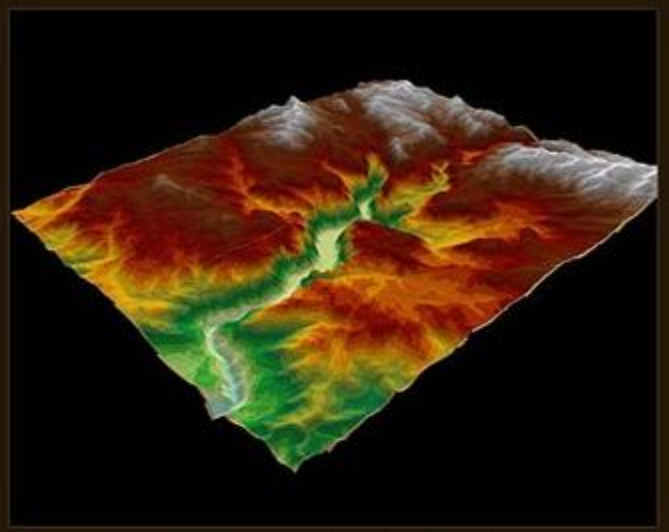
History of mapping II: the digital era

http://www.davidrumsey.com/GIS/3D.htm

Step 1: *The original flat scan of the 1883 Yosemite Valley historical map.*



Step 2: *The modern digital elevation model (DEM) of Yosemite Valley.*

Step 3: *The flat historic map image and the DEM combined.*

Step 4: *The image similates the user moving through the 3D map.*

The digital era and mapping changes

1975-90: digital but costly data/hardware/software

1995: real growth of desktop computer mapping

- World wide web (1994); UNBC campus open

- government stopped 'making maps' (Canada) and focused on providing data for others to use

- BC completed TRIM I; end of digitising tables

- First colour laser printers

Digital plotting – Laser or ink-jet printers

1995 - present: laser printer/plotters (limited copies)

Map layers generated by software often to PDF - as in GEOG 205 ☺

~50 cents per page – letter / tabloid

Or just don't print it – no hardcopy needed

leave it onscreen ('softcopy')
- No print cost

Digital plotting: ‘small runs’ –> ink-jet plotters ~$5-10/sq.ft
Large runs –> offset printing (printing plates) - $000s

Many copies (thousands): commercial maps are still printed by **rotary offset presses**, using flexible aluminum-alloy printing plates, same as pre-digital but .. ‘activated’ by digital file layers, e.g rivers, roads etc..


Poster size plotter (48 x 36”)

New millenium-mapping changes

2000s: Data more freely available (post 2005)

2005: Map viewers e.g. Google Maps/Earth

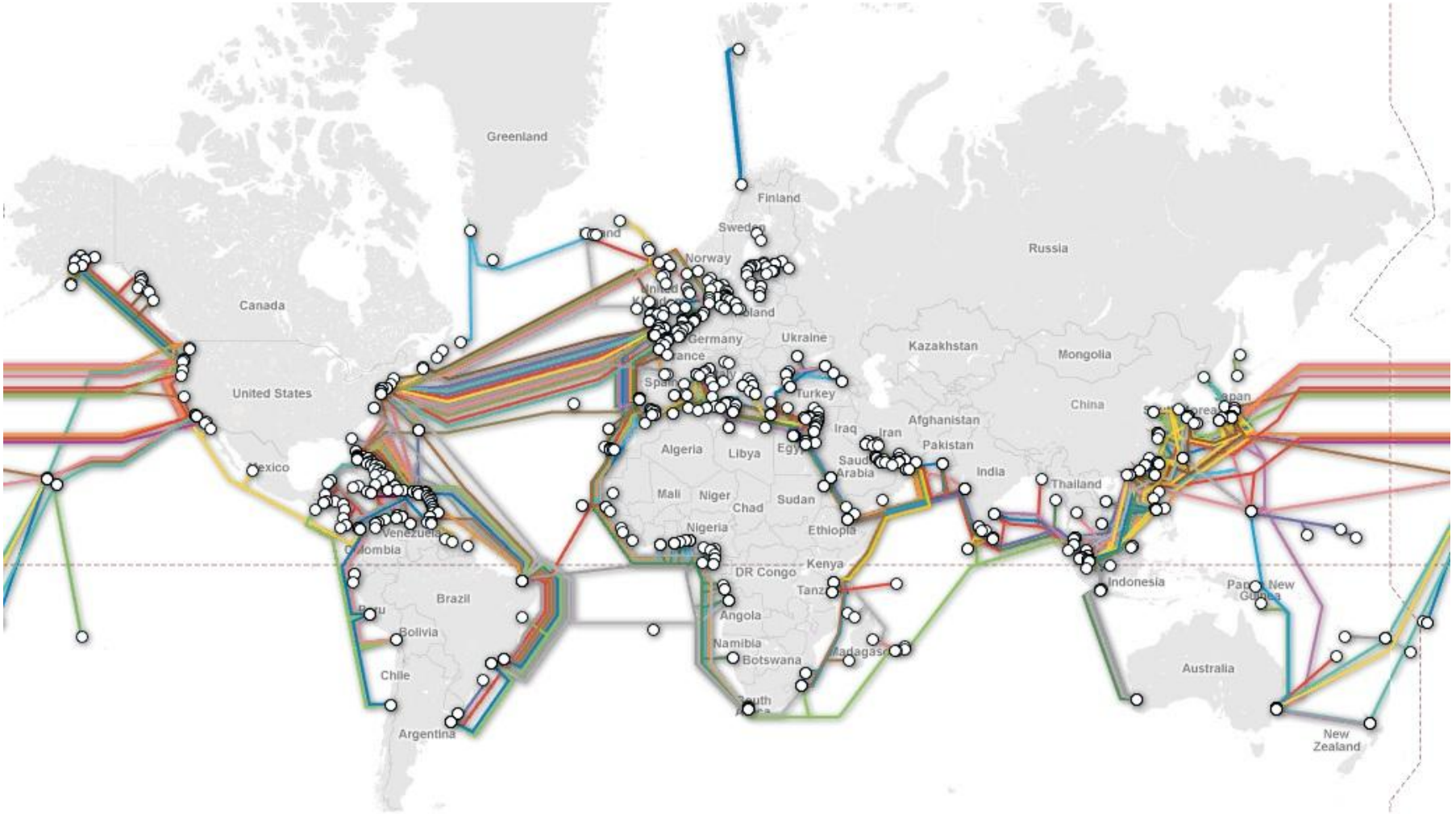
2008: Landsat (NASA) data free

2009: Canada: NTDB and TRIM data free online

2010s: new data sources e.g. UAVs (drones); LiDAR

- more satellite images, higher resolution
- Open source (free) software
- Mapping in 'the cloud'

Mapping in ‘the cloud’ (=mostly under the sea)



Submarine internet cables

The promise of digital cartography 1970s-80s

1. **Fast updating**… in theory (√?)

Canada NTDB – roads only

BC TRIM (1995), TRIM II ongoing

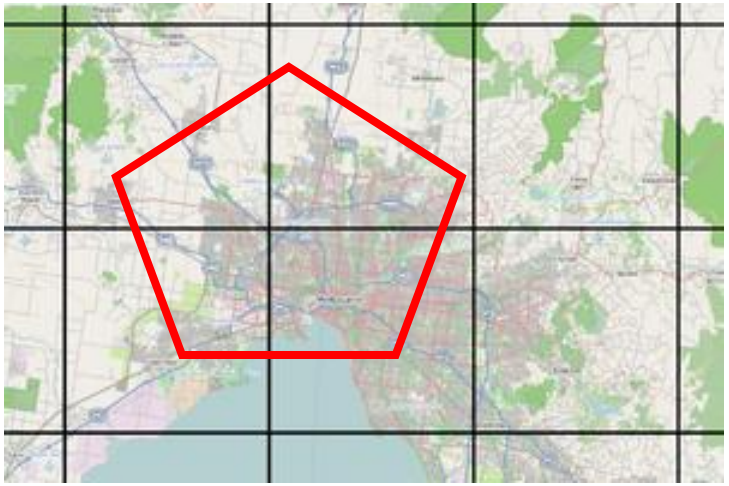
PGmap updated weekly …

Small regions/countries - annual

2. **Seamless databases** √

Google maps 2005

download NTDB/TRIM/PG by AOI -2017 (Area of interest) or map tiles



Mapping software – 6 groups

a. Draw programs

These are the simplest, may be appropriate for simple location maps.

Many display 'bitmap'/raster images, not suitable for fine line detail.

Free with
Operating System:

MacDraw, Paintbrush (Mac)

Paint (Windows)

GIMP (Linux, Mac, Windows)

MapMaker (Google maps)

Sketchup (Google Earth)

http://cartographersguild.org/

b. Graphic design programs

- more options than draw programs and better cartographic output

- They can store data on separate 'layers' to generate a series of maps.

- Intended for general graphics design, not specifically mapping.
  But they are widely used for maps in books, magazines and newspapers, and courses teaching cartographic design.

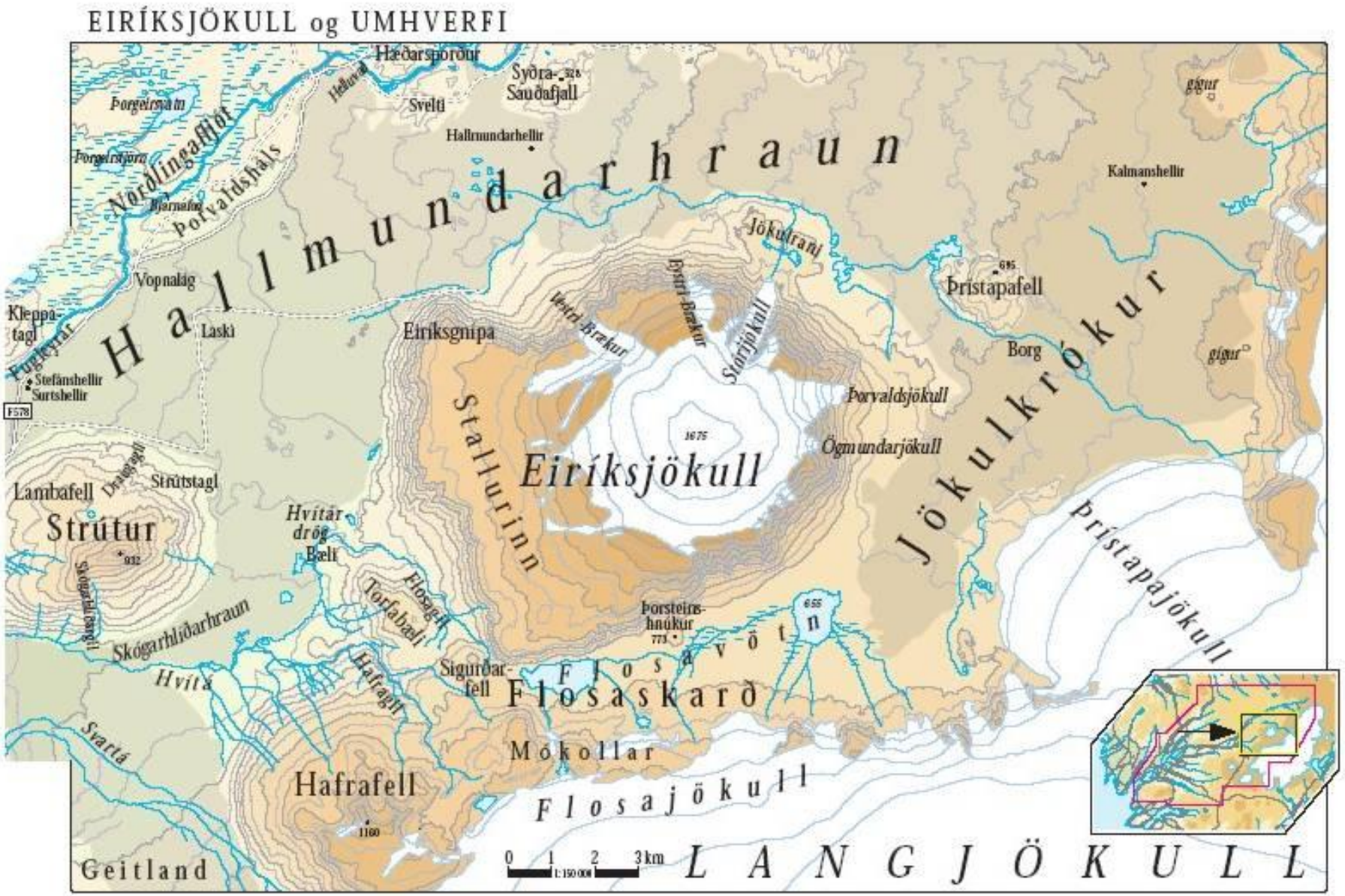
- Graphic Design programs do not address **spatial georeferencing**.
- Data layers can be overlain but do not have geographic coordinates.

Examples: Adobe Illustrator and CorelDraw (founded in Ottawa)

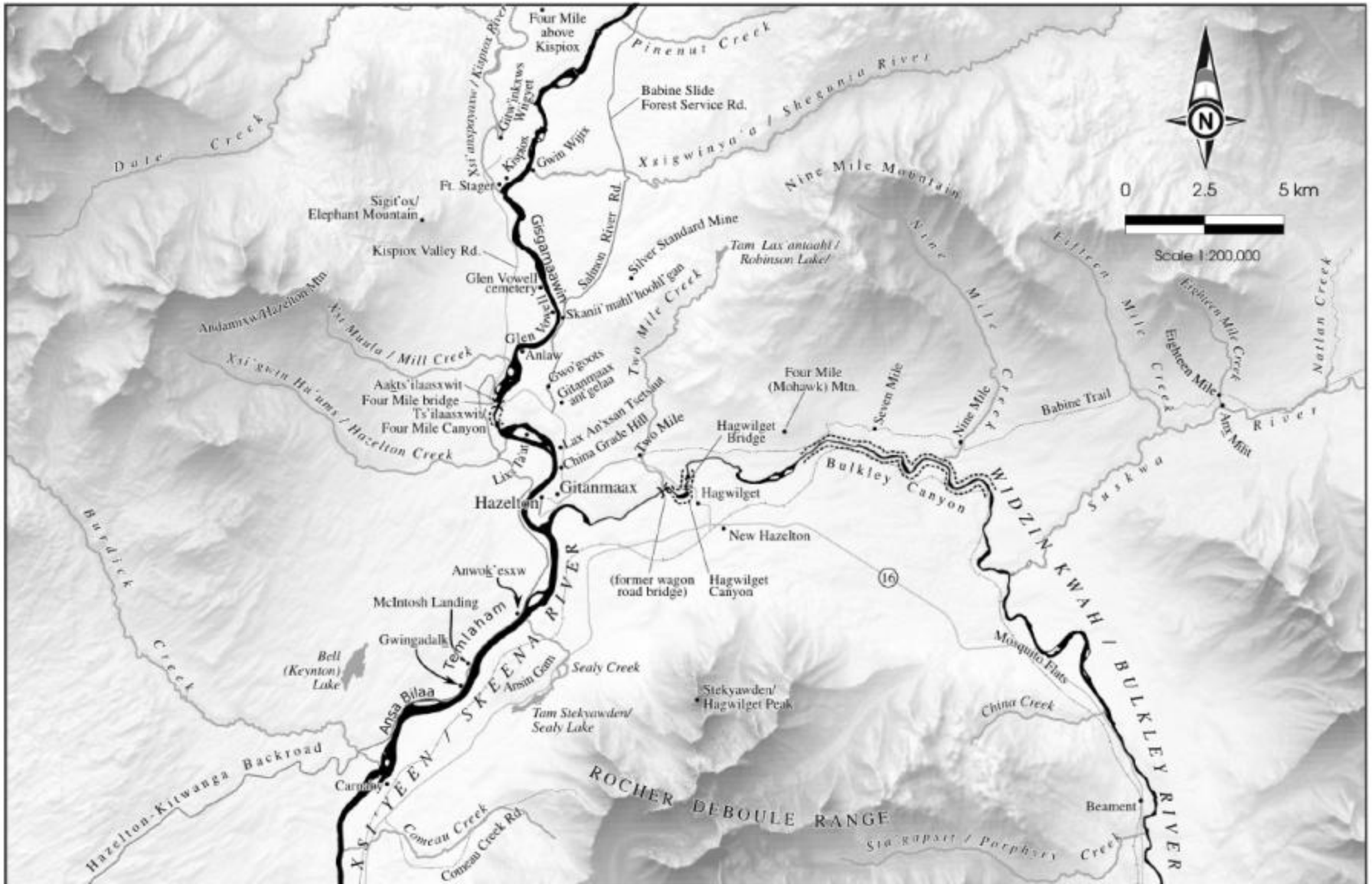
Inkscape (Linux, Macintosh, Windows) - free

Free base maps: http://d-maps.com/

Iceland travel map – made with Illustrator (Gudmund Ingvarsson)



Northern BC example, by Morgan Hite using **Inkscape** software



c. Desktop mapping programs

developed specifically for mapping and can import geo-referenced data

Examples: Mapinfo

GPS mapping: OZIexplorer

Some mapping programs have 3D (DEM) options: Global Mapper

Simply Analytics – mapping census data: https://simplyanalytics.com

A Canadian company - Avenza - has created 'Map Publisher' to work as an add-on with Illustrator, or Geographic Imager for Photoshop (see next slide) .. This adds georeferencing (but not for CorelDraw)

Map Publisher

https://www.avenza.com/map-gallery/glacier-coast-aoraki-mount-cook-region/

Also:

http://www.avenza.com/resources/map-gallery

d. Computer-assisted design (CAD) programs

These were initially intended for architectural and municipal design; therefore reach a market larger than just for mapping applications.

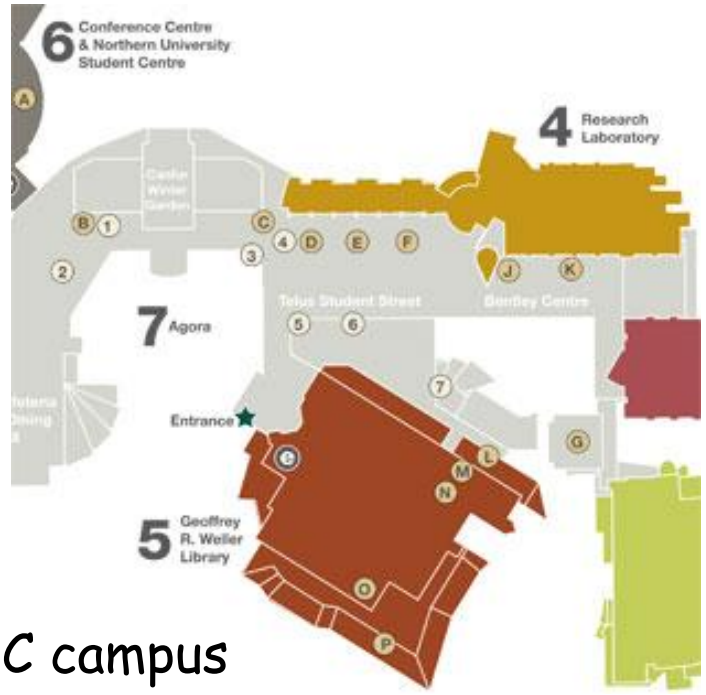
The two industry examples are:
AutoCad (1982- architecture) and Microstation (1987 - forestry).

The data formats (.dxf and .dgn) are standard formats for importing and exchanging data with GIS programs.

Attributes describe design not features

CAD programs do **not** do 'GIS' analysis
e.g. cannot create hillshading, buffering

They can involve georeferencing



UNBC campus

Urban planning and design before the invention of AutoCAD, 1950-1980

General Motors Technical Center in Warren Michigan.

e. GIS programs : designed for mapping and analysis

These differ from mapping programs as they can also perform:

- analysis e.g. shaded relief, overlay

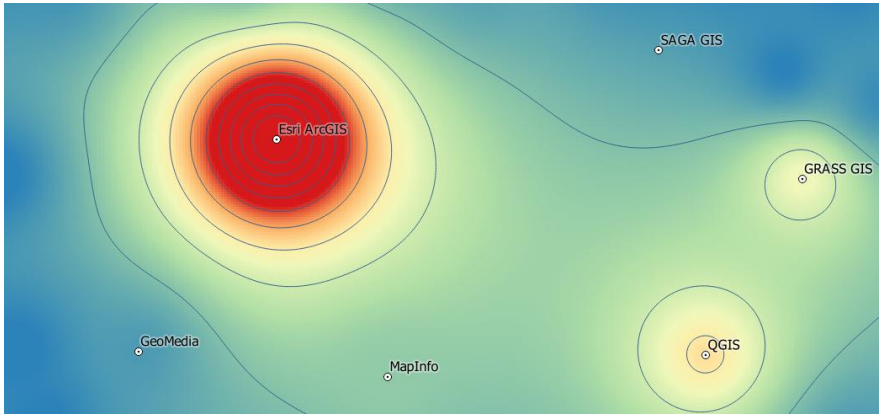
- database management
  (e.g. mapping by attributes)

- Management of different projections

	plot_id	stand	sp1	sp2	stand_age	age_cl	stand_ht	height_cl
2	1	341	''	''	0	0	0	0
3	2	653	'S'	'AT'	140	7	32	4
4	3	461	''	''	0	0	0	0
5	4	654	'AT'	'EP'	120	6	28	3
6	5	732	''	''	0	0	0	0
7	6	653	'S'	'AT'	140	7	32	4
8	7	651	'AT'	'EP'	60	3	18	2
9	8	652	'S'	'PL'	30	2	14	2
10	9	780	'EP'	'AT'	80	4	24	3
11	10	739	'AT'	'S'	90	5	23	3
12	11	320	''	''	0	0	0	0
13	12	320	''	''	0	0	0	0
14	13	461	''	''	0	0	0	0
15	14	636	'PL'	'S'	90	5	19	2
16	15	530	''	''	0	0	0	0

e.g. ArcGIS, QGIS, Idrisi, CARIS

It was very common to import GIS files into graphic design programs for final output, but less common now as GIS vendors have 'beefed up' output options. ArcGIS has a developed cartography base.



https://gisgeography.com/best-gis-software

SCANDINAVIA
Railway Crossings

Using road-rail intersections

FINLAND

SWEDEN

NORWAY

DENMARK

Helsinki

Oslo

Stockholm

Copenhagen

Legend

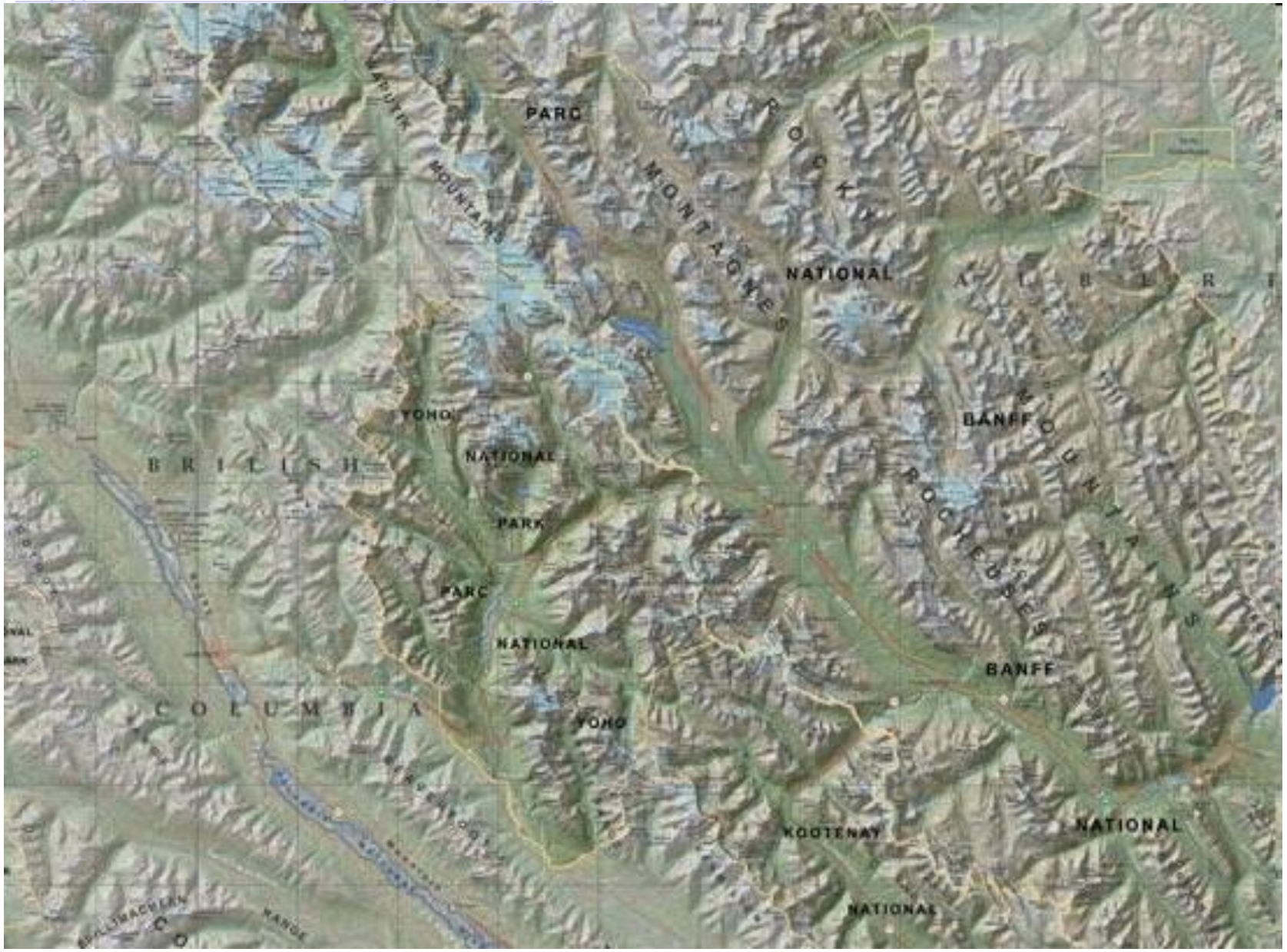
- Railway Crossings
- Capitals
- Sweden
- Norway
- Finland
- Denmark

0 125 250 500 Kilometres

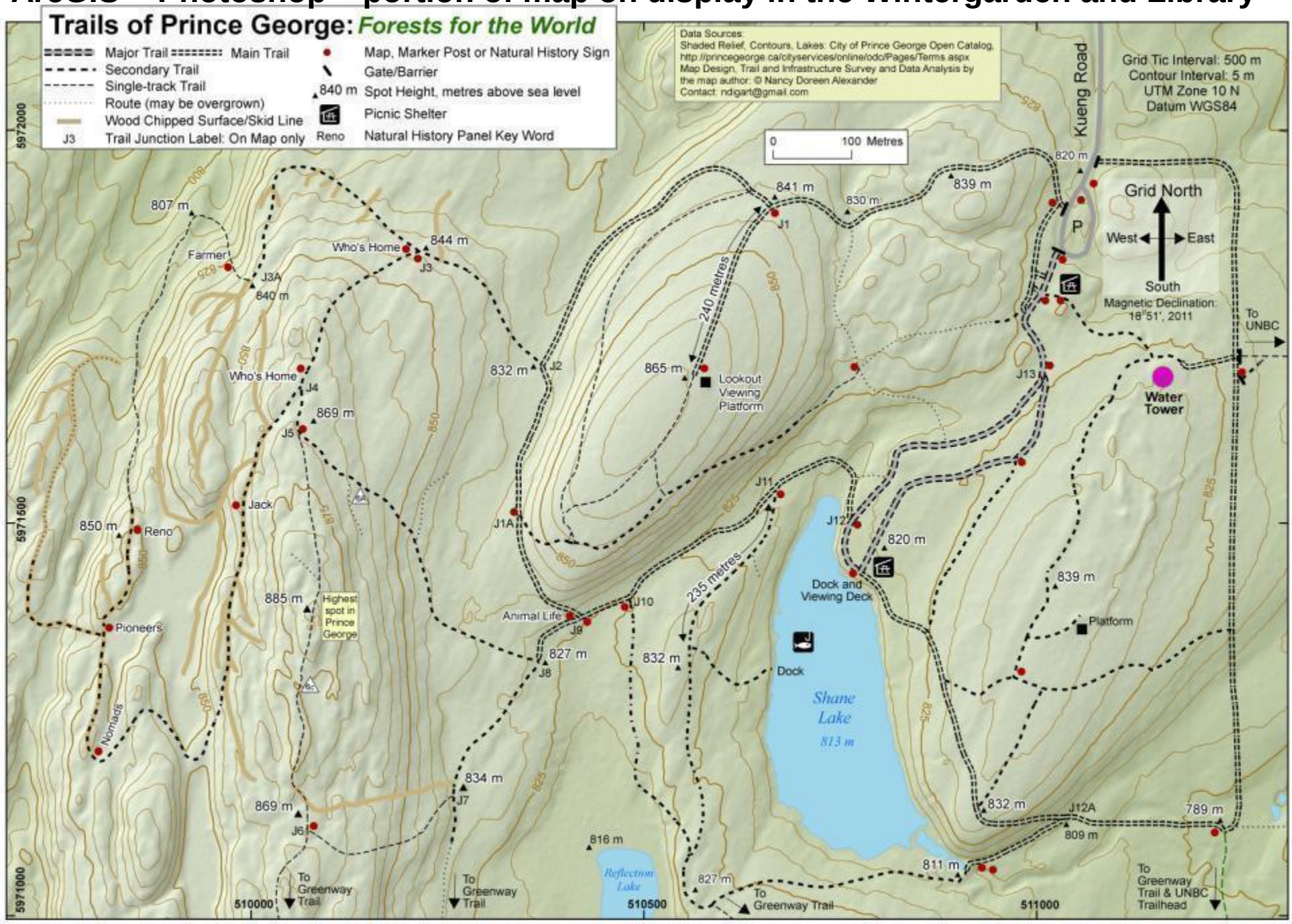
Layer import and design using ArcMap, final design in Photoshop

ESRI Canada 2010 mapbook: April **Banff, Yoho and Kootenay National Parks**

http://www.esricanada.com/english/9487.asp



ArcGIS + Photoshop – portion of map on display in the Wintergarden and Library



Evolution of Esri software ('The Microsoft of GIS')

Esri: Environmental Systems Research Institute

1981: Arc/Info command line interface (UNIX)

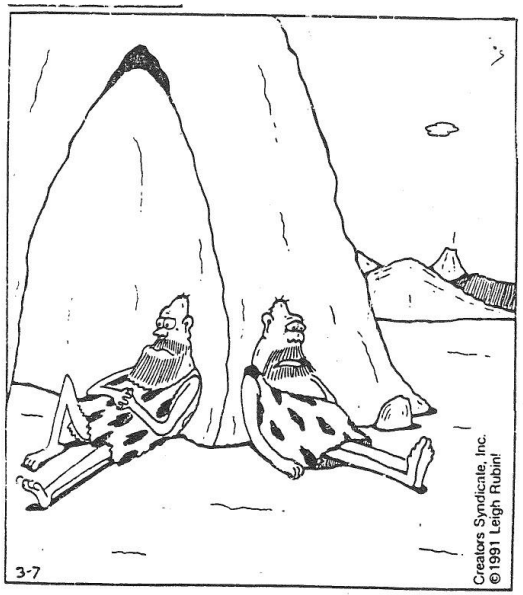
1992: Arcview Graphic User Interface (Windows/Mac/UNIX)

2000: ArcMap (ArcGIS)

2012: ArcGIS online

2015: ArcGIS Pro (UNBC 2019)

Data portals etc..



"First it was fire, then the wheel . . . it's so hard to keep up with all this modern technology. How I yearn for simpler times when things were less complex."

f. Online web mapping

https://en.wikipedia.org/wiki/Web_mapping

Online seamless maps / map viewers – zoom / interactive
-created using programming code and input display layers
e.g. Google Maps, Openstreetmap

Proprietary: ArcGIS online

Open Source options

QGIS2Web: GIS based web mapping for QGIS

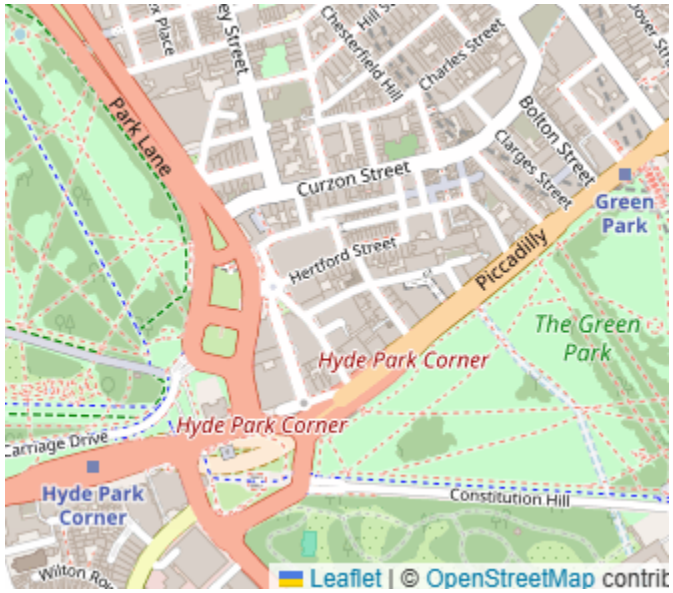
Leaflet: JavaScript Library for interactive maps

GDAL: Geospatial Data Abstraction Library

MapBox: Online custom maps

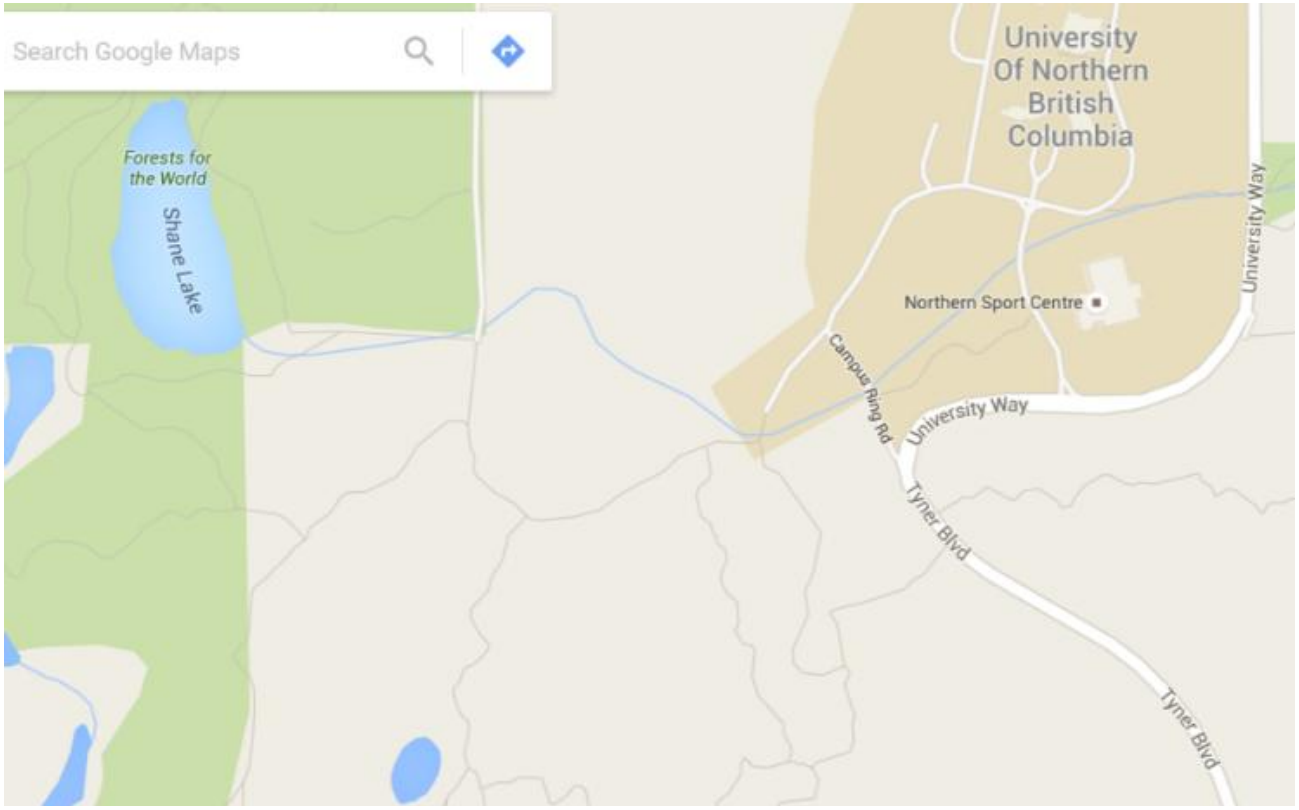
CartoDB: Cloud computing in a web browser

Jupyter notebooks: Python programming



Advantages of digital cartography:
… compared to manual cartography

Digital mapping – easier to update (but not always done)
Google maps – updated regularly by local users using GPS



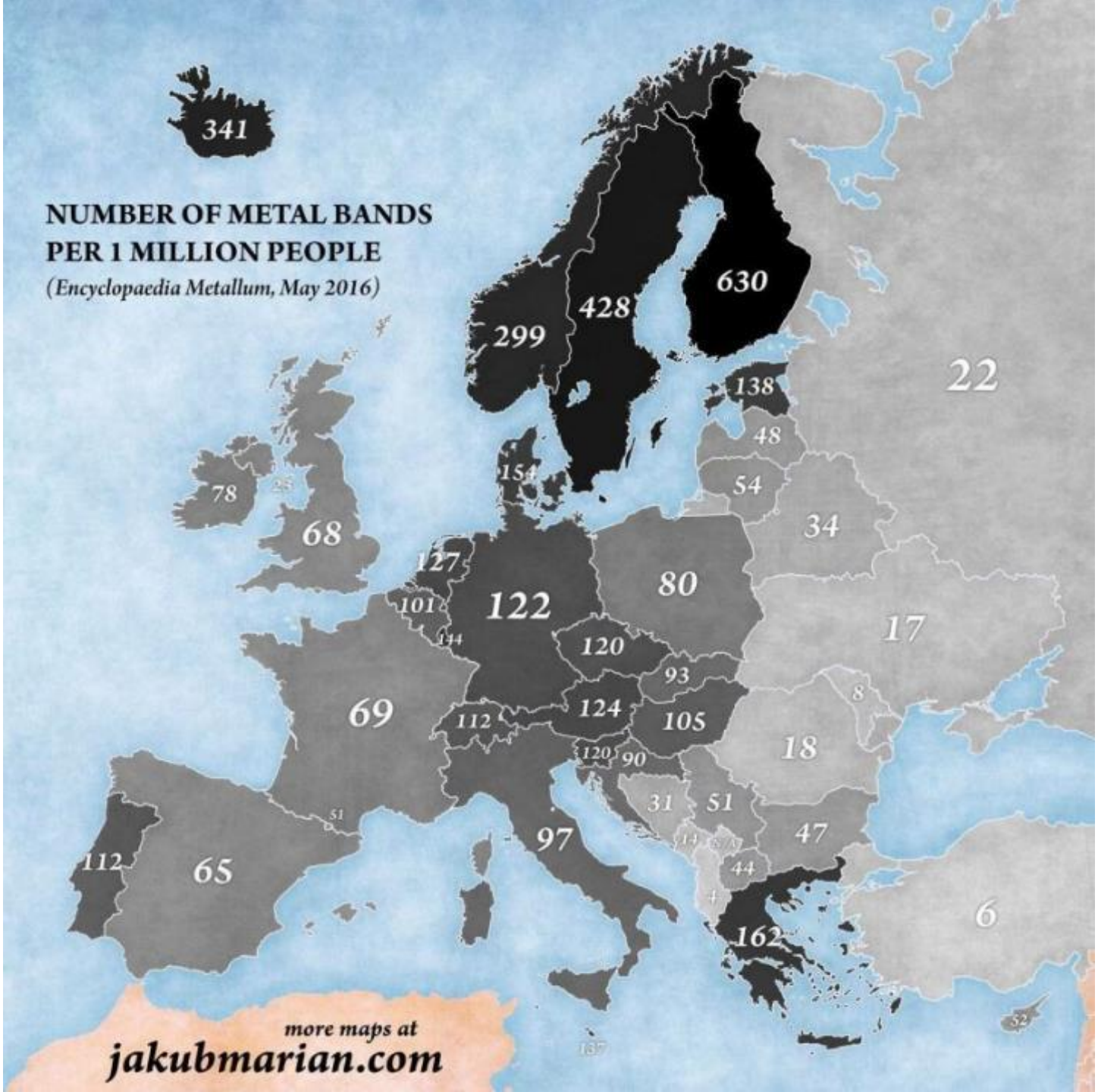
Advantages of digital cartography:

- Less graphic / artistic skills needed
- Colours / patterns easier to apply
- Easier to make changes and updates
- Easier to import layers and print
- Conversion of map projections
- Integration of geomatics – mapping, GPS, imagery
- Mapping is ‘cool’ ? and new types of maps

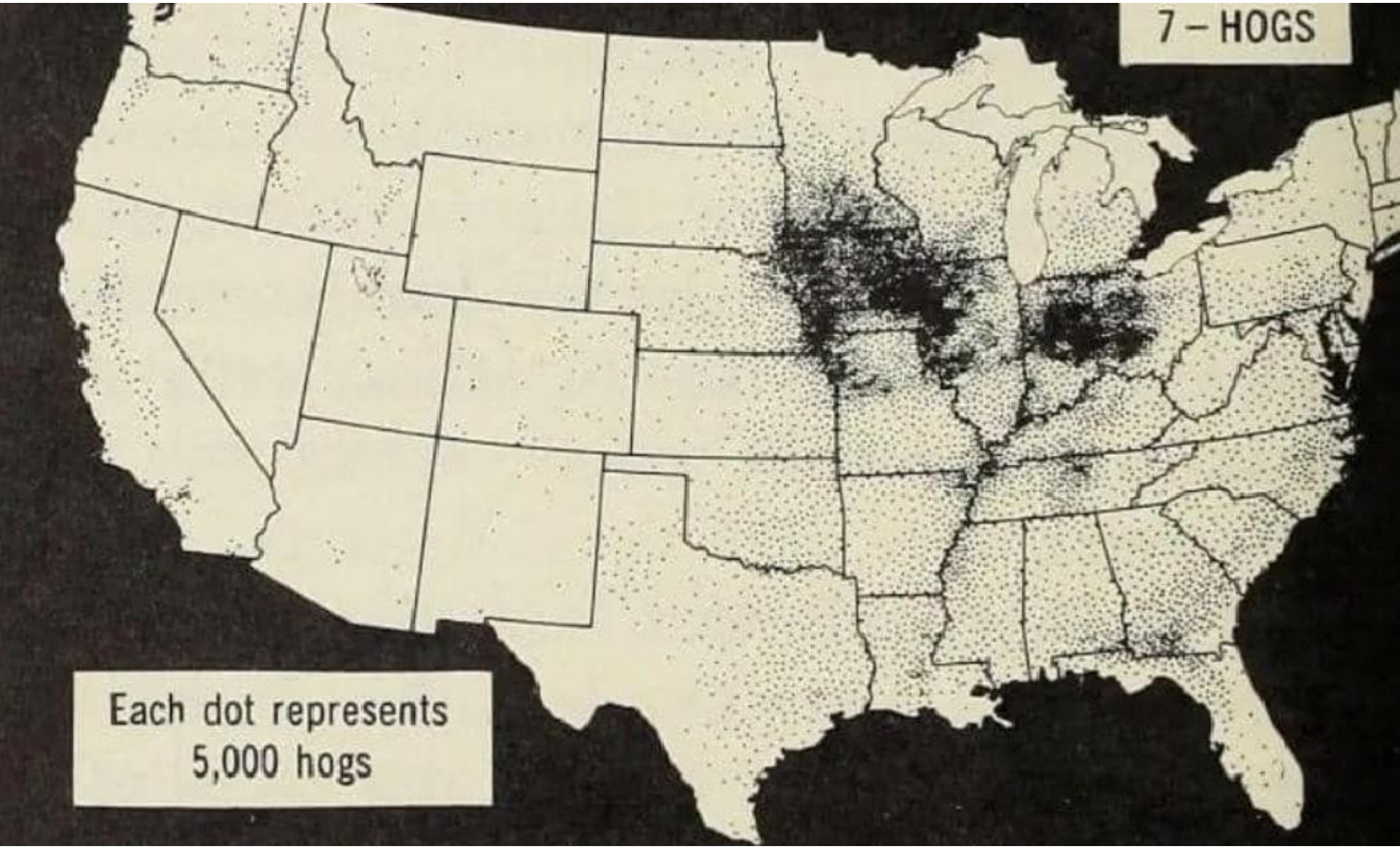
Many new map types from digital data tables

Base map + spreadsheet

Easier to make more maps



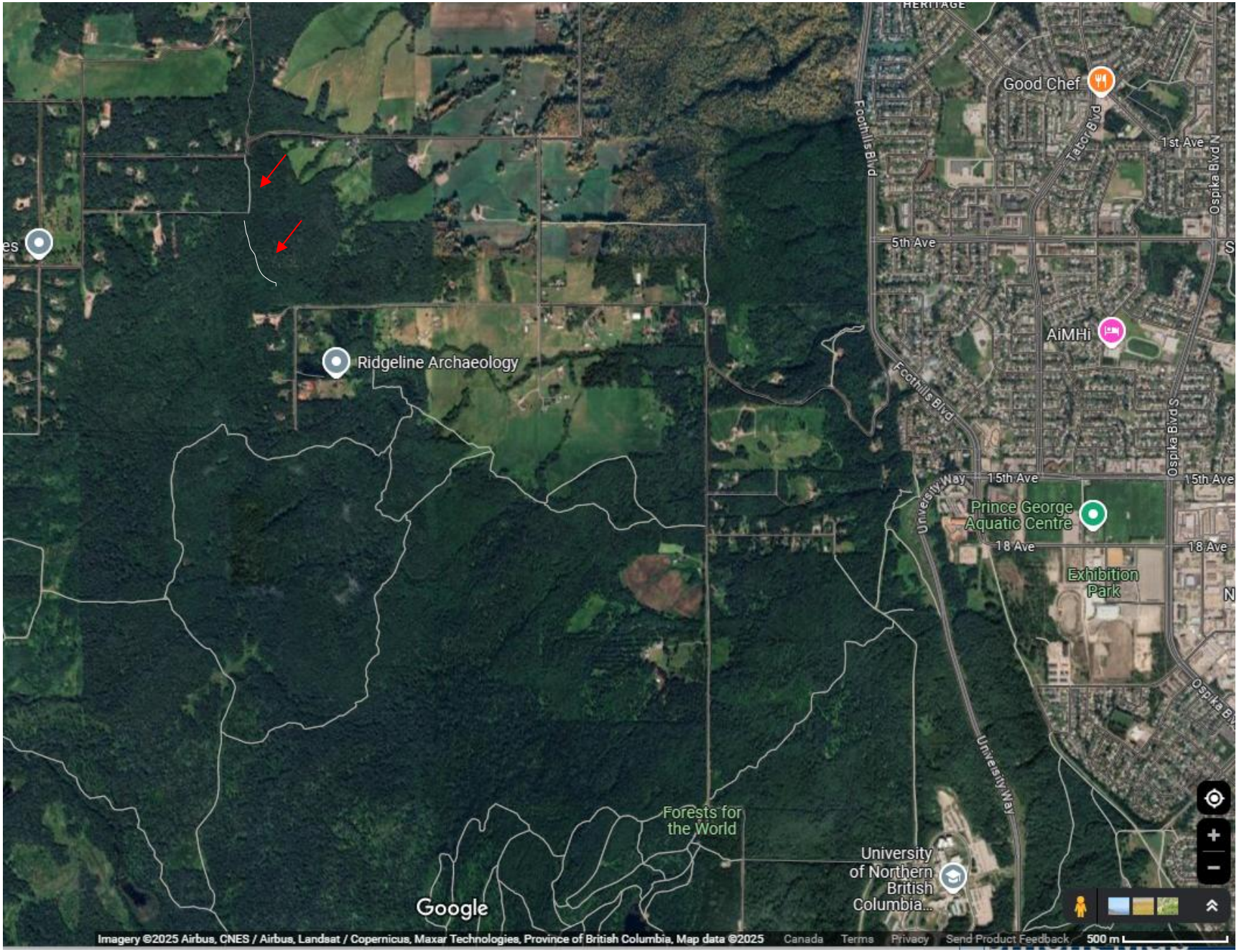
But maybe no stranger than this … 1948



Disadvantages of digital over manual

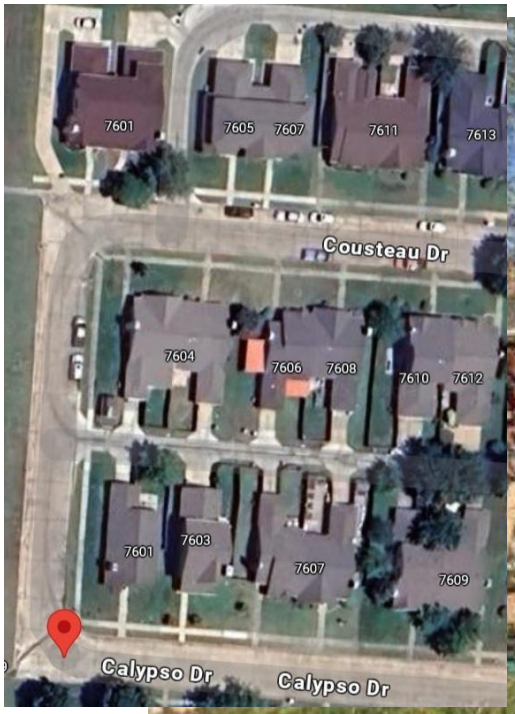
- So much new to learn, options .. complex systems
- Dependence on data / connections / networks
- Cost of hardware/software (some free options)
- Maps can be produced by anyone … ☺
- More data but more ways to generate errors

Local example of ‘GPS error’ –incorrect GPS route (no road)



Google Maps Error Sees Wrong House Demolished

Demolition workers were supposed to knock down 7601 Cousteau Drive, but Google Maps directed them one block away to 7601 Calypso Drive. I mean, this is just the worst," Diaz told North Texas news outlet WFAA. But "it's not a big deal" say Billy L. Nabors Demolition, whose motto is *'We could wreck the world; but Jesus Saves'*



http://www.newsweek.com/google-maps-error-sees-wrong-house-demolished-mistake-440256

Digital changes in Cartography in the late 20th/ 21st centuries

-> much bigger than the breakup of the Soviet Union

Independence

- **March 1990**
  (1) Lithuania
- **May 1990**
  (2) Latvia
  (3) Estonia
- **April 1991**
  (4) Georgia
- **August 1991**
  (5) Ukraine, (6) Moldova,
  (7) Azerbaijan, (8) Uzbekistan,
  (9) Kyrgyzstan
- **September 1**
  (10) Tajikistan,
- **October 1991**
  (12) Turkmenis
- **December 19**
  (13) Belarus
  (14) Russia
  (15) Kazakhsta

Redrawing the countries
- Not so bad compared to switching to digital technology

It's just a few extra lines or polygons ..