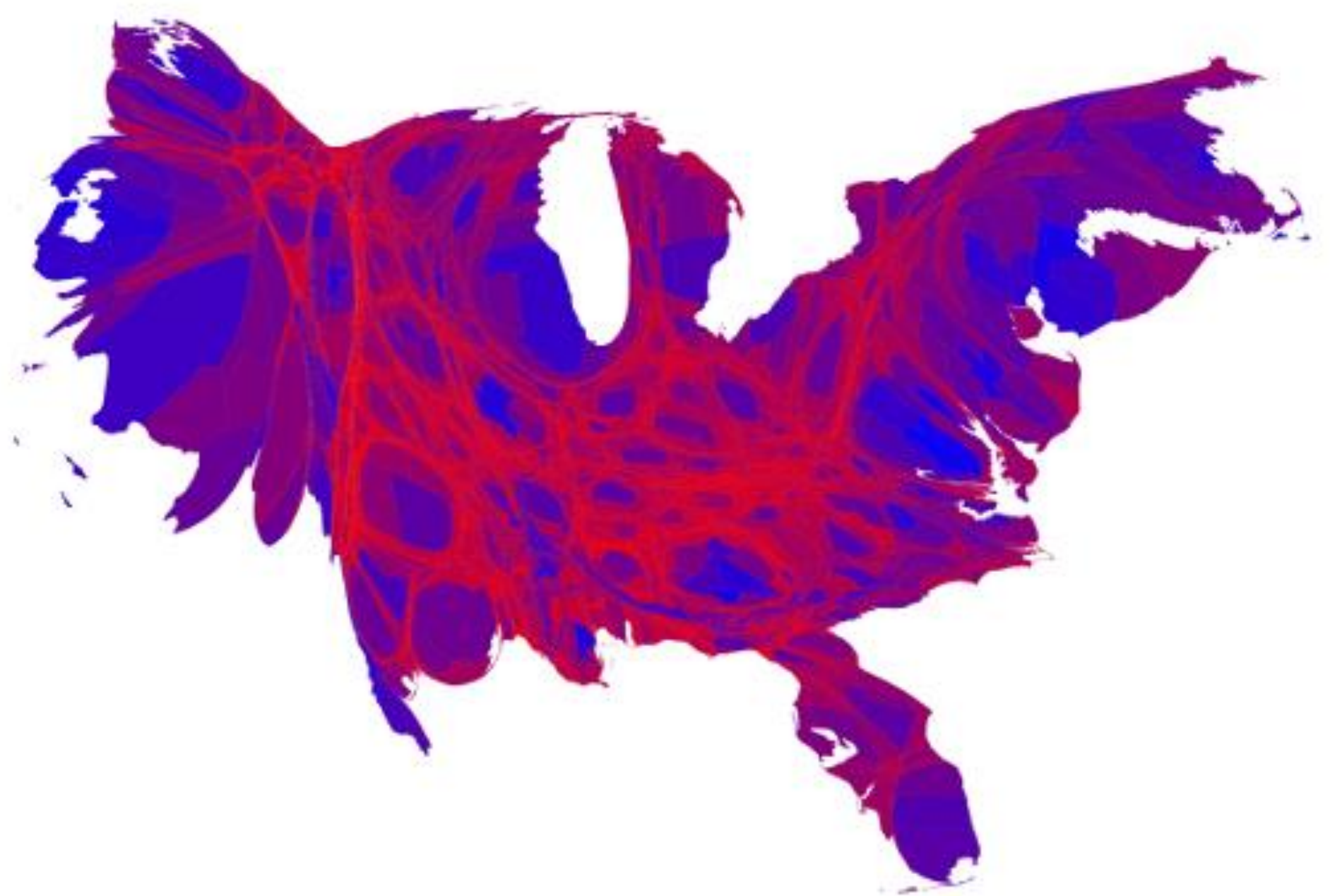








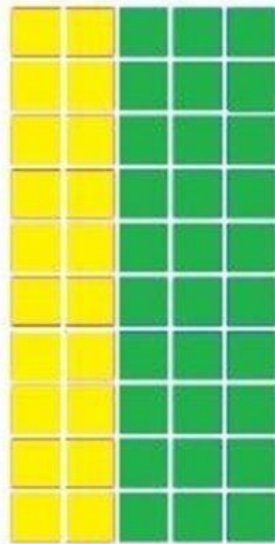






50 Precincts

5 Districts

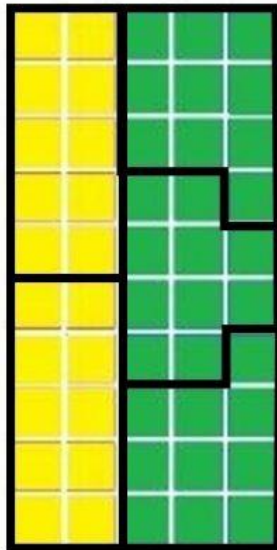


60% of
voters

40% of
voters

Green has
small majority

Districting A

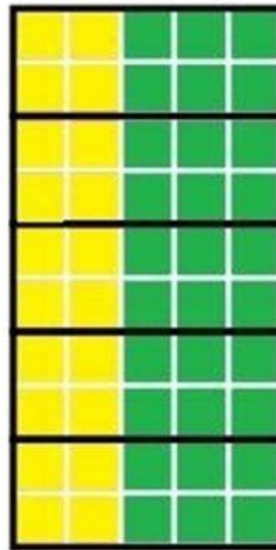


3 districts
60%

2 districts
40%

Green wins
as expected

Districting B

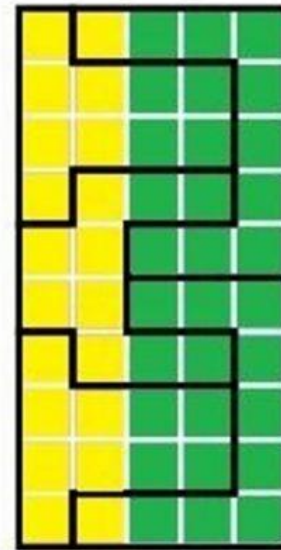


5 districts
100%

0 districts
0%

Green
dominates

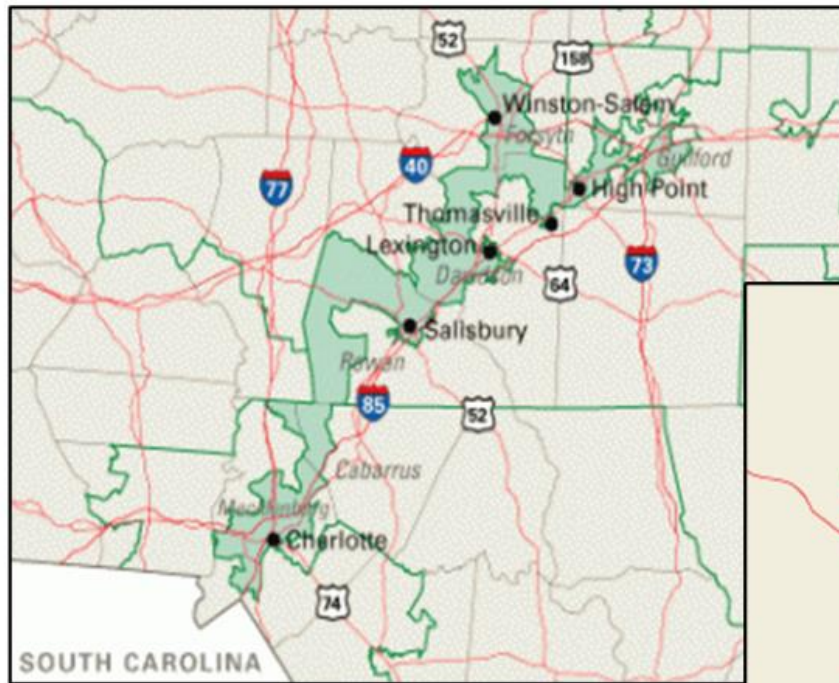
Districting C



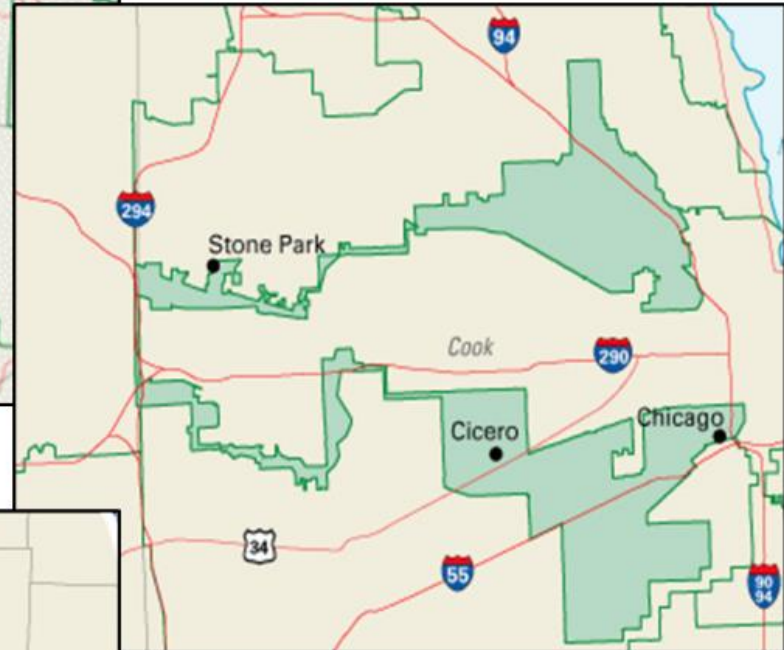
2 districts
40%

3 districts
60%

Yellow wins
unexpectedly



North Carolina
District 12



Illinois
District 4



Ohio
District 7

