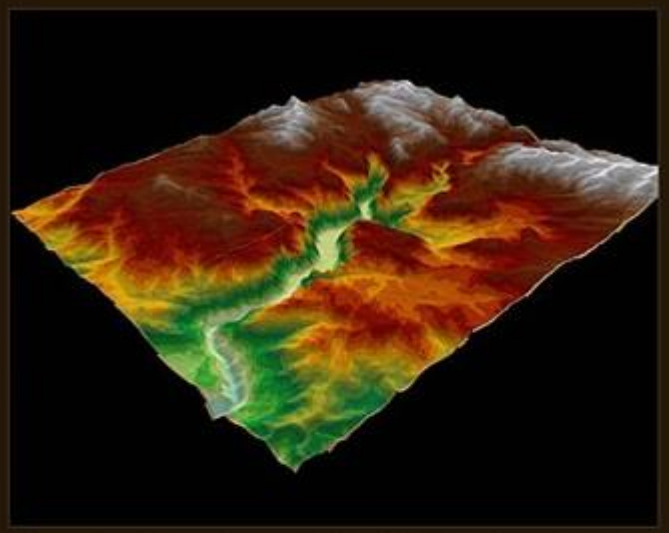
History of mapping II: the digital era

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.*

Map making through history

Pre-1450: engraving/drawing on rocks, paper, birch-bark, bones etc..

1450-1875: drawing on paper (single copies);
Or printing from plates: wood, copper, lithostone (mirror image)
[Copper plates lasted until ~1950]

1875-> offset printing enabled by intermediate image transfer

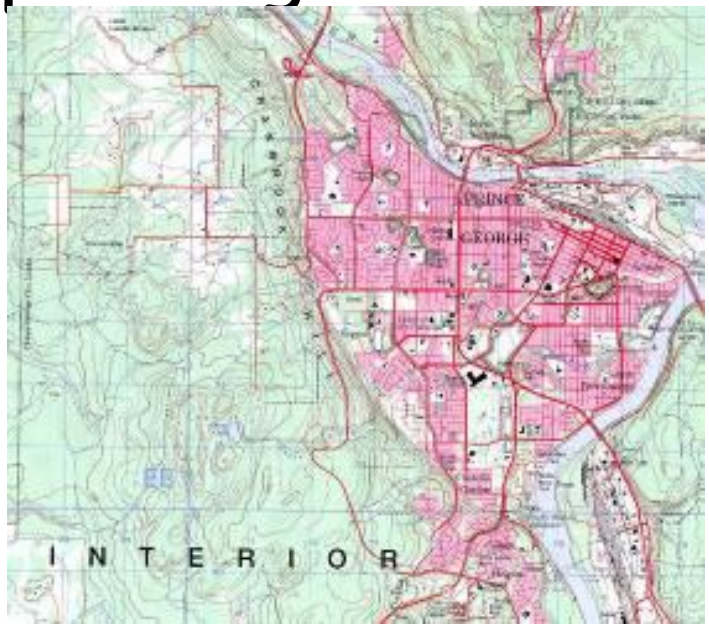
1950- ~1990: colour - photomechanical - artwork negative to flexible plates
Monochrome maps – prints from plates or copy devices (fewer copies)

1980 - present: copiers and inkjet-> laser printer/plotters (limited copies)
Map layers generated by software often to PDF - as in GEOG 205 ☺

Many copies (thousands): commercial maps are still printed by **rotary offset presses**, using flexible aluminum-alloy printing plates
- Now 'activated' by digital file layers, e.g rivers, lakes, roads etc..

Multi-colour map printing

BLUE PLATE Points: dams, waterfalls Lines: rivers, coastlines, lake outlines Areas: lakes, oceans Lettering: names	**BLACK PLATE** Points: buildings Lines: railways
LIGHT BLUE (screened) PLATE Lines: UTM lines Lettering: UTM co-ordinates	**GREEN PLATE** Areas: vegetation
BROWN PLATE Lines: contours Lettering: elevations	**RED PLATE** Points: important buildings, names Lines: roads Areas: urban areas



each colour ink is produced by exposure to negatives for each layer.

This principle of map layers for printing, is the basis for modern mapping / GIS.

Although computers have changed map printing, large print runs would need these types of printing plates, now produced digitally.

The digital era and mapping changes

1980: digital mapping, but not much data/software

1989: GPS operational

1994: UNBC campus opens

1995: real growth of desktop computer mapping

- 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
- Internet is developing

Digital plotting – Laser or ink-jet printers

~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

Poster size plotter (48 x 36")

New millenium-mapping changes II

2000s: Data more freely available (post 2005)

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

2008: Landsat (NASA) data free

2009: NTDB data free (free at last …) and BC TRIM

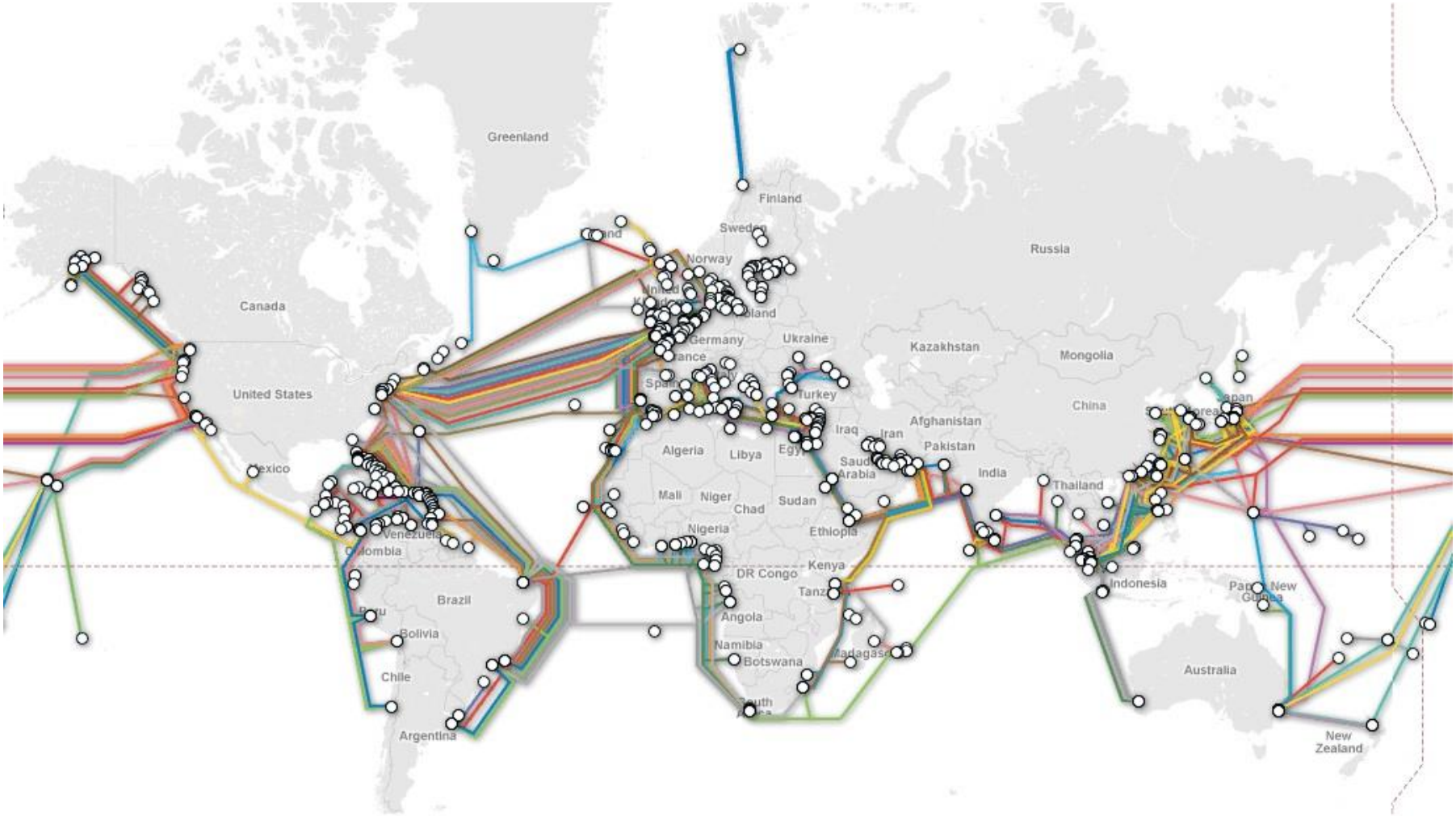
2010s: new data sources e.g. UAVs (drones); LiDAR

- more satellite images, higher resolution

- Mapping in 'the cloud'

- Open source (free) software

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



Submarine internet cables

Mapping software

a. Draw programs

These are the simplest, and 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.

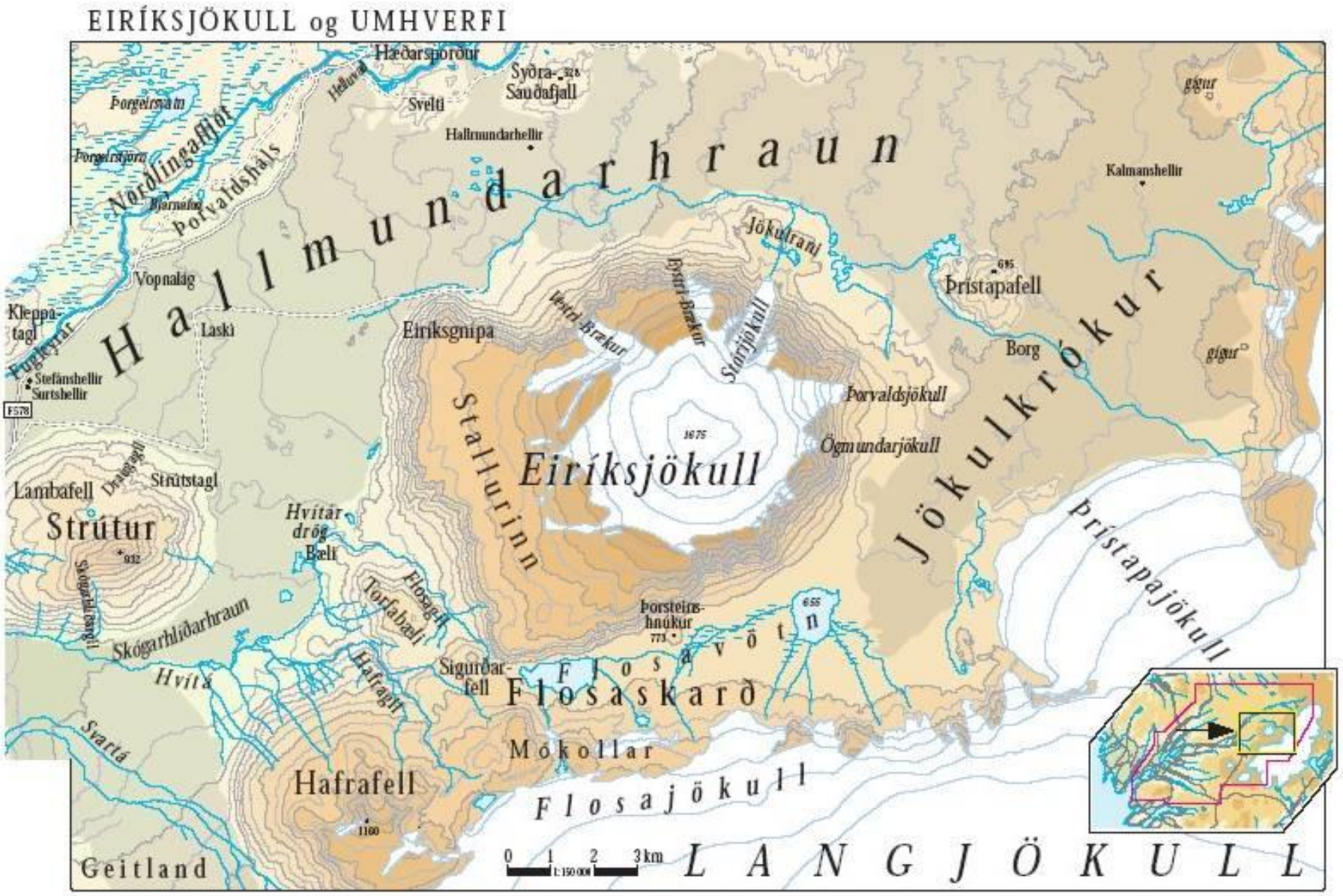
- Graphic Design programs do not address **spatial georeferencing**.
- Data layers can be overlain but do not have geographic coordinates.

Examples: Adobe Illustrator and CorelDraw - Ottawa

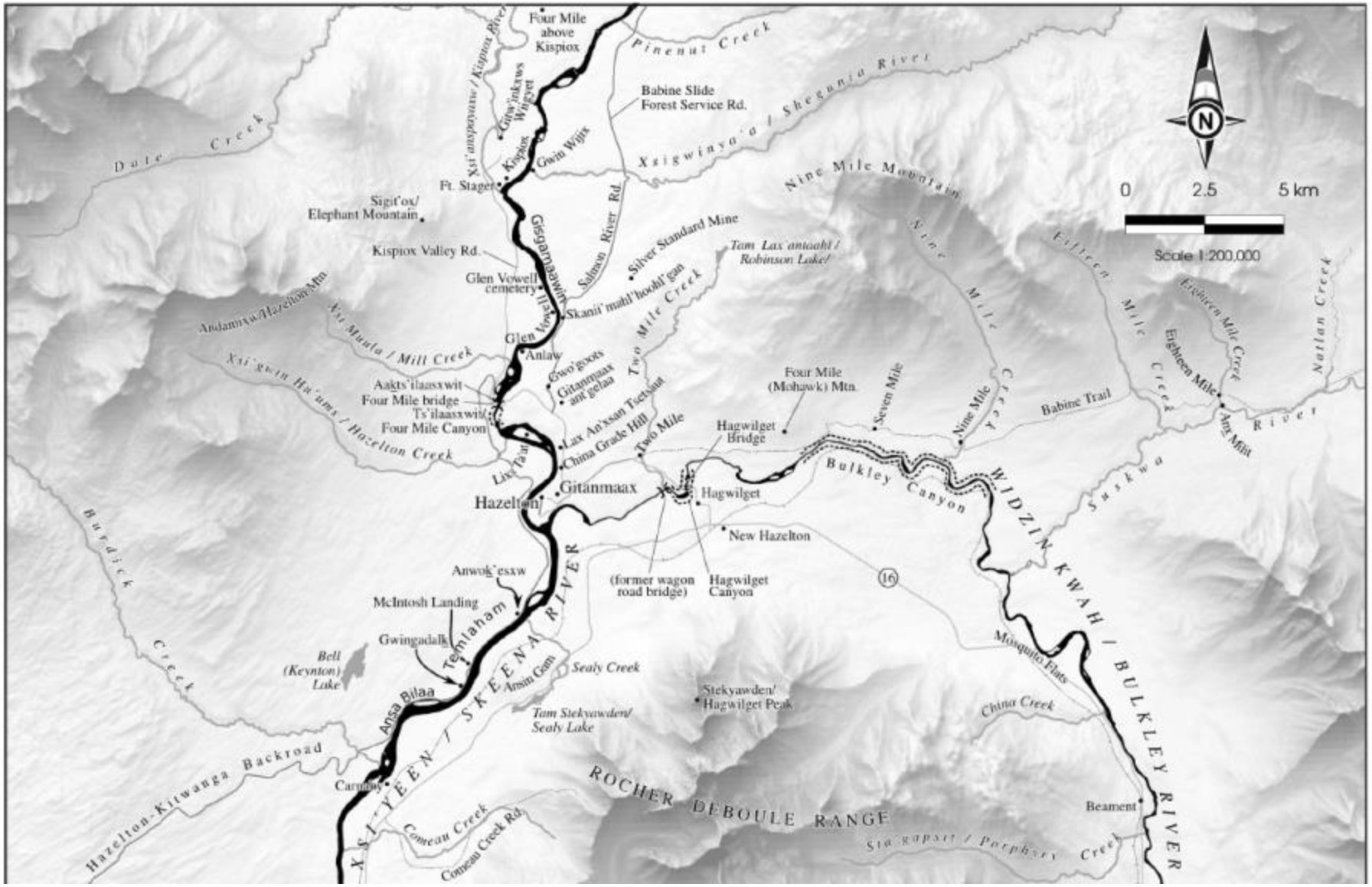
Inkscape (Linux, Macintosh, Windows) - free

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 Fugawi (free)

Some mapping programs have 3D (DEM) options: OZIexplorer3D

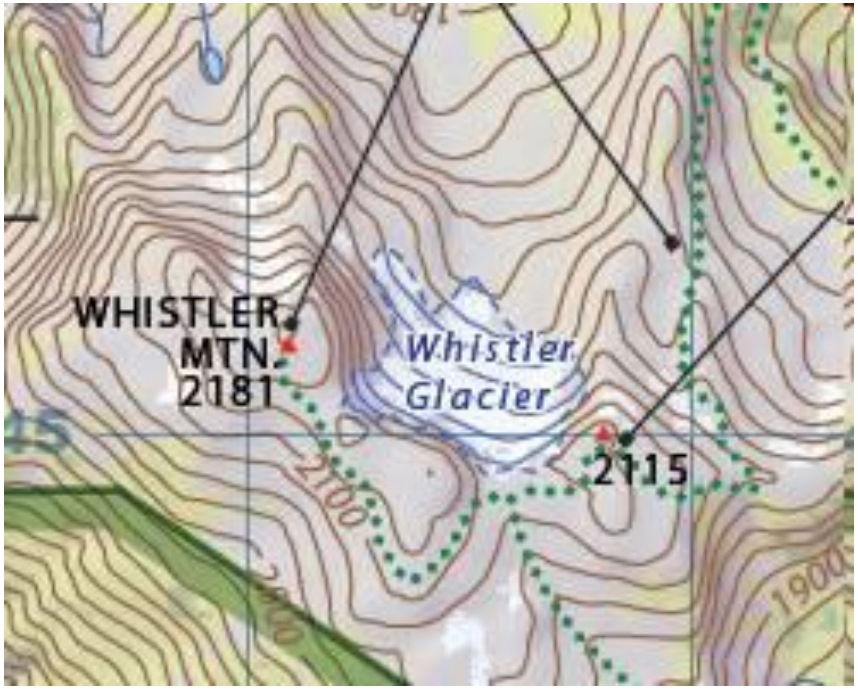
SimplyMap: http://geographicresearch.com/simplymap/

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 example

Jeff Clark
Spatial Vision Group
North Vancouver, British Columbia
www.spatialvisiongroup.com

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



d. Computer-assisted design (CAD) programs

These were initially intended for architectural and municipal design, and 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

https://rarehistoricalphotos.com/life-before-autocad-1950-1980/

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

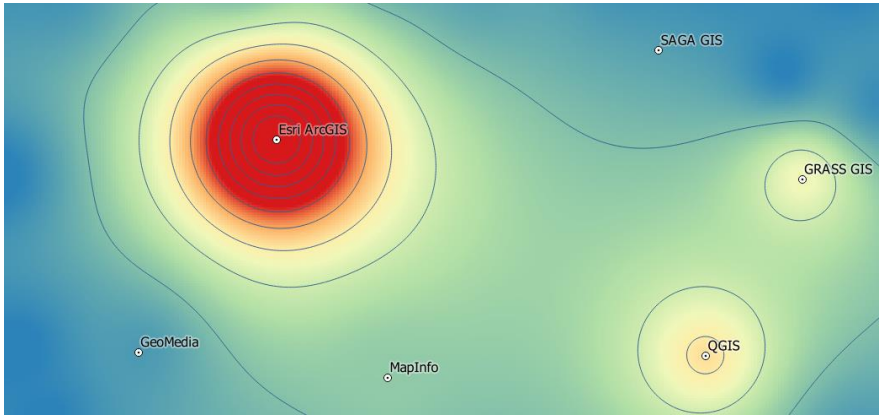
These differ from mapping programs as they can also perform:

- 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

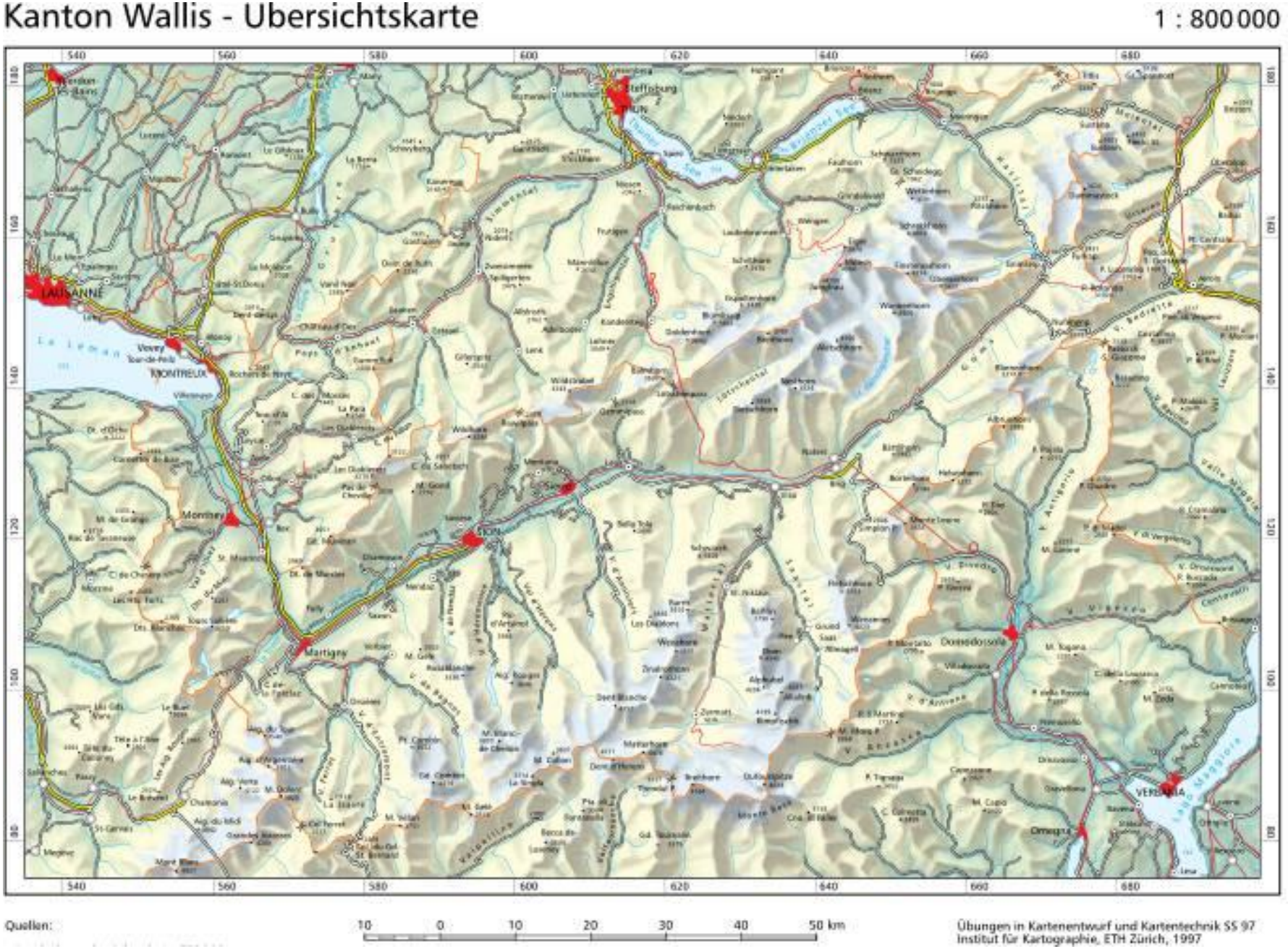
e.g. ArcGIS, QGIS, Idrisi, CARIS, GRASS

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.



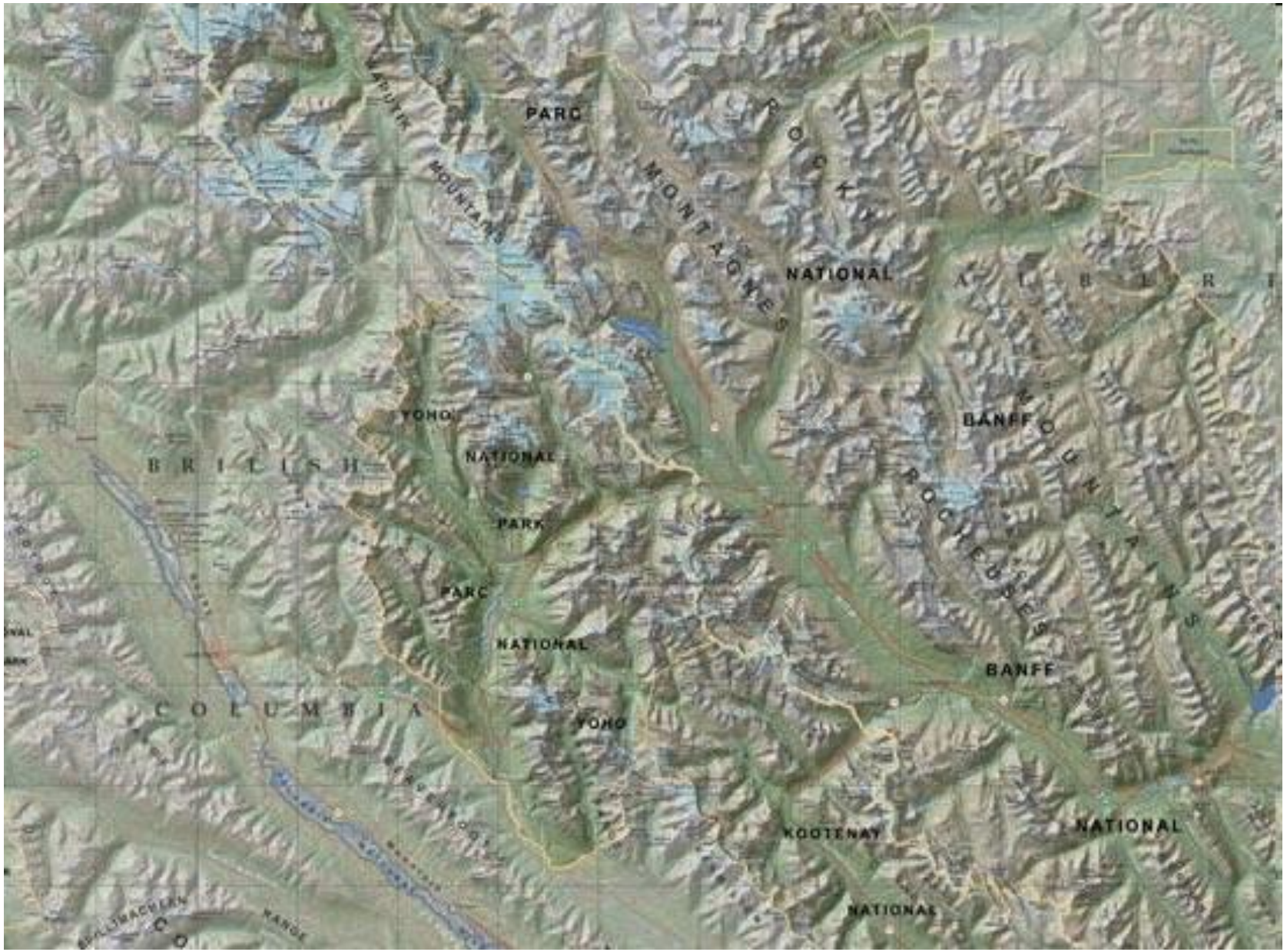
https://gisgeography.com/best-gis-software

Data acquisition through ArcGIS; design with CorelDraw (Andreas Neumann)

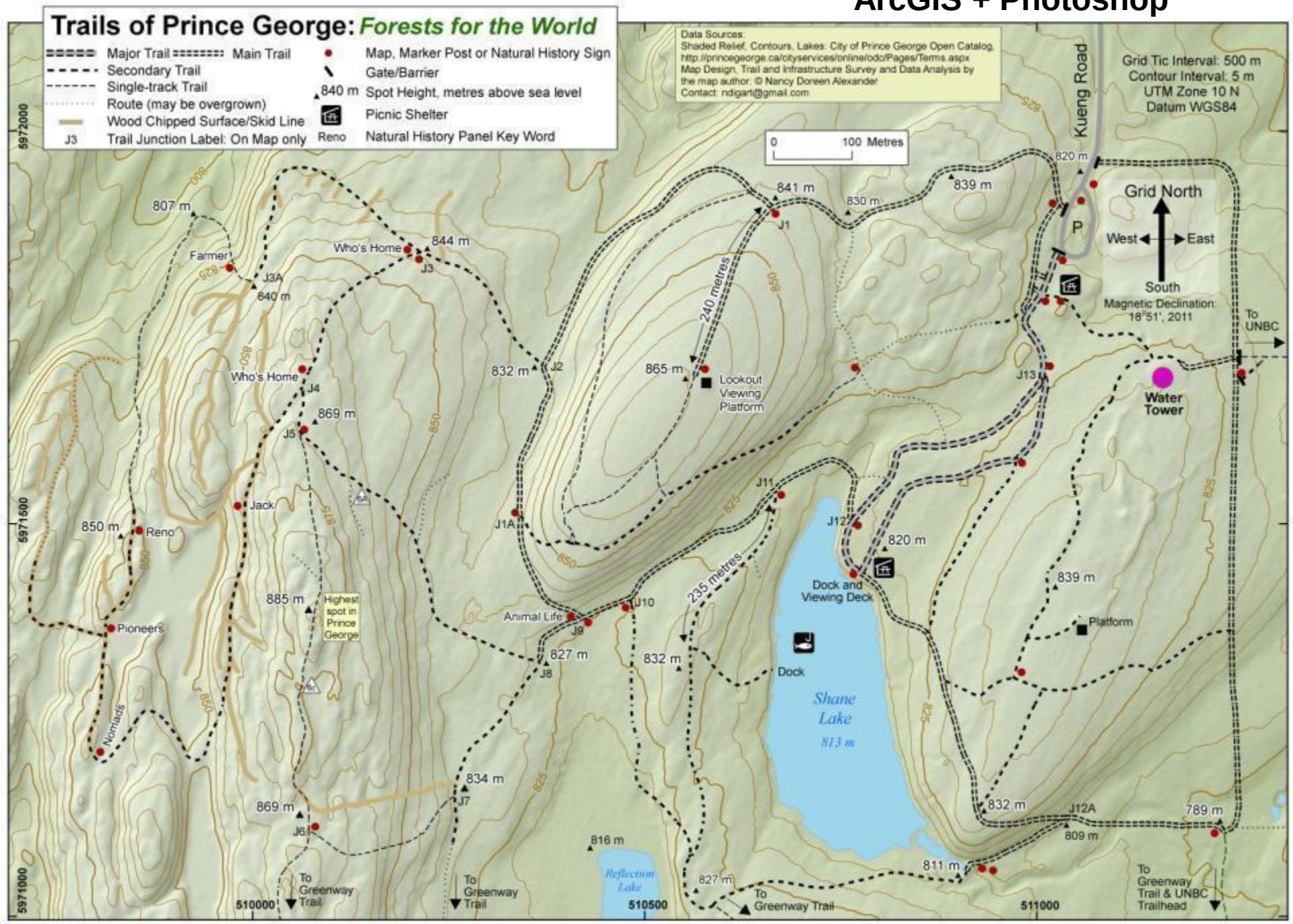


Layer import and design using ArcMap, final design in Photoshop
ESRI Canada 2010 mapbook: April **Banff, Yoho and Kootenay National Parks**

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



ArcGIS + Photoshop



Evolution of Esri software

Esri: Environmental Systems Research Institute

1981: Arc/Info (command line- UNIX workstation)

1992: Arcview (GUI: Graphic User Interface – UNIX/PC/Mac)

2000: ArcGIS - ArcMap (PC-Windows)

2019: ArcGIS Pro (PC-Windows)

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

OpenLayers: open source JavaScript

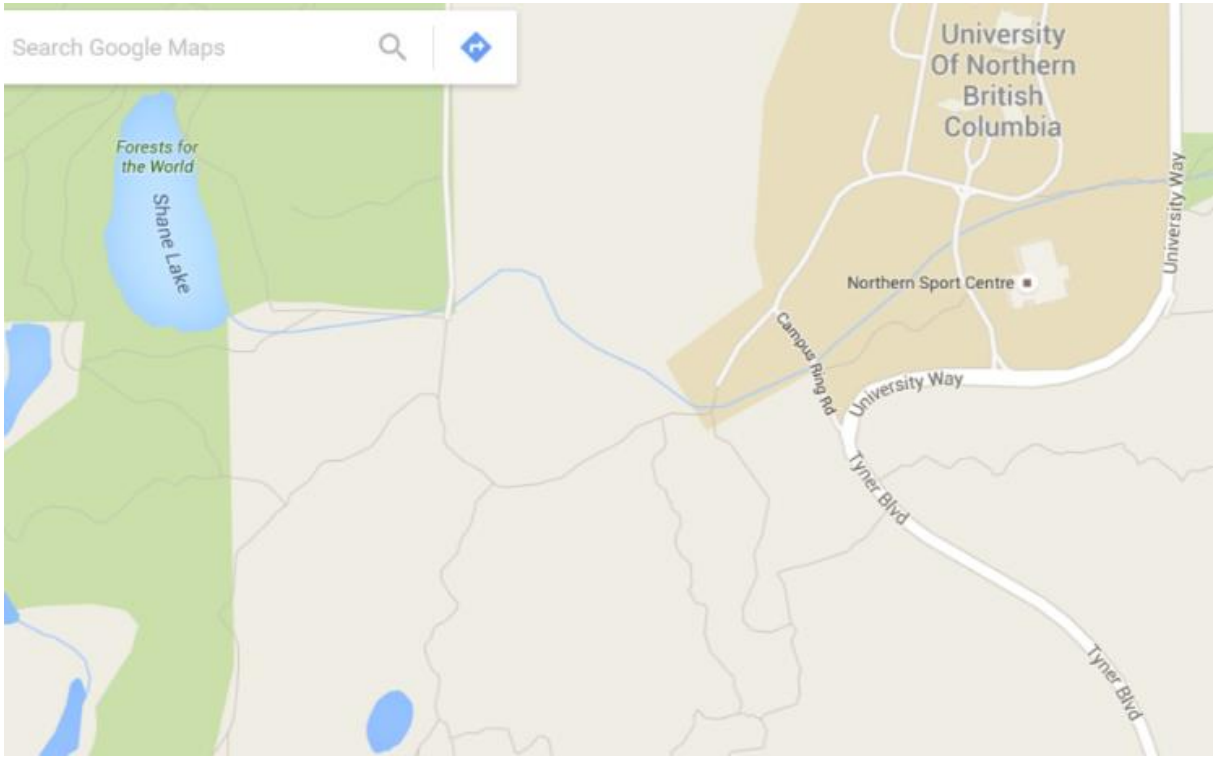
MapBox: online custom maps

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)
e.g. 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' ? (if the system works well)

Disadvantages of digital over manual

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

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

The promise of digital cartography 1960s-80s

1. **Fast updating**... in theory (✓?)

Canada NTDB – roads only

BC TRIM (1995), not updated

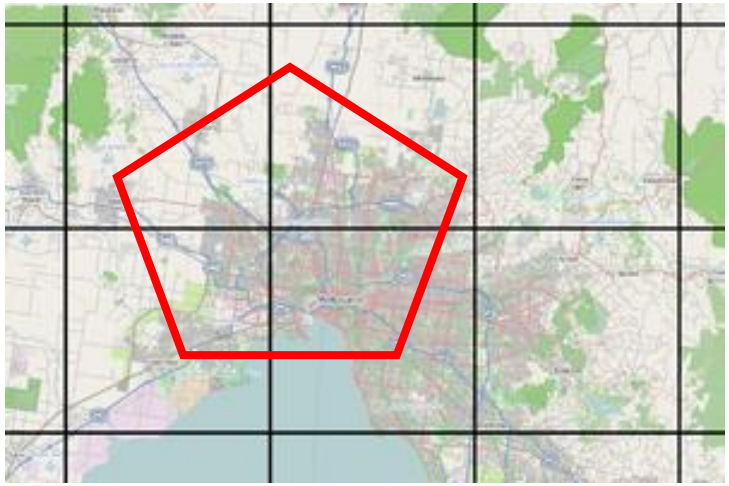
PGmap updated weekly …

Small regions/countries - annual

2. **Seamless databases** ✓

Google maps 2005

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



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

-> much bigger than the breakup of the Soviet Union

Just a few extra polygons ..