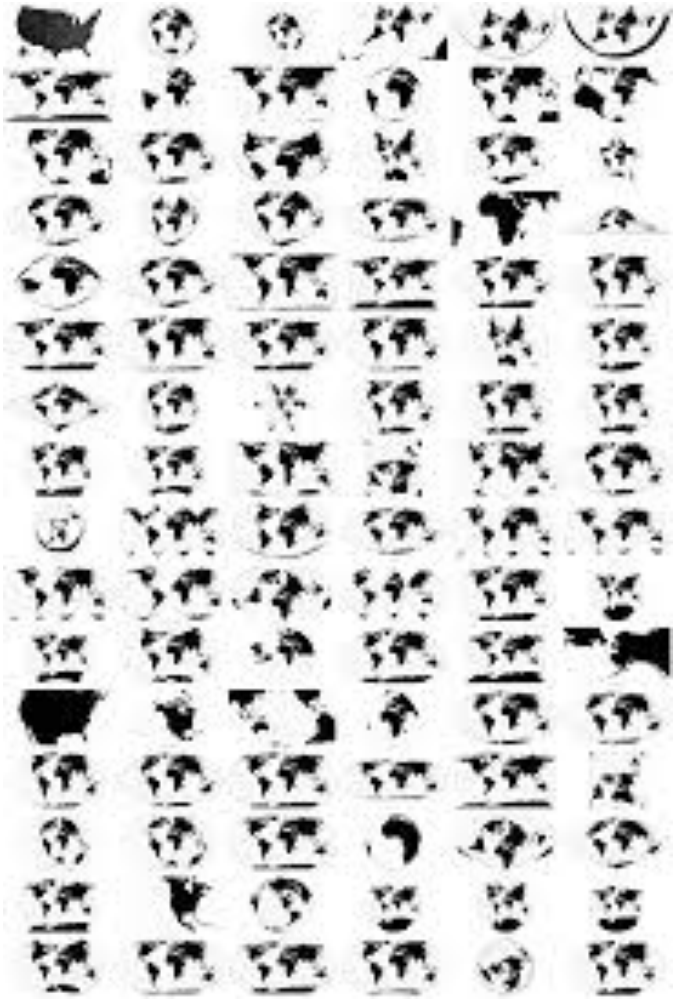
Module #8c:
Map Visualization

Visualizing data with maps

- Visualizing data with maps involves making decision in three basic areas:
  1. Projection: mathematical transformations of the curved three-dimensional surface of the globe onto a flat, two-dimensional plane.
  2. Scale: degree of reduction of the map
  3. Symbolization: visual encoding

1. Projections

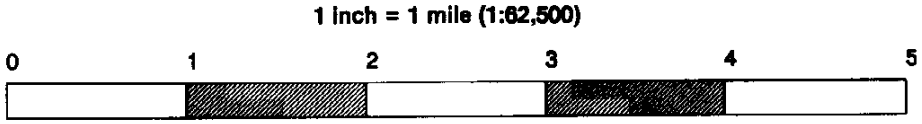
- Tableau, D3 and other visualization tools offer many projections
- See *d3-geo* and *d3-geo-projection*

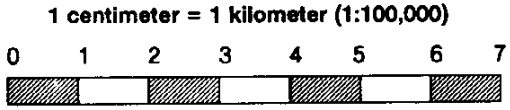


2. Scale

- Map scale: degree of reduction of the map
  - 1:10,000

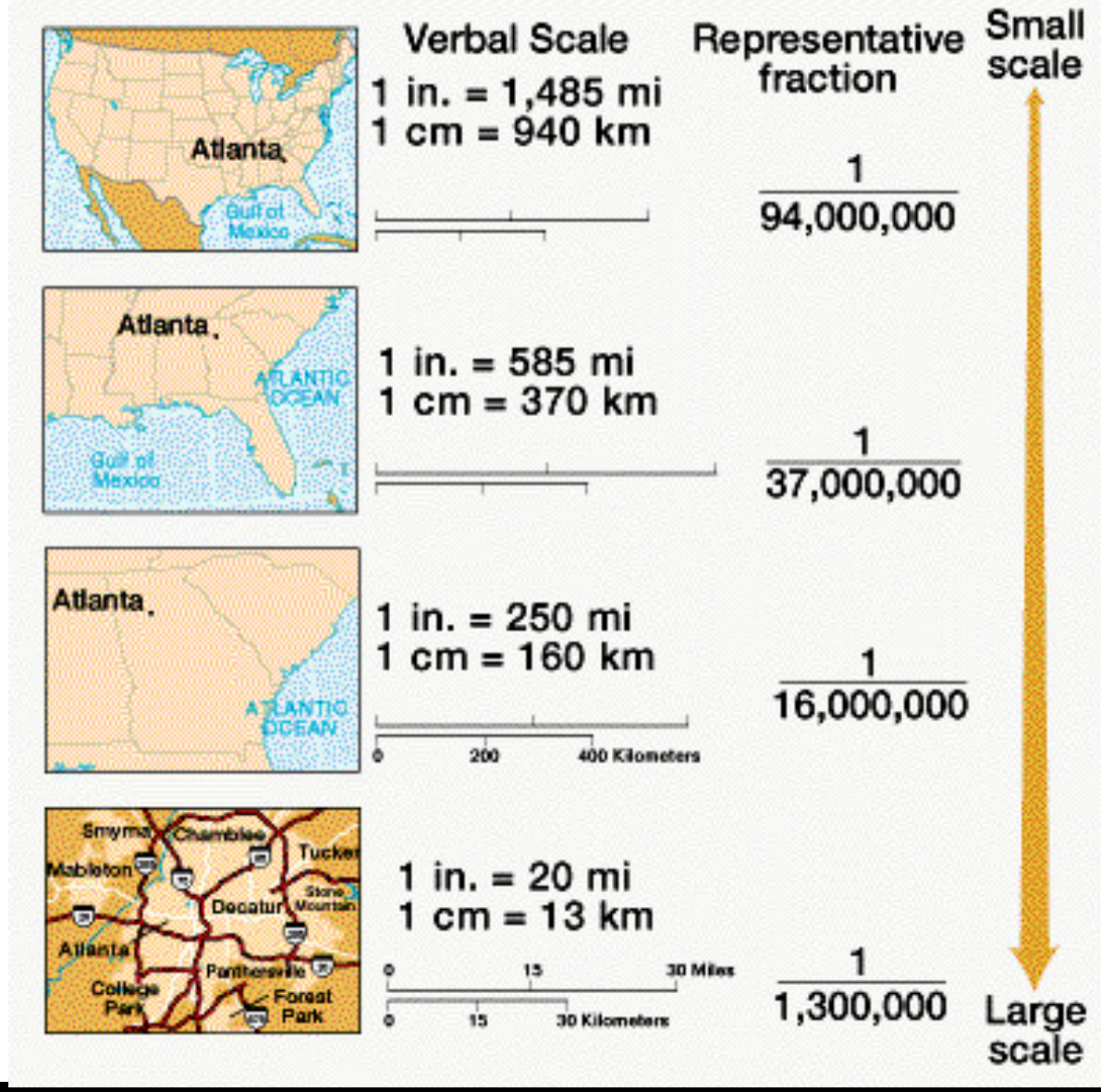
- Scale tells us what extent the portion of the earth represented on the map has been reduced from its original size to fit on the map.





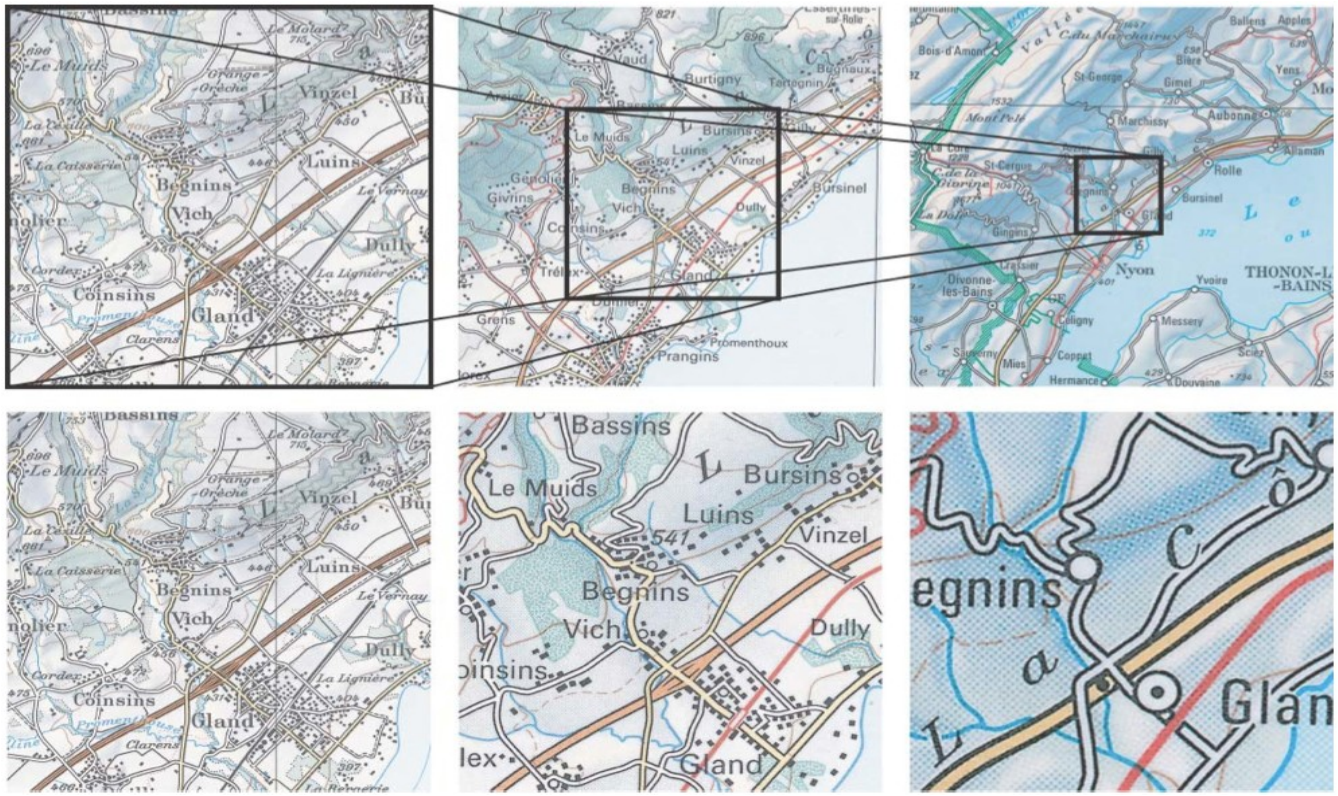
2. Scale

- Counterintuitive part of mapping:
  - The more “zoomed in” the map is on an area, the larger is its map scale.
    - large-scale map depicts a smaller area
  - The less “zoomed in” the map is on an area, the smaller is its scale.
    - Small-scale map depicts a larger area

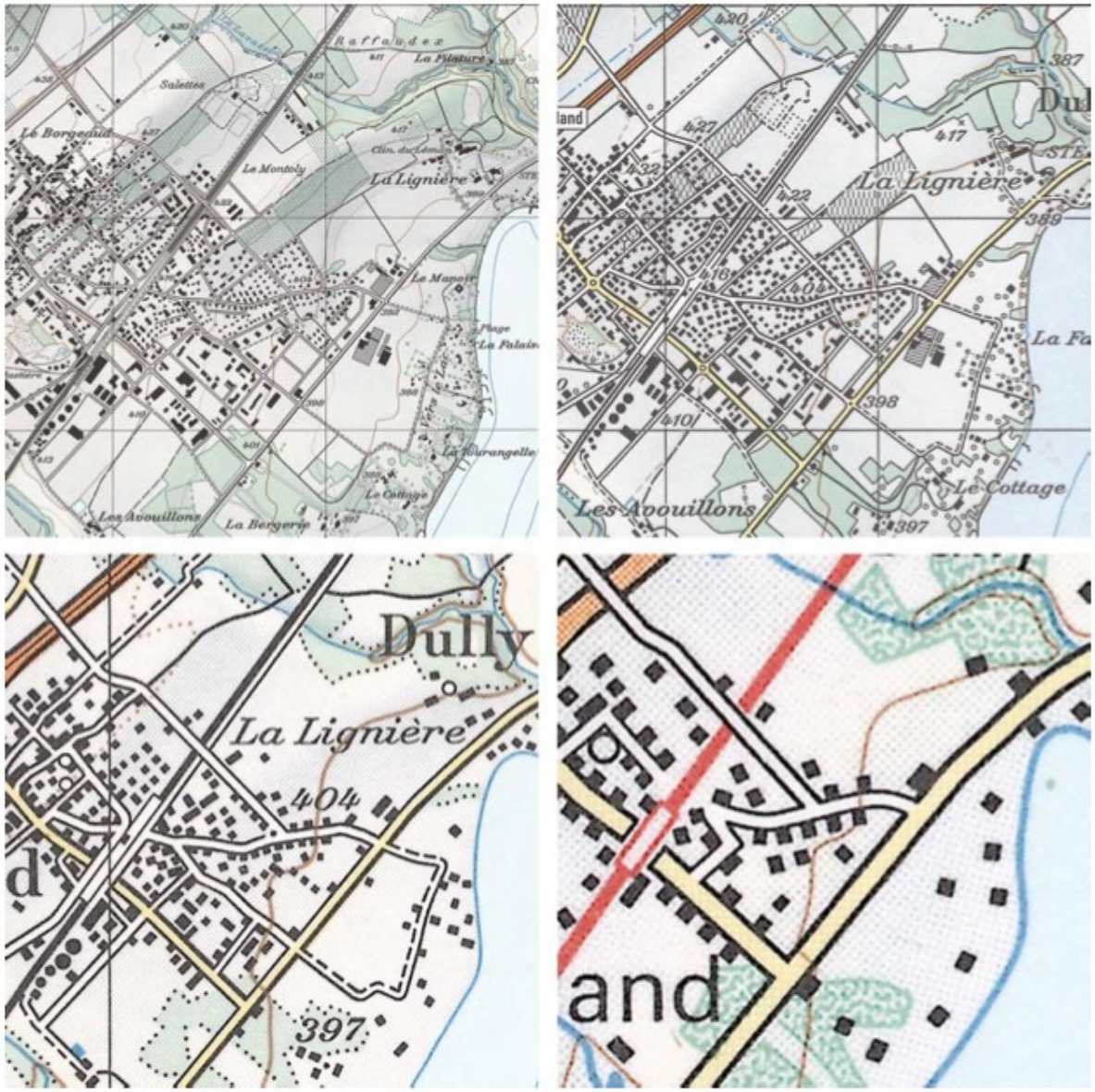


Scale

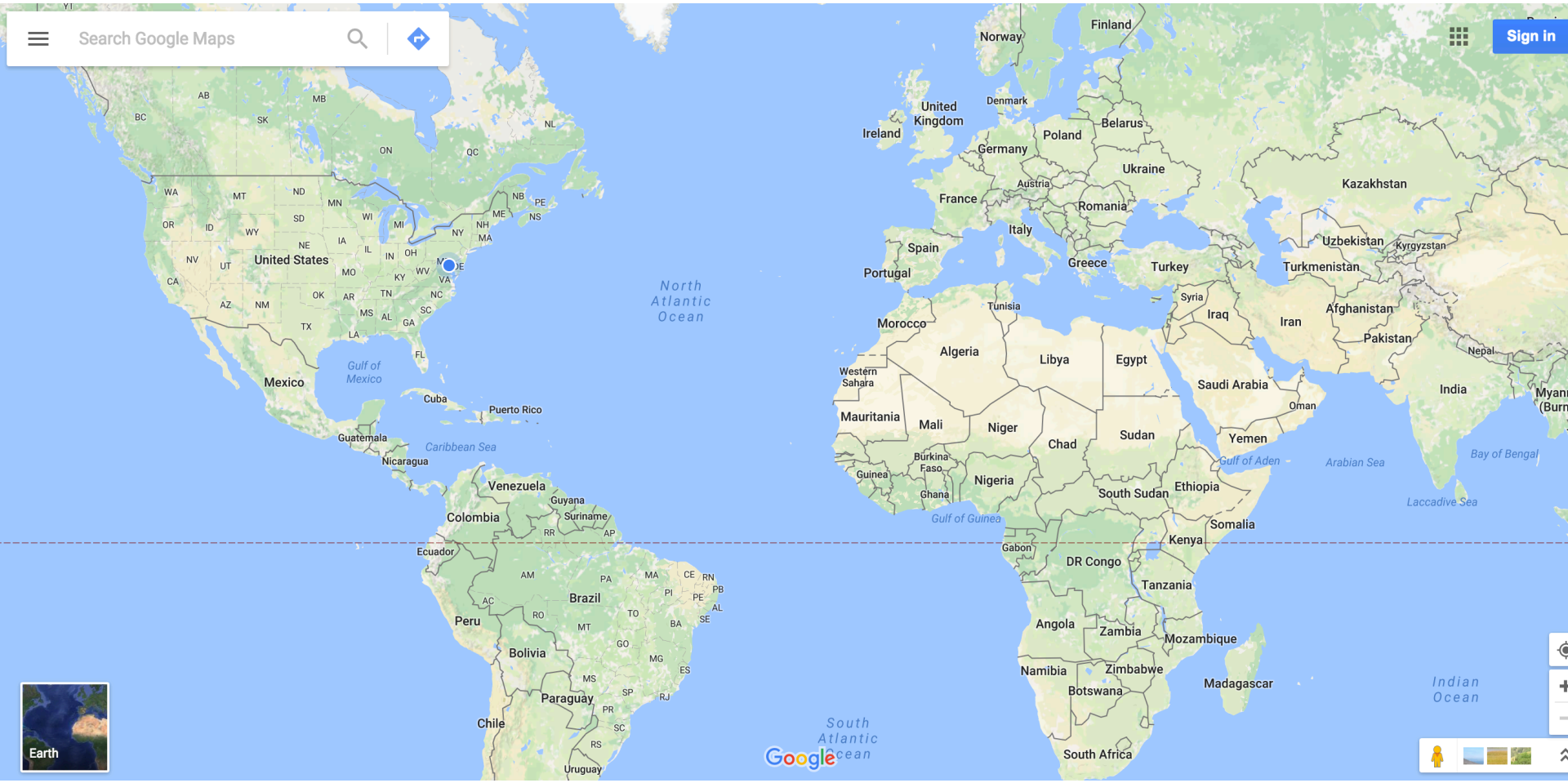
- Choose the right content at different scales

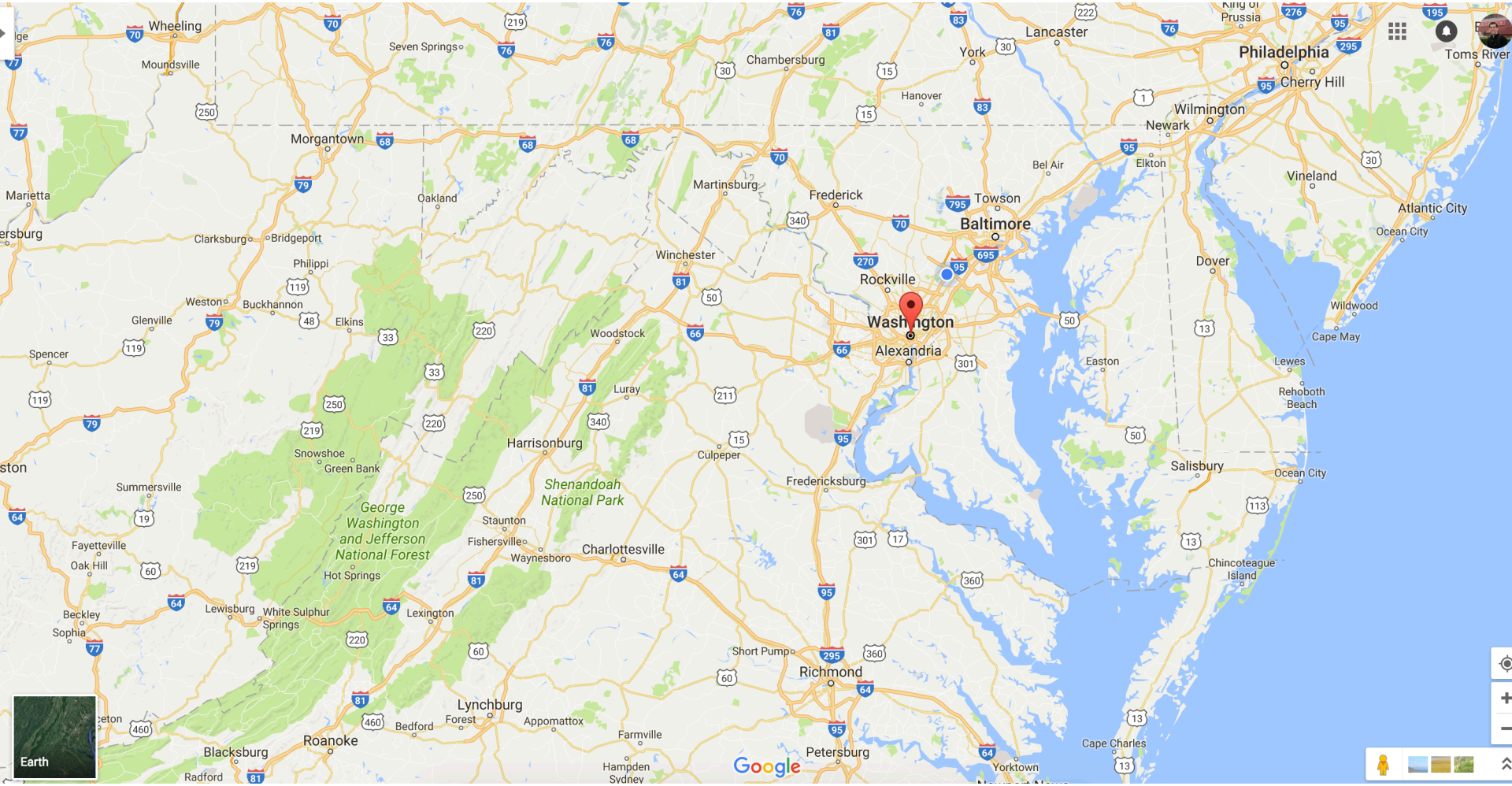


Four maps, same area



What to show at different scales

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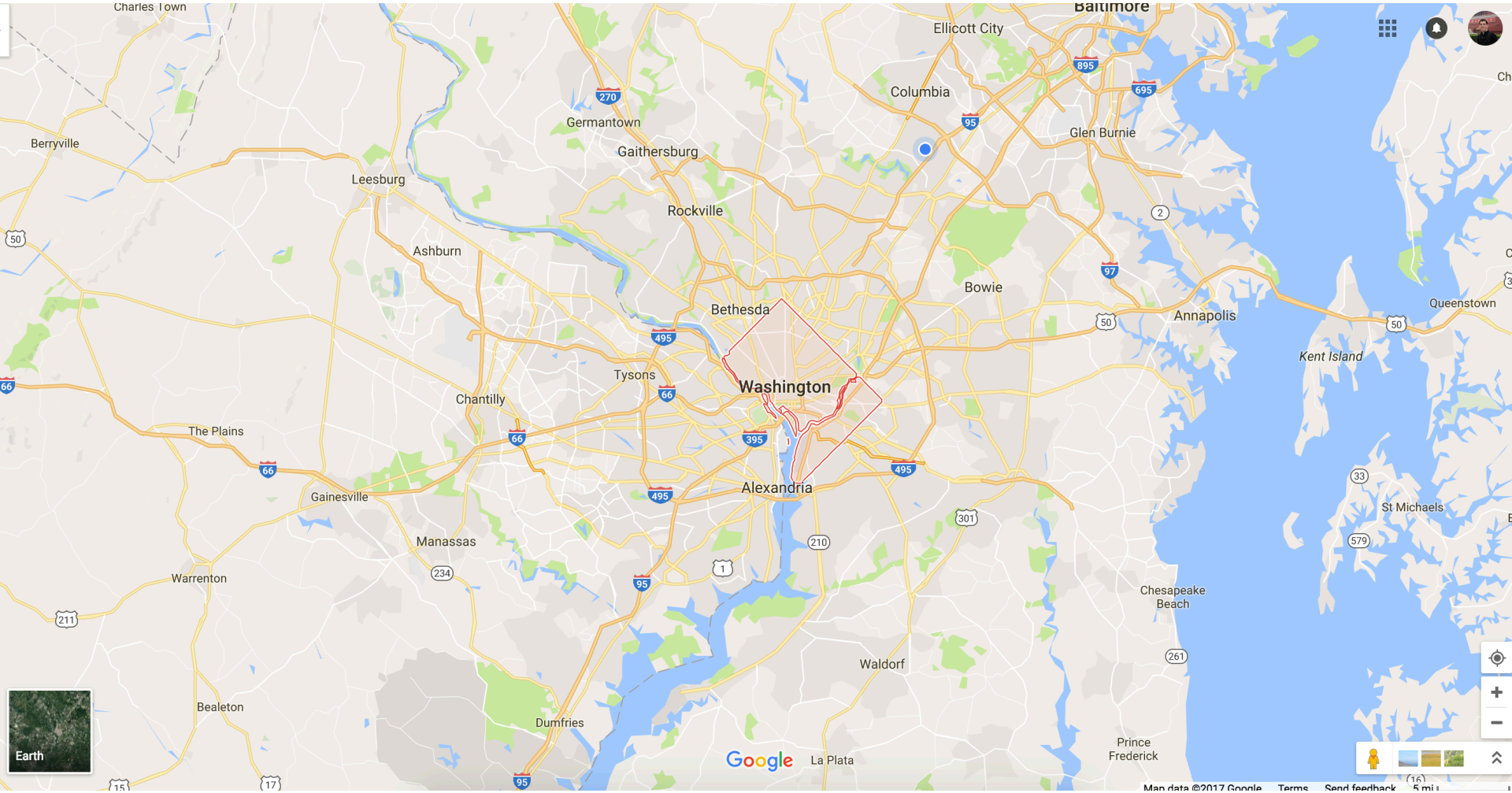
Moundsville
Seven Springs
Chambersburg
Lancaster
York
Philadelphia
Cherry Hill
Toms River
Hanover
Wilmington
Newark
Morgantown
Bel Air
Elkton
Vineland
Marietta
Oakland
Martinsburg
Frederick
Towson
Baltimore
Atlantic City
Ocean City
Clarksburg
Bridgeport
Philippi
Winchester
Rockville
Dover
Weston
Buckhannon
Glenville
Elkins
Washington
Alexandria
Wildwood
Cape May
Spencer
Woodstock
Easton
Lewes
Luray
Rehoboth Beach
Harrisonburg
Culpeper
Snowshoe
Green Bank
Salisbury
Ocean City
Summersville
Fredericksburg
Shenandoah National Park
George Washington and Jefferson National Forest
Staunton
Fayetteville
Oak Hill
Fishersville
Waynesboro
Charlottesville
Chincoteague Island
Hot Springs
Beckley
Sophia
Lewisburg
White Sulphur Springs
Lexington
Short Pump
Richmond
Lynchburg
Forest
Bedford
Appomattox
Roanoke
Blacksburg
Farmville
Petersburg
Cape Charles
Radford
Hampden Sydney
Yorktown
Earth
Google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Baltimore
Ellicott City
Columbia
Glen Burnie
Germantown
Gaithersburg
Berryville
Leesburg
Rockville
Ashburn
Bowie
Bethesda
Annapolis
Queenstown
Kent Island
Tysons
Washington
Chantilly
The Plains
Alexandria
Gainesville
St Michaels
Manassas
Warrenton
Chesapeake Beach
Waldorf
Bealeton
Dumfries
Prince Frederick
La Plata
Earth
Google
Map data ©2017 Google
Terms
Send feedback
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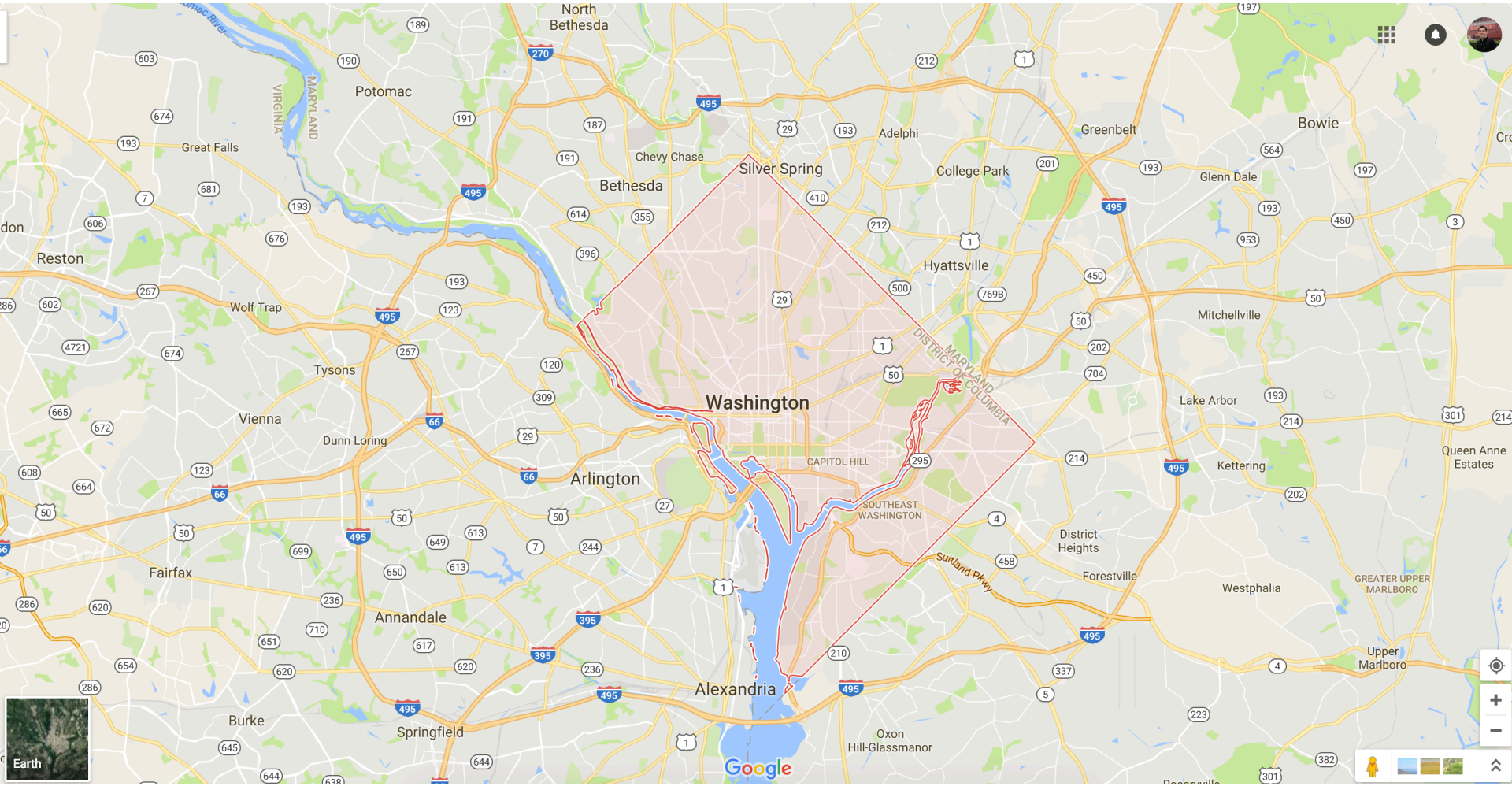
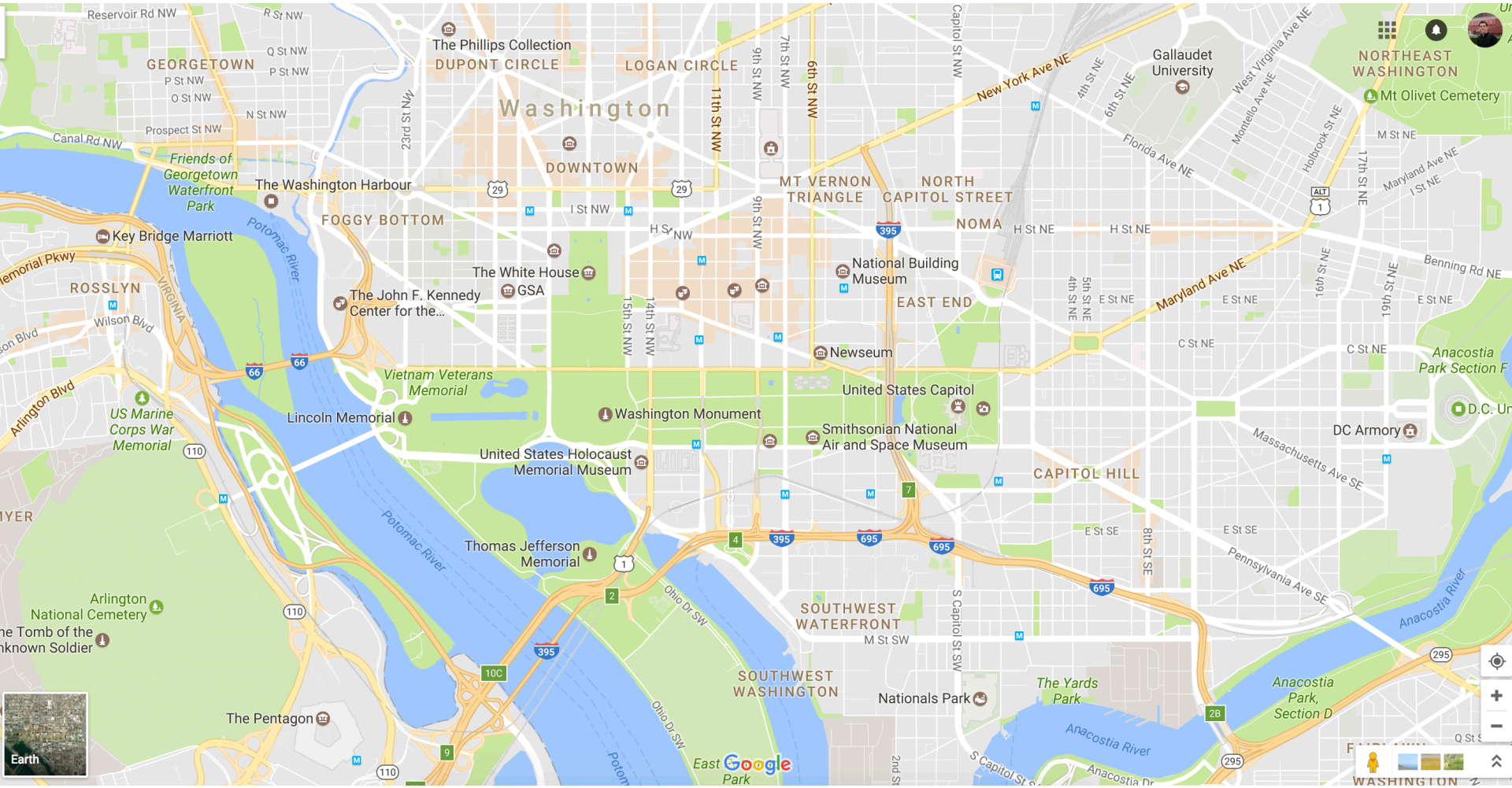
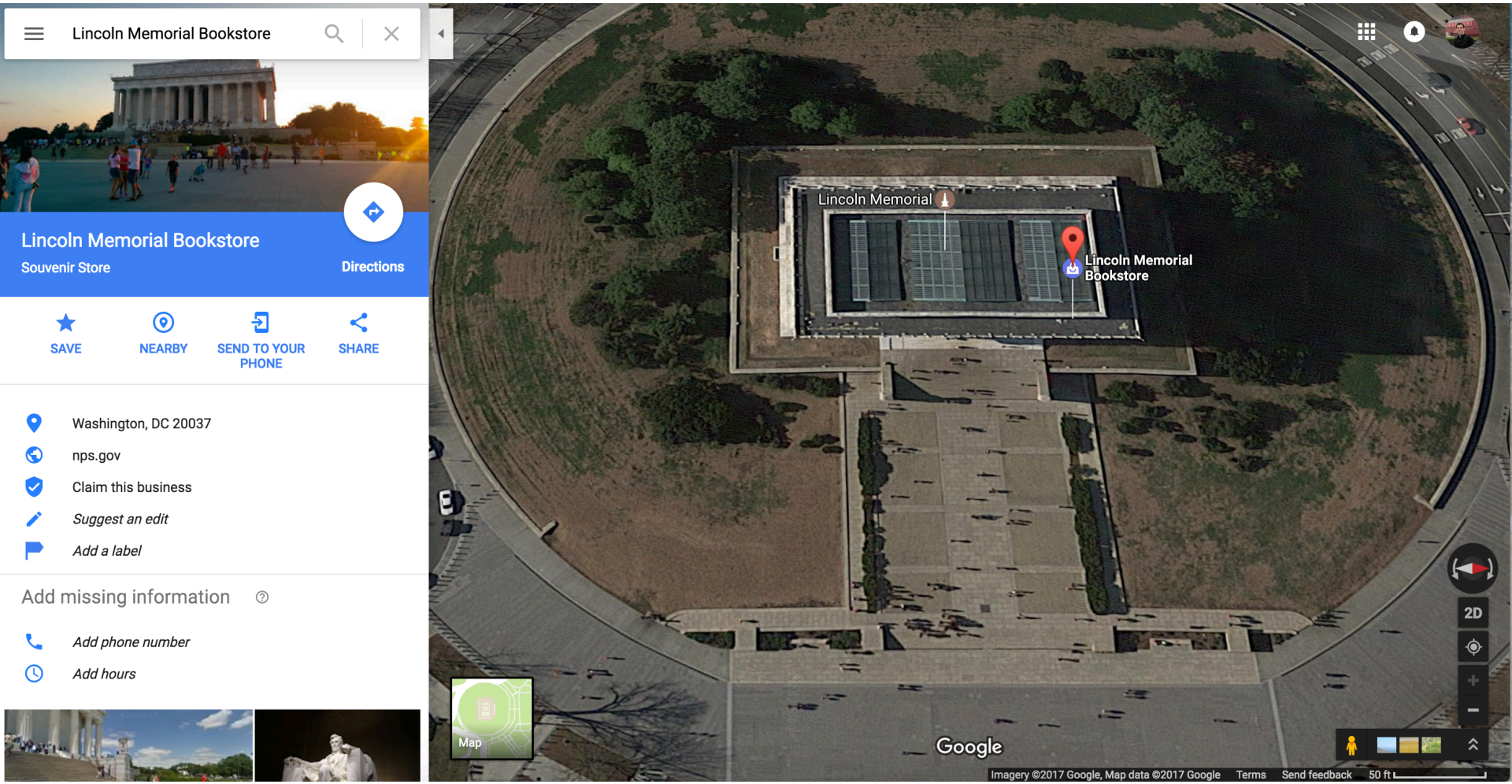

North Bethesda
Potomac
VIRGINIA
MARYLAND
Great Falls
Chevy Chase
Bethesda
Silver Spring
Adelphi
College Park
Greenbelt
Bowie
Glenn Dale
Reston
Wolf Trap
Hyattsville
Mitchellville
Tysons
Vienna
Dunn Loring
Washington
DISTRICT OF COLUMBIA
MARYLAND
CAPITOL HILL
SOUTHEAST WASHINGTON
Lake Arbor
Kettering
Queen Anne Estates
Arlington
Fairfax
Annandale
District Heights
Forestville
Suitland Pkwy
Westphalia
GREATER UPPER MARLBORO
Upper Marlboro
Alexandria
Burke
Springfield
Oxon Hill-Glassmanor
Earth
Google


Reservoir Rd NW
R St NW
Q St NW
P St NW
O St NW
N St NW
Prospect St NW
Canal Rd NW
GEORGETOWN
The Phillips Collection
DUPONT CIRCLE
LOGAN CIRCLE
Washington
DOWNTOWN
Friends of Georgetown Waterfront Park
The Washington Harbour
FOGGY BOTTOM
Key Bridge Marriott
Potomac River
ROSSLYN
Wilson Blvd
VIRGINIA
The White House
GSA
The John F. Kennedy Center for the...
I St NW
H St NW
MT VERNON TRIANGLE
NORTH CAPITOL STREET
NOMA
H St NE
National Building Museum
EAST END
E St NE
C St NE
Newseum
Vietnam Veterans Memorial
Lincoln Memorial
Washington Monument
United States Capitol
US Marine Corps War Memorial
Arlington Blvd
United States Holocaust Memorial Museum
Smithsonian National Air and Space Museum
CAPITOL HILL
DC Armory
Massachusetts Ave SE
Thomas Jefferson Memorial
Potomac River
Arlington National Cemetery
Tomb of the Unknown Soldier
SOUTHWEST WATERFRONT
M St SW
SOUTHWEST WASHINGTON
Nationals Park
The Yards Park
Anacostia Park, Section D
Anacostia River
The Pentagon
East Potomac Park
Ohio Dr SW
Pennsylvania Ave SE
E St SE
8th St SE
S Capitol St SW
NORTHEAST WASHINGTON
Mt Olivet Cemetery
Gallaudet University
New York Ave NE
Florida Ave NE
Maryland Ave NE
Benning Rd NE
M St NE
Anacostia Park Section F
D.C. Un
Earth


The White House
The Hamilton
F St NW
W Washington D.C
The National Theatre
The White House South Lawn
Pershing Park
President's Park
Pennsylvania Ave NW
GSA
The John F. Kennedy Center for the...
Virginia Ave NW
E St NW
23rd St NW
21st St NW
19th St NW
18th St NW
17th St NW
15th St NW
14th St NW
Easby Point
DAR Daughters of the American Revolution
DAR Constitution Hall
D St NW
C St NW
The Ellipse
Ronald Reagan Building and International Trade...
22nd St NW
Organization of American States
Pan American Annex
Constitution Ave NW
Vietnam Veterans Memorial
Constitution Gardens
Smithsonian National Museum
Lincoln Memorial
Lincoln Memorial Reflecting Pool
World War II Memorial
Washington Monument
Korean War Veterans Memorial
Ash Woods
Independence Ave SW
Ohio Dr SW
Arlington Memorial Bridge
Earth
Google

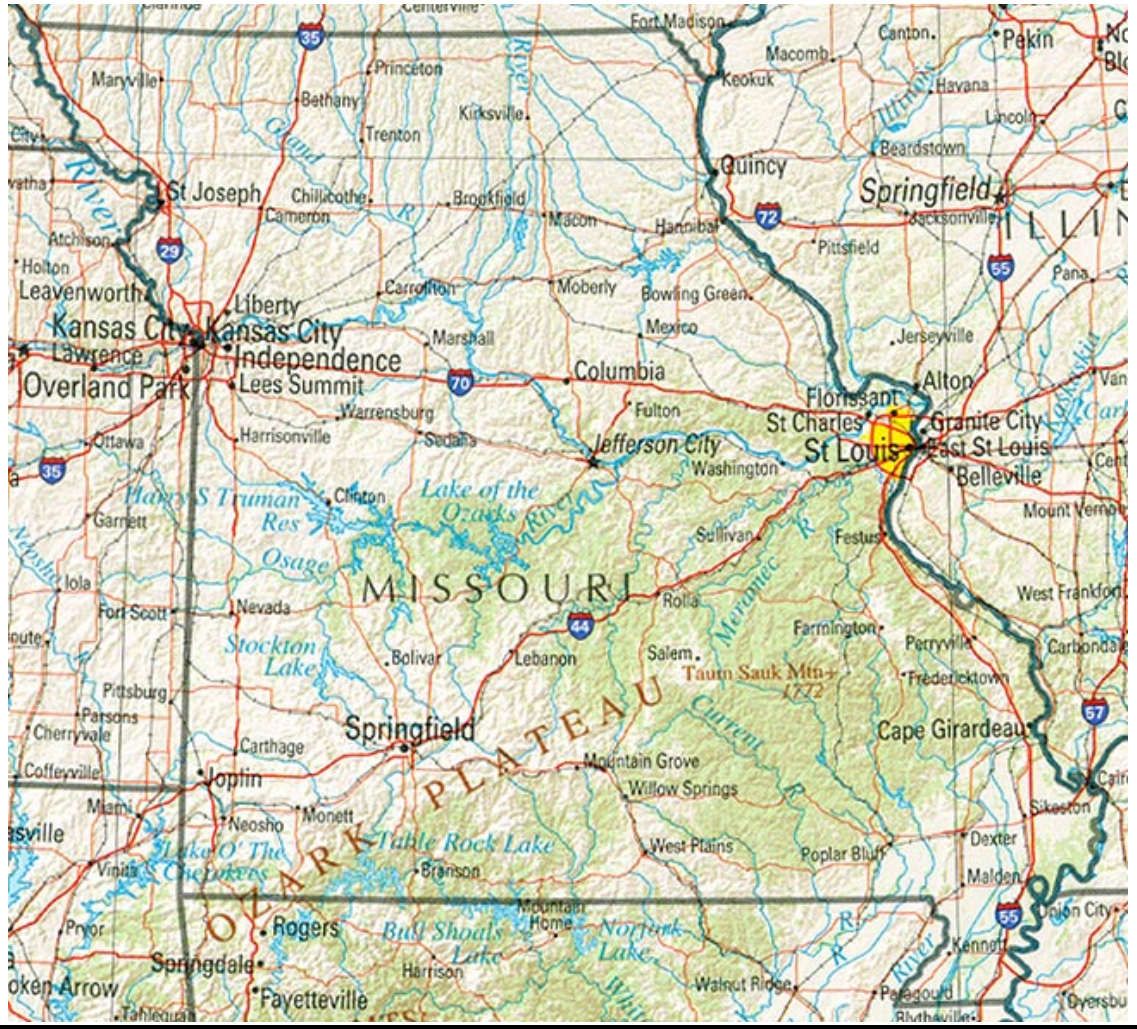

Lincoln Memorial Bookstore
Lincoln Memorial Bookstore
Souvenir Store
Directions
SAVE
NEARBY
SEND TO YOUR PHONE
SHARE
Washington, DC 20037
nps.gov
Claim this business
Suggest an edit
Add a label
Add missing information
Add phone number
Add hours
Lincoln Memorial
Lincoln Memorial Bookstore
2D
Map
Google
Imagery ©2017 Google, Map data ©2017 Google
Terms
Send feedback
50 ft

3. Symbolization

- How to encode the information
  - Geographical
  - Data
- Depends on our goal

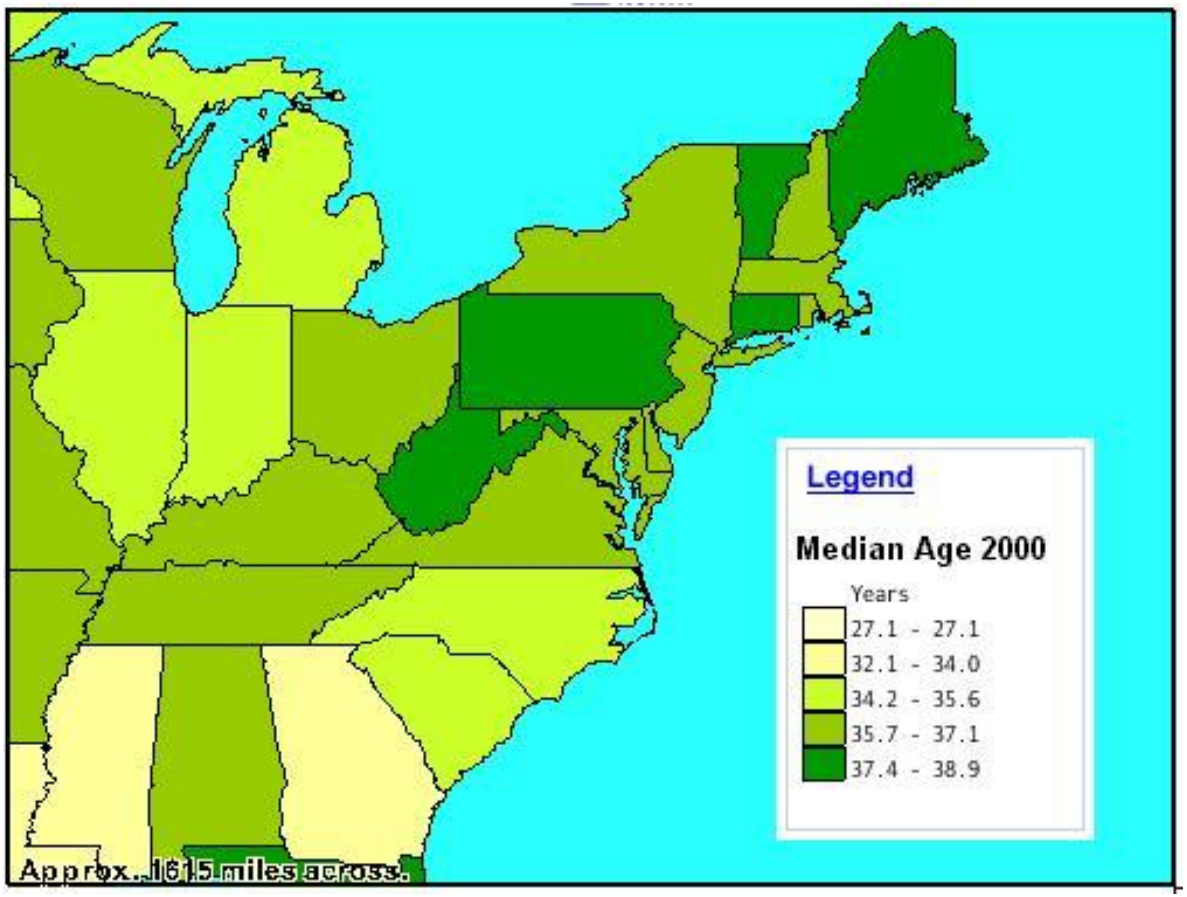
Reference Map

- Show locations of places and geographic features.



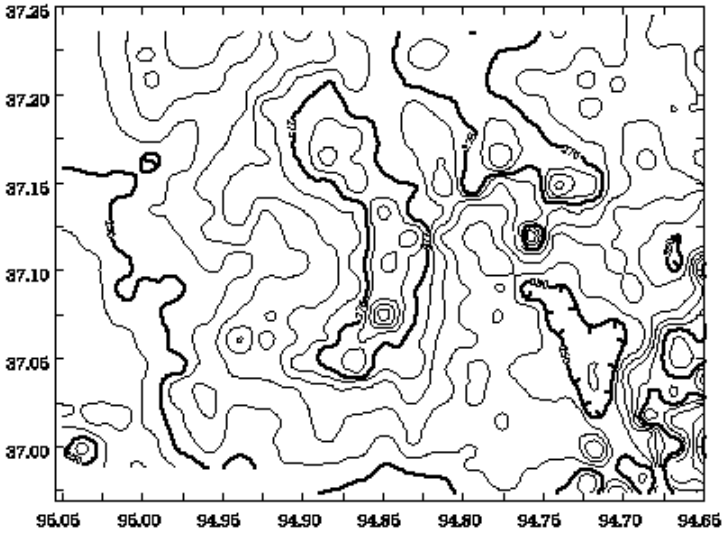
Thematic Map

- Tell a story about the degree of an attribute, the pattern of its distribution, or its movement.



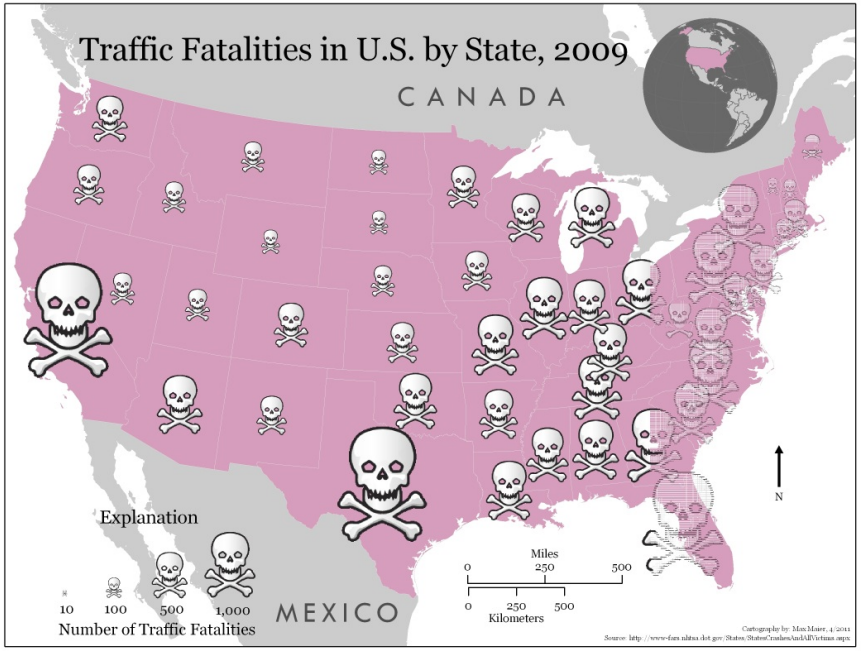
Contour Maps (Isopleths)

- **Isolines-** Lines on a map depicting areas of same or like values.
- Contour maps use **isolines**, or contour lines, to depict where the same elevation exists.
- The **contour interval** of a contour map is the difference in elevation between successive contour lines.

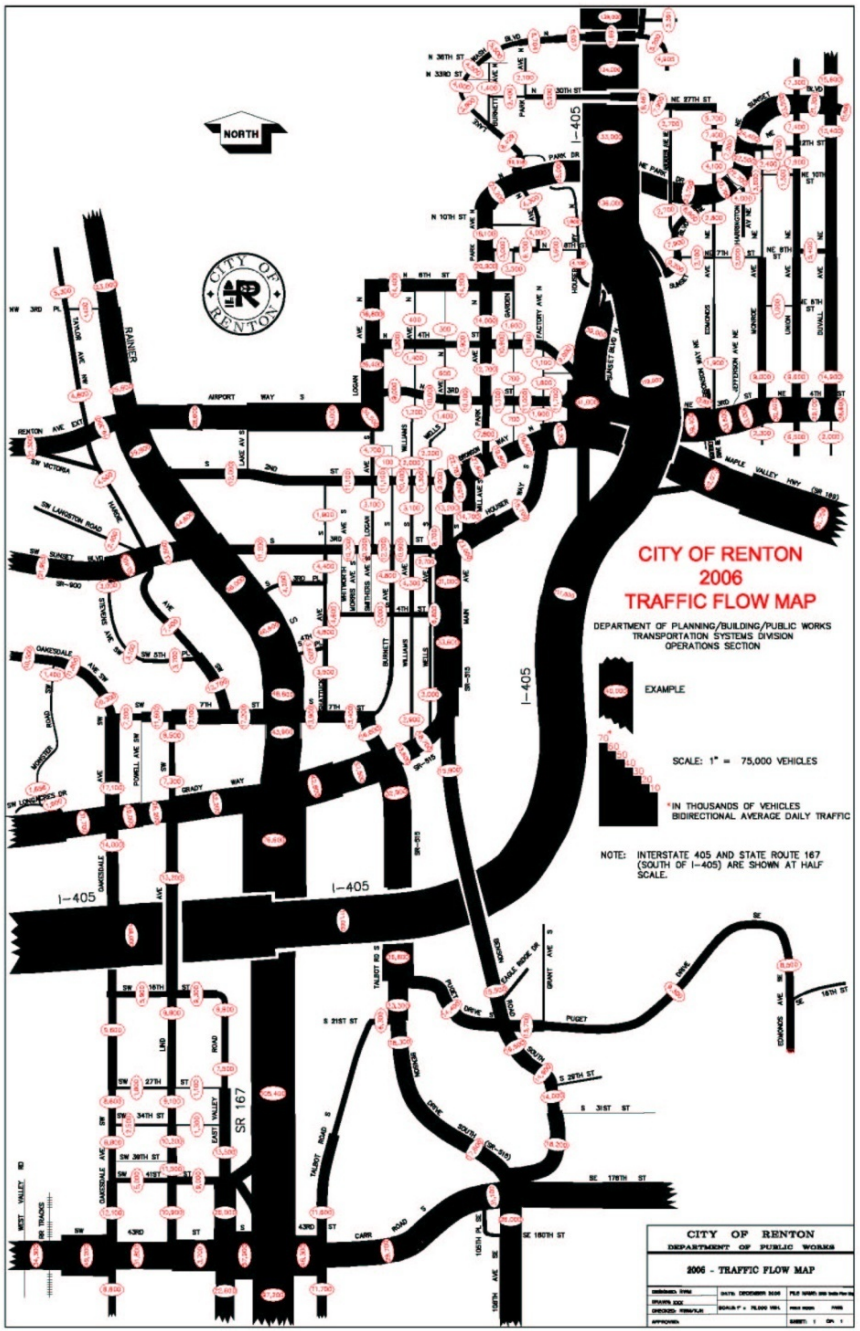


Proportional Symbols Map

- The proportional symbol technique uses symbols of different sizes to represent data associated with different areas or locations within the map.



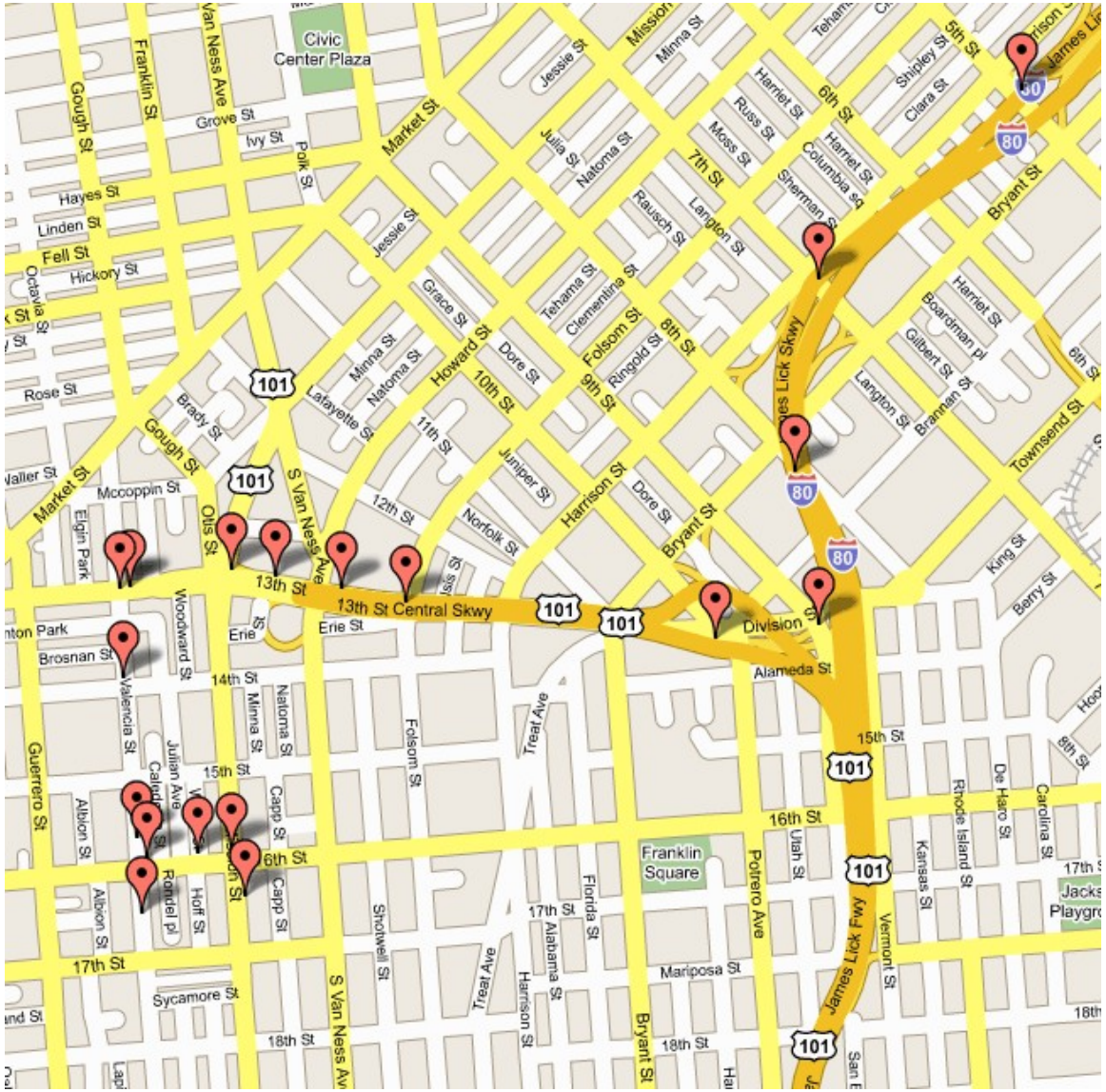
Proportional Symbols Map



Dot Map

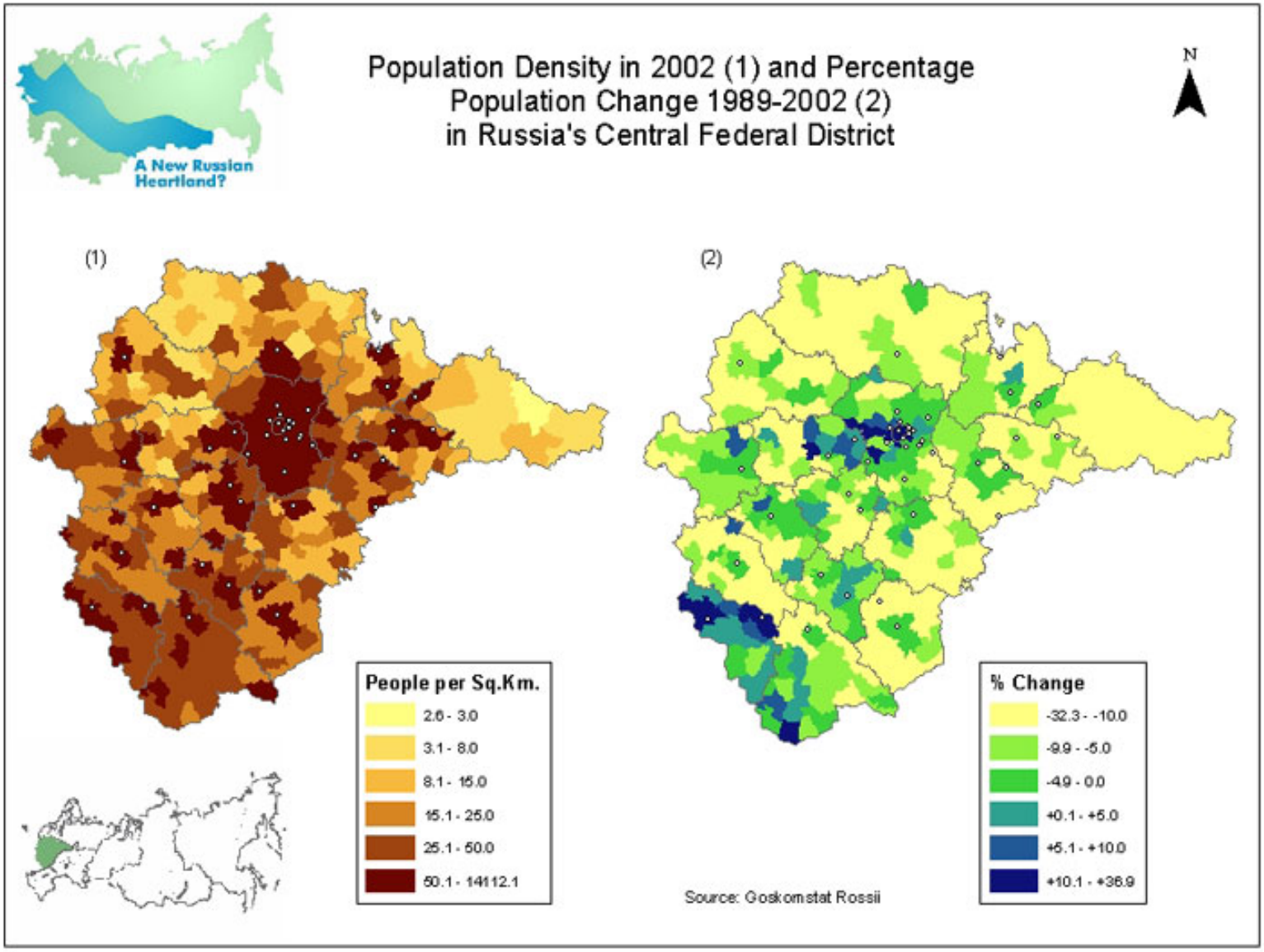
- A dot may be used to locate each occurrence of a phenomenon.
- Where appropriate, a dot may indicate any number of entities, for example, one dot for every 100 voters.

Military families in Ohio


Civic Center Plaza
Franklin St
Van Ness Ave
Gough St
Grove St
Hayes St
Linden St
Fell St
Hickory St
Market St
Ivy St
Polk St
Jessie St
Mission
Minna St
Julia St
Natoma St
Harriet St
Russ St
Moss St
Columbia sq
Sherman St
Shipley St
Clara St
5th St
6th St
7th St
Rausch St
Langton St
Bryant St
Tehama St
Clementina St
Folsom St
8th St
Ringold St
9th St
Grace St
Howard St
Dore St
10th St
11th St
Lafayette St
Rose St
Brady St
Waller St
Mccoppin St
Elgin Park
Otis St
S Van Ness Ave
12th St
Juniper St
Norfolk St
Harrison St
13th St
13th St Central Skwy
Erie St
Woodward St
Brosnan St
14th St
Valencia St
Julian Ave
Capp St
15th St
16th St
Guerrero St
Albion St
Hoff St
Rondel pl
17th St
Sycamore St
18th St
Shotwell St
Treat Ave
Florida St
Alabama St
Harrison St
Bryant St
Mariposa St
Franklin Square
Potrero Ave
Utah St
Kansas St
Rhode Island St
De Haro St
Carolina St
Vermont St
James Lick Skwy
Division
Alameda St
King St
Berry St
Townsend St
Boardman pl
Gilbert St
Brannan St
Langton St
Harriet St
80
101
30

Choropleth Map

- Shows statistical data aggregated over predefined regions, such as counties or states, by **coloring** or shading these regions.
- For example, countries with higher rates of infant mortality might appear darker on a choropleth map.

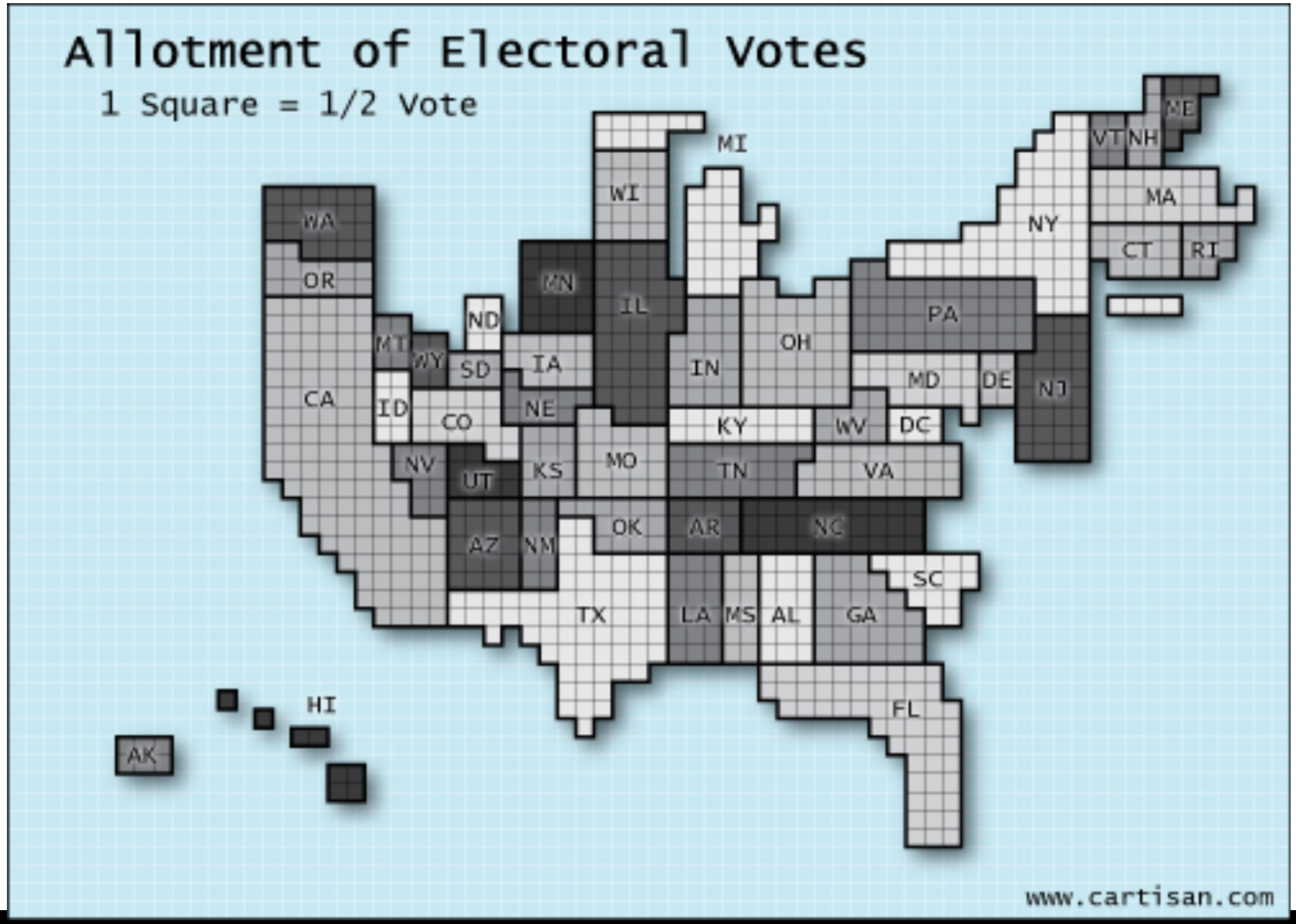

A New Russian Heartland?
Population Density in 2002 (1) and Percentage Population Change 1989-2002 (2) in Russia's Central Federal District
N
(1)
(2)
People per Sq.Km.
2.6 - 3.0
3.1 - 8.0
8.1 - 15.0
15.1 - 25.0
25.1 - 50.0
50.1 - 14112.1
% Change
-32.3 - -10.0
-9.9 - -5.0
-4.9 - 0.0
+0.1 - +5.0
+5.1 - +10.0
+10.1 - +36.9
Source: Goskomstat Rossii

Cartogram

- A **cartogram** is a map in which some thematic mapping variable is substituted for land area or distance.
- The geometry or space of the map is distorted in order to convey the information of this alternate variable.

Cartogram


RUSSIA
CANADA
UNITED STATES
U.K.
GERMANY
UKRAINE
FRANCE
ITALY
TURKEY
IRAN
PAKISTAN
CHINA
S. KOREA
JAPAN
MEXICO
EGYPT
INDIA
BANGLADESH
MYANMAR
NIGERIA
ETHIOPIA
PHILIPPINES
THAILAND
COLOMBIA
PACIFIC OCEAN
PERU
BRAZIL
D.R. CONGO
ATLANTIC OCEAN
INDONESIA
SOUTH AFRICA
INDIAN OCEAN
AUSTRALIA
NEW ZEALAND
ARGENTINA
ANTARCTICA

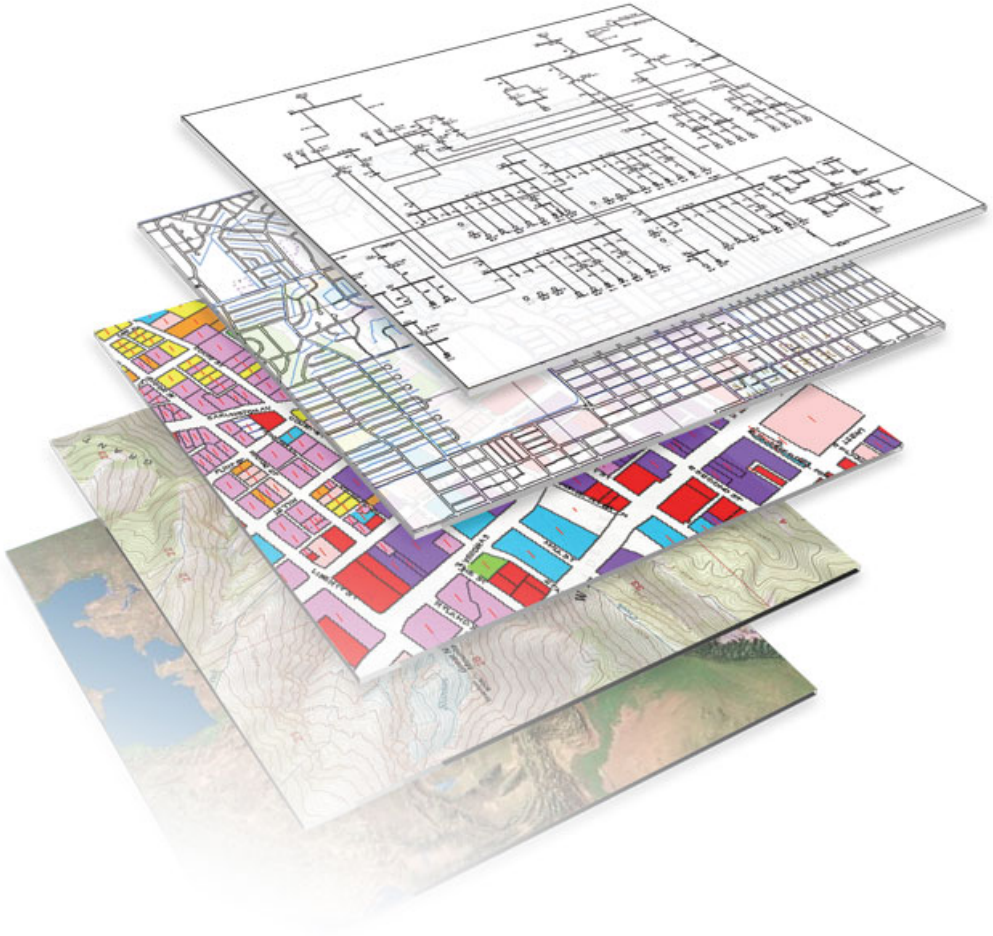

Allotment of Electoral Votes
1 Square = 1/2 Vote
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
MD
DC
DE
NJ
CT
RI
MA
VT
NH
ME
HI
AK
www.cartisan.com

Cartogram

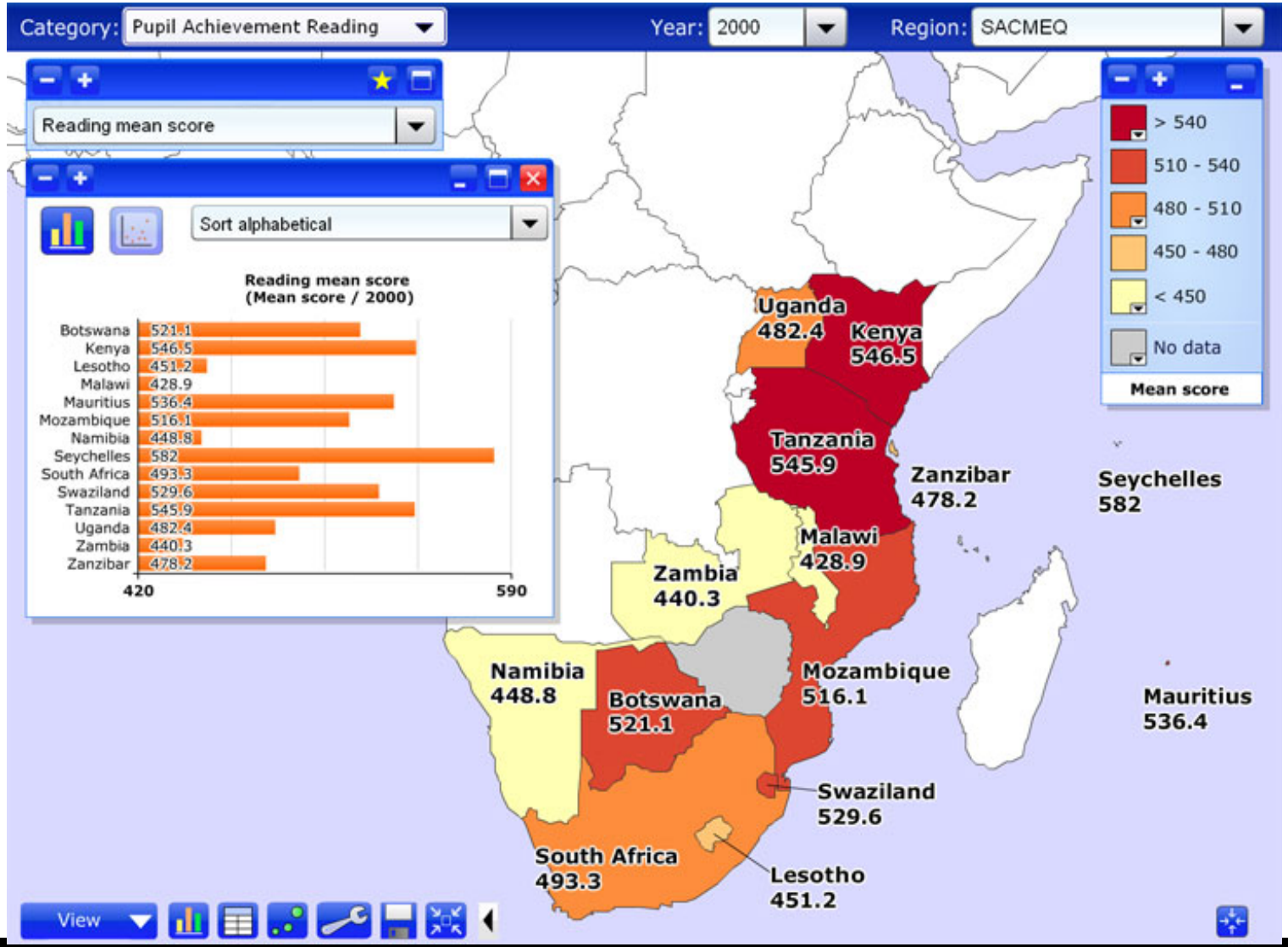
GIS map

- A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.
- GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.

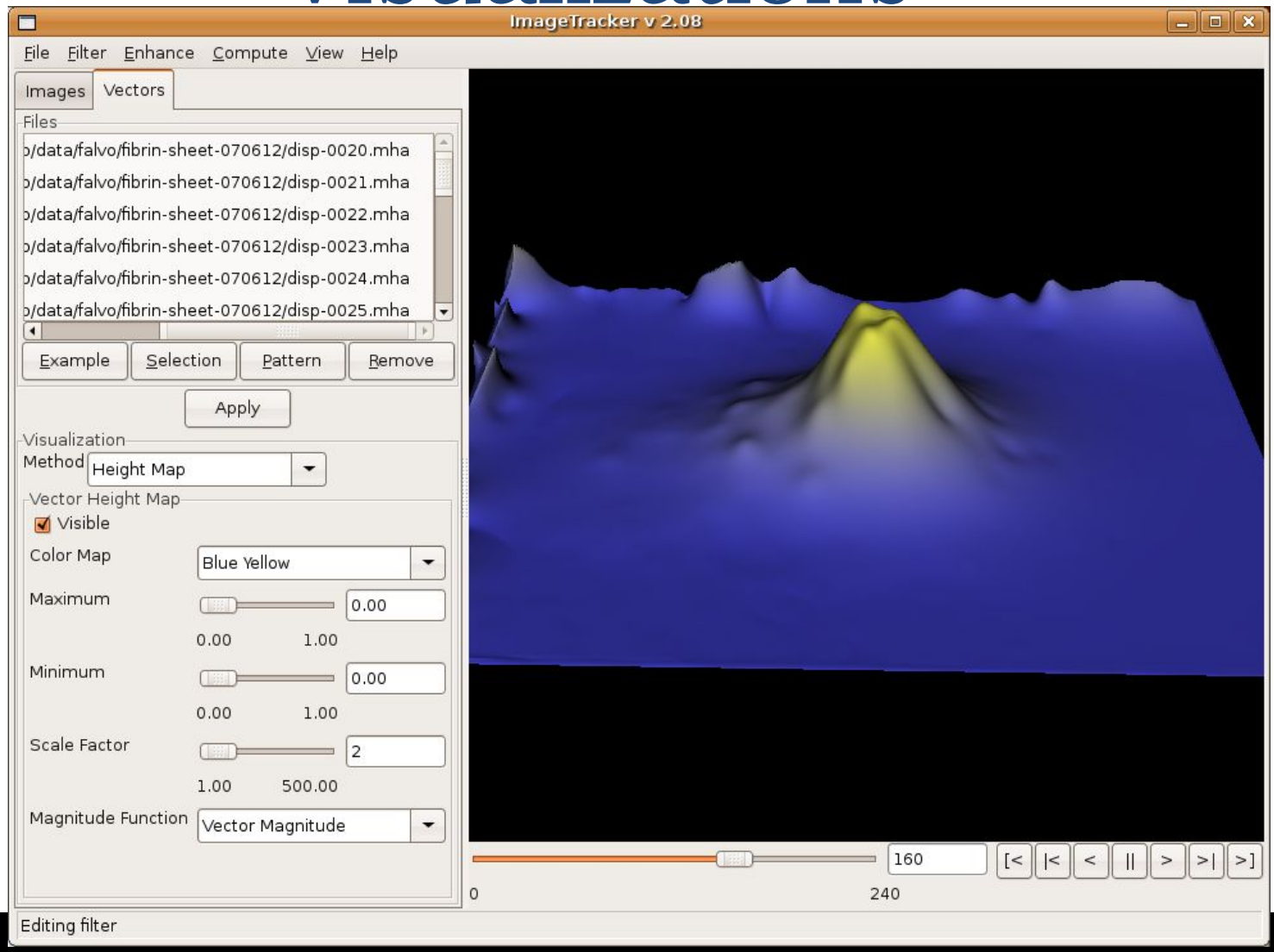
GIS map



Location Chart

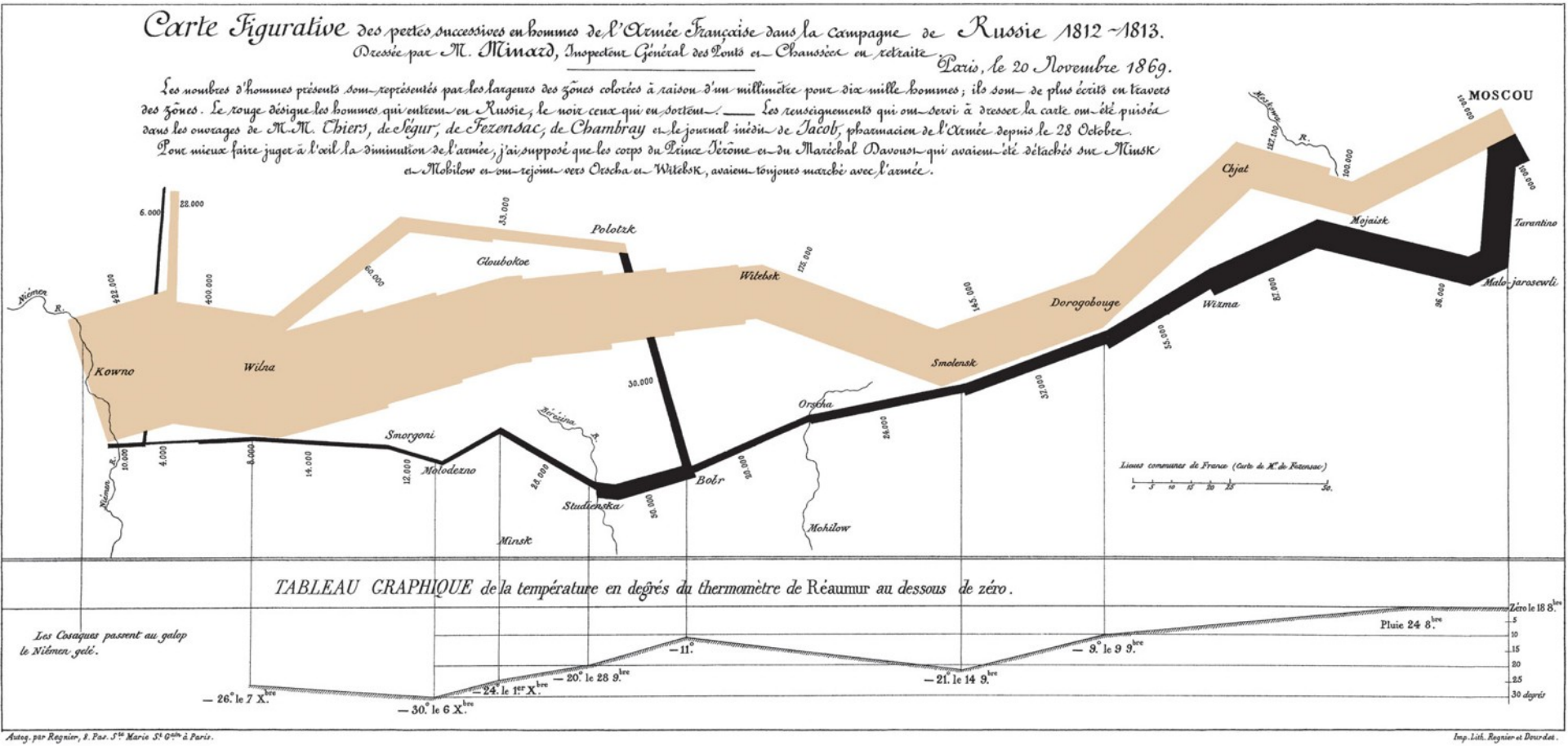


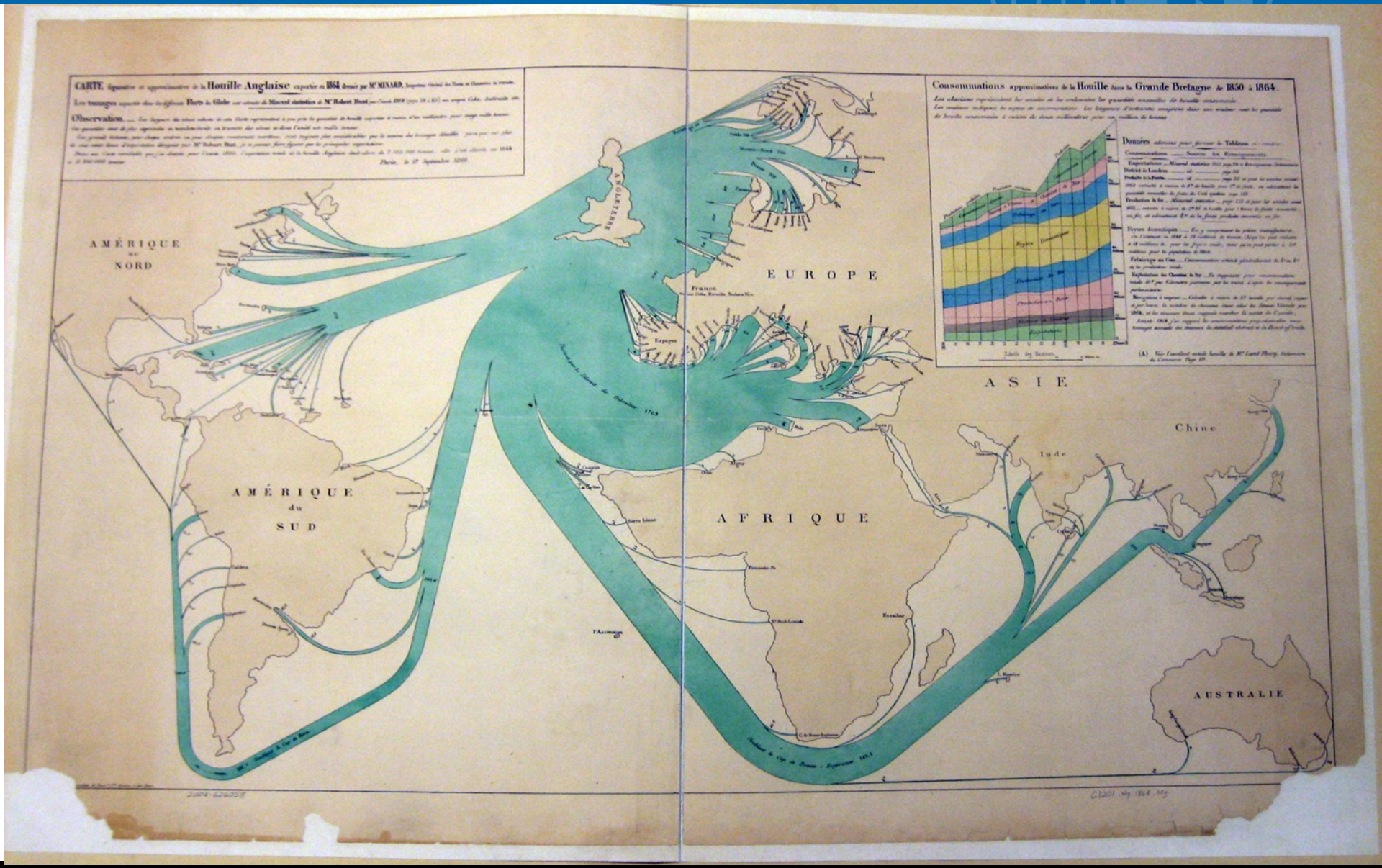
Visualizations



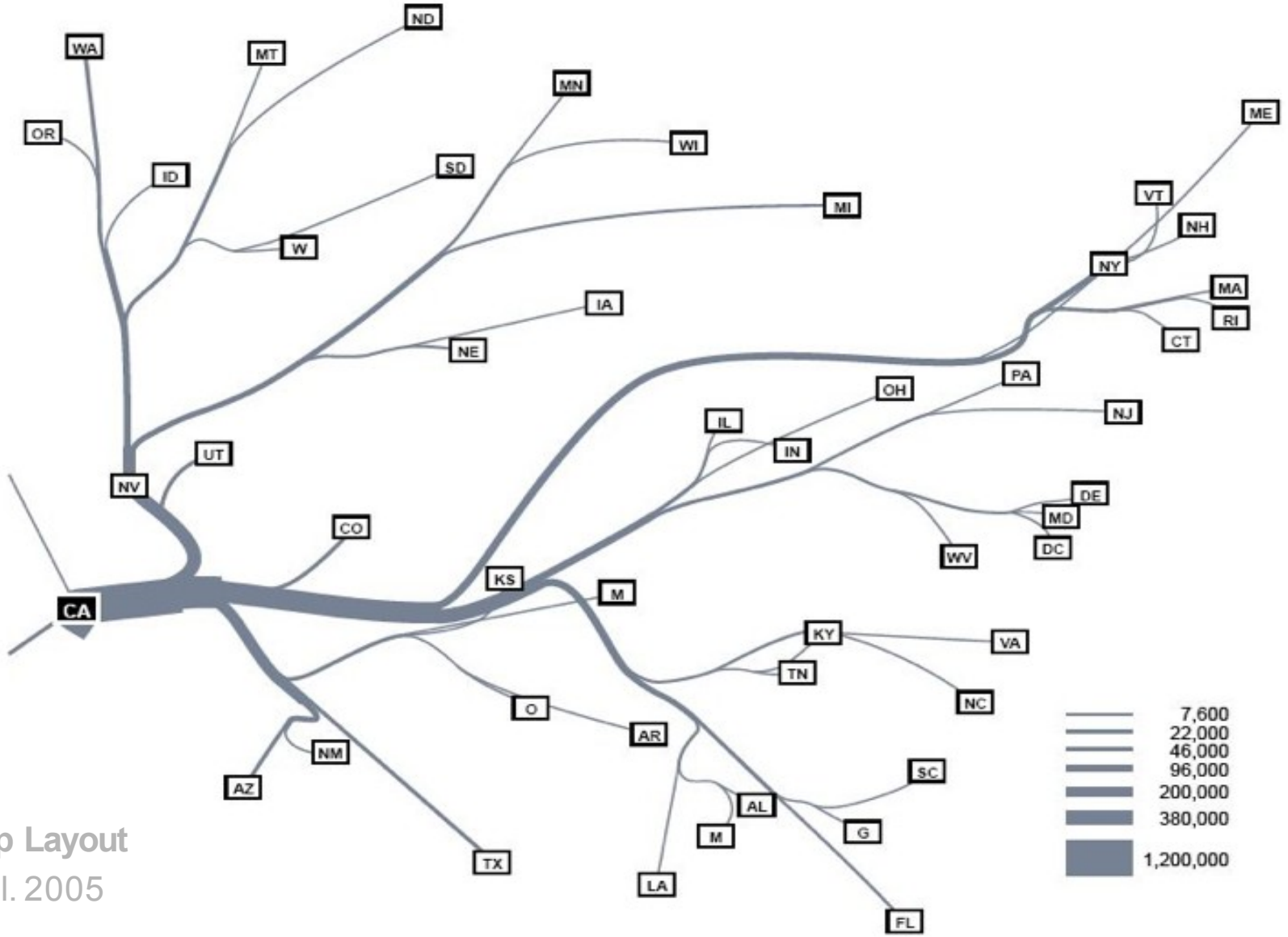
Flow Maps

Minard 1869: Napoleon's march





1864 British Coal Exports, Charles Minard



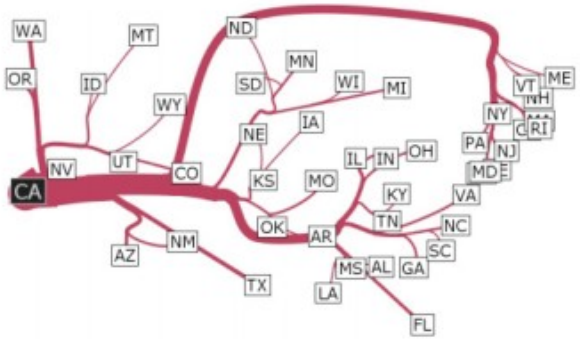
Flow Map Layout

Phan et al. 2005

Migration from California, 95-00

Tobler 1987

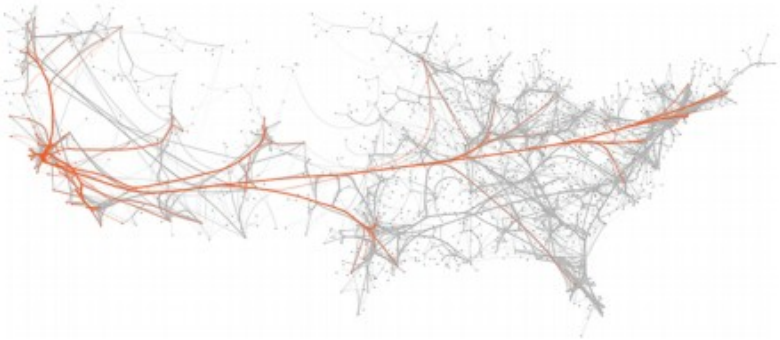
Phan et al. 2005



Verbeek et al. 2011

Cui et al. 2008

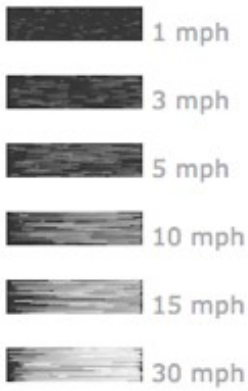
Holten & van Wijk 2009

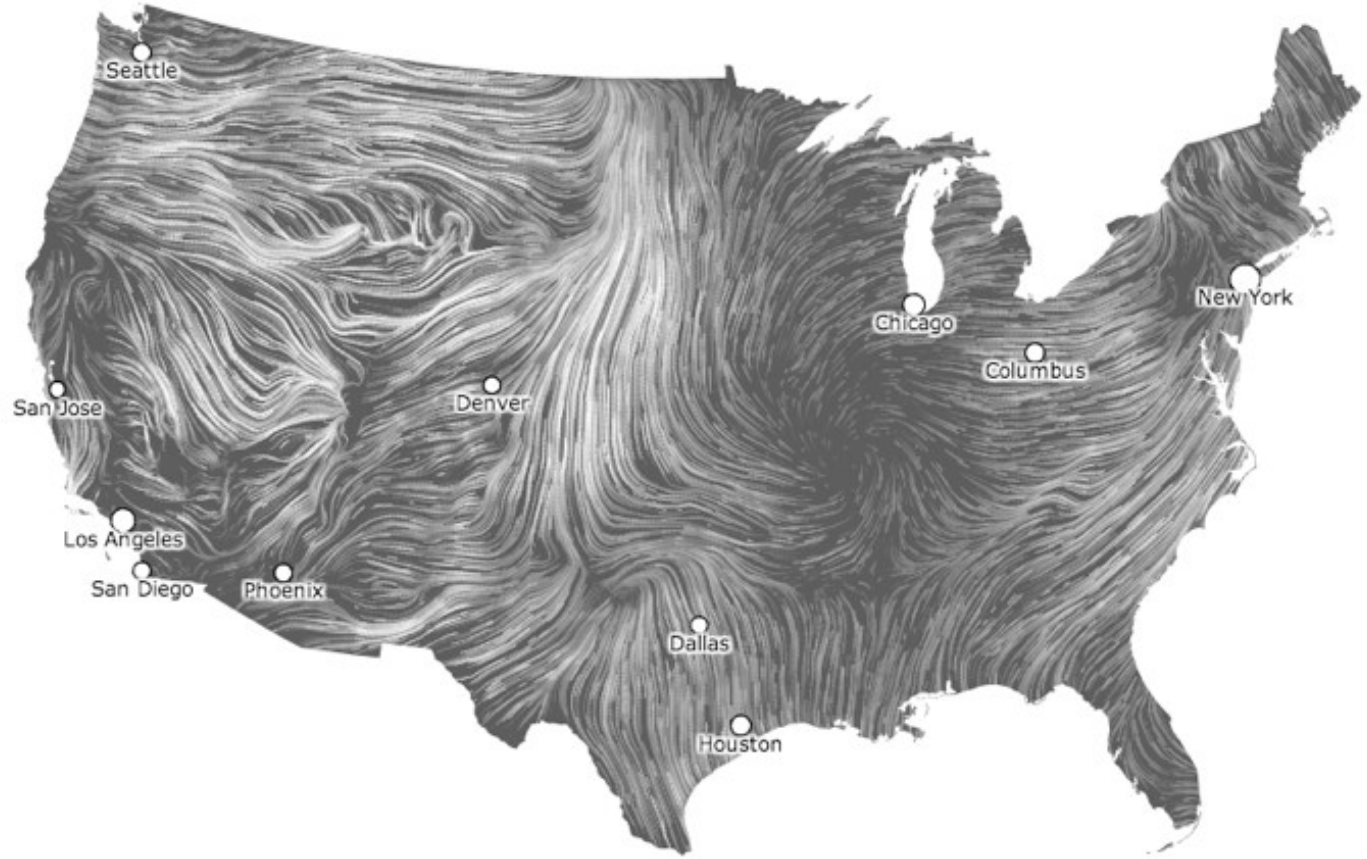


wind map

February 19, 201
11:55 am EST
(time of forecast download)

top speed: **35.3 mph**
average: **11.6 mph**





Conclusion

- Discuss Common Geospatial Visualizations
- Learn about the Process of encoding Geospatial Visualization
- Familiarize with the benefits and tradeoffs of map types

JOHNS HOPKINS
WHITING SCHOOL
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