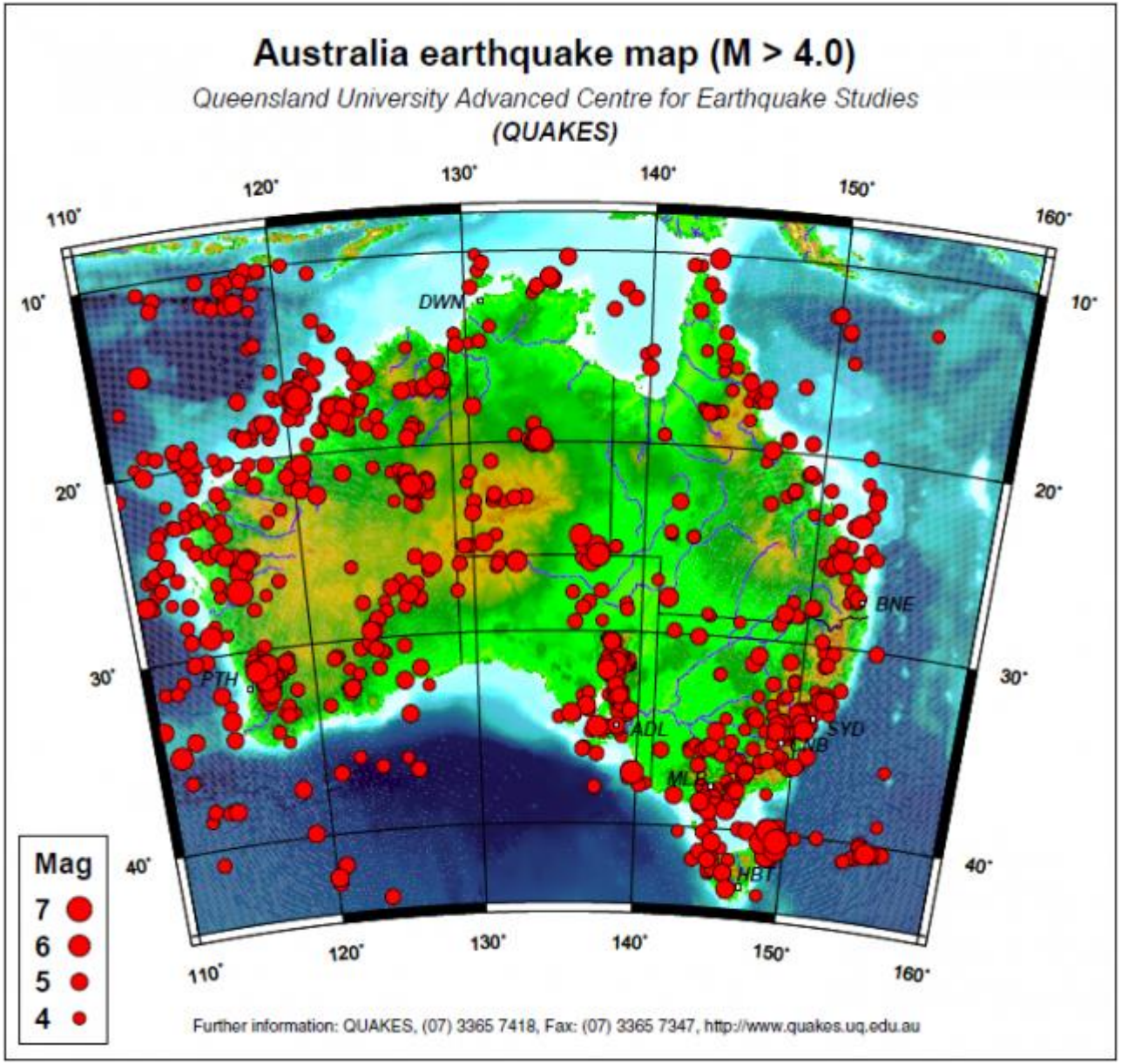
Review: Proportional point symbols - example



https://mappingignorance.org/2013/12/16/the-complexity-of-drawing-good-proportional-symbol-maps/

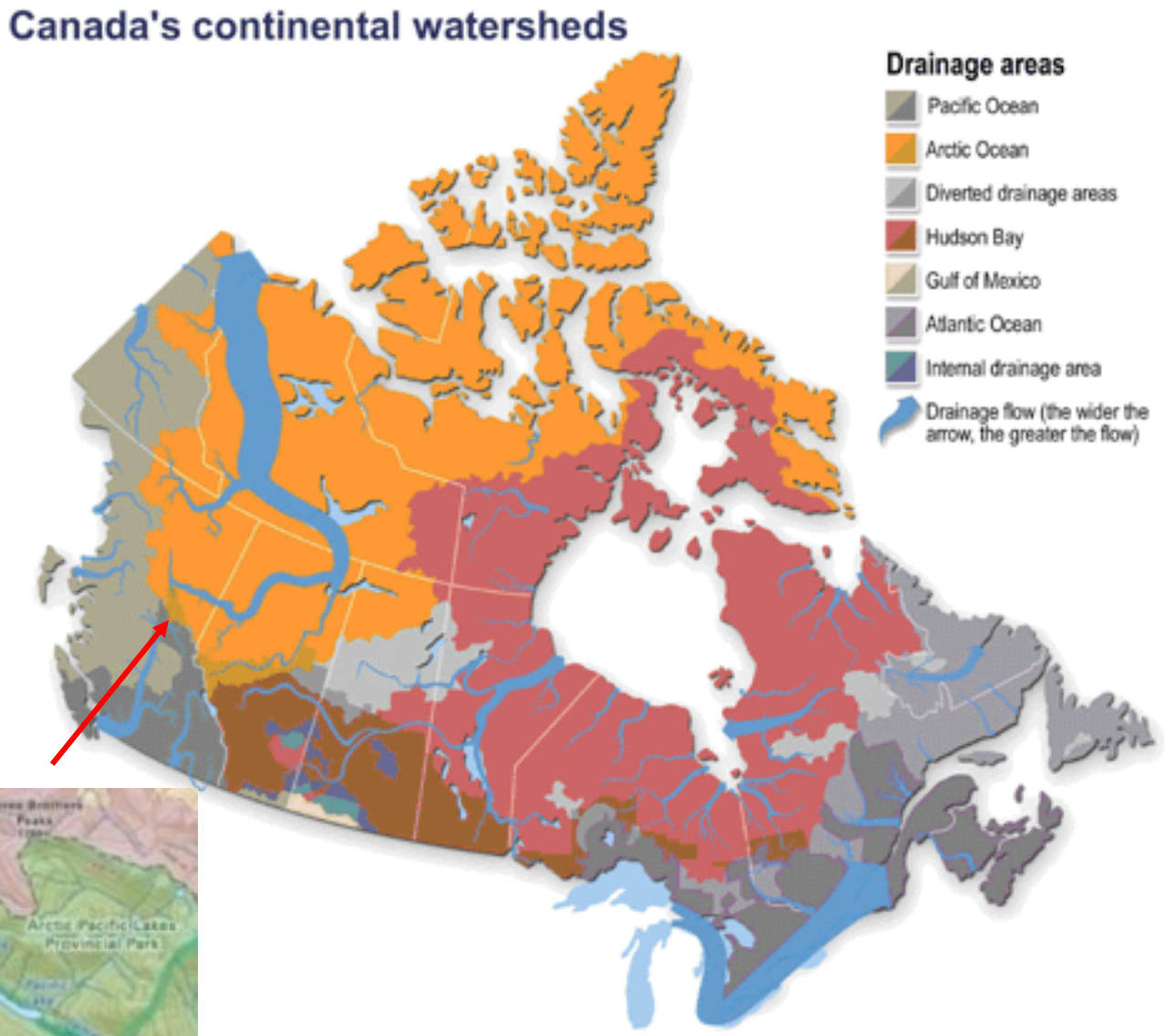
"Both the actual size and the ratio between symbol sizes are crucial in order to communicate the message. Therefore, a huge effort has been made aiming for the most effective communication …"

Richter Magnitude	TNT for Seismic Energy Yield
1.0	30 pounds
2.0	1 ton
3.0	29 tons
4.0	1,000 tons
5.0	32,000 tons
6.0	1 million tons
7.0	32 million tons
8.0	1 billion tons
8.5	5 billion tons
9.0	32 billion tons
10.0	1 trillion tons

+1 = 32 x energy release

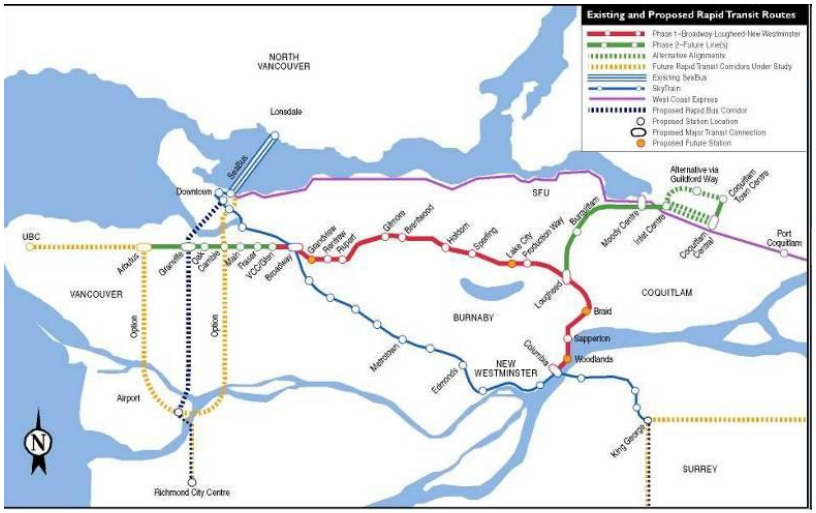
Line techniques: 1. Graduated line symbols:

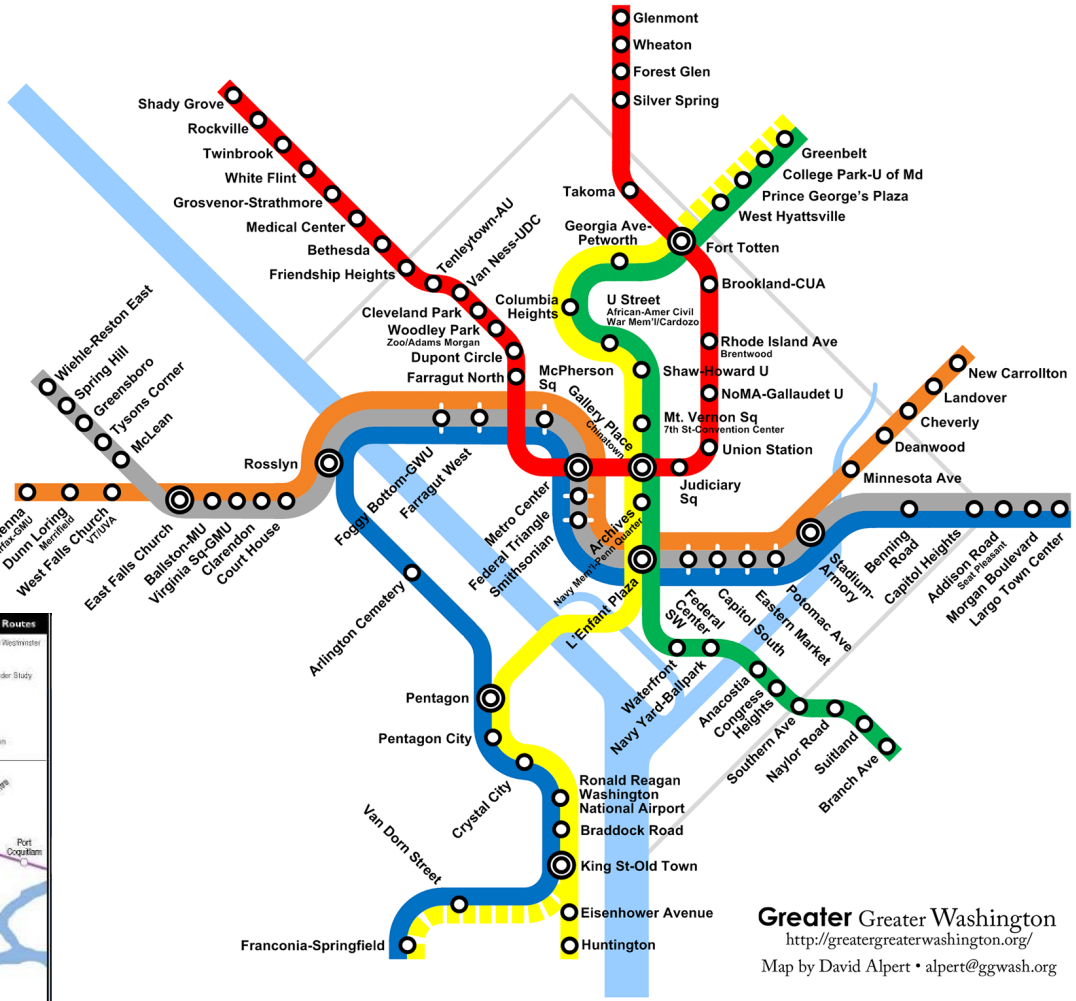
(width=amount) show movement



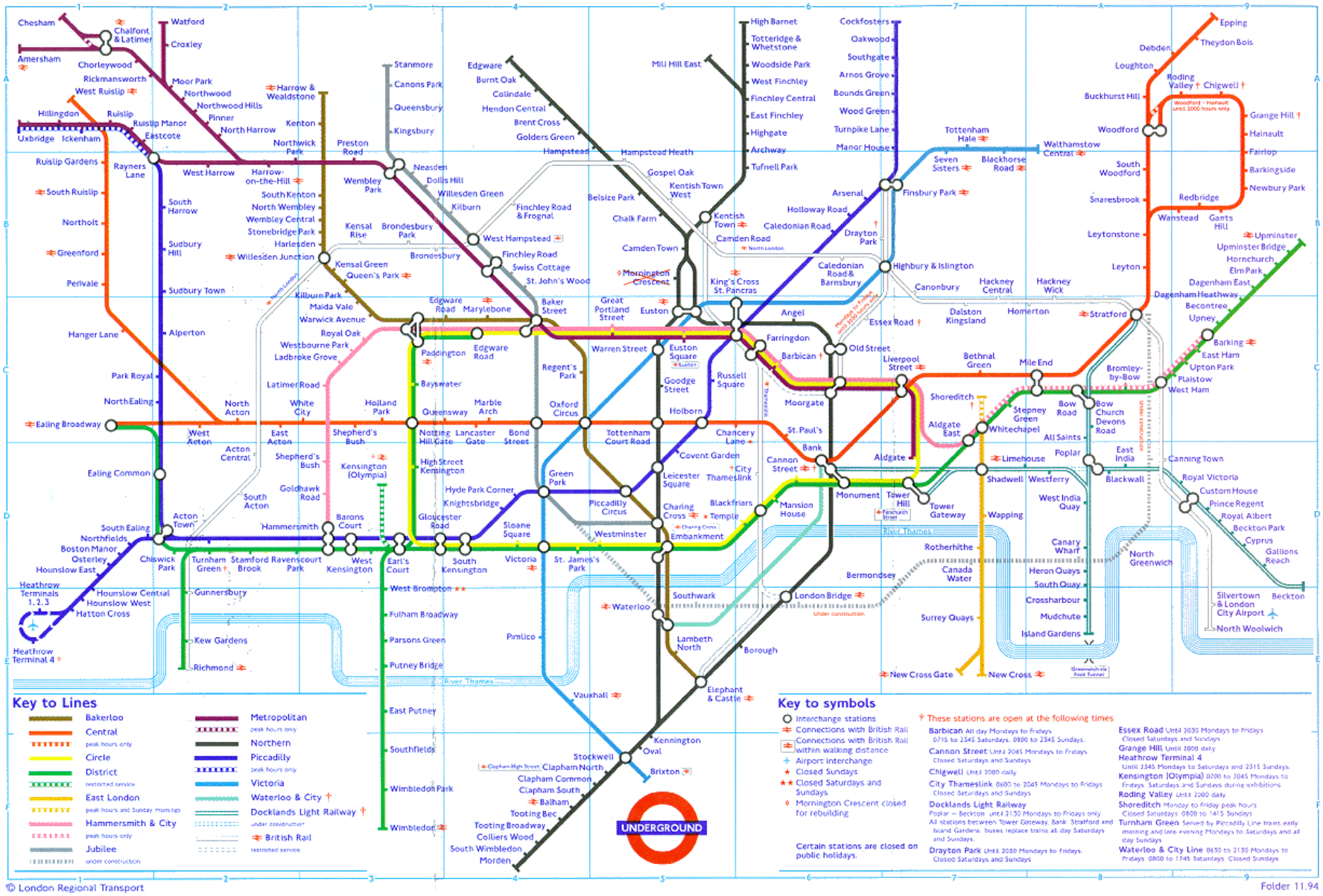
2. **Topological** Cartograms

These are based on shape (geometry) and **connectivity** e.g. route networks; distance is relatively unimportant; the classic examples are city underground and train maps,



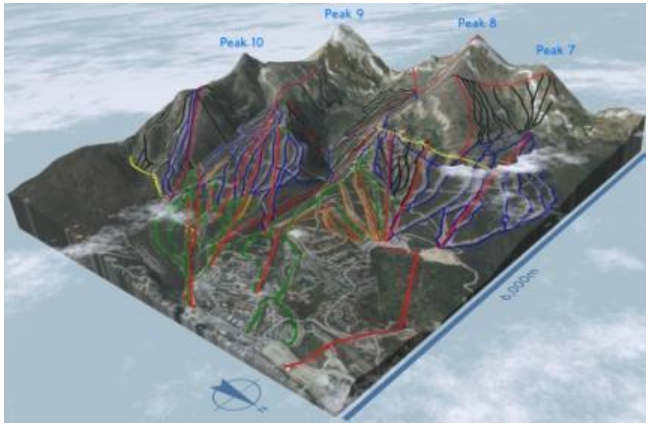


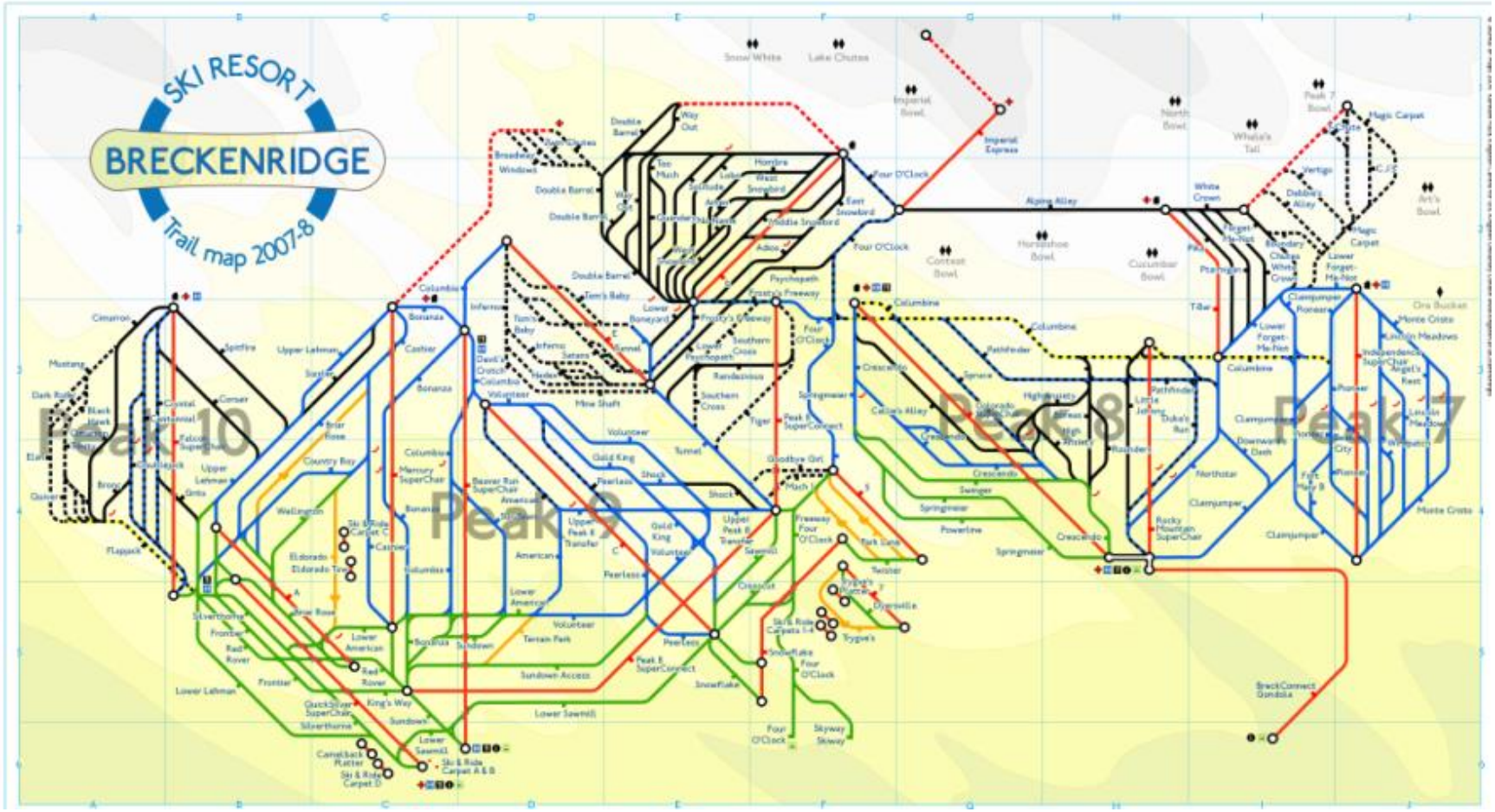
London: http://www.afn.org/~alplatt/tube.html



Ski map prototype example:

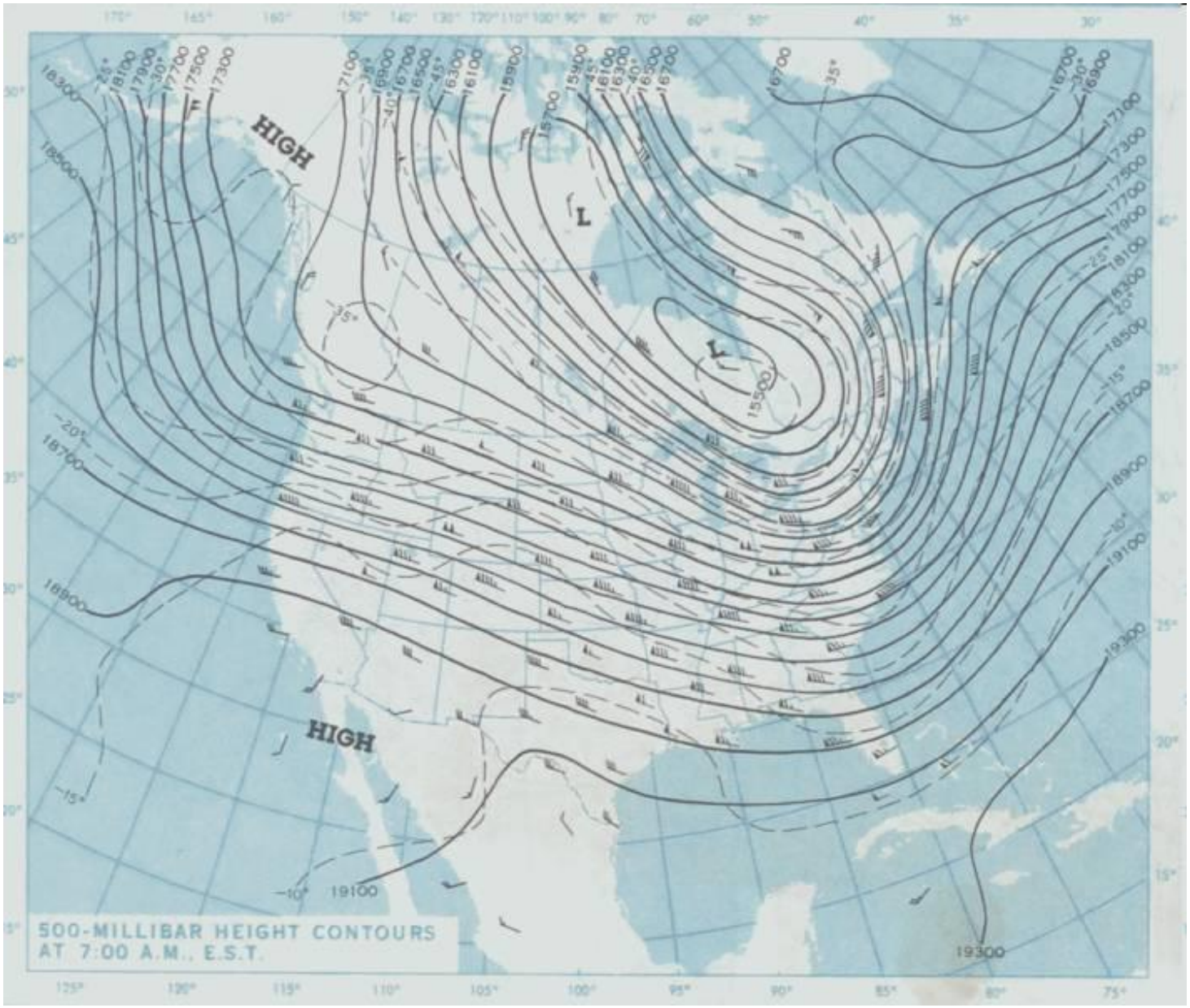
Ken Field (Esri)





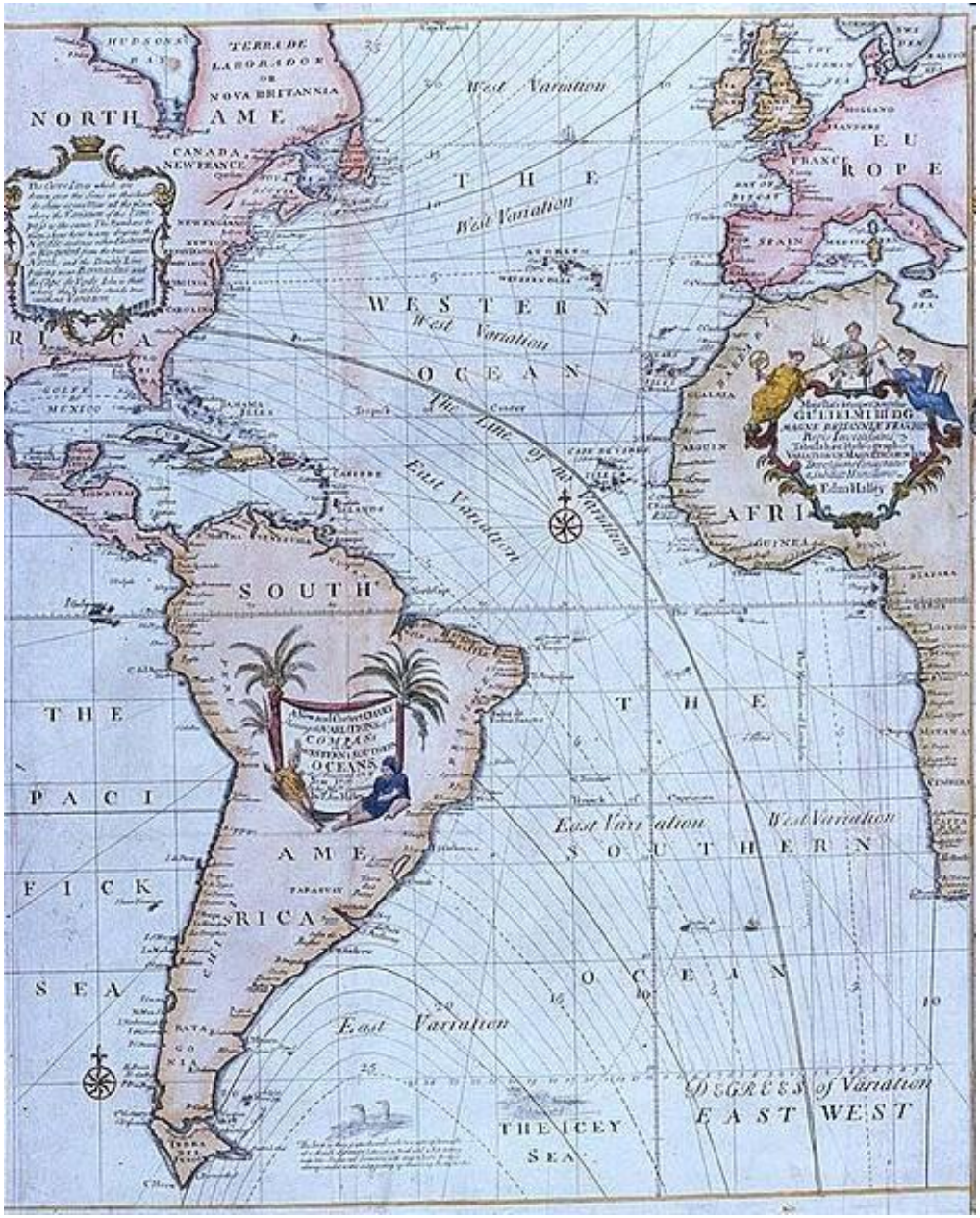
3. Isarithms (Isolines) - lines of equal value e.g. barometric pressure (isobars)

* Created from point data



Early thematic map:
[Halley, Isogonic map 1701]

Isogones:
Lines of equal magnetic declination = difference between true north and magnetic north



Some selected types of isarithms – mostly climatic

Isobath	depth below a datum (e.g. mean sea level)
Isogonic line	magnetic declination
Isocline	magnetic dip (inclination) or angle of slope
Isohypse (contour)	elevation above a datum (e.g., mean sea level)
Isodynamic line	value of intensity or a component of the intensity of the magnetic field
Isotherm	temperature (usually average)
Isobar	atmospheric pressure (usually average)
Isohyet	precipitation
Isobront	occurrence of thunderstorms
Isanther	time of flowering of plants
Isopag	duration of ice cover
Isodem	population
Isoamplitude	amplitude of variation (often of annual temperature)
Isoseismal line	number (or intensity) of earthquake tremors
Isochasm	annual frequency of aurorae

Isodynam	equal traffic tension
Isonoet	average degree of intelligence

Canadian wins world Scrabble title: Isogriv

CBC News Posted: Nov 08, 1999 7:50 AM ET Last Updated: Nov 08, 1999

A Montreal (McGill) music professor, Joel Wapnick, has won the World Scrabble Championship

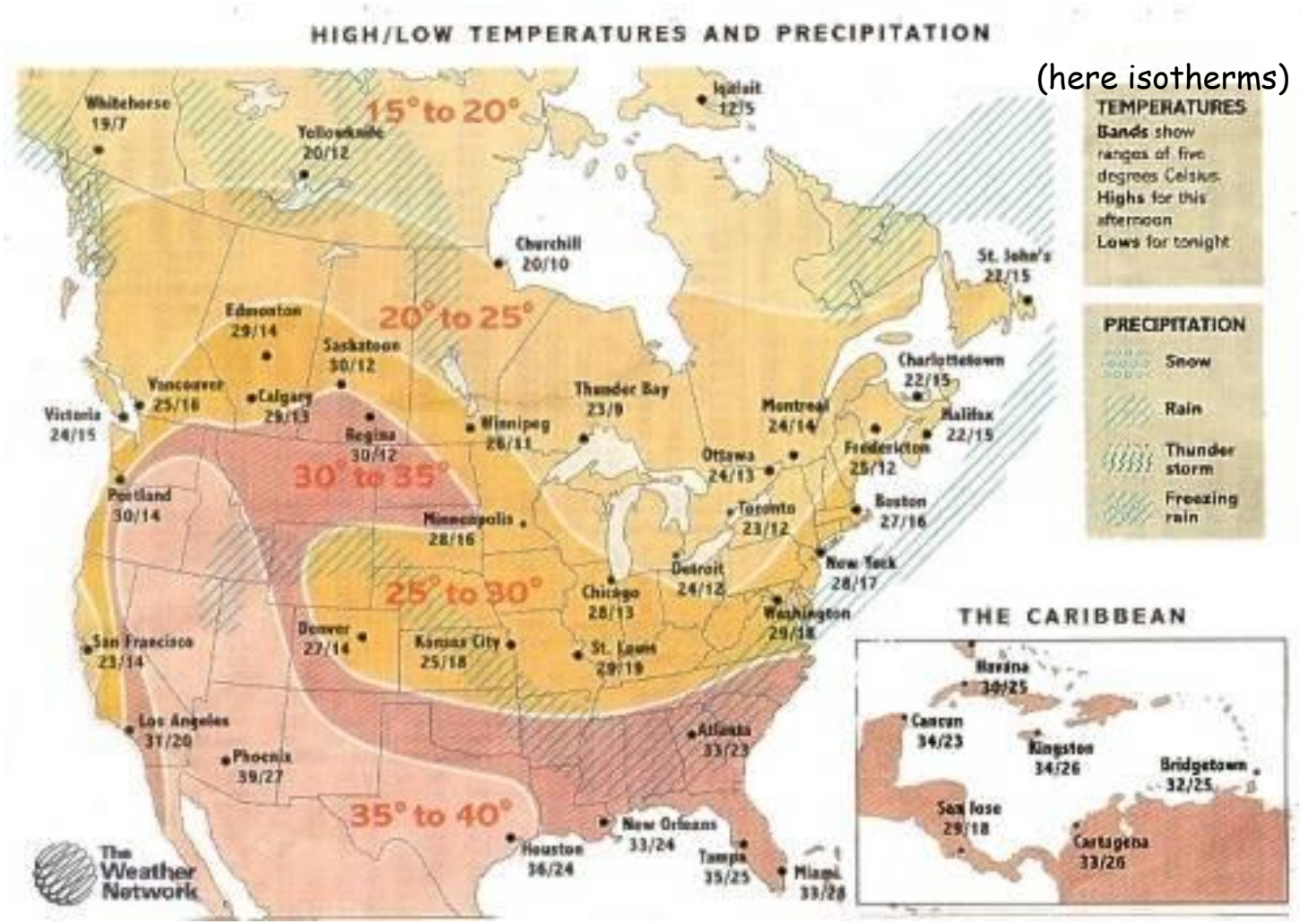
Observers described Wapnick's opening move as "brilliant" ….because he used all seven tiles to form the word "**isogriv**"

= a line of equal declination between magnetic and grid north

More than 100 players from 35 countries took part. Wapnick, won $22,500.

```
   a b c d e f g h i j k l m n o
   -----------------------------
 1|= Q   '       R       ' P E A|1
 2|   I D     "   I   T A L A -  |2
 3|     E       ' V '   M   P E A|3
 4|' T O -     l A I C I Z E D '|4
 5|   A X   -     G     C        |5
 6|   B Y     "   E   H E     "  |6
 7|J O '       '   ' O       I   |7
 8|O R   '       E N N U   S   =|8
 9|   E M B O G U E ' E       O   |9
10|   T       "     F Y       g " |10
11|   S     -       O   -     R   |11
12|'      -       N U       G I R T|12
13|W A I D E   D U R A L     V   |13
14|   S T I F L E R S "         -  |14
15|K H A N       L         '     =|15
   -----------------------------
   a b c d e f g h i j k l m n o
```

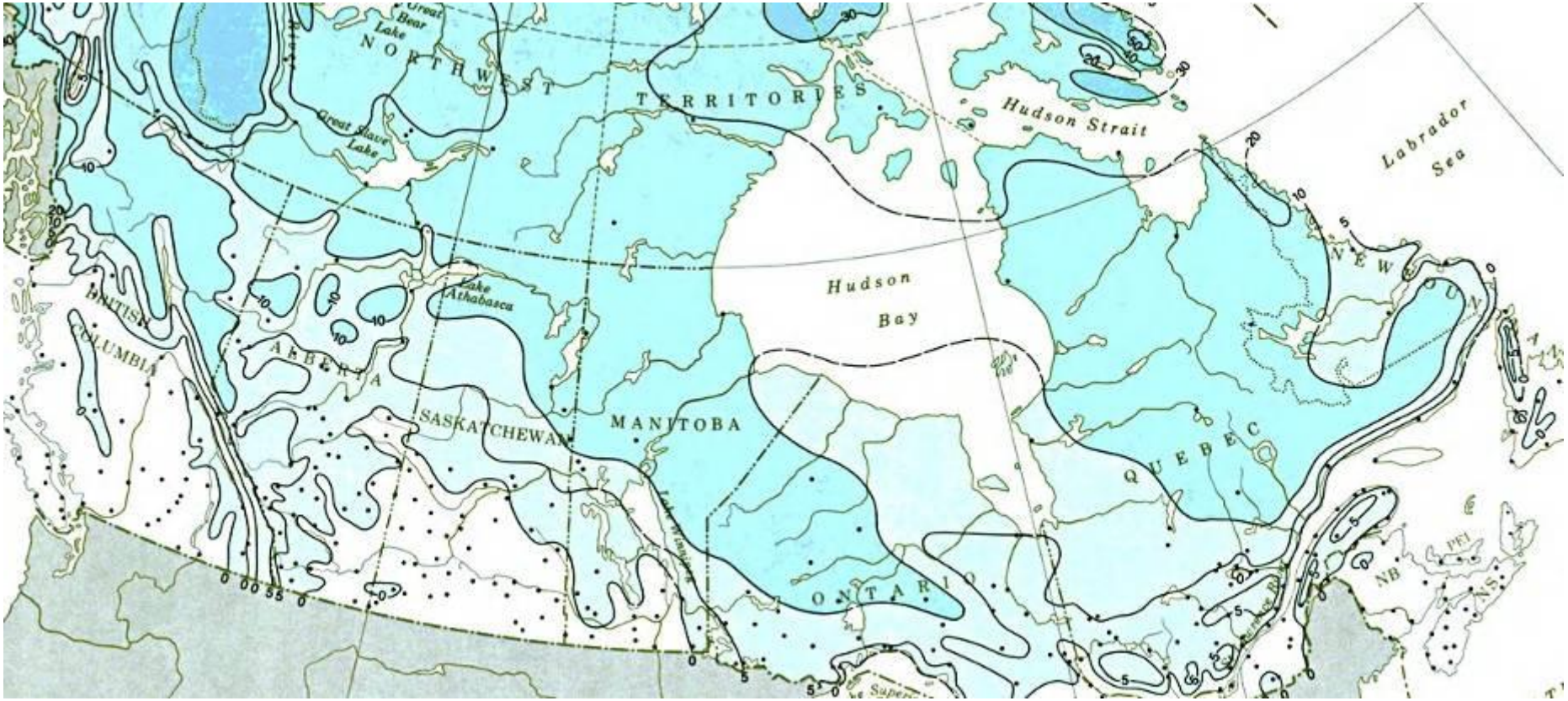
C. Thematic area maps: 1. Isopleths (Isarithms)



colours selected according to the feature being mapped, e.g. blue & red for temperature, yellow for sunshine. Increased chroma are used for higher values

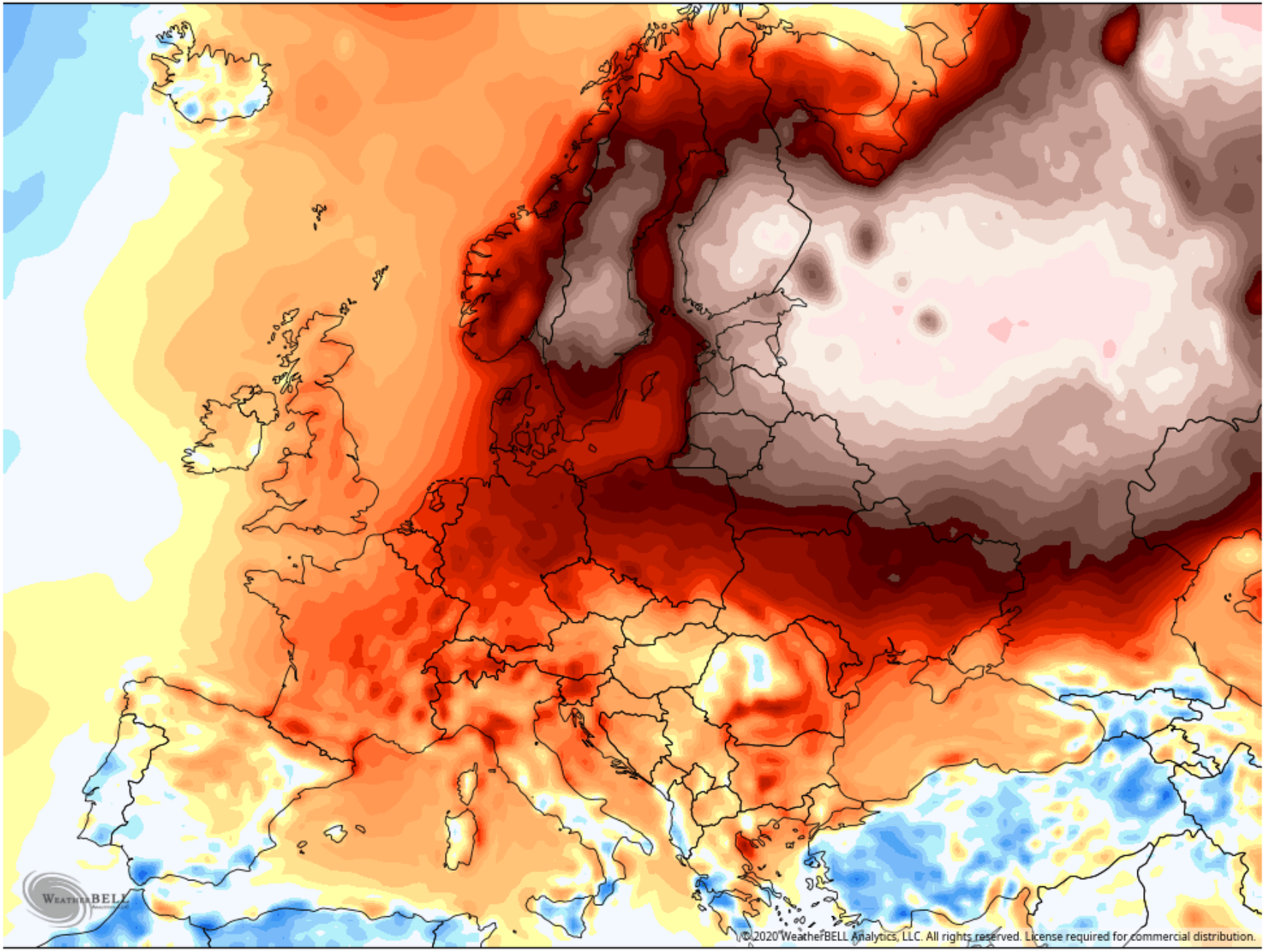
Isopleths

- Data are gathered by points and interpolated to make lines/areas
- This adapts a line technique - with ranges filled with colour tints

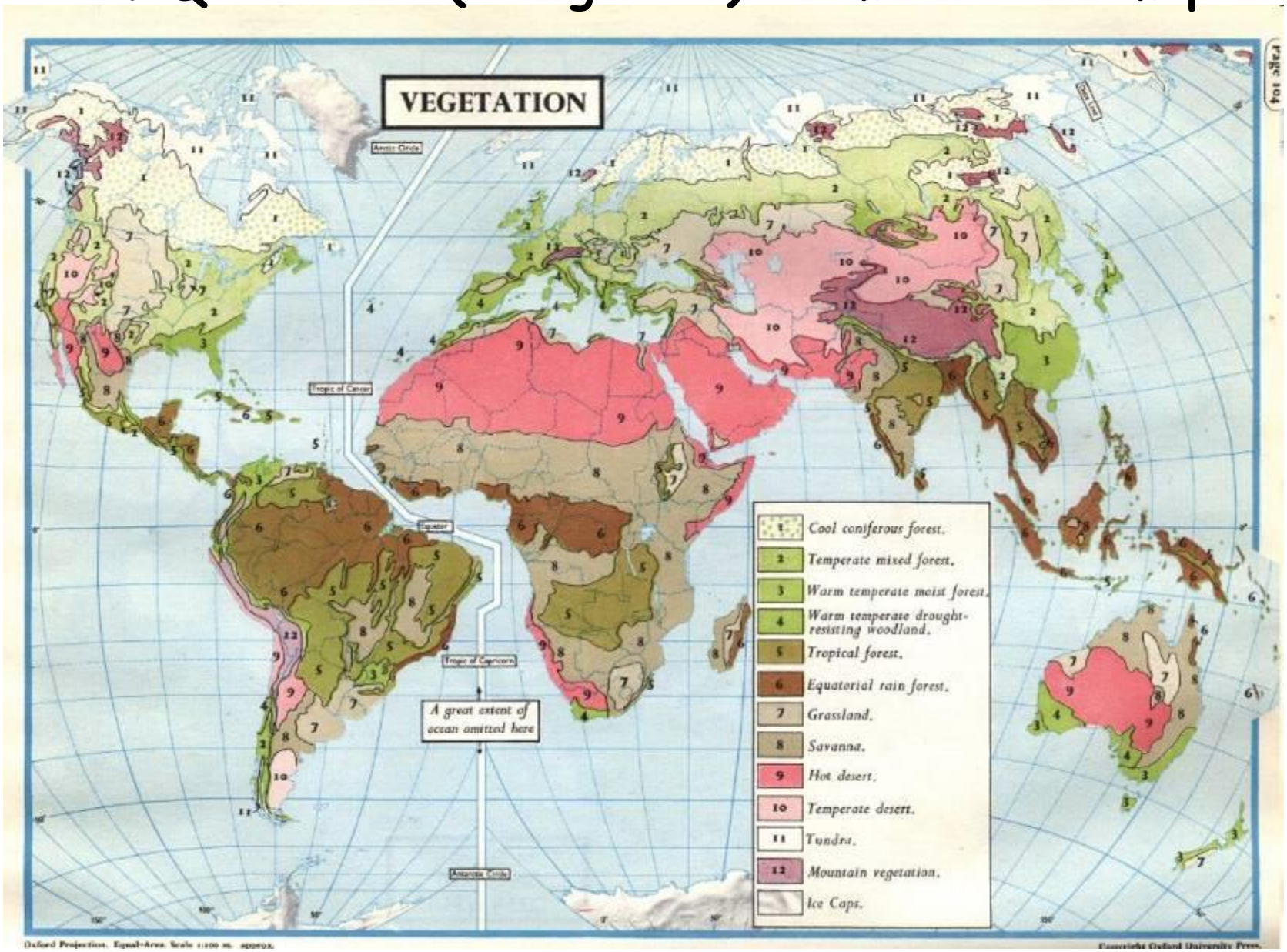


Average snow depth, Nov 15 … use of blue to suggest snow/cold

CDAS 0.5° • Year-to-Date Averaged Temperature Anomaly (°F) **Valid**: 06z Mon 3 Feb 2020



2. Qualitative (categorical) thematic area maps

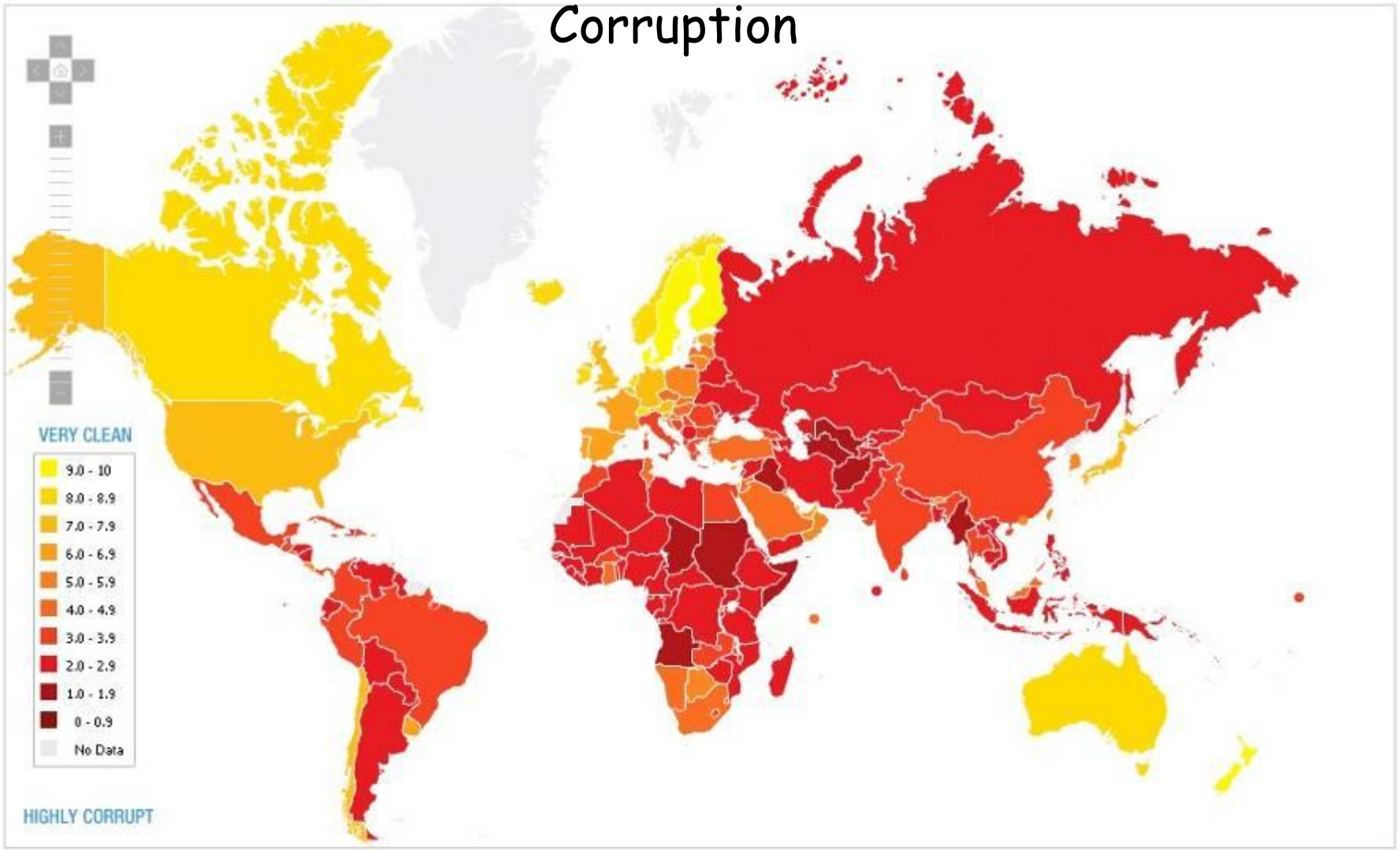


The boundaries can be subjective and should not be interpreted as 'hard lines'.


N
Terrestrial ecozones
Arctic Cordillera
Northern Arctic
Southern Arctic
Taiga Plains
Taiga Shield
Boreal Shield
Atlantic Maritime
Mixedwood Plains
Boreal Plains
Prairies
Taiga Cordillera
Boreal Cordillera
Pacific Maritime
Montane Cordillera
Hudson Plains
Tundra Cordillera
Semi-Arid Plateaux
Atlantic Highlands
YT
NT
NU
BC
AB
SK
MB
ON
QC
NL
PE
NB
NS
Canada
0 250 500 1,000 Kilometers

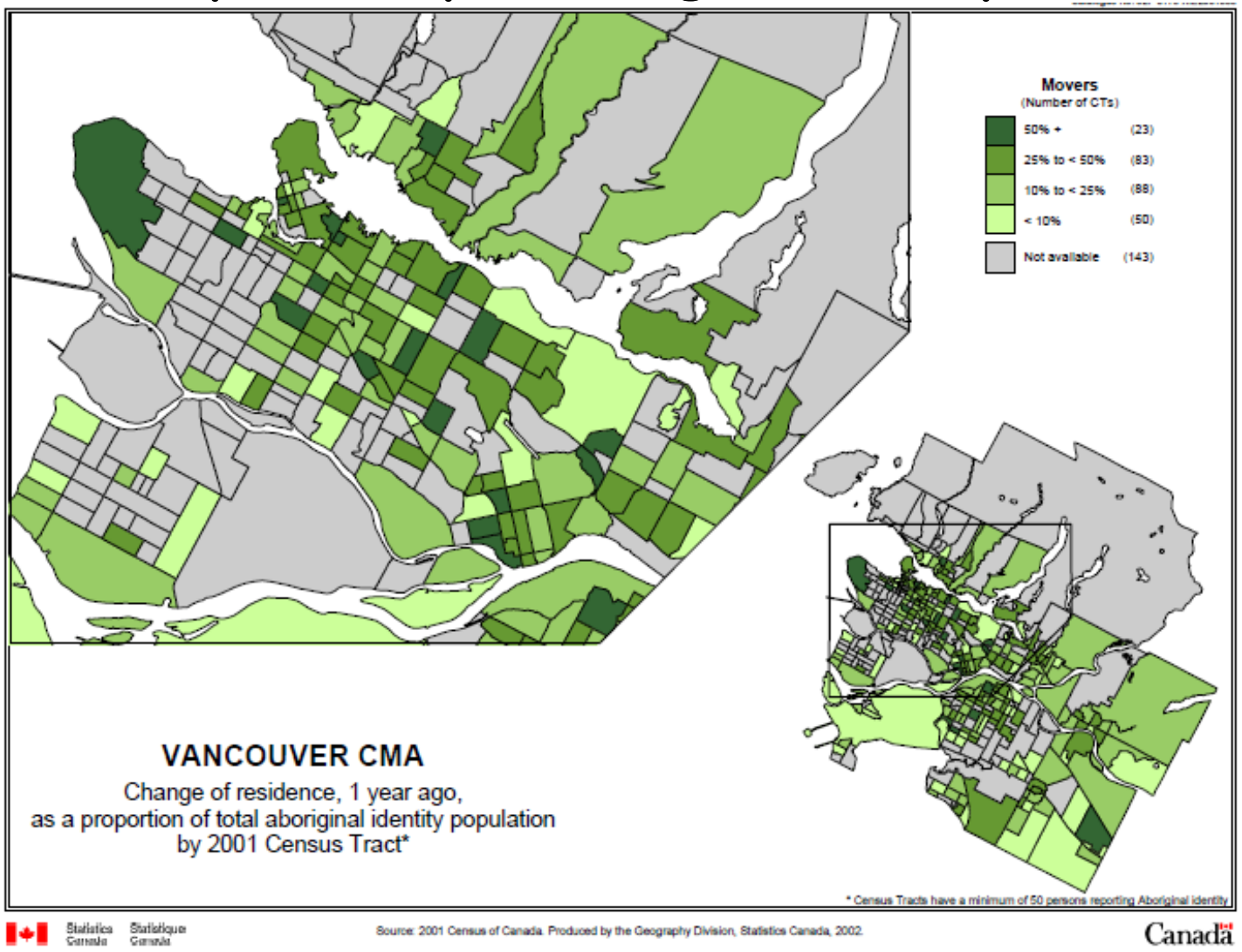
3. Thematic mapping – choropleth = 'magnitude at place'

One value per 'collection unit' (here each country)



http://transparency.org/policy_research/surveys_indices/cpi/2010/results

Choropleth maps = 'magnitude at place'



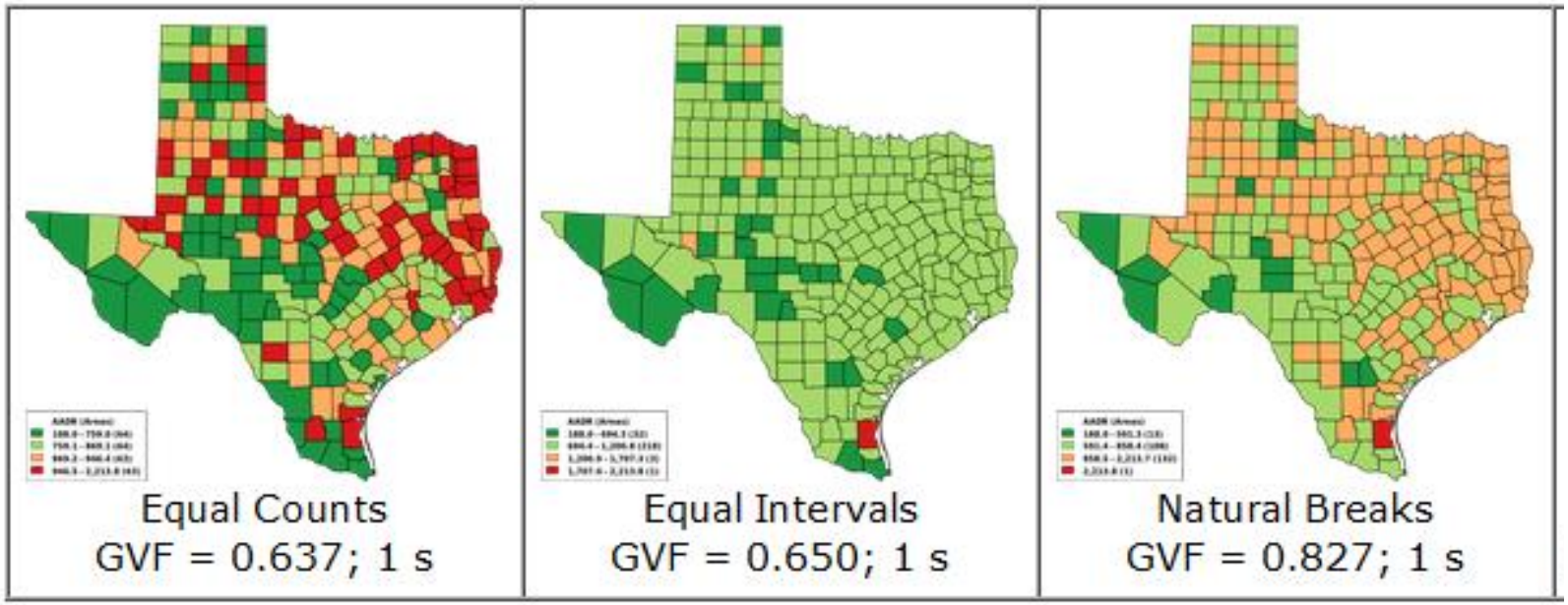
Choropleth maps show data from collection units such as census districts or larger areas. They map intensity, % more than numbers.

Design of Choropleth Classes

On Isarithmic maps, the intervals are even ('equal-steps');

But for choropleth maps:
the class ranges may be changed to match the data distribution
Often 'equal intervals' give too many values in one class (see below)

TX 2005 Age Adjusted Death Rate, 4 Ranges



General class design goals:

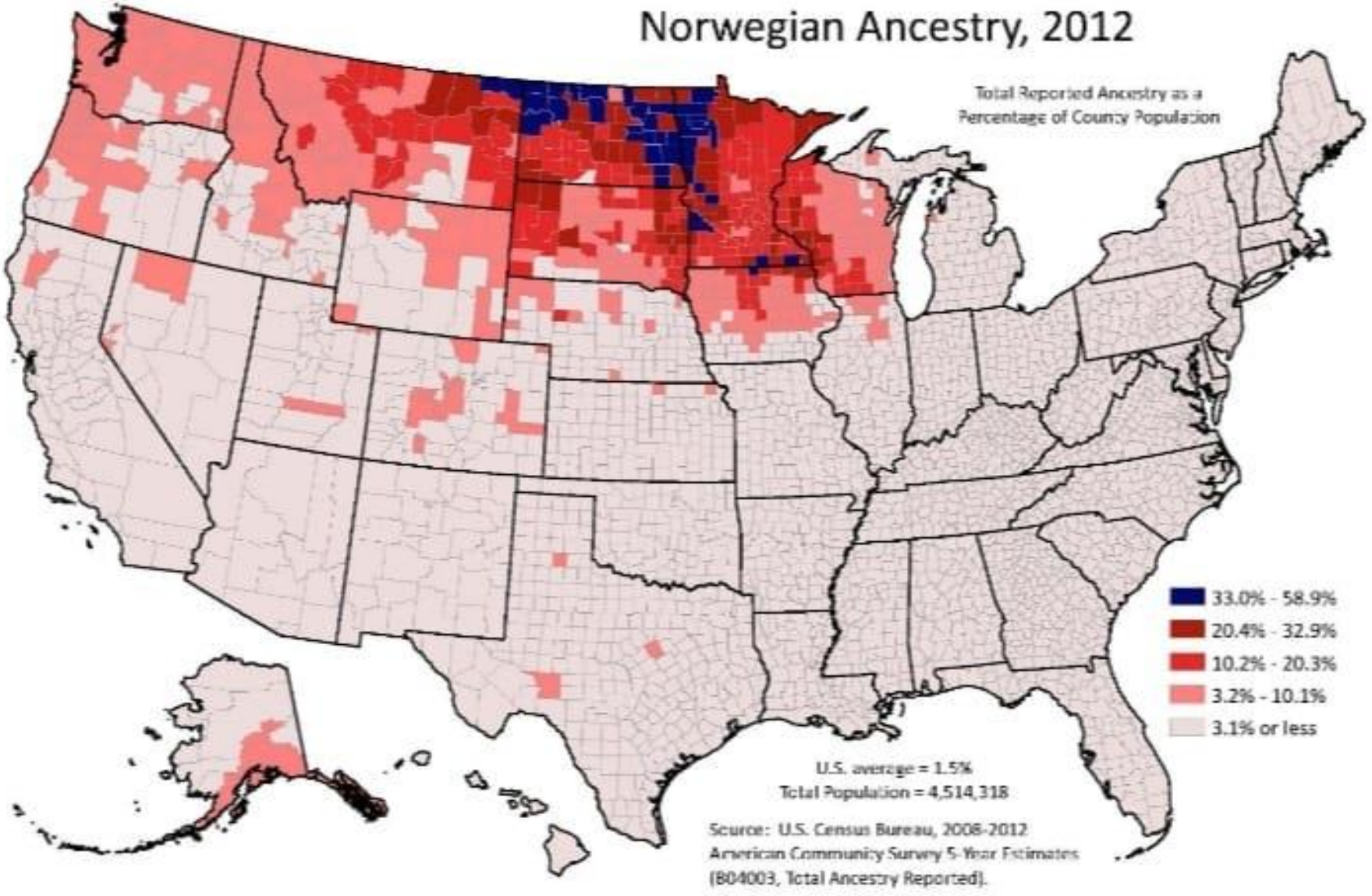
- maximize difference between classes and minimize contrast within classes
- minimize or eliminate empty classes and avoid too many values in one class

Schemes include these options:
e.g. 4 classes

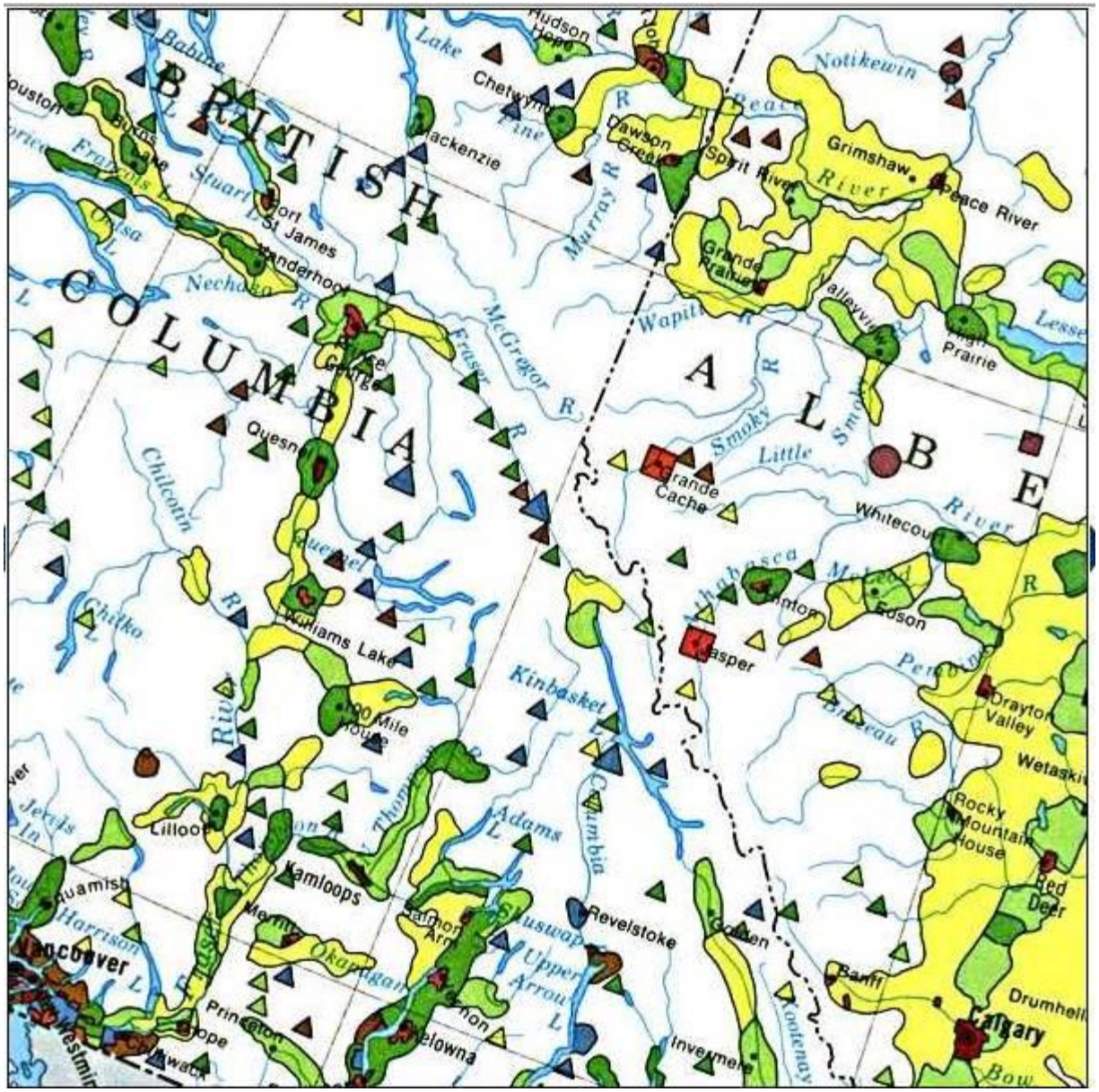
- **Equal steps** 0 –10 –20 –30 -40
- **Geometric** 2- 4 – 8 – 16 – 32
- **Quantiles** (equal counts)
  2 - 4 - 7.5 - 10.4 - 40
- **Natural breaks**
  2 – 4 – 6 – 15 - 40

2.0	4.4	7.6	10.5
2.7	4.8	7.7	14.1
3.3	4.9	7.9	19.1
3.4	5.3	9.0	22.6
3.5	7.2	10.4	39.8

Norwegian Ancestry, 2012



4. Dasymetric = 'measure of density'



Dasymetric maps depict intensities

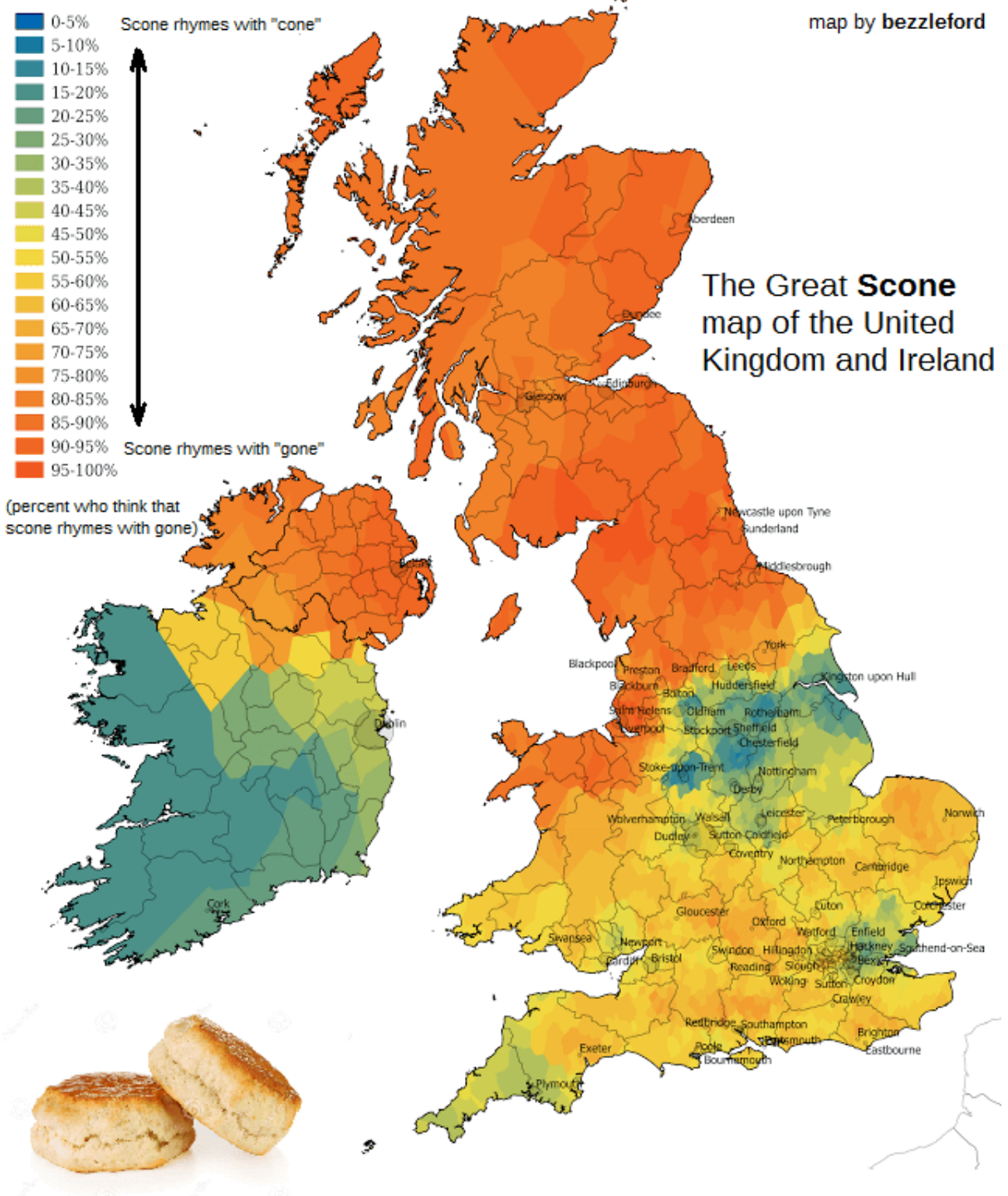
e.g. %, ratios, densities.

They involve analysis beyond admin. districts;

i.e. they do not assume homogeneity within districts.

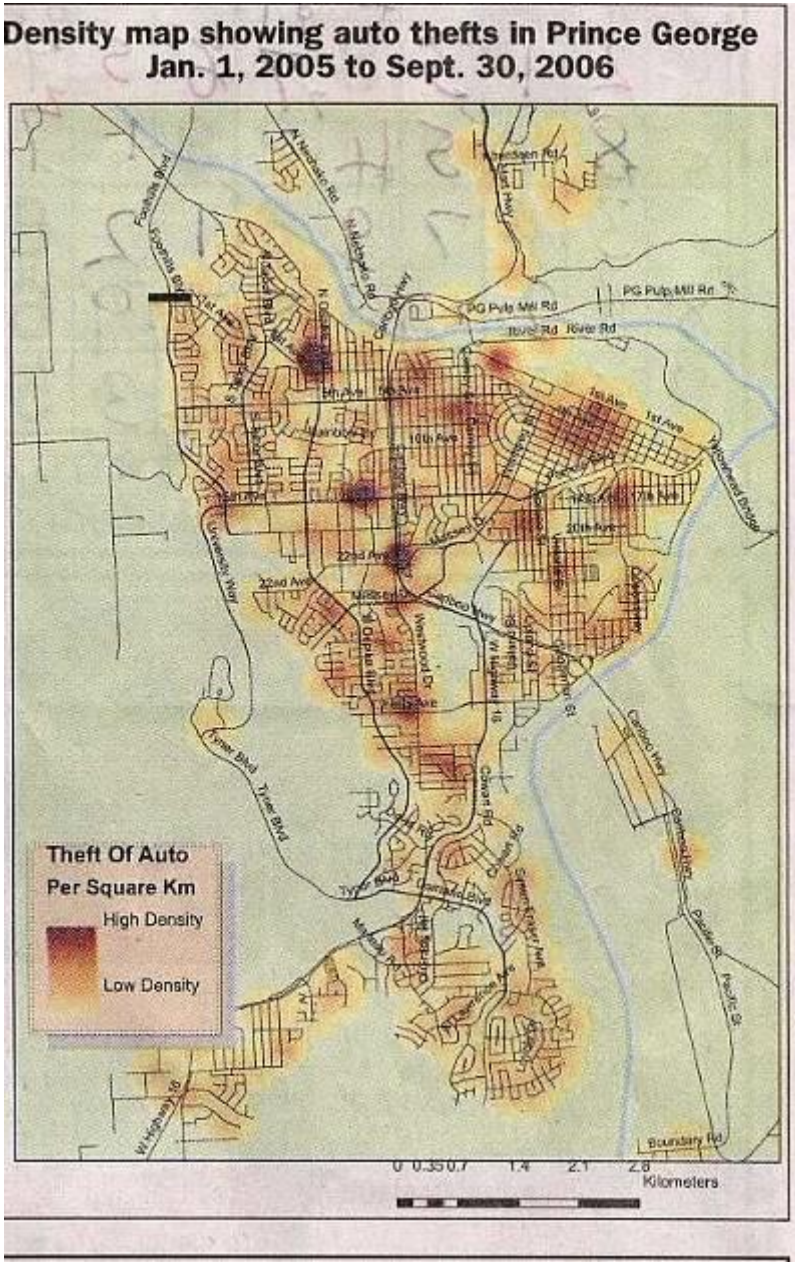
Most commonly applied to population density maps

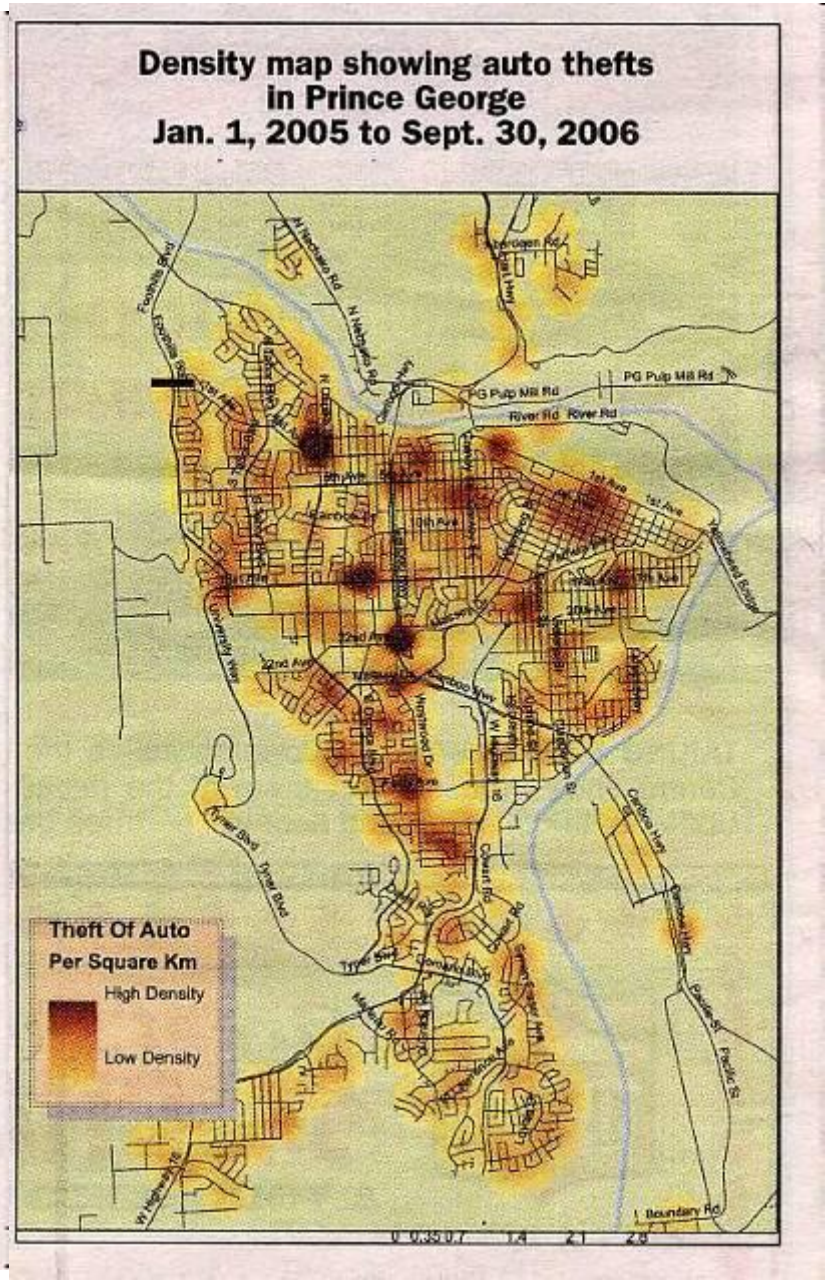
How should you say ‘scone’ ?



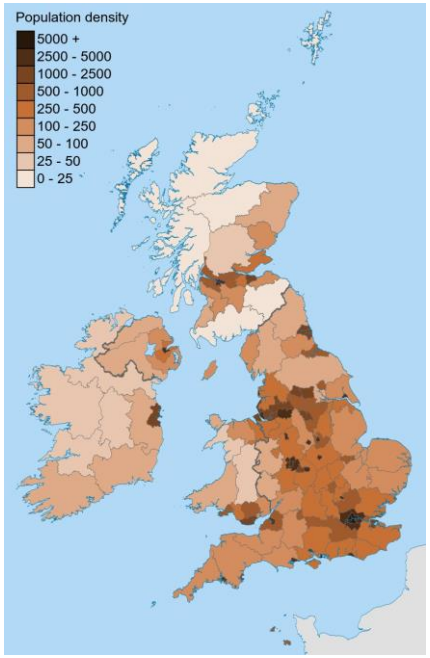
Prince George Citizen 'Heat map' PG week review

Ordinal data



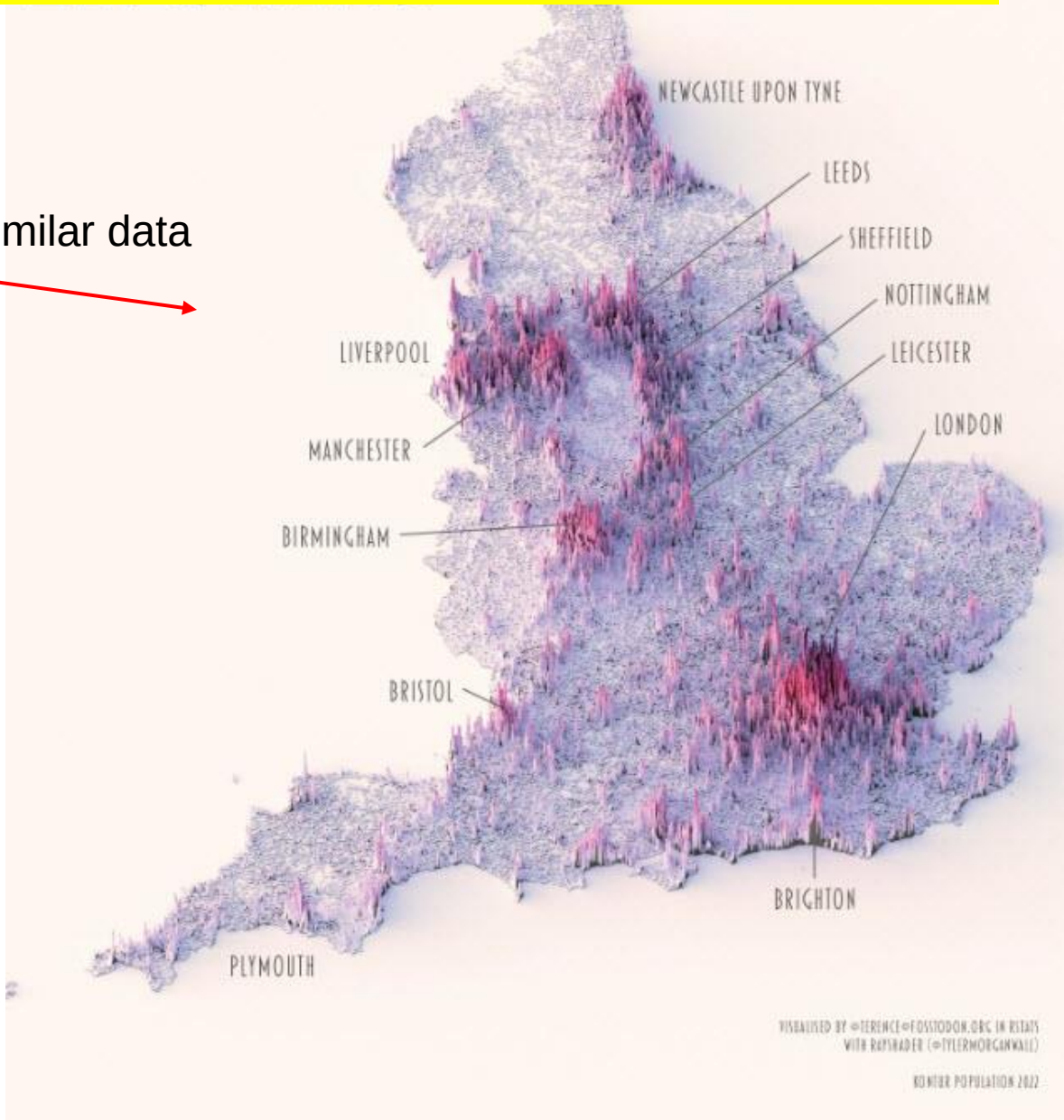


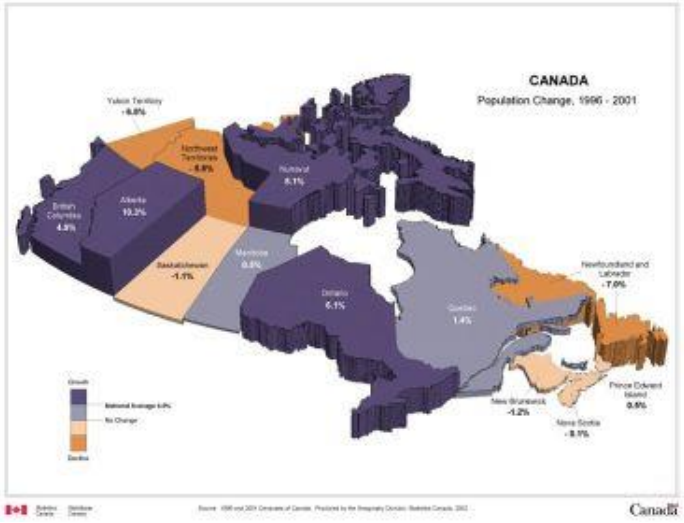
5. Topograms can avoid the need to create classes, using height



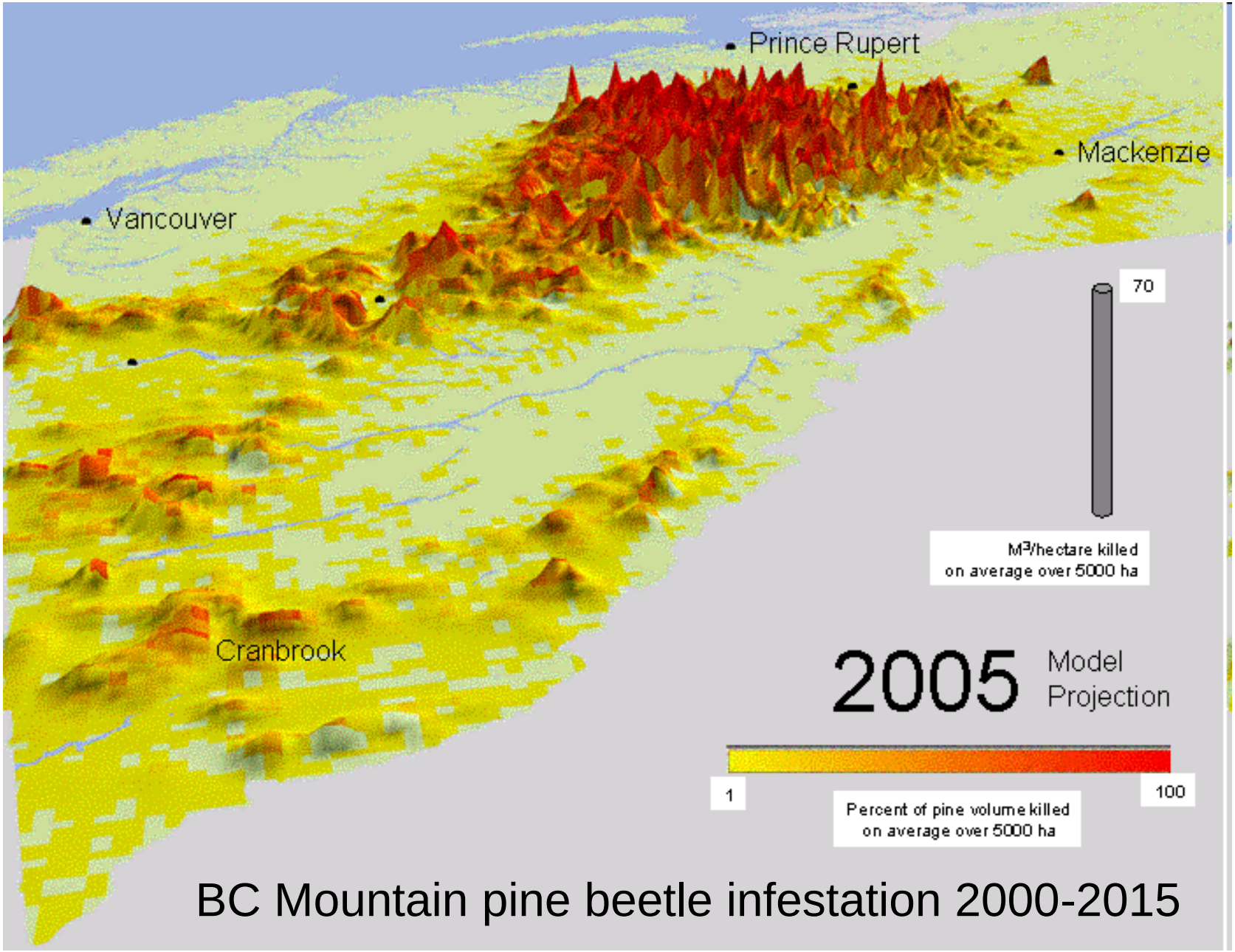
2022

Similar data





Topogram technique applied to isarithmic data (bivariate – 2 variables)



6. Value-by-area cartograms

a cartogram has no 'cartesian' scale - but here, area is based on **another geographic variable**

World population

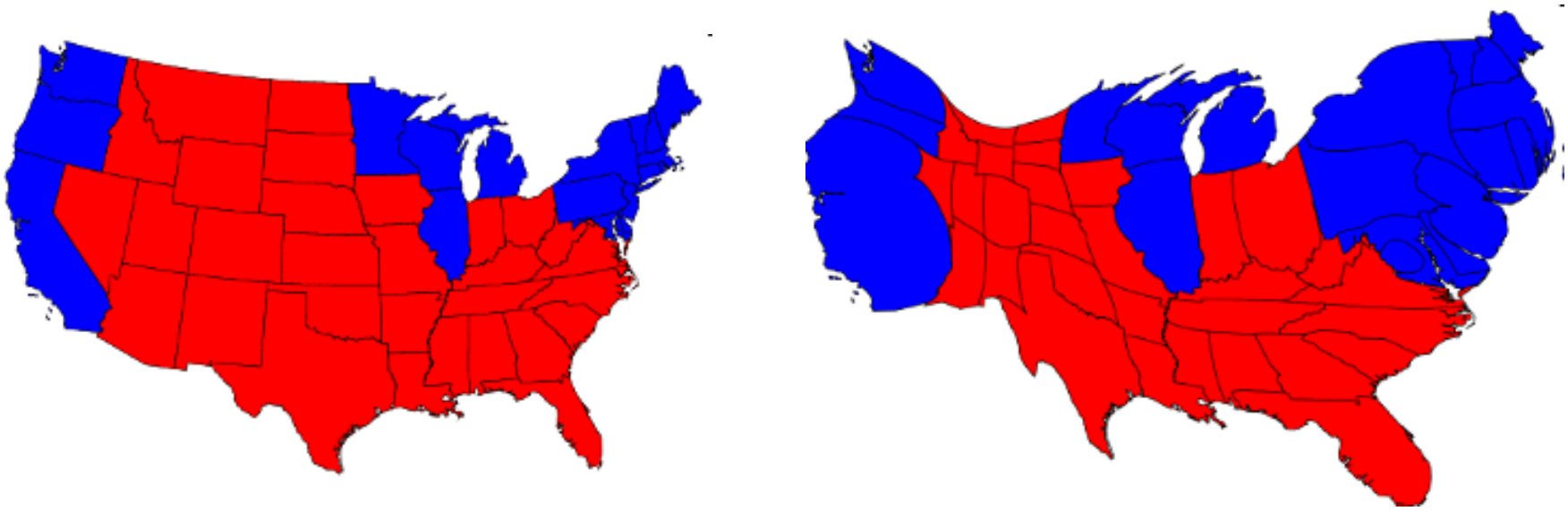
More examples: http://www.worldmapper.org/

Design principles:

- Area scale accurately represents a selected variable
- Regional Contiguity is maintained
- Shapes should remain recognisable (if possible)

USA examples

US election results: 2012 2008



US population cartograms and animation
http://www.ravi.io/us-population-trends-cartogram

Cartogram software: Scape Toad

https://www.arcgis.com/home/item.html?id=d348614c97264ae19b0311019a5f2276

US Presidential Election 2020

Results mapped at county level showing the candidate with the largest vote share in each area

Preliminary results*

Biden
78,780,121 votes (50.9%)
306 electoral votes

Trump
73,163,140 votes (47.3%)
232 electoral votes

Vote share
of candidate with most votes

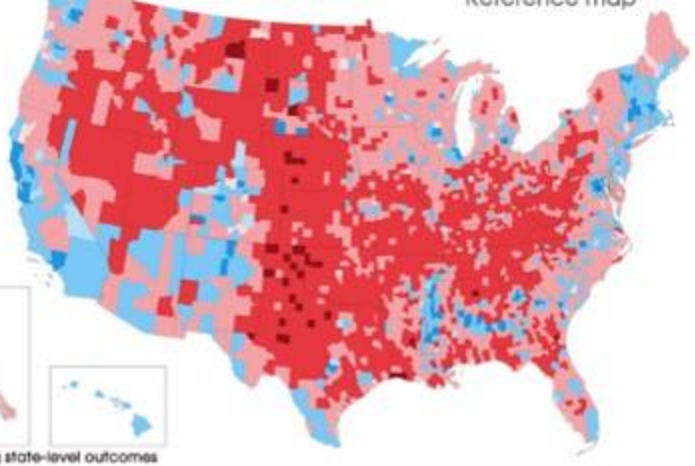
0 50 70 90%

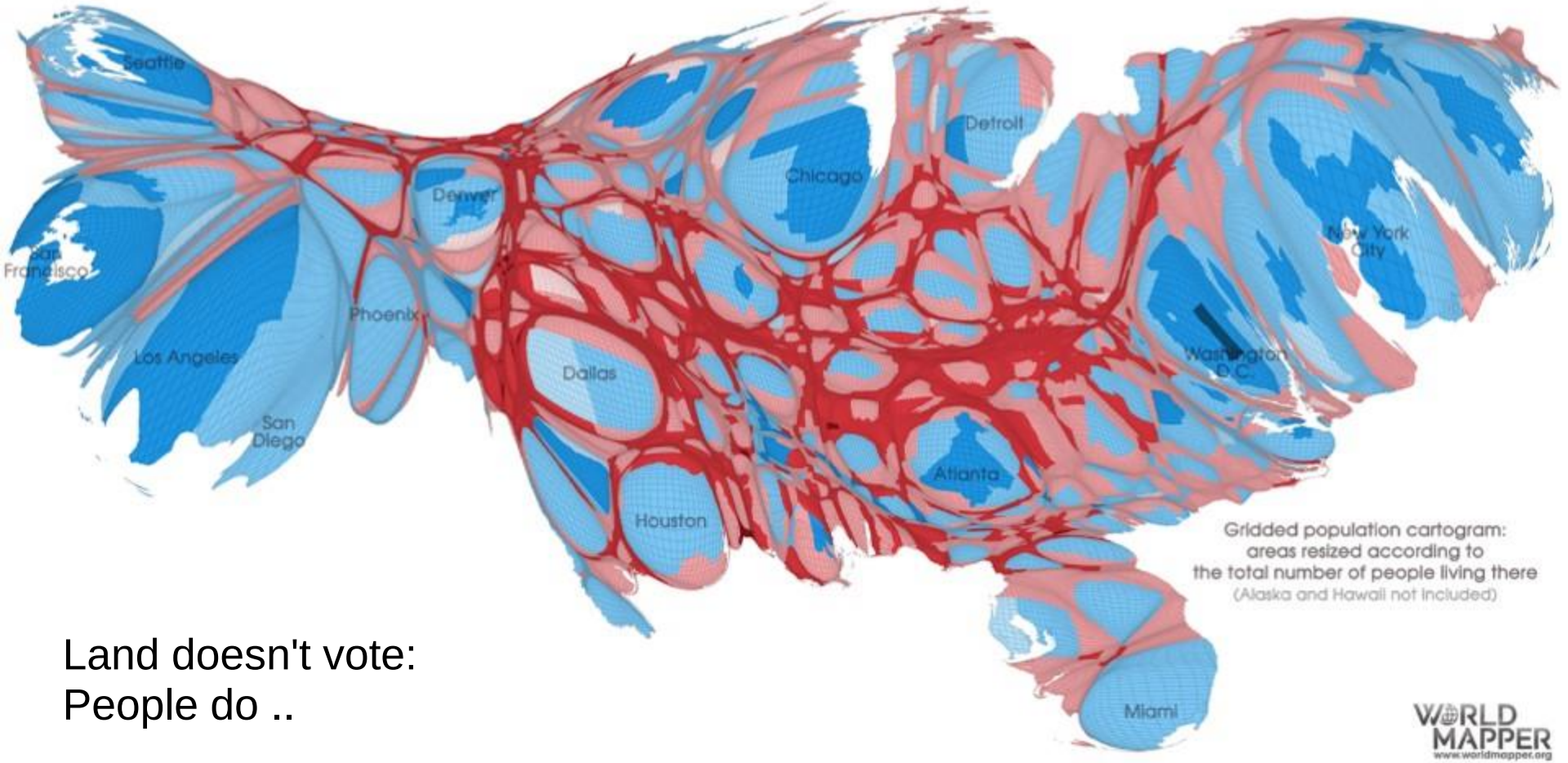
Biden

Trump

* not confirmed final result, last updated 16. Nov 2020
Source: https://github.com/tawstats/USElection2020-NYT-Results/

Alaska and Hawaii showing state-level outcomes





Gridded population cartogram:
areas resized according to
the total number of people living there
(Alaska and Hawaii not included)

Land doesn't vote:
People do ..

WORLD MAPPER
www.worldmapper.org

2016

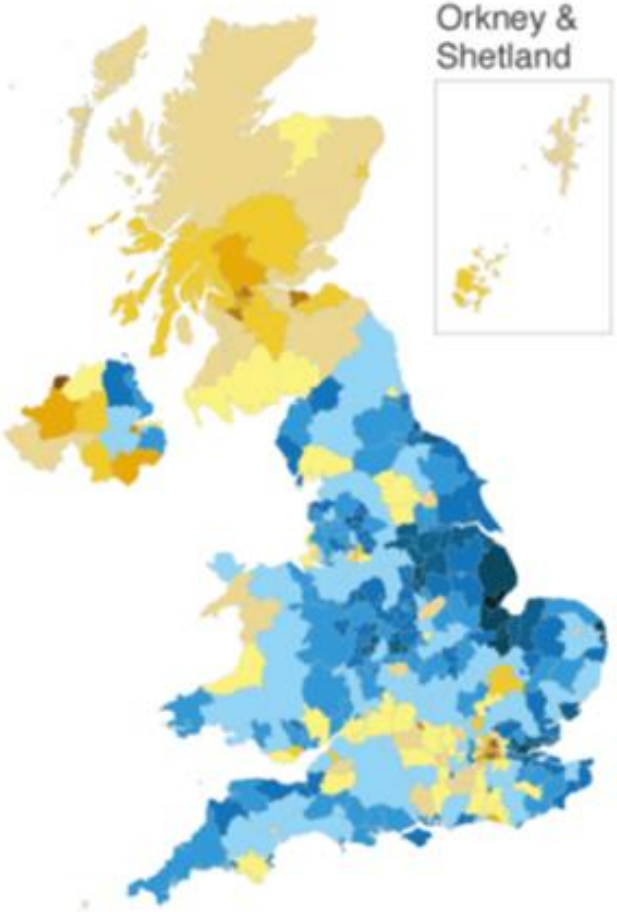
Question asked: **"Should the UK remain a member of the European Union or leave the European Union?"**

a and vote share

Remain
Leave

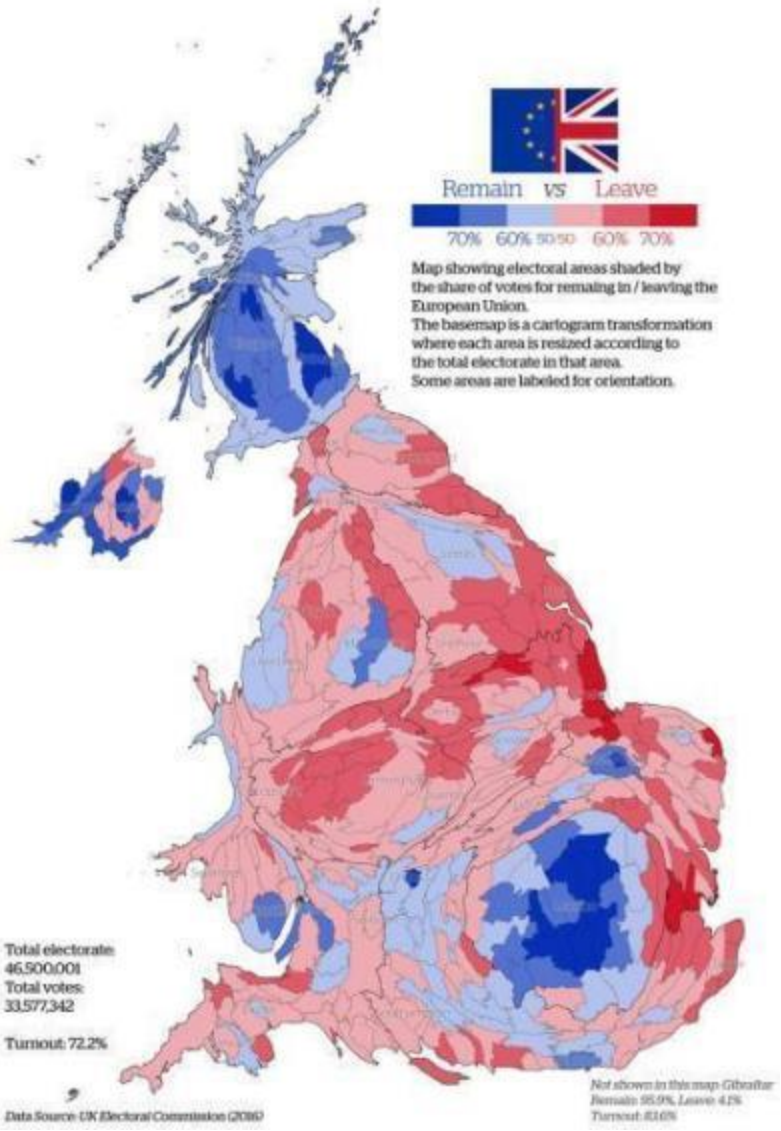
70 75 80

Orkney & Shetland



EU Referendum
A Divided Kingdom

Map by Benjamin Hennig
www.viewsoftheworld.net



Thematic techniques and data types

Raw values / totals

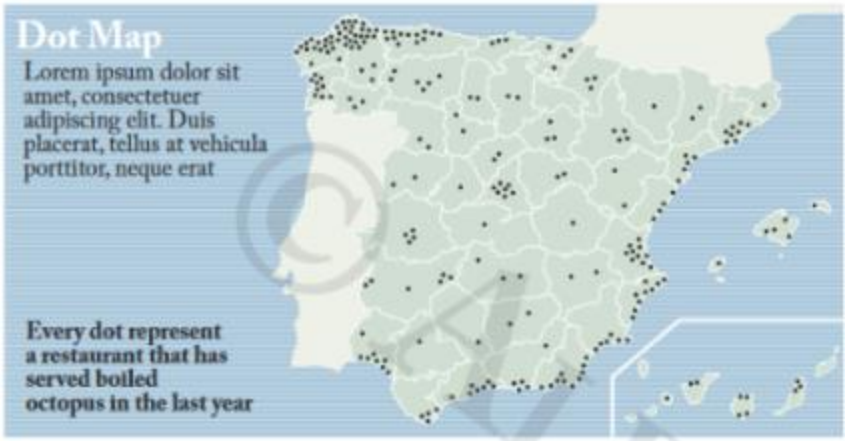
- Dot maps
- Graduated symbols
- Graduated lines
- Cartograms (value by area)

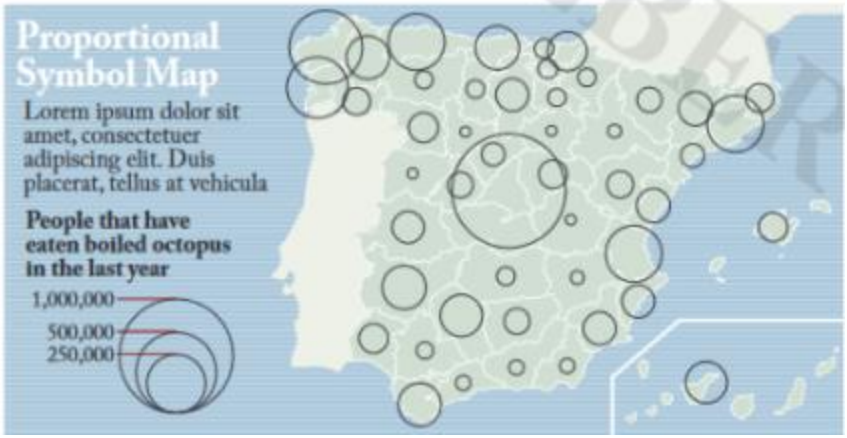
Derived densities / % values

- Choropleth
- Topograms
- Isarithms (mostly)

Figure: Alberto Cairo, TKnightcenter ->

https://geographyfieldwork.com/DataPresentationMappingTechniques.htm





7. Cartograms – Mental maps

(based on perceived space)

A tool of psychological research:

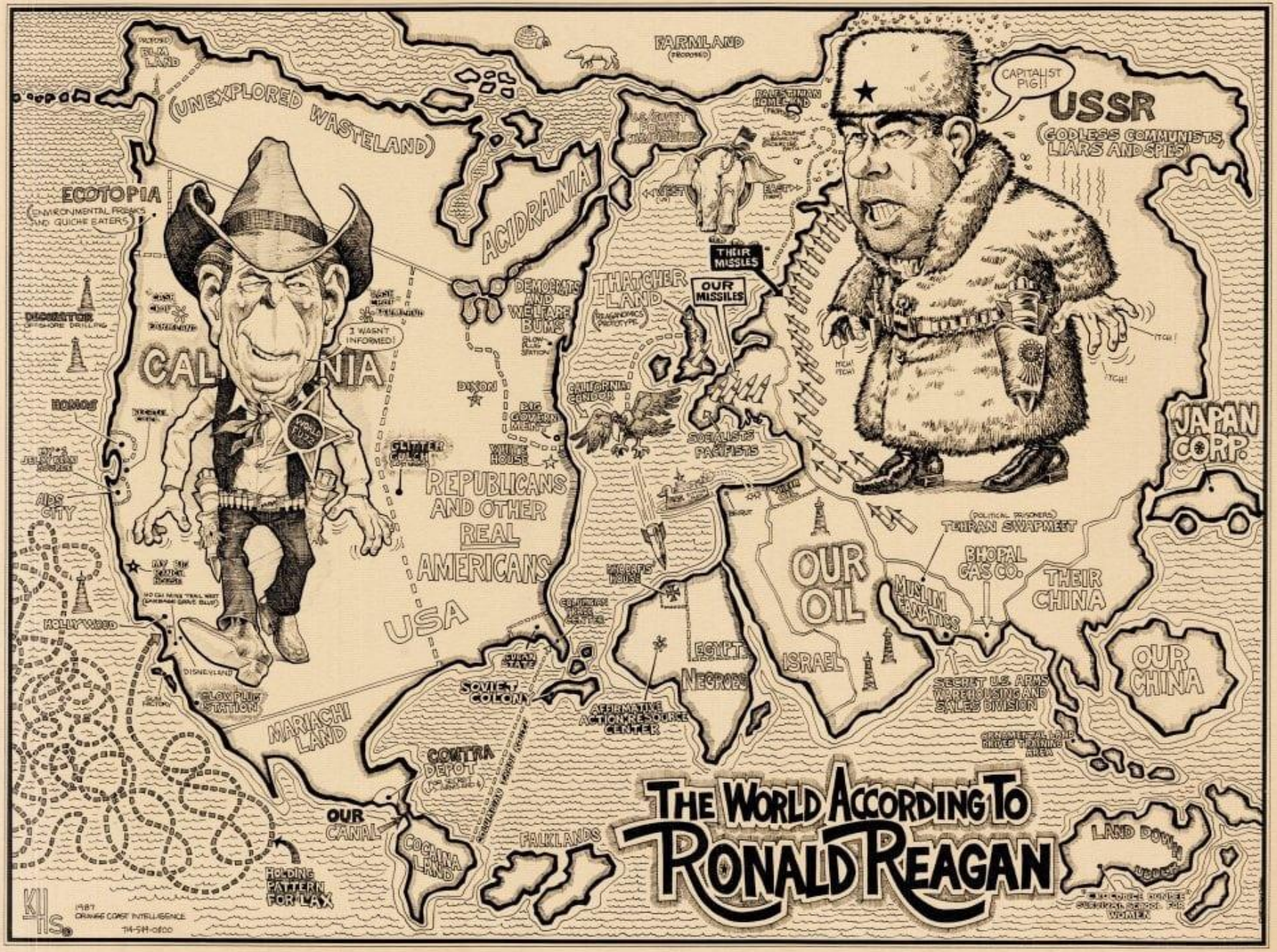
People behave according to how they see their 'map'

They tend to:

exaggerate the size and importance of their home area

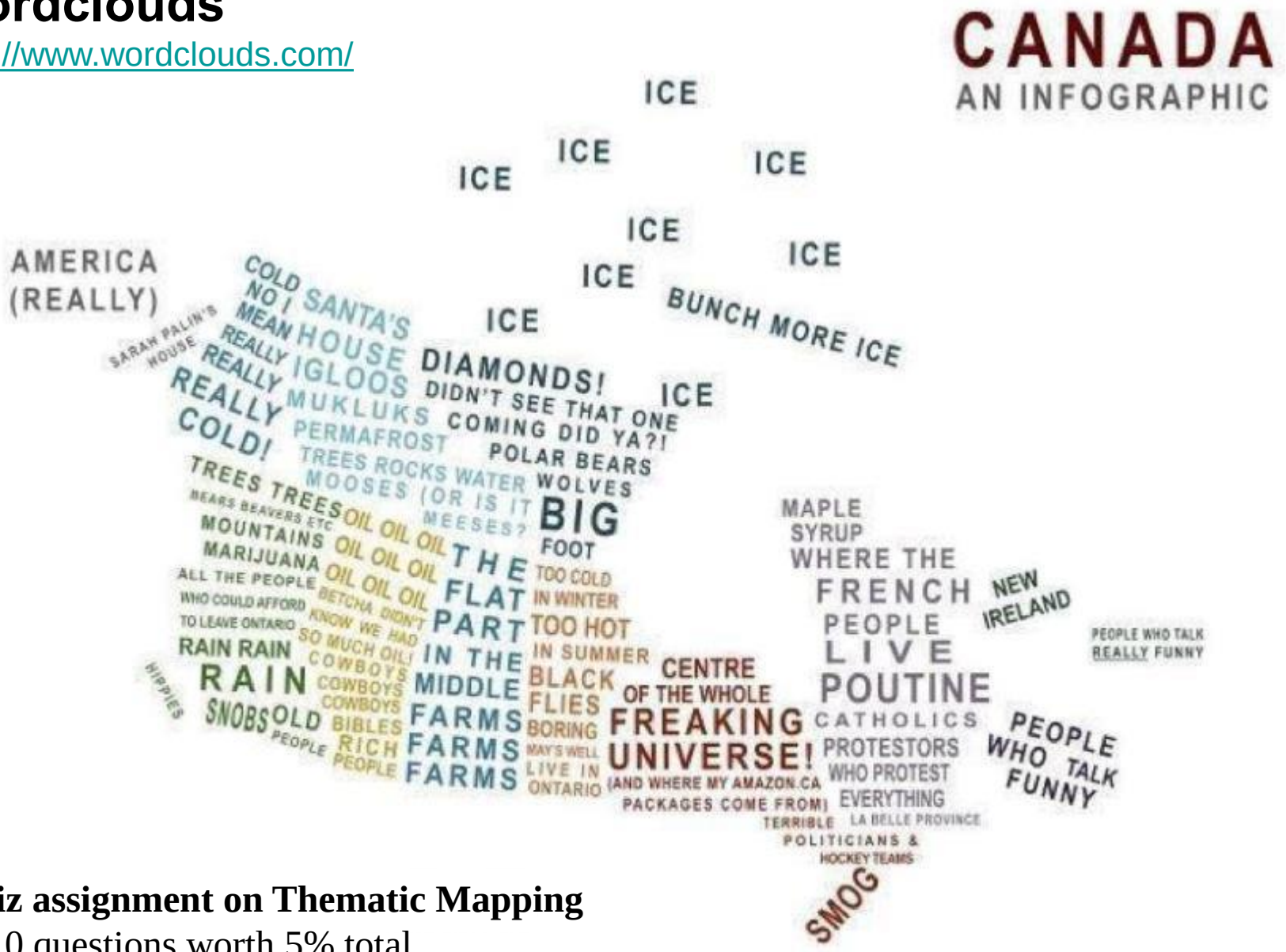
recall unusual features,

- e.g. the Florida peninsula, 'boot' of Italy, shape of Hudson Bay, etc..


(UNEXPLORED WASTELAND)
FARMLAND
(PROPOSED)
PROPOSED BLM LAND
ECOTOPIA
(ENVIRONMENTAL FREAKS AND QUICHE EATERS)
ACIDRAINIA
DEMOCRATS AND WELFARE BUMS
I WASN'T INFORMED!
DISASTER
OFFSHORE DRILLING
BOMOS
AIDS CITY
HOLLYWEED
DISNEYLAND
CLOW PLUG STATION
MARIACHI LAND
OUR CANAL
HOLDING PATTERN FOR LAX
REPUBLICANS AND OTHER REAL AMERICANS
USA
SOVIET COLONY
CONTRA DEPOT
COCHINA LAND
FALKLANDS
AFFIRMATIVE ACTION RESOURCE CENTER
EGYPT
NEGROES
ISRAEL
THATCHER LAND
(REAGONOMICS PROTOTYPE)
THEIR MISSILES
OUR MISSILES
CALIFORNIA CONDOR
SOCIALIST PACIFISTS
OUR OIL
MUSLIM FANATICS
(POLITICAL PRISONERS)
TEHRAN SWAPMEET
BHOPAL GAS CO.
THEIR CHINA
OUR CHINA
SECRET U.S. ARMS WAREHOUSING AND SALES DIVISION
JAPAN CORP.
USSR
(GODLESS COMMUNISTS, LIARS AND SPIES)
CAPITALIST PIG!!
ITCH!
THE WORLD ACCORDING TO RONALD REAGAN
LAND DOWN UNDER
1987
GRAPHIC CORP. INTELLIGENCE
714-541-0800

‘Wordclouds’

https://www.wordclouds.com/



Quiz assignment on Thematic Mapping

5 -10 questions worth 5% total

- will be posted later today -> midnight

Submit via Moodle Wednesday 8th Feb (23.59)