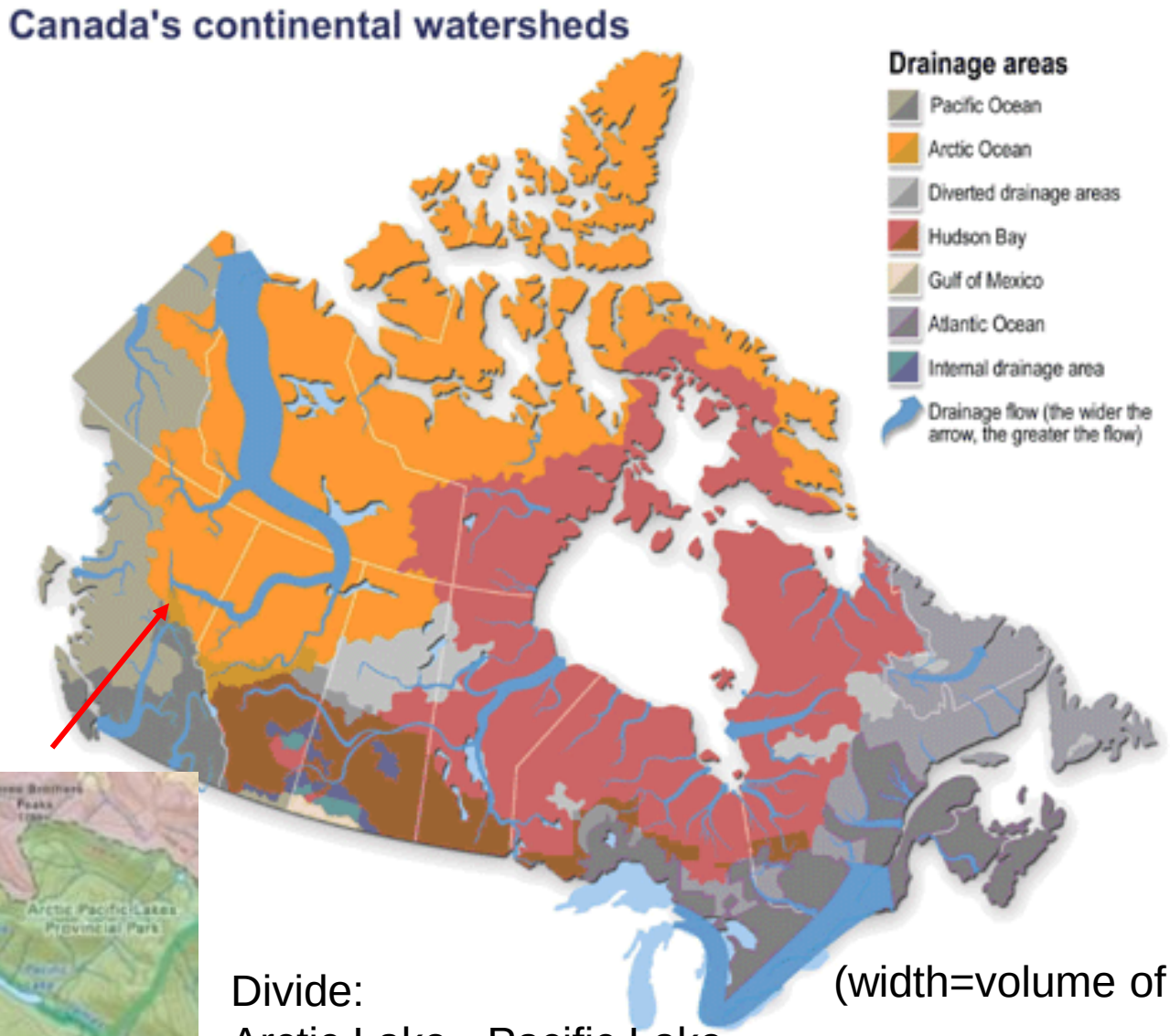
Review: Thematic Line techniques: 1. Graduated lines

show **movement** **(proportional)**

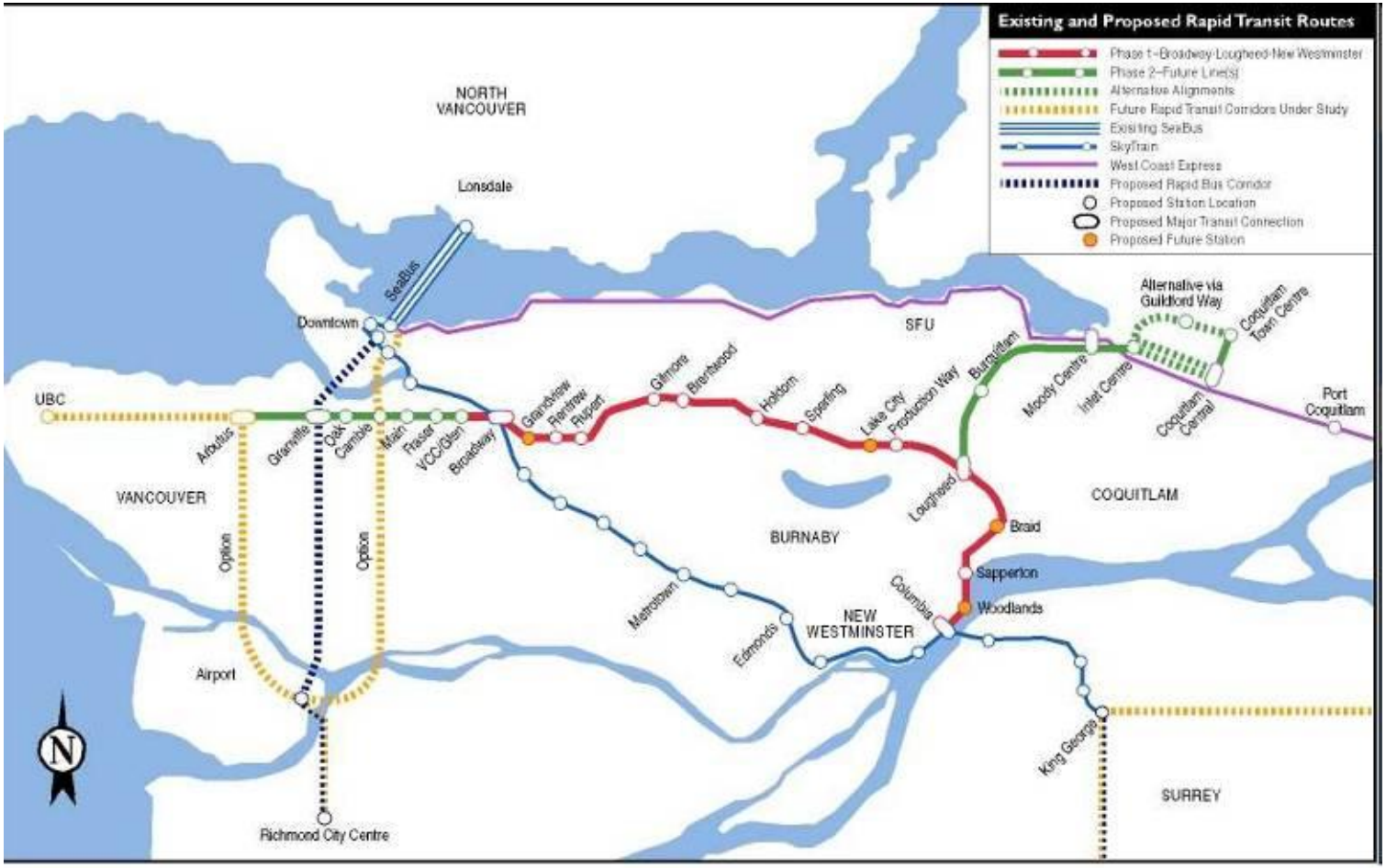


Divide:
Arctic Lake - Pacific Lake

(width=volume of water flow)

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,

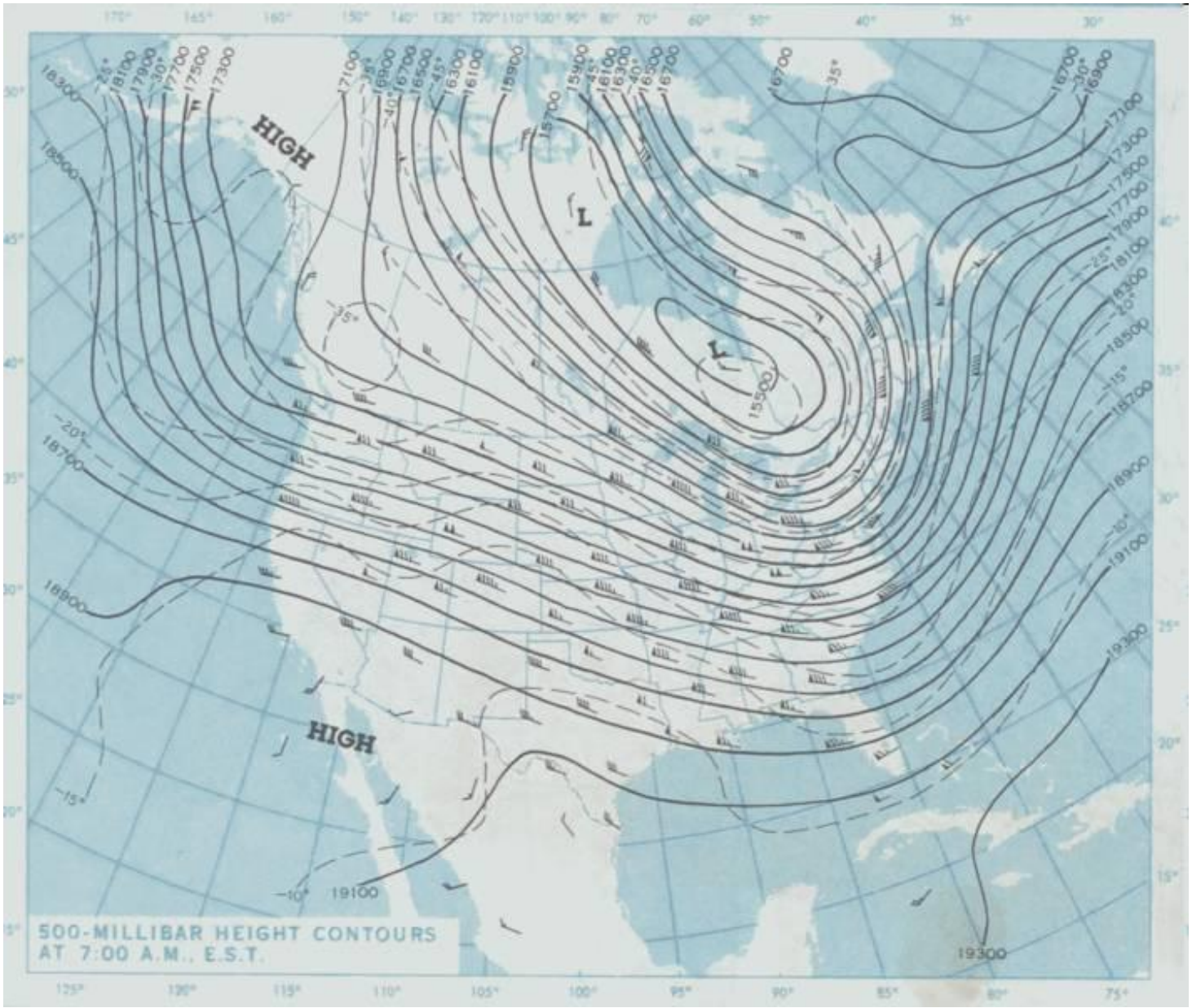


ide. Proposed alignment and station locations subject to change

3. Isarithms (Isolines) - lines of equal value

* Often created from point data

e.g. barometric pressure (isobars)

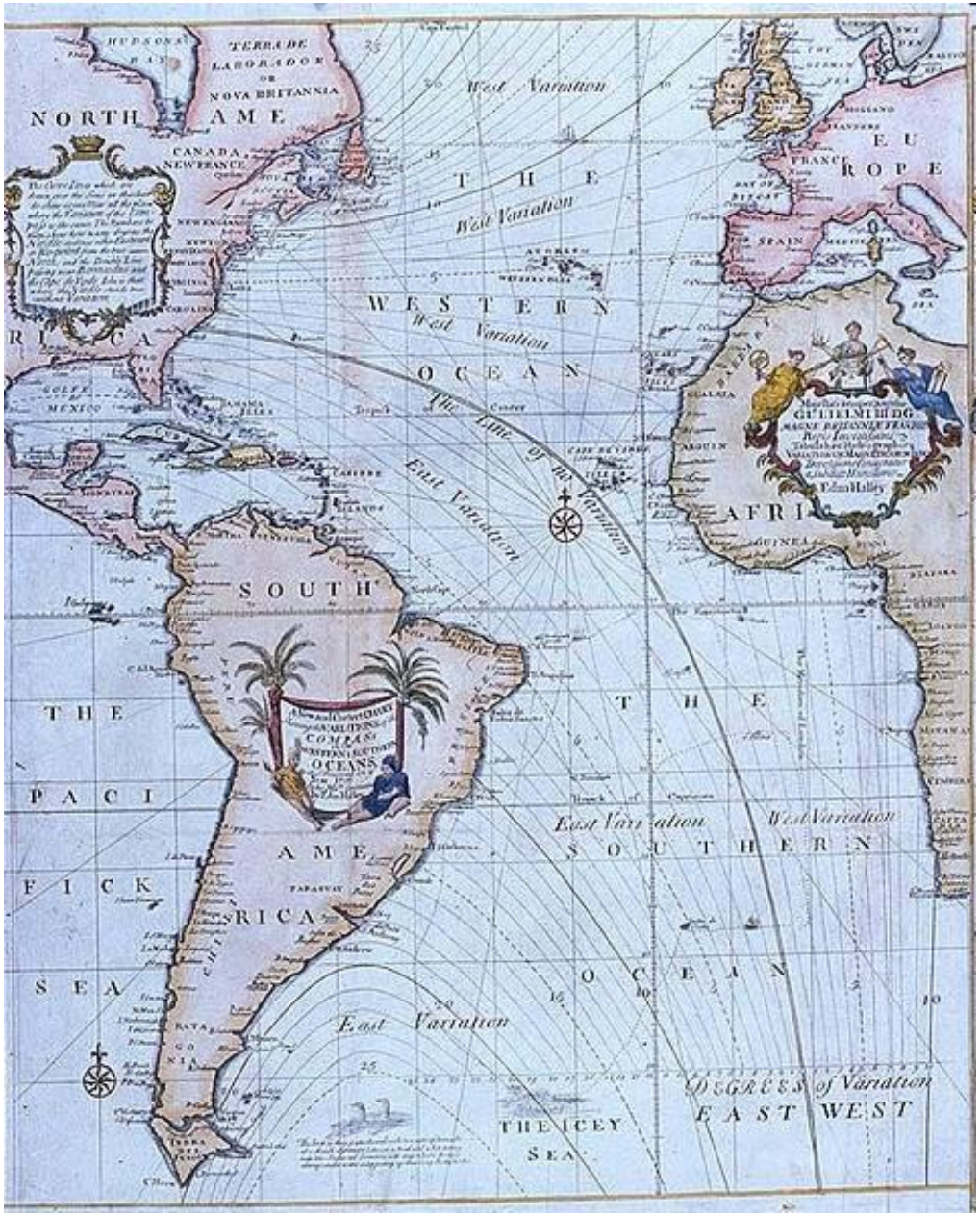


Early thematic map:
[Halley, Isogonic map 1701]

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**"

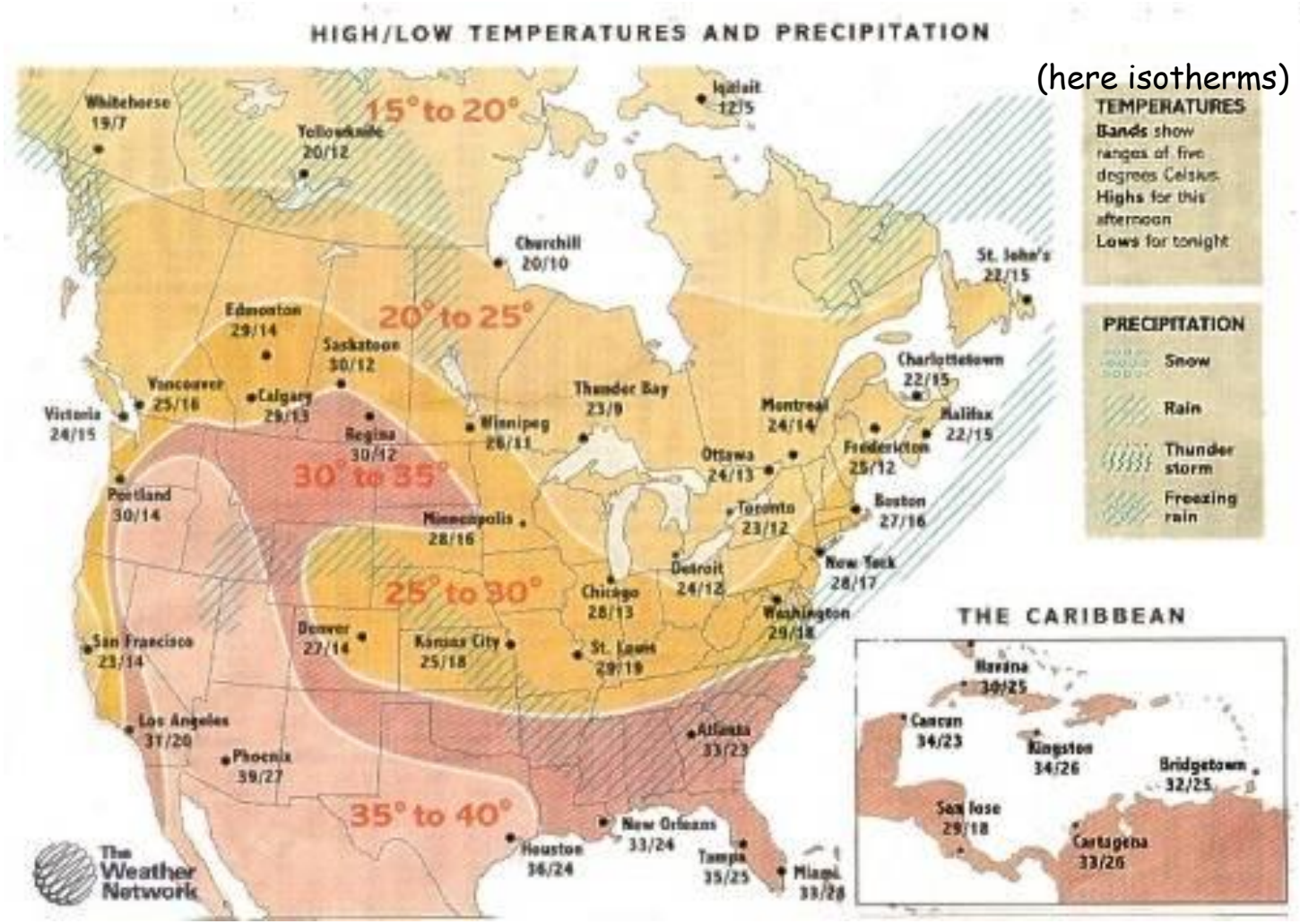
= a line of equal declination between magnetic and grid north

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
```

Thematic area mapping: 1. Isopleths (Isarithms)

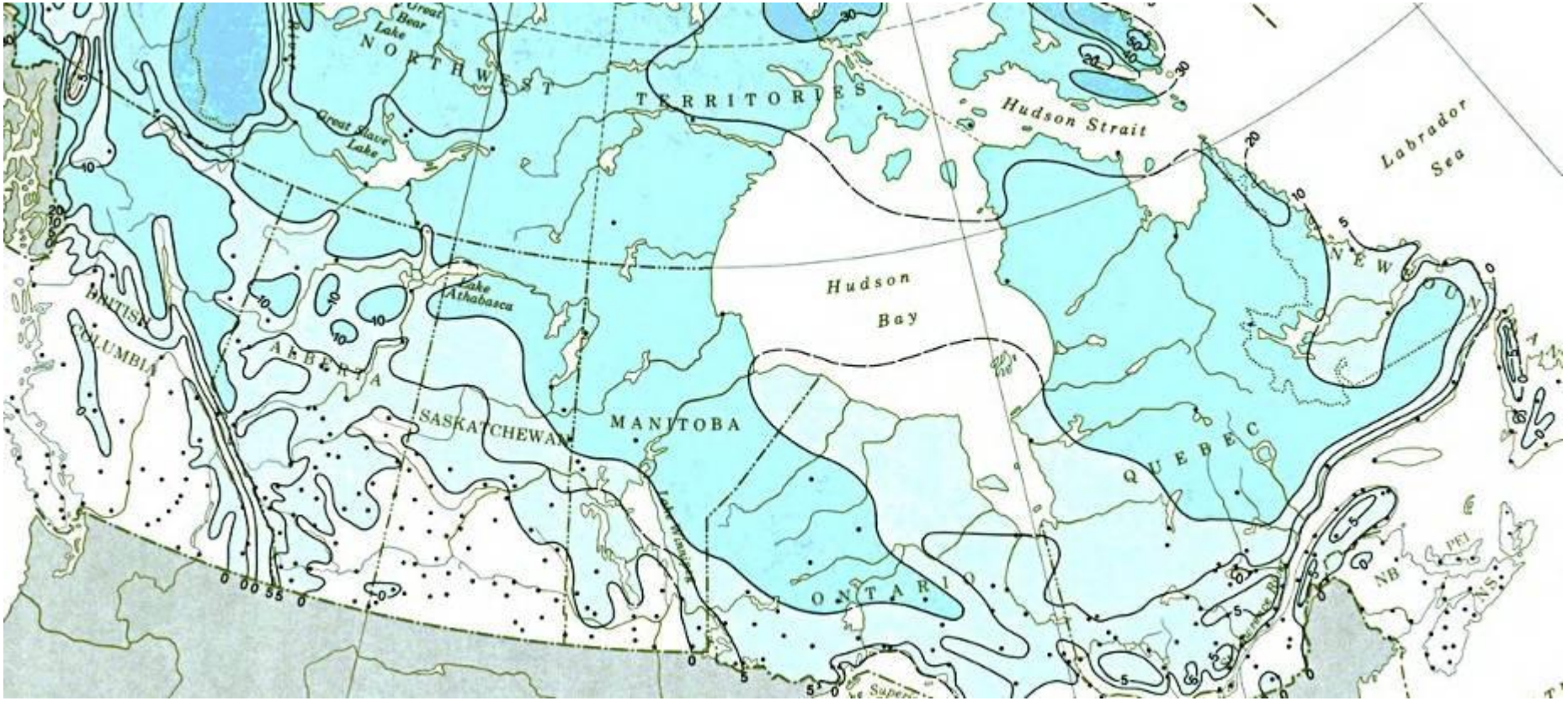
Also usually created from point data



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

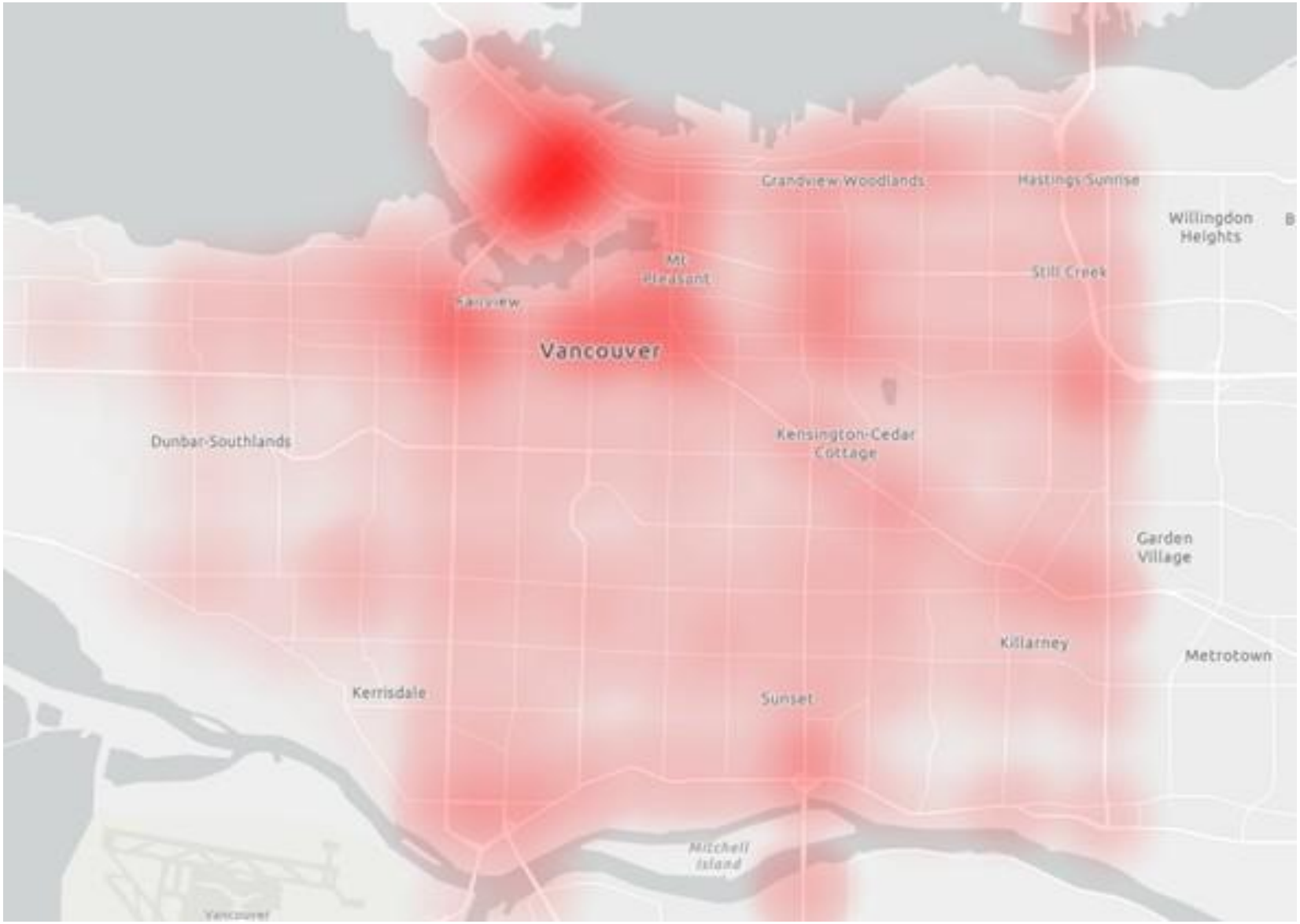
Isopleths

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



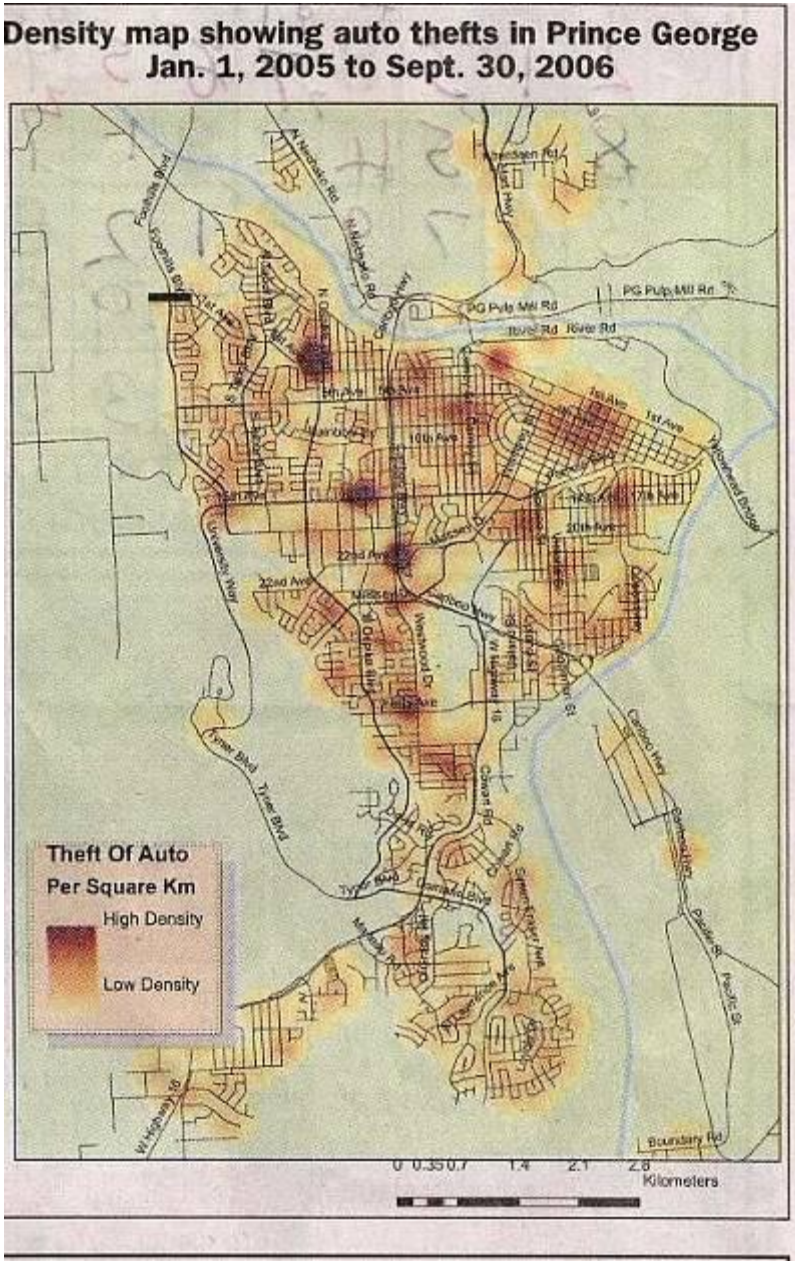
Average snow depth, Nov 15 … use of blue to suggest snow/cold

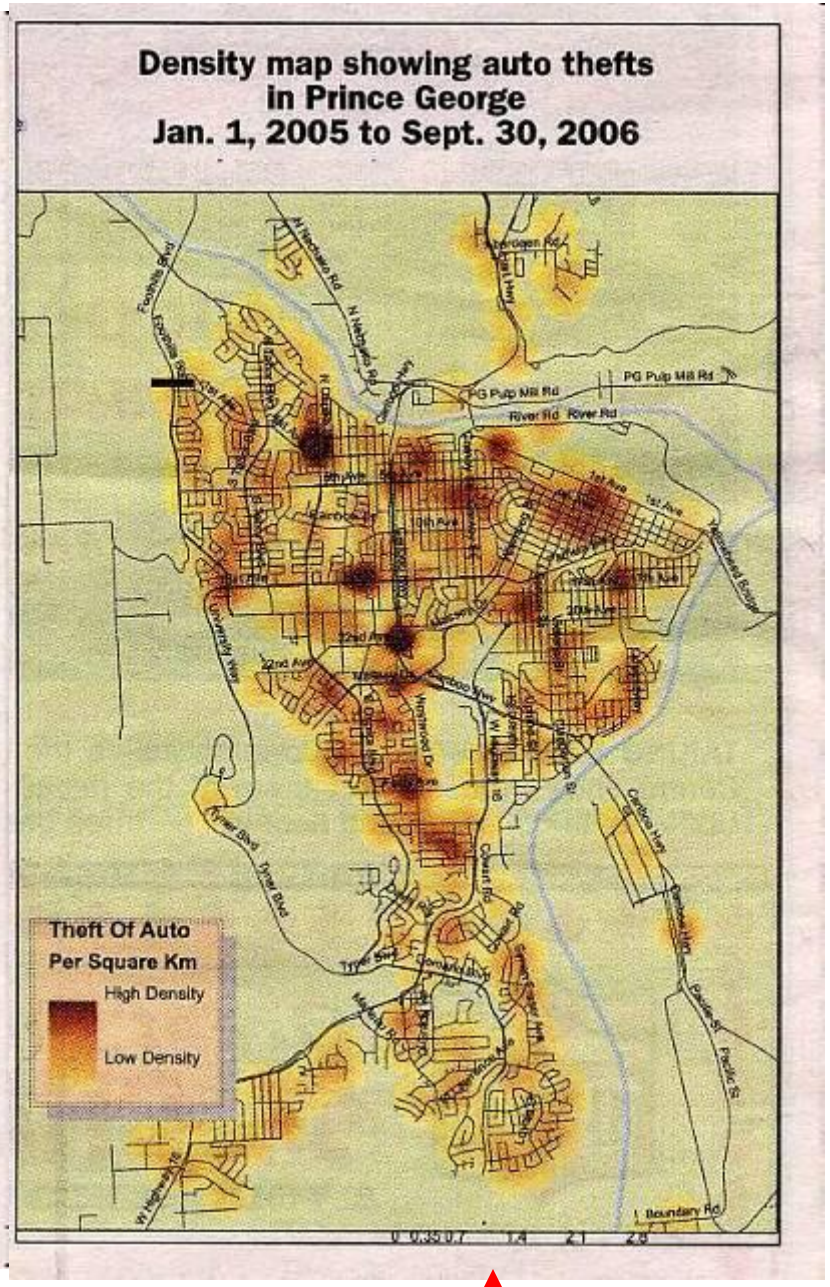
Heat map – Vancouver, traffic accidents (software option . 2000)



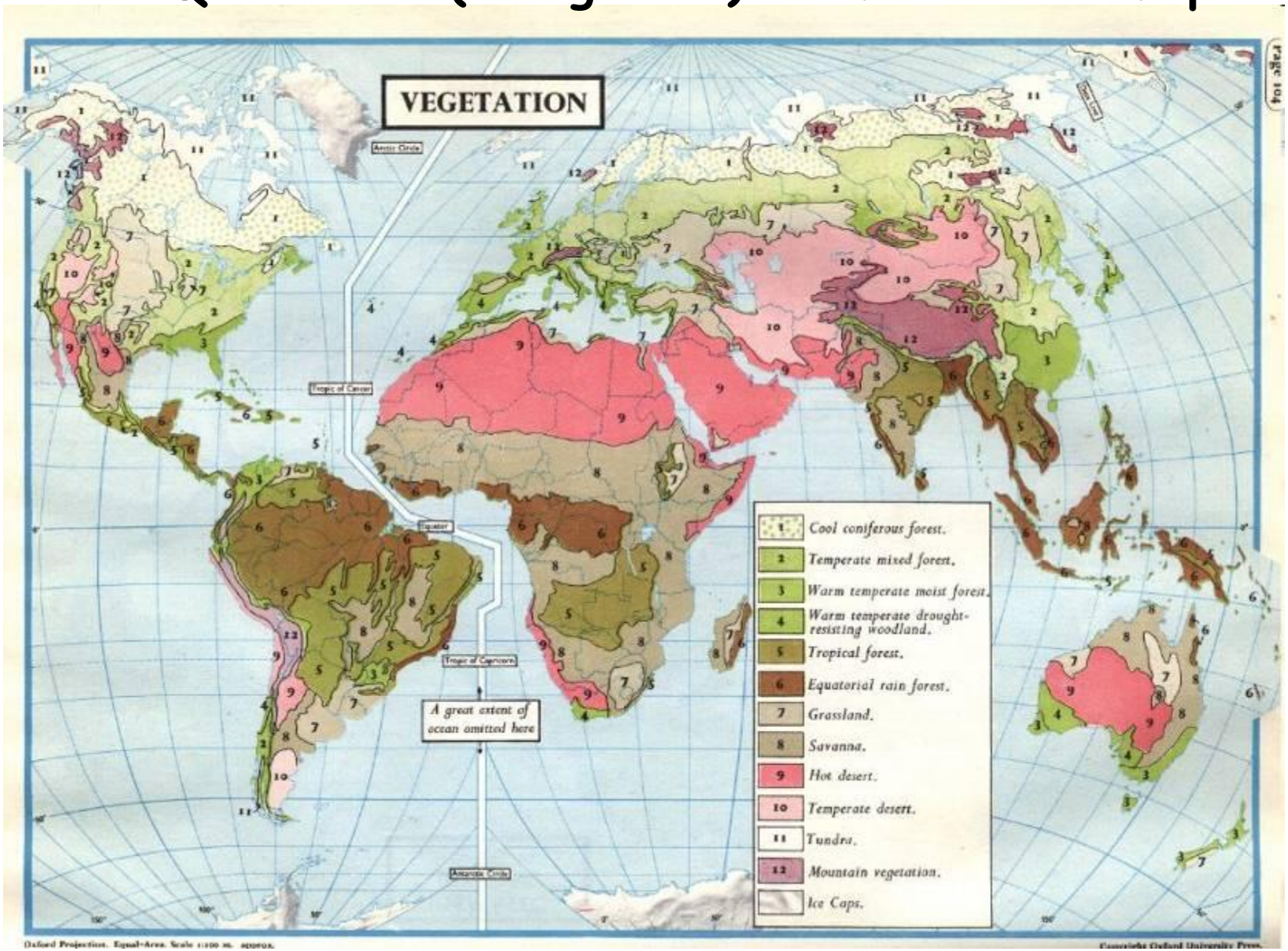
Prince George Citizen 'Heat map' PG week review

Ordinal data





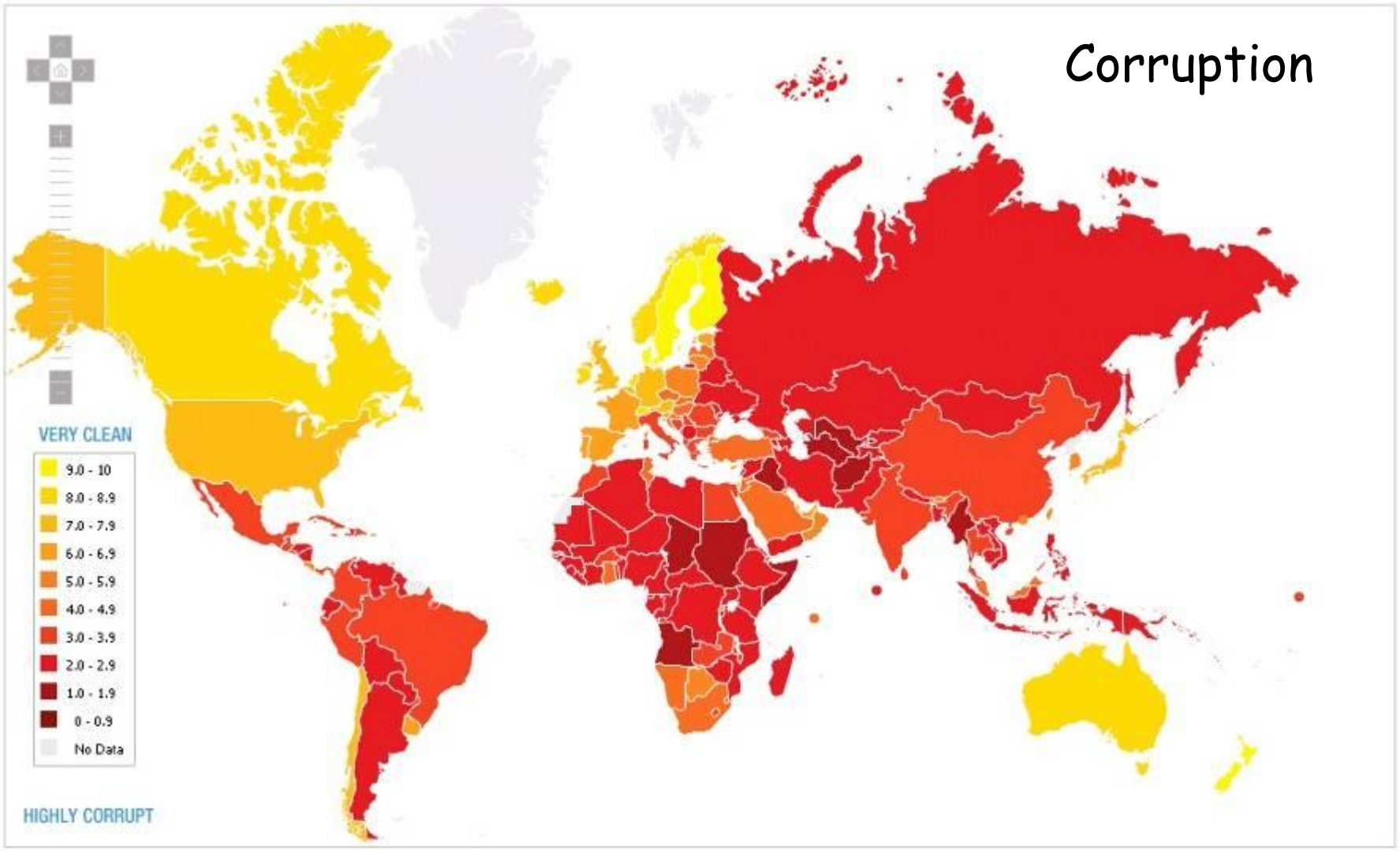
2. Qualitative (categorical) thematic area maps



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

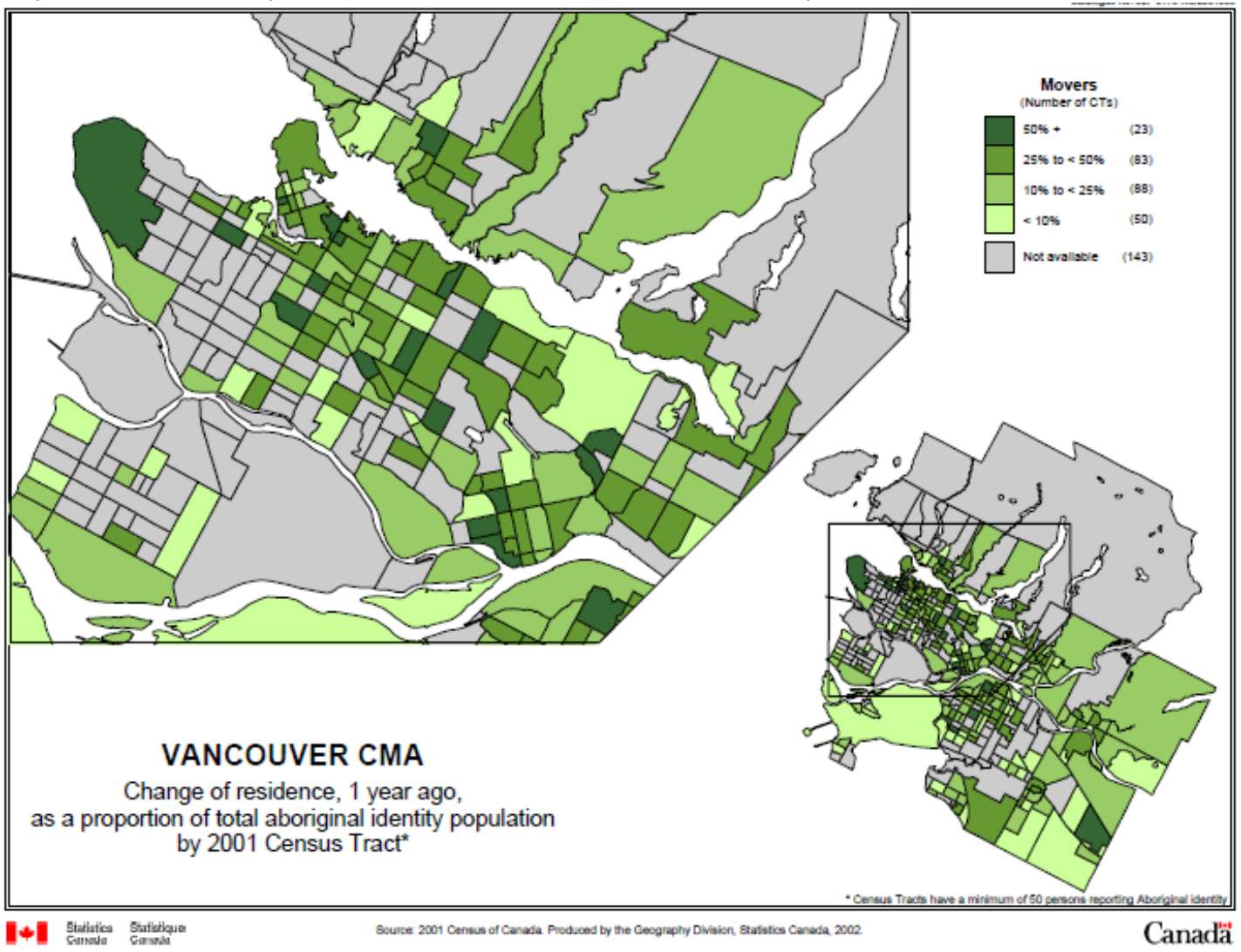
3. Thematic mapping – choropleth = 'magnitude at place'

One value per 'collection unit' (here each country) is it homogenous ?



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

Choropleth maps = 'magnitude at place' (census data)



Choropleth maps show data from collection units e.g. census districts

They map intensity, % more than numbers.

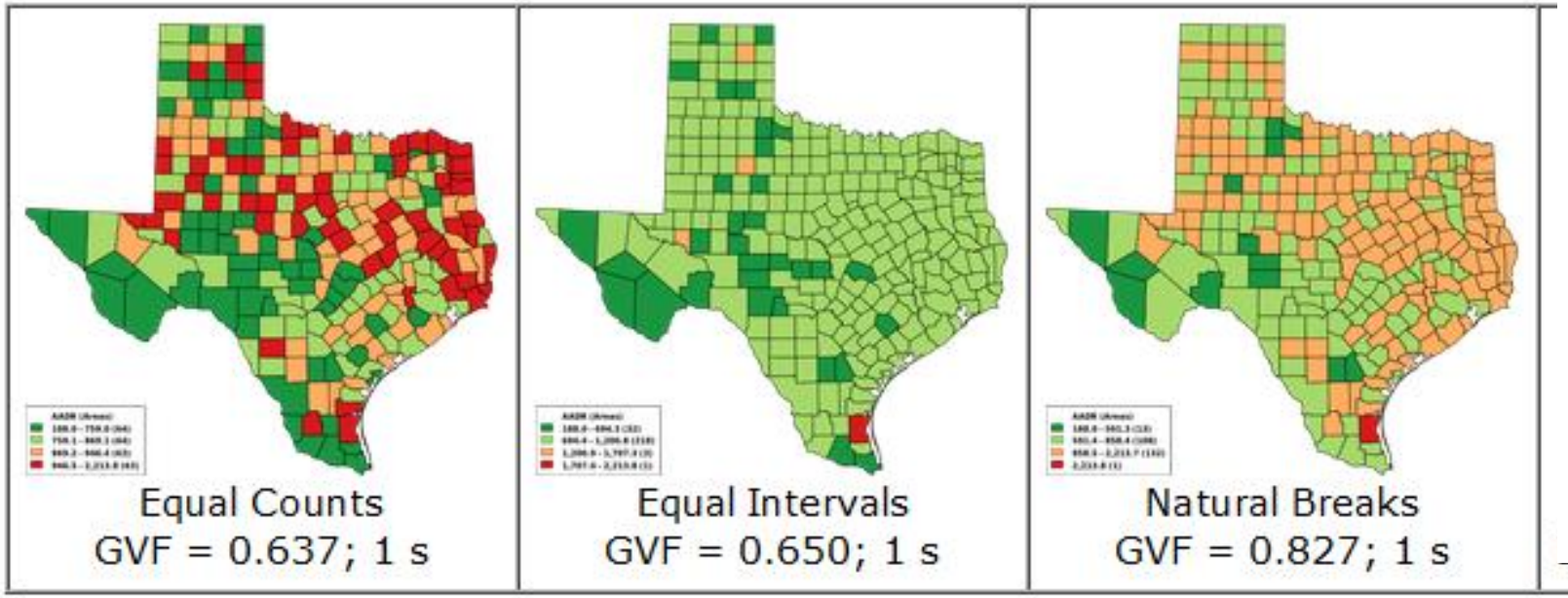
Design of Choropleth Classes

On Isarithmic / isopleth 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:

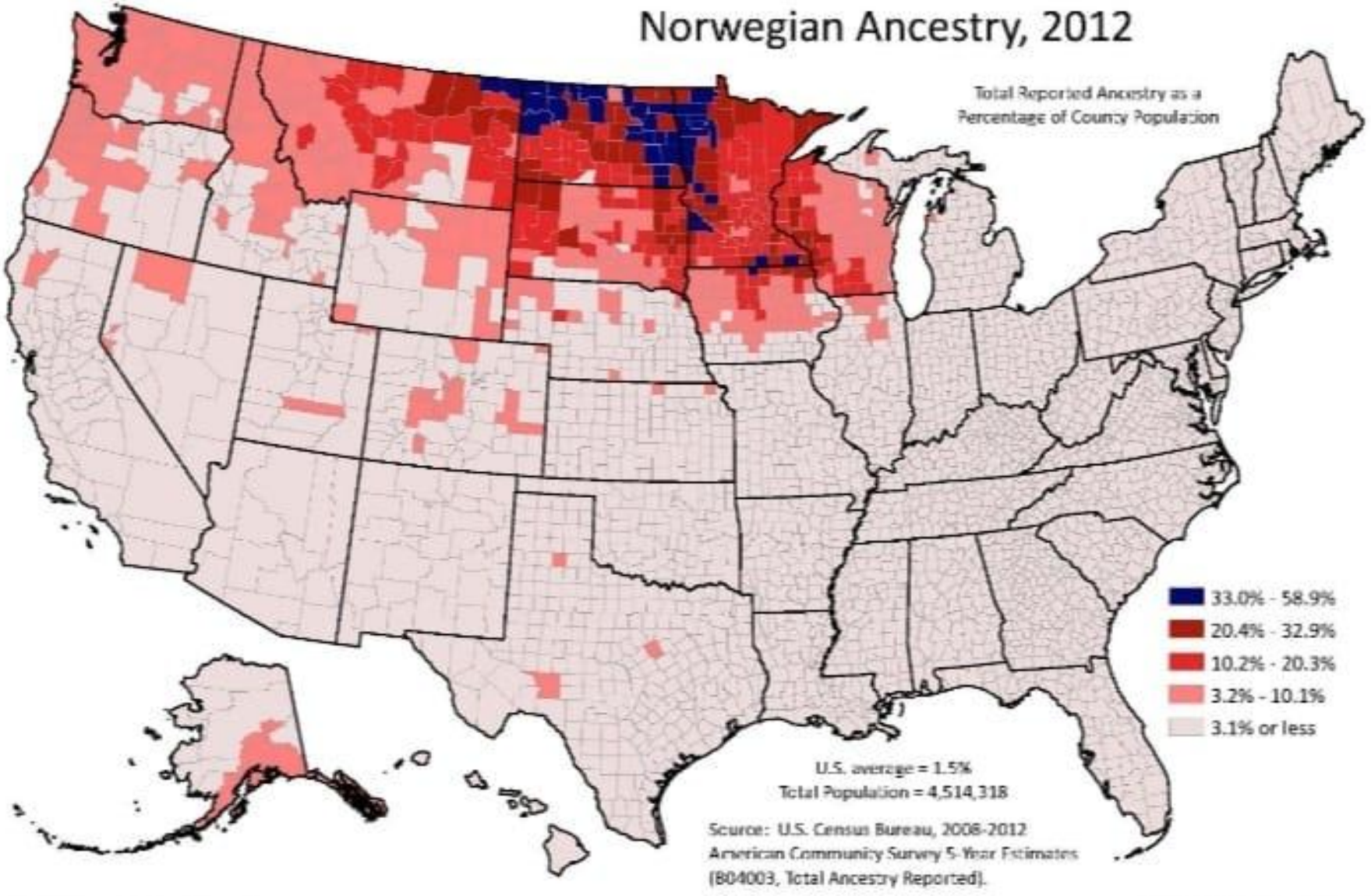
- maximize difference between classes and minimize contrast within classes
- minimize or eliminate empty classes and avoid too many values in one class

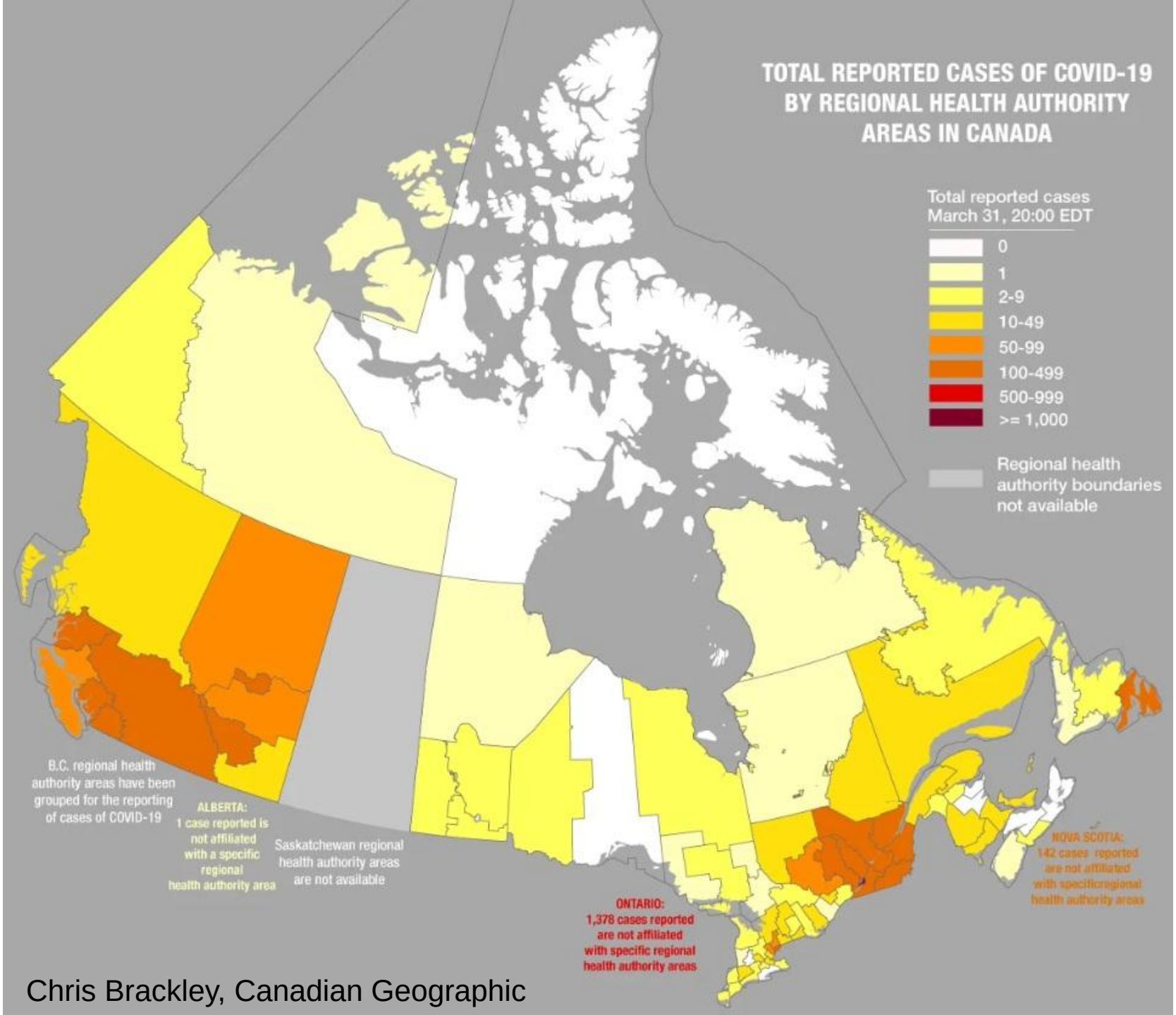
Schemes include these options:
e.g. 5 classes

- **Equal steps** 0 –10 –20 –30 -40
- **Geometric** 2- 4 –8 –16 –32(64)
- **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

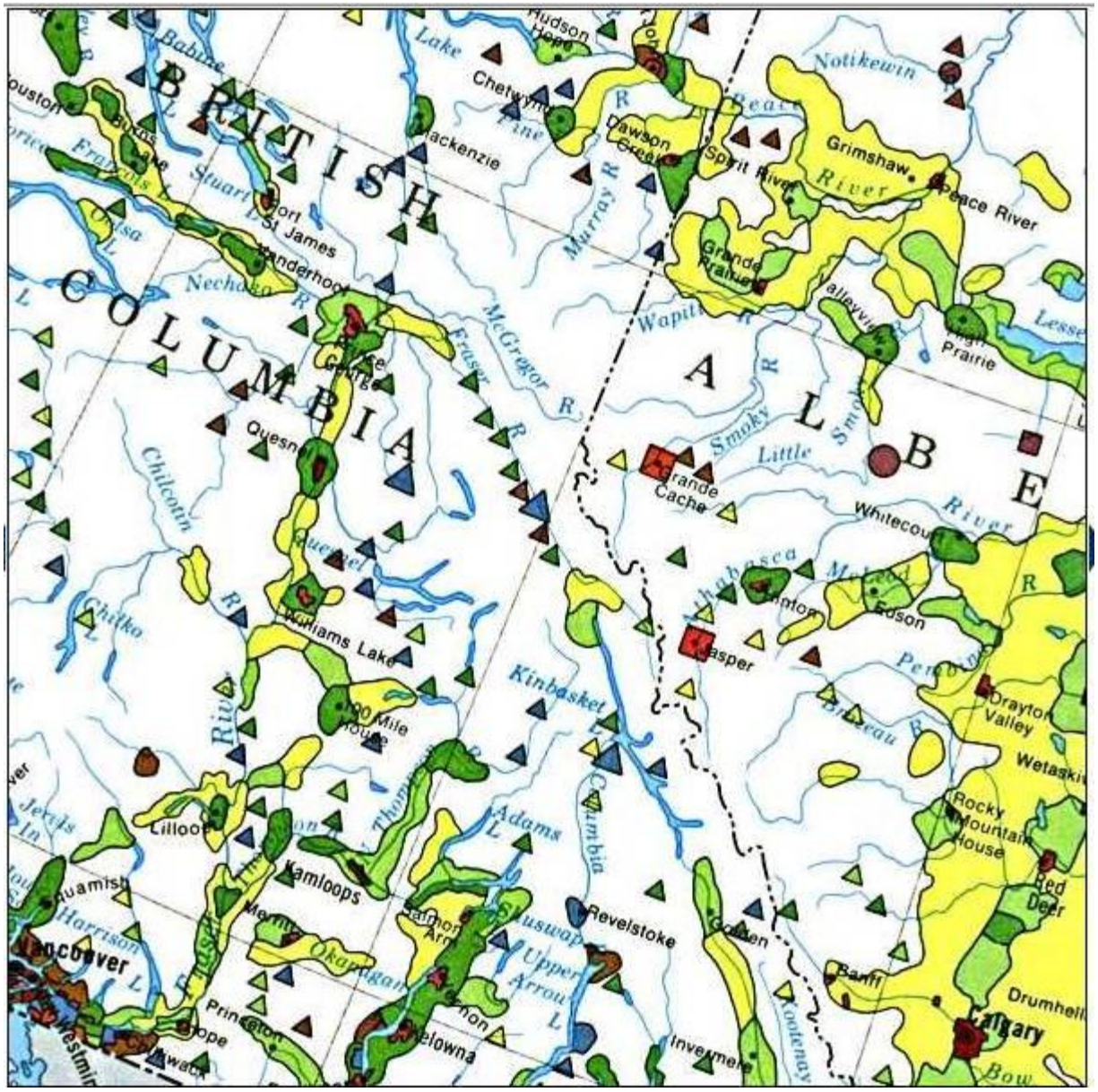
Norwegian Ancestry, 2012





Chris Brackley, Canadian Geographic

4. Dasymetric = 'measure of density'



Dasymetric maps also depict intensities

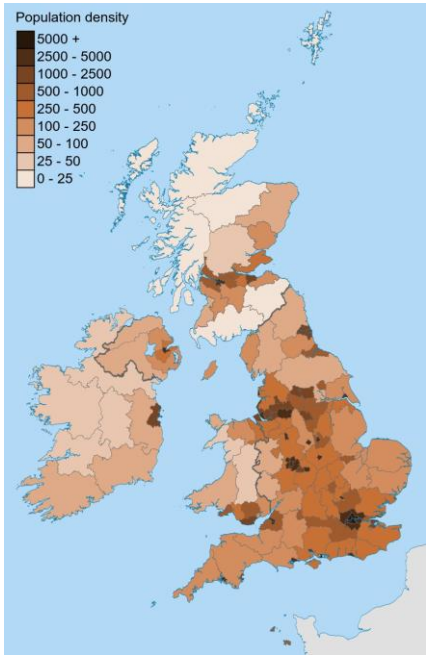
e.g. %, ratios, densities.

They involve analysis beyond admin.districts;

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

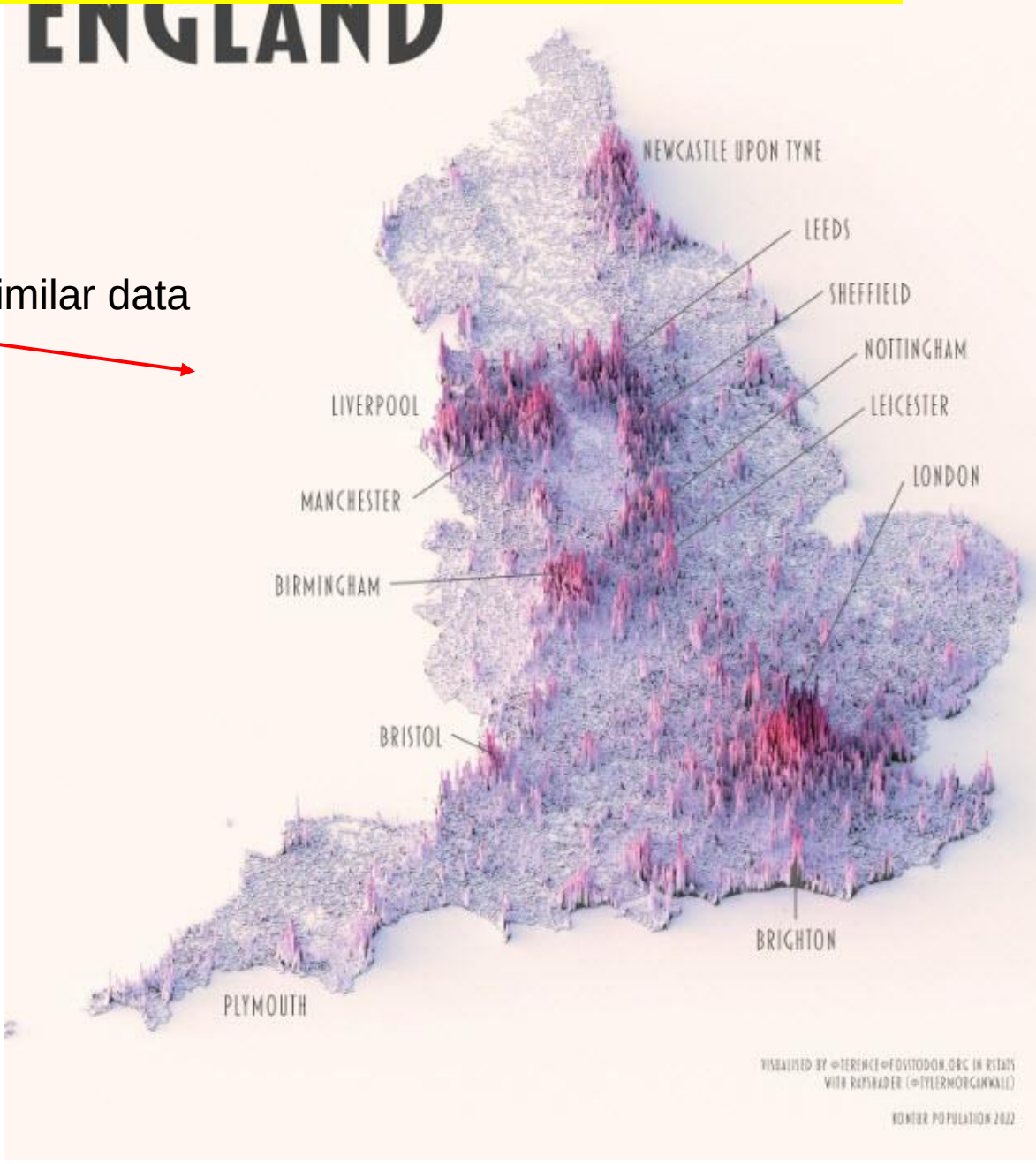
Most commonly applied to population density maps; dasymetric / choropleth are best used for relative measures e.g. %, density not absolute values

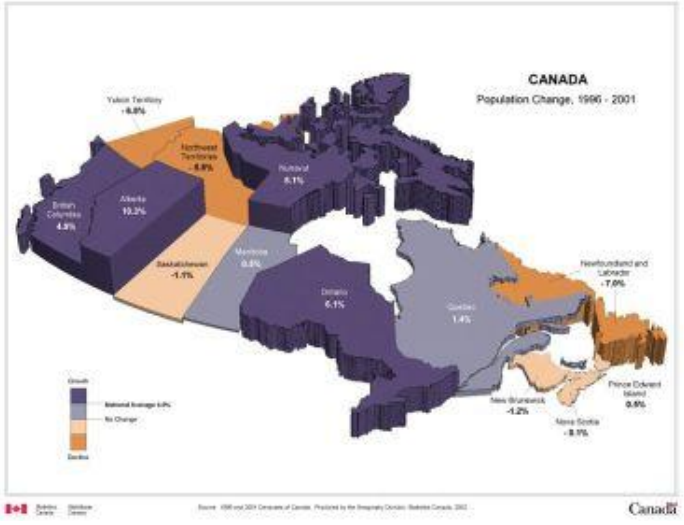
5. Topograms use height to avoid the need to create classes



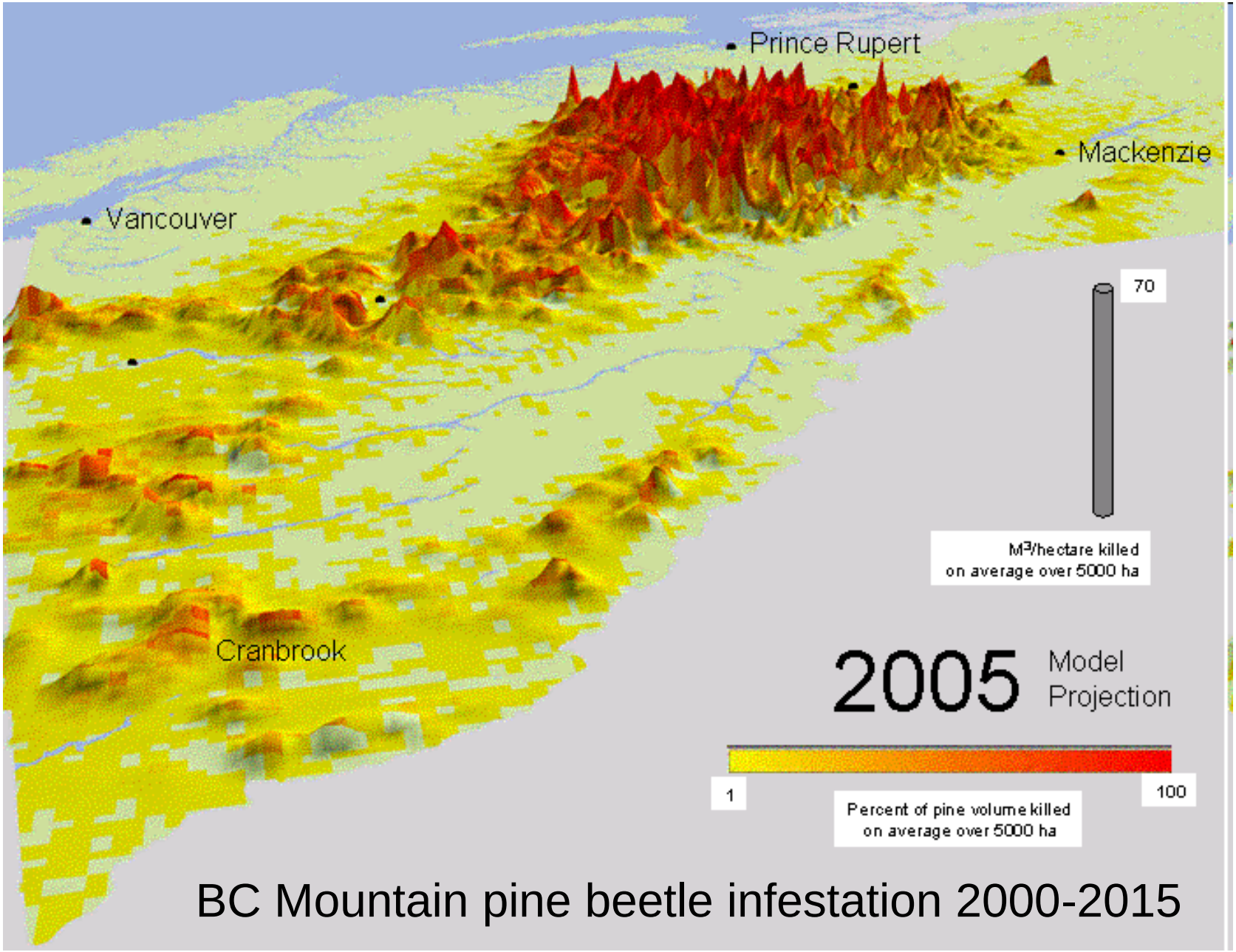
2022

Similar data





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



6. Value-by-area cartograms

cartograms have no 'cartesian' (distance) scale
- but here, area is based on **another geographic variable**

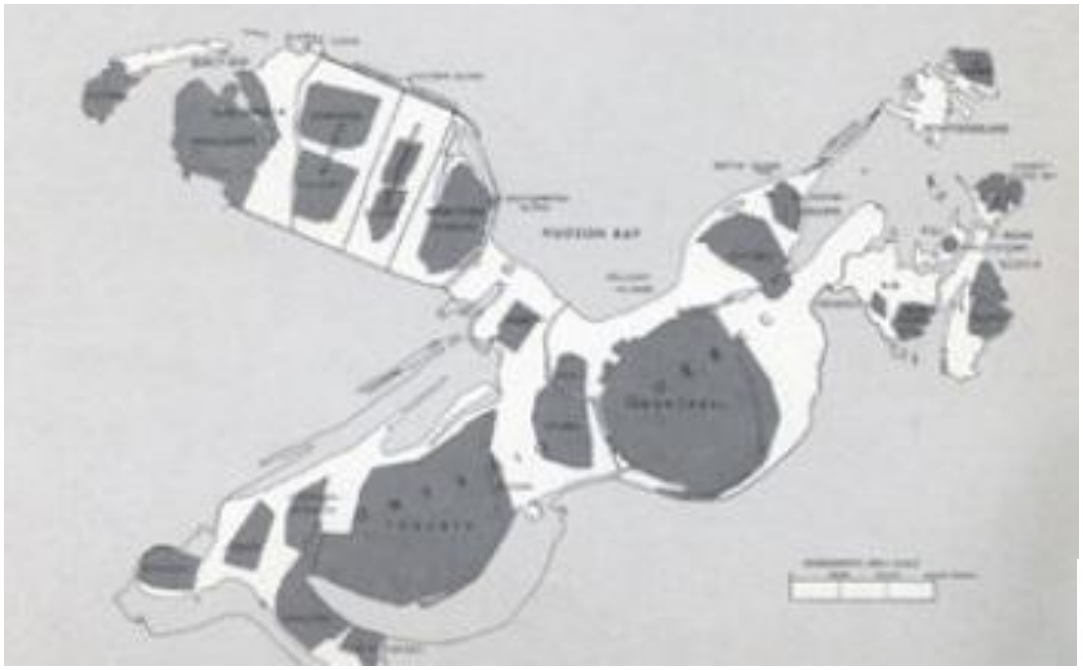
World population

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)

Lou Skoda and J.C. Robertson:
The Isodemographic Map of Canada, 1972



Pre-digital
‘value by area’ maps

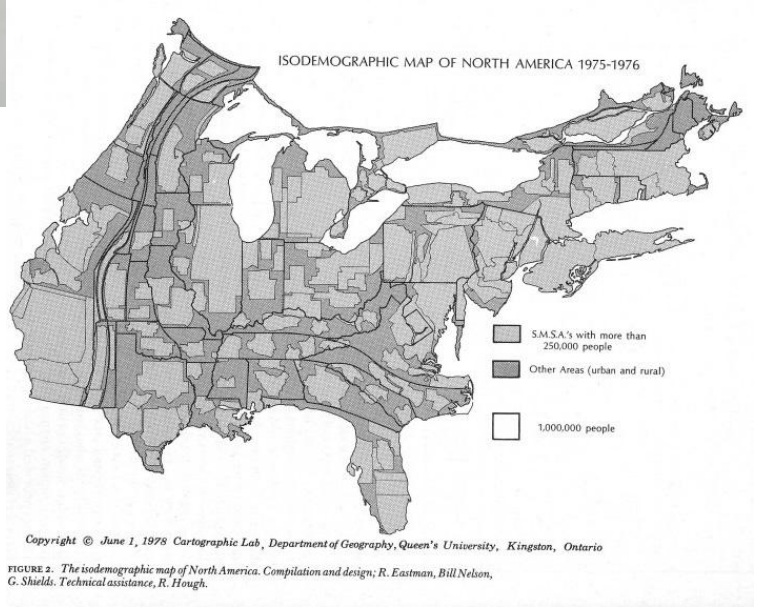
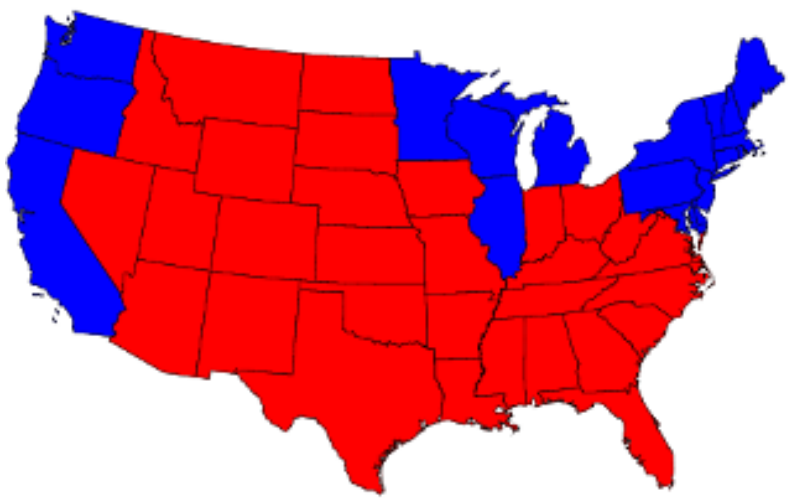


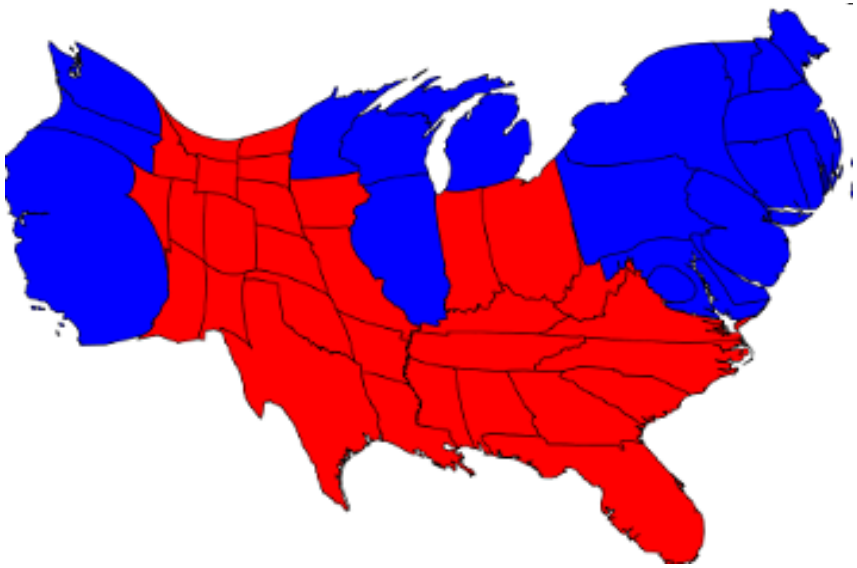
FIGURE 2. *The isodemographic map of North America. Compilation and design; R. Eastman, Bill Nelson, G. Shields. Technical assistance, R. Hough.*

Isodemographic map of North America

USA examples

US election results: 2012 **2008**





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

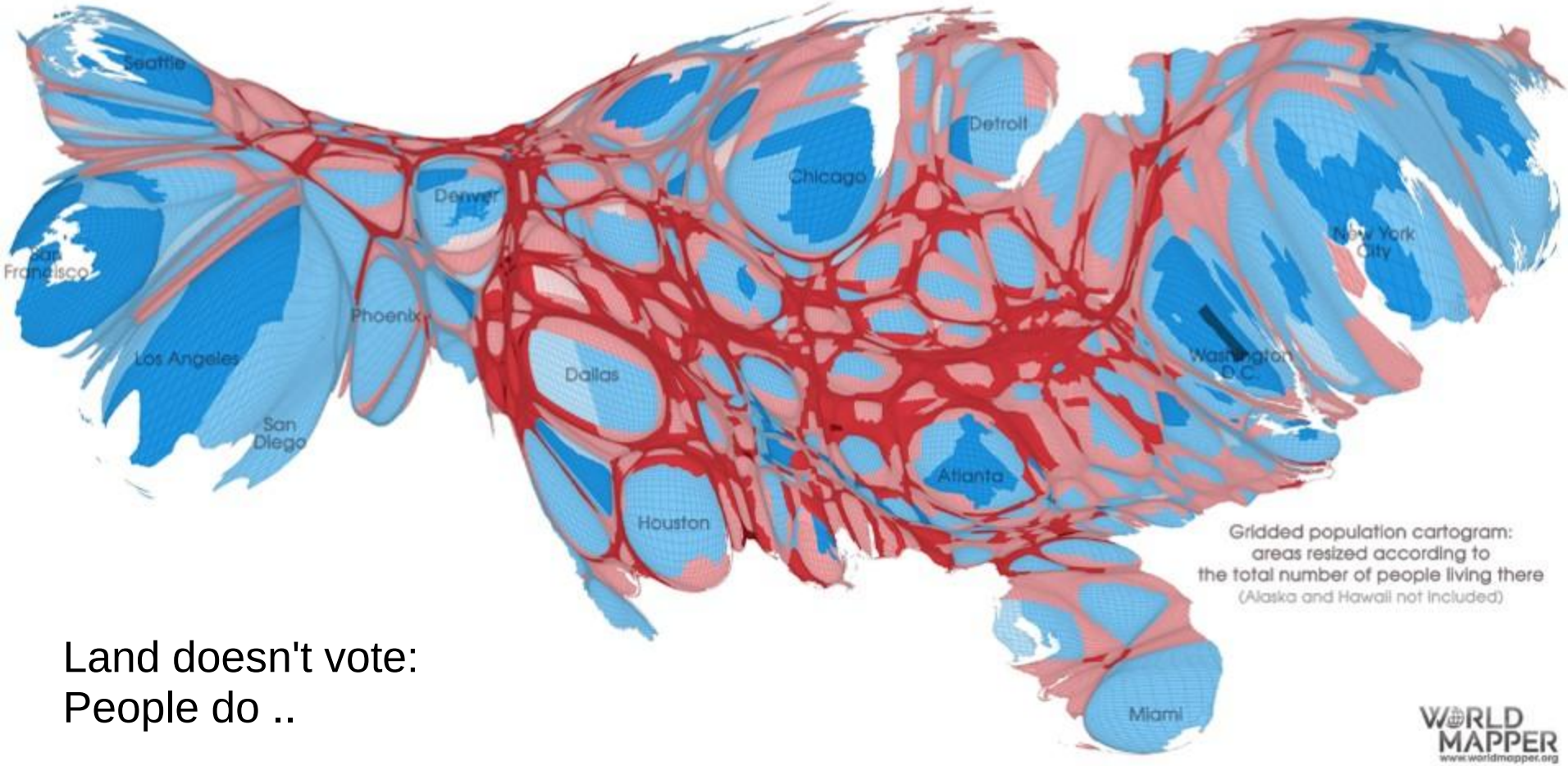
Biden

0 50 70 90%

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)

WORLD MAPPER
www.worldmapper.org

Land doesn't vote:
People do ..

2016

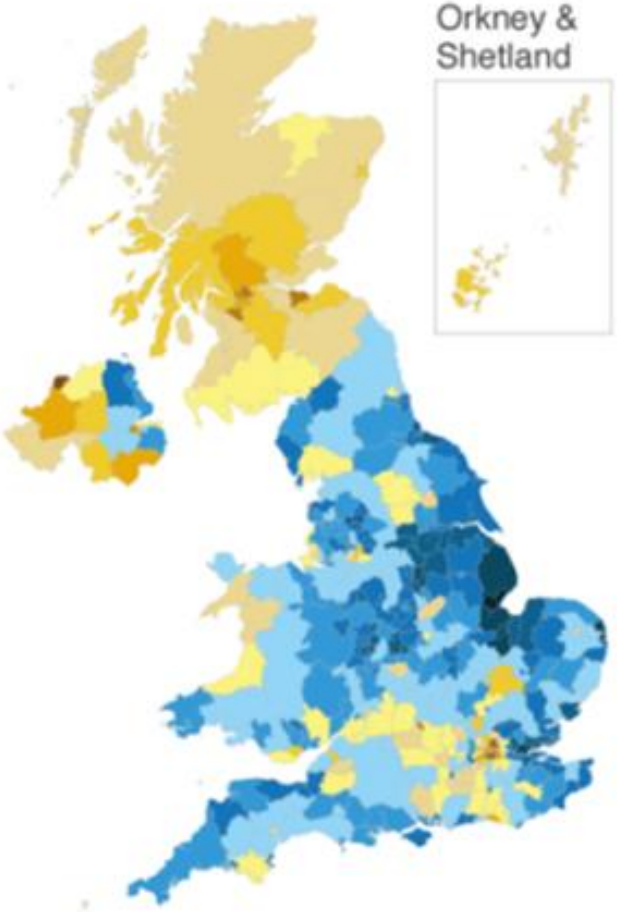
Question asked: **"Should the UK remain a member of the European Union or leave the European Union?"**

a and vote share

Remain
Leave

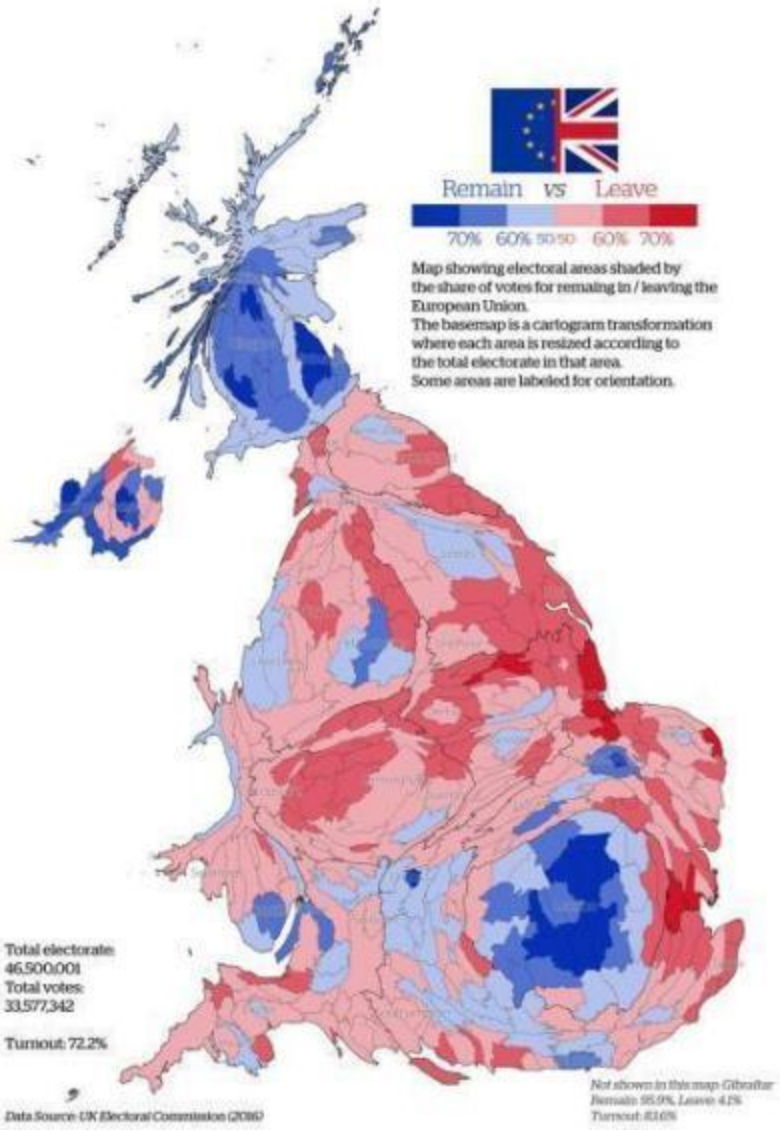
70 75 80

Orkney & Shetland



EU Referendum
A Divided Kingdom

Map by Benjamin Hennig
www.viewsoftheworld.net



Thematic techniques and data types

Raw values / totals

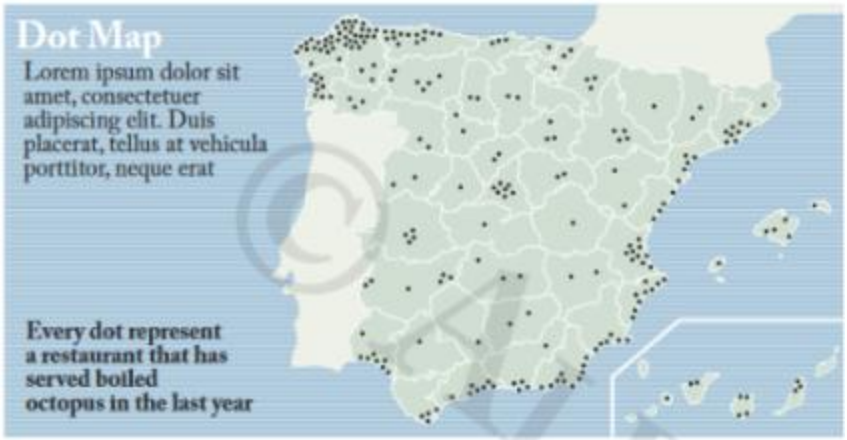
- Dot maps
- Proportional/Graduated symbols
- Graduated lines
- Cartograms (value by area)

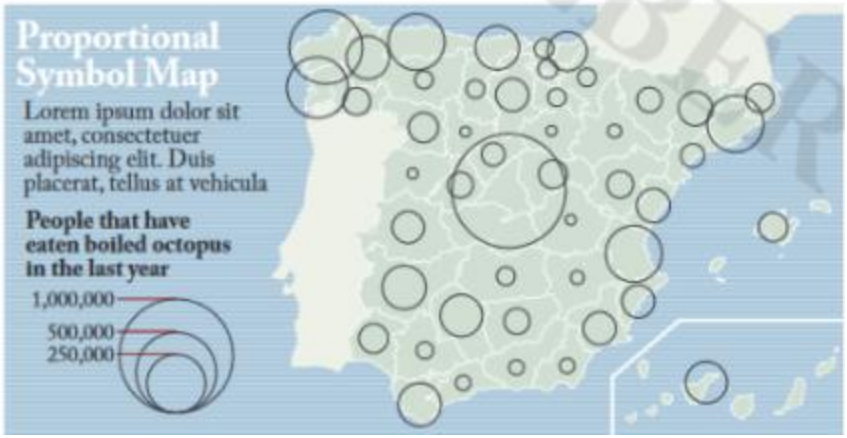
Derived densities / % values

- Choropleth
- Topograms
- Isarithms / isopleths (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'

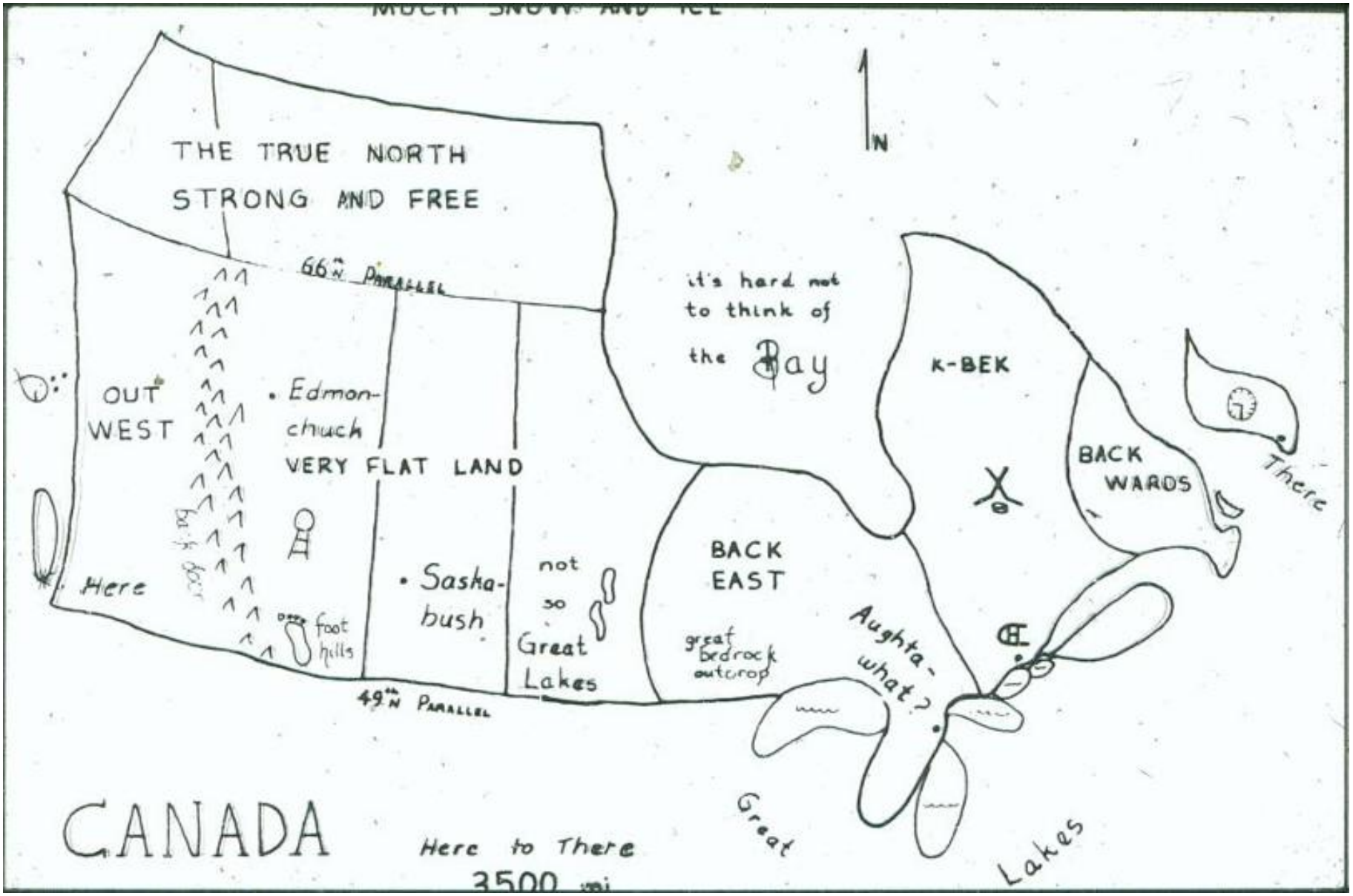
They tend to:

exaggerate the size and importance of their home area

recall unusual features

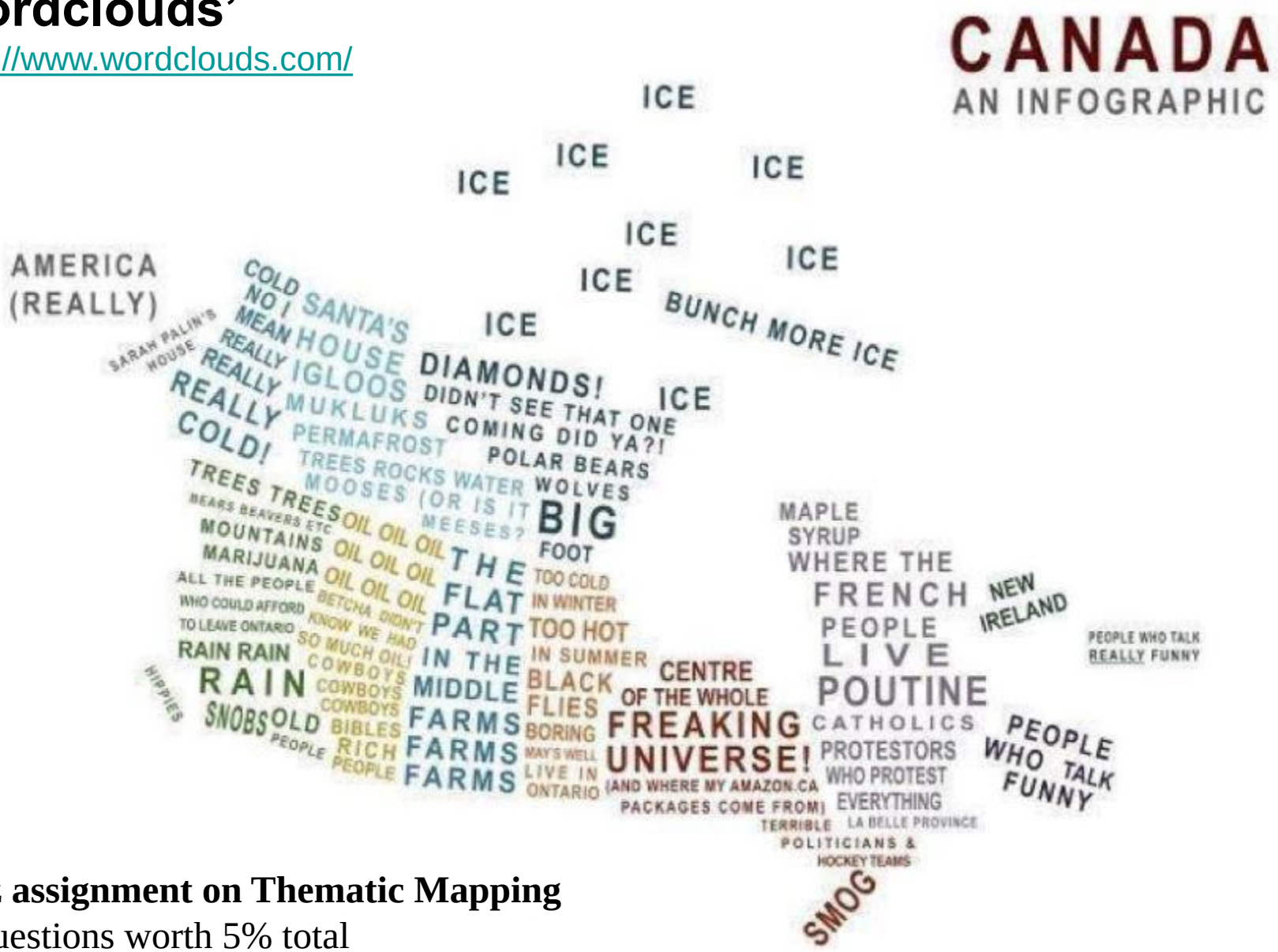
- e.g. the Florida peninsula, 'boot' of Italy, shape of Hudson Bay, etc..
- Know less about distant places – North England, or 'beyond Hope' in BC

Mental map of Canada



‘Wordclouds’

https://www.wordclouds.com/



Quiz assignment on Thematic Mapping

10 questions worth 5% total

- should be posted by noon today
- – due by Tuesday 9pm