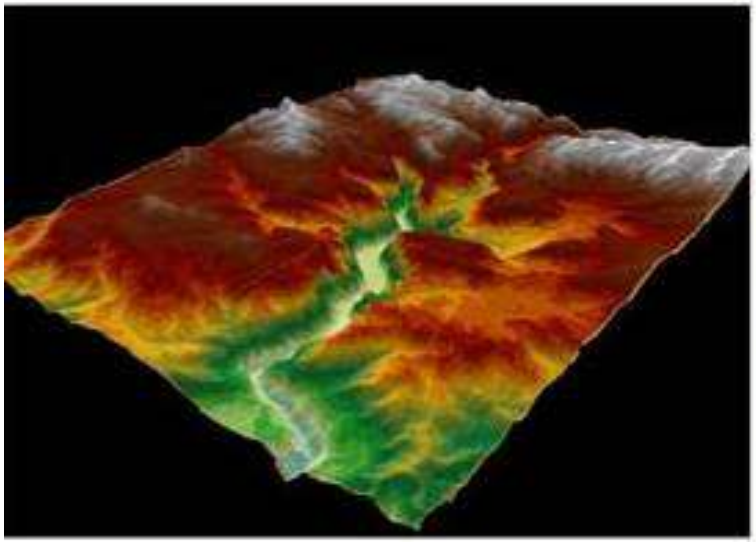
History of mapping II: the digital era

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



These images show the melding of historic maps and modern DEMs

The digital era and mapping changes

1960s: experimental and research only

1970s: little affordable software, hardware or data

1980s: PC /Mac but expensive and not very powerful
… more software (including GIS) but still no data

Early **1990s**: data starting to slowly flow

The digital era and mapping changes

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, distributed GIS data layers
- End of digitising tables, and manual cartography
- First colour laser printers

Digital plotting – Laser or ink-jet printers

~50cents 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 ~$10/sq.foot
Large runs – offset printing (+set-up charge) - 000s – printing plates from digital files (instead of negatives)

The digital era and mapping changes >2000

2000s: data more freely available (-> post 2005)

2005: Map viewers e.g. Google Maps/Earth (PGmap)

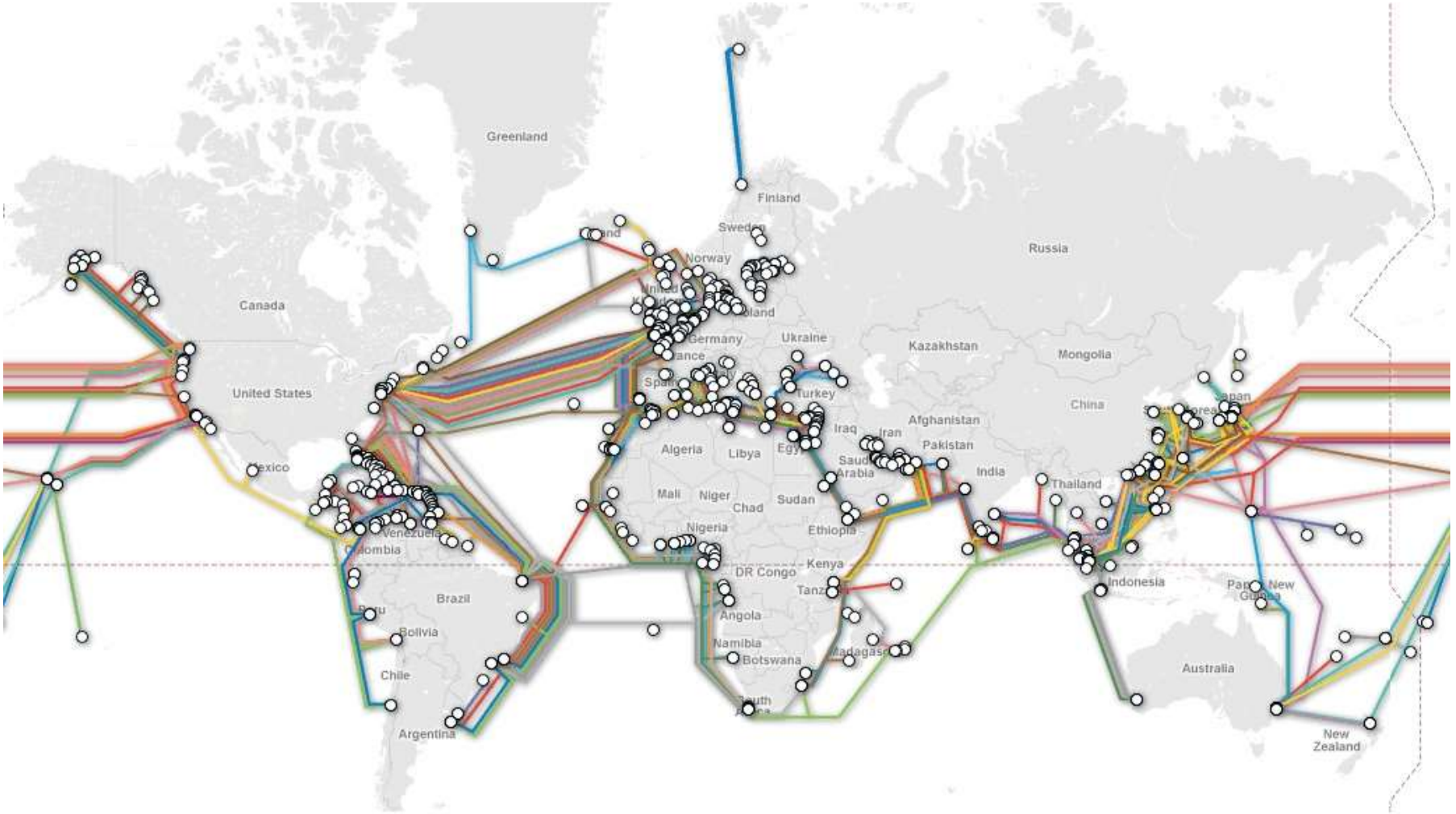
2008: Landsat (NASA) satellite data free

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

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

more satellite images, higher resolution

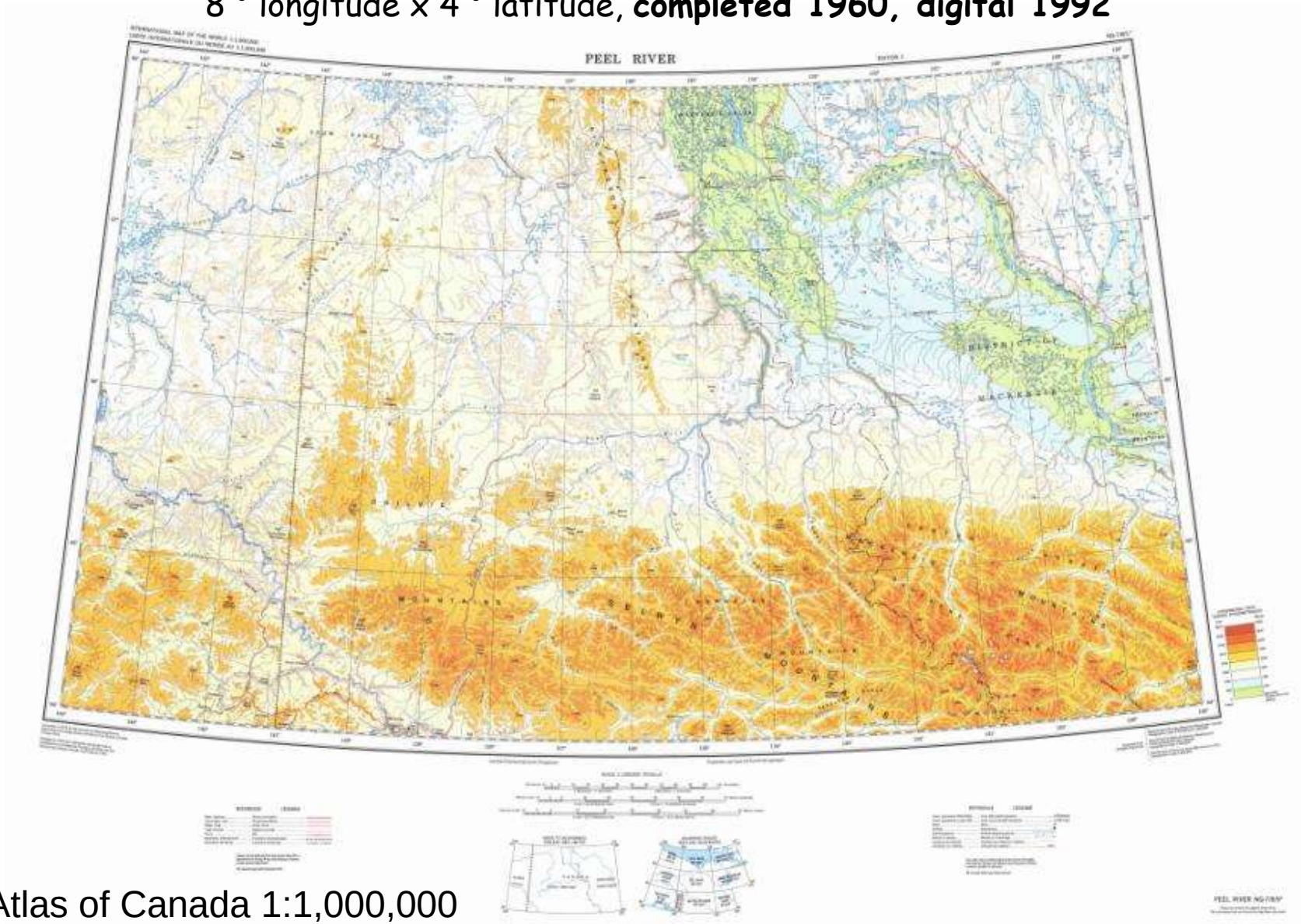
Mapping in ‘the cloud’ (=mostly under the sea)



Submarine internet cables: 99% of all data

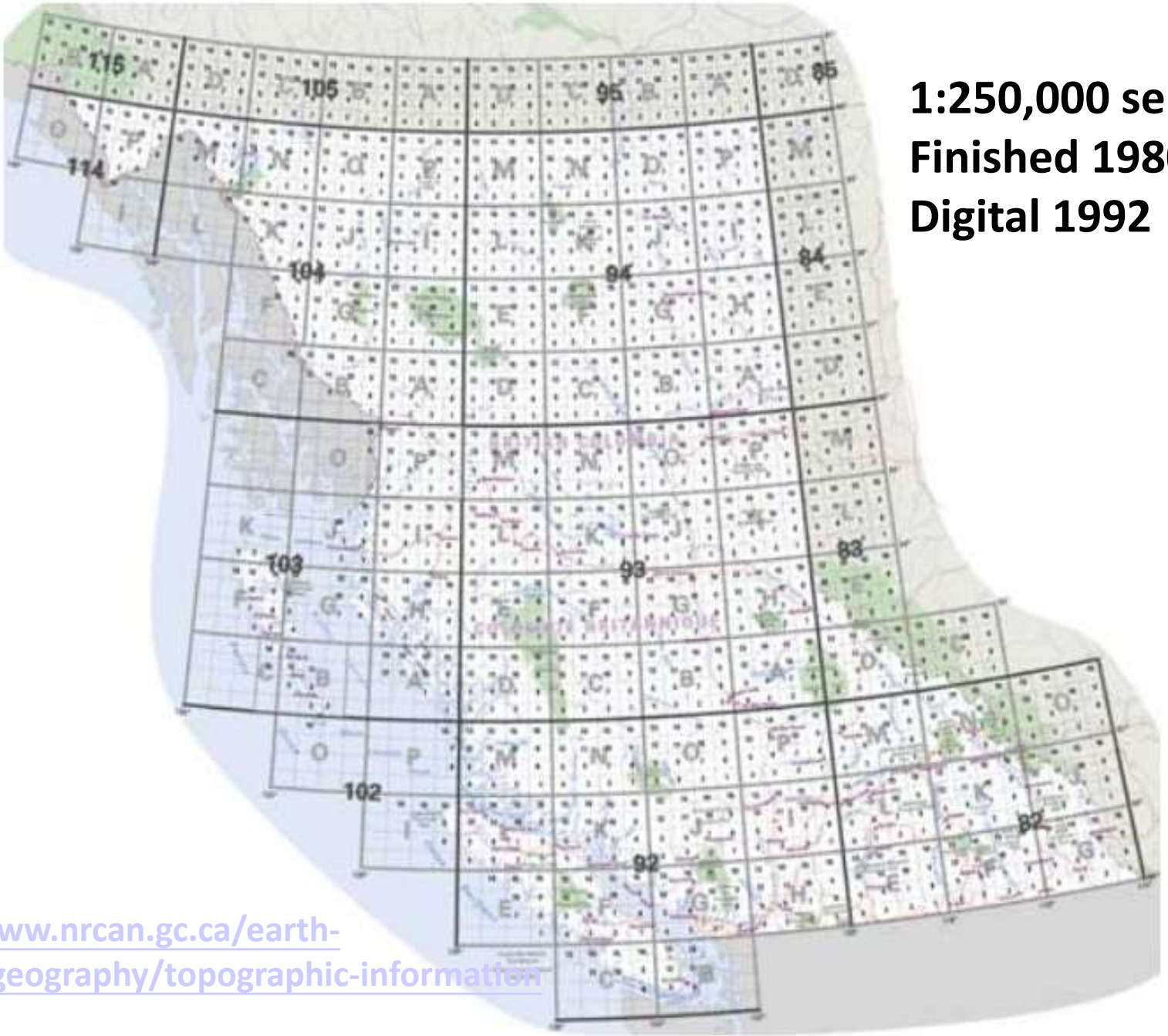
Digital topographic data

Canada is divided into (120) 1:1,000,000 sheets,
8 ° longitude x 4 ° latitude, **completed 1960, digital 1992**



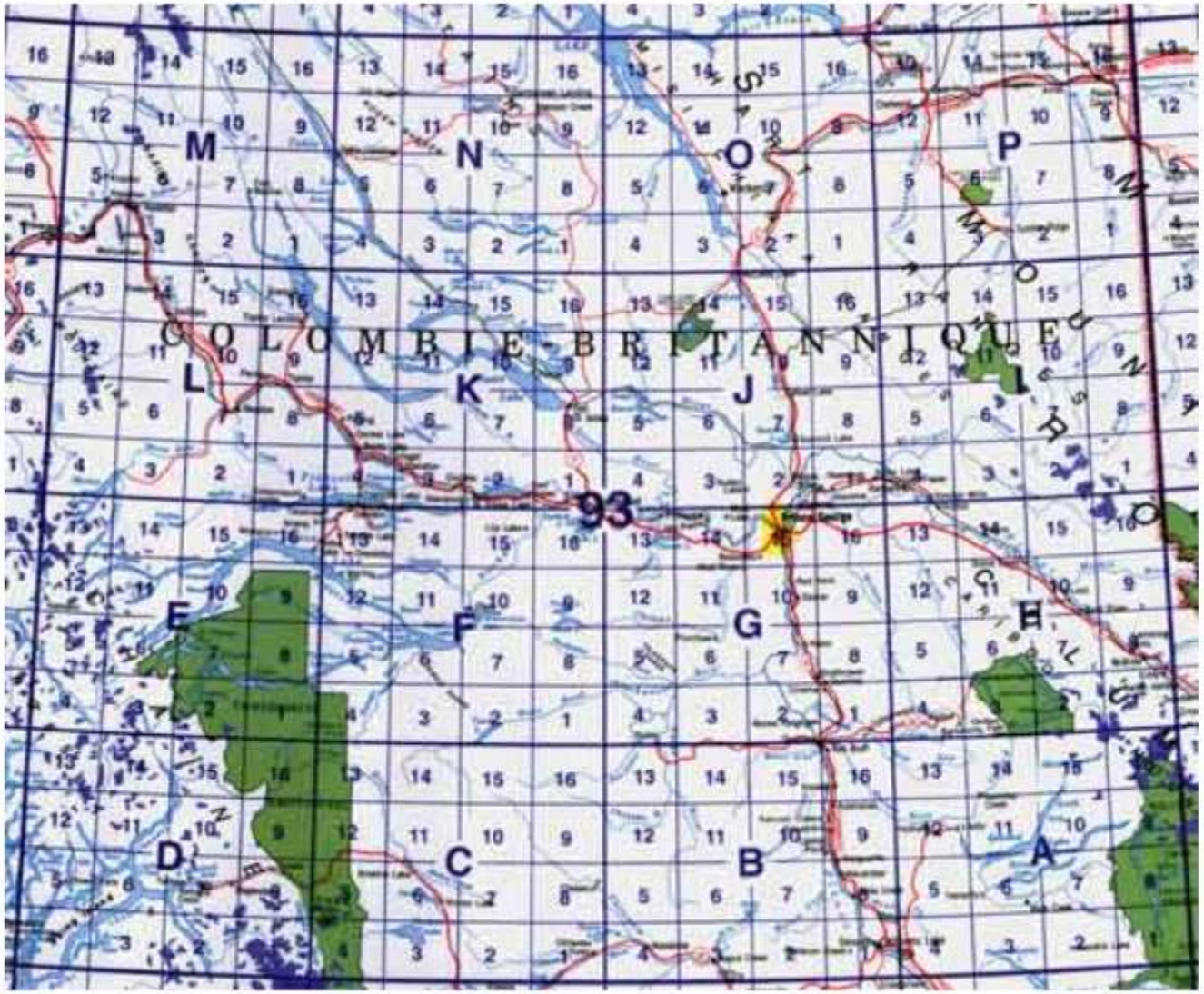
Atlas of Canada 1:1,000,000

https://open.canada.ca/data/en/dataset/6a8e6c9f-72a7-4bae-8613-40d39c8a1520



1:250,000 series
Finished 1980
Digital 1992

https://www.nrcan.gc.ca/earth-sciences/geography/topographic-information



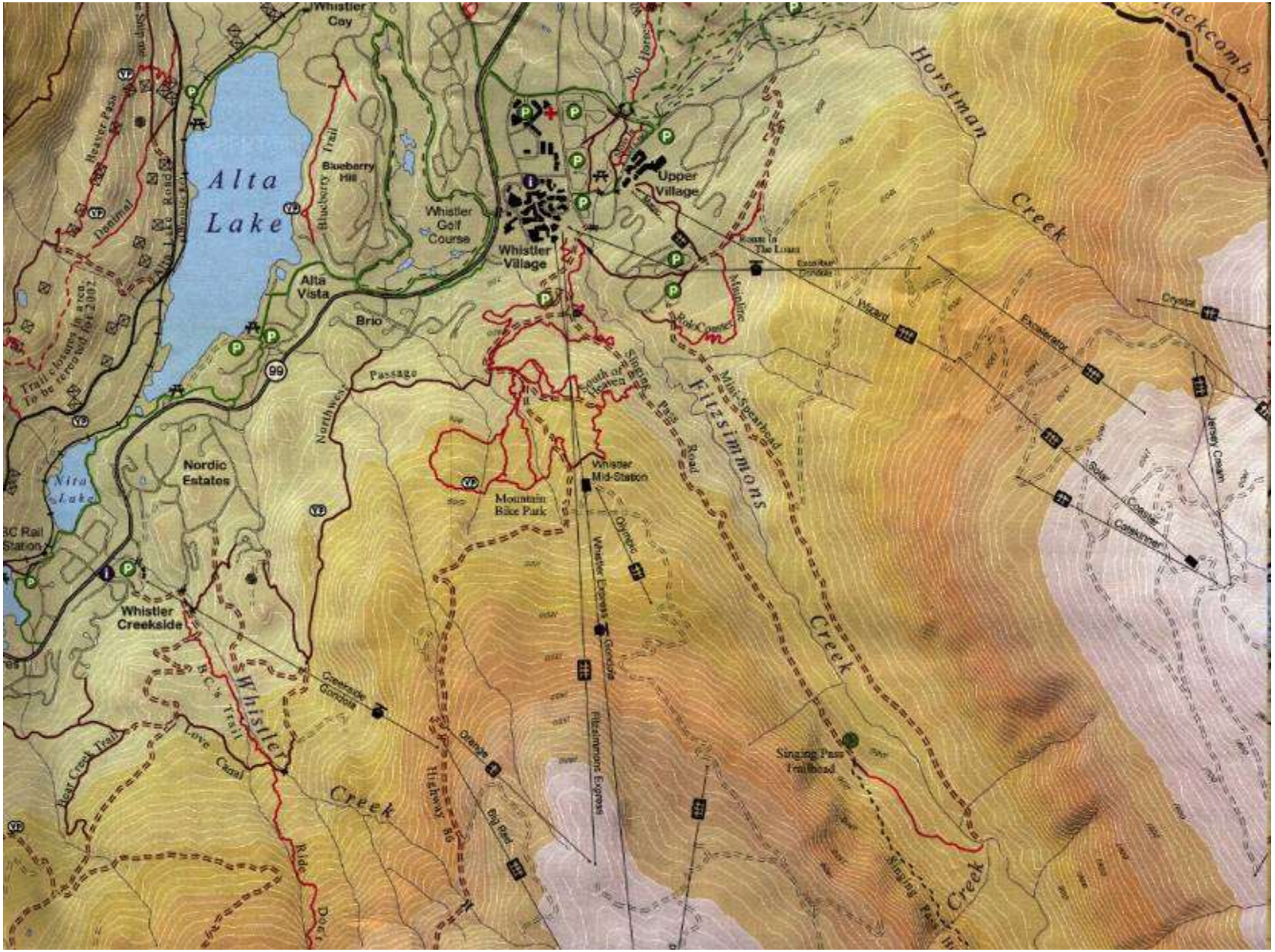
1:50,000 series

Completed 1995 for provinces, 2012 for Territories

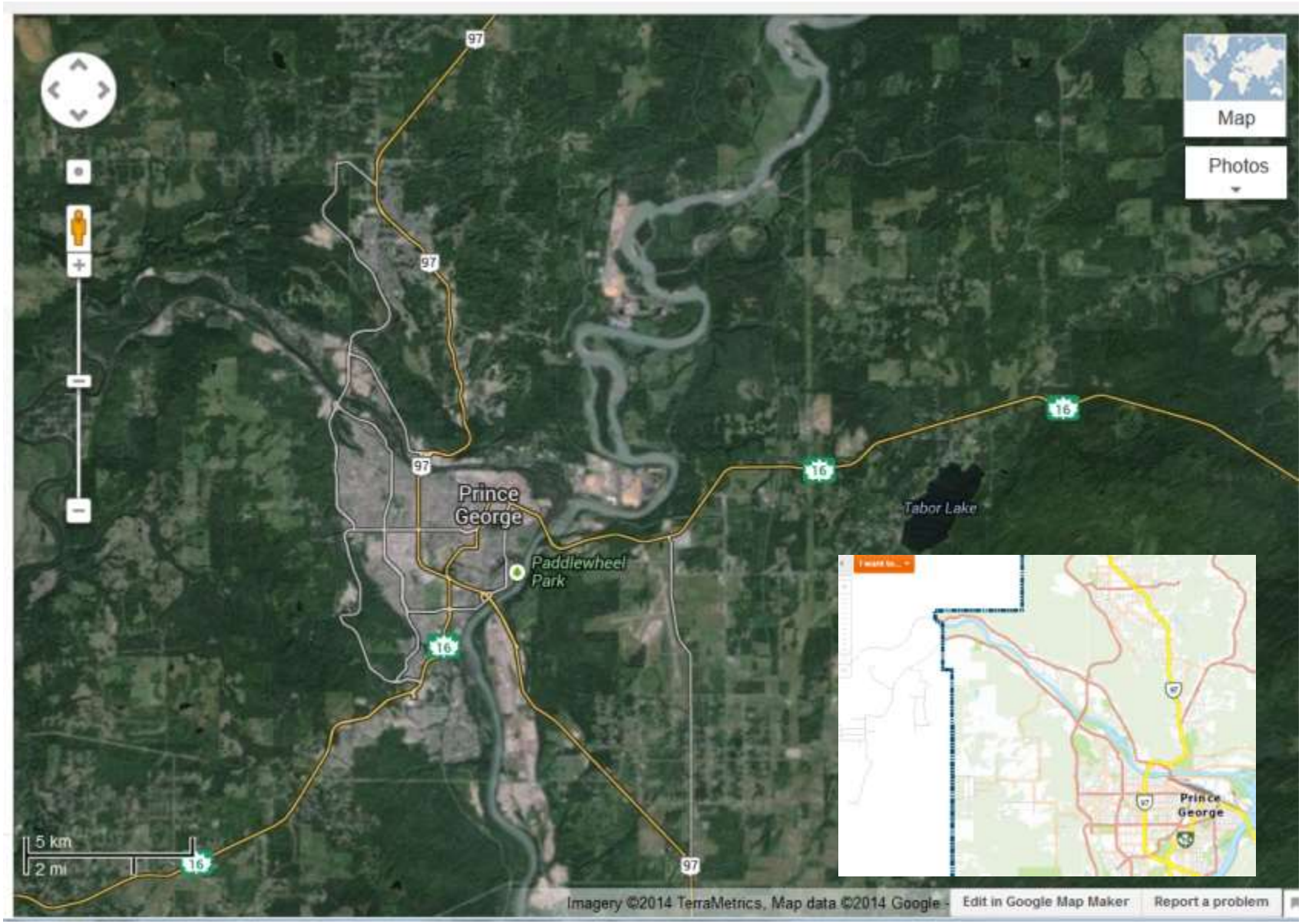
available by 2000 but cost $500 per map sheet; free > 2009

https://www.nrcan.gc.ca/earth-sciences/geography/topographic-information

BC TRIM Digital mapping 1:20,000 mapped 1980s, free ~2010

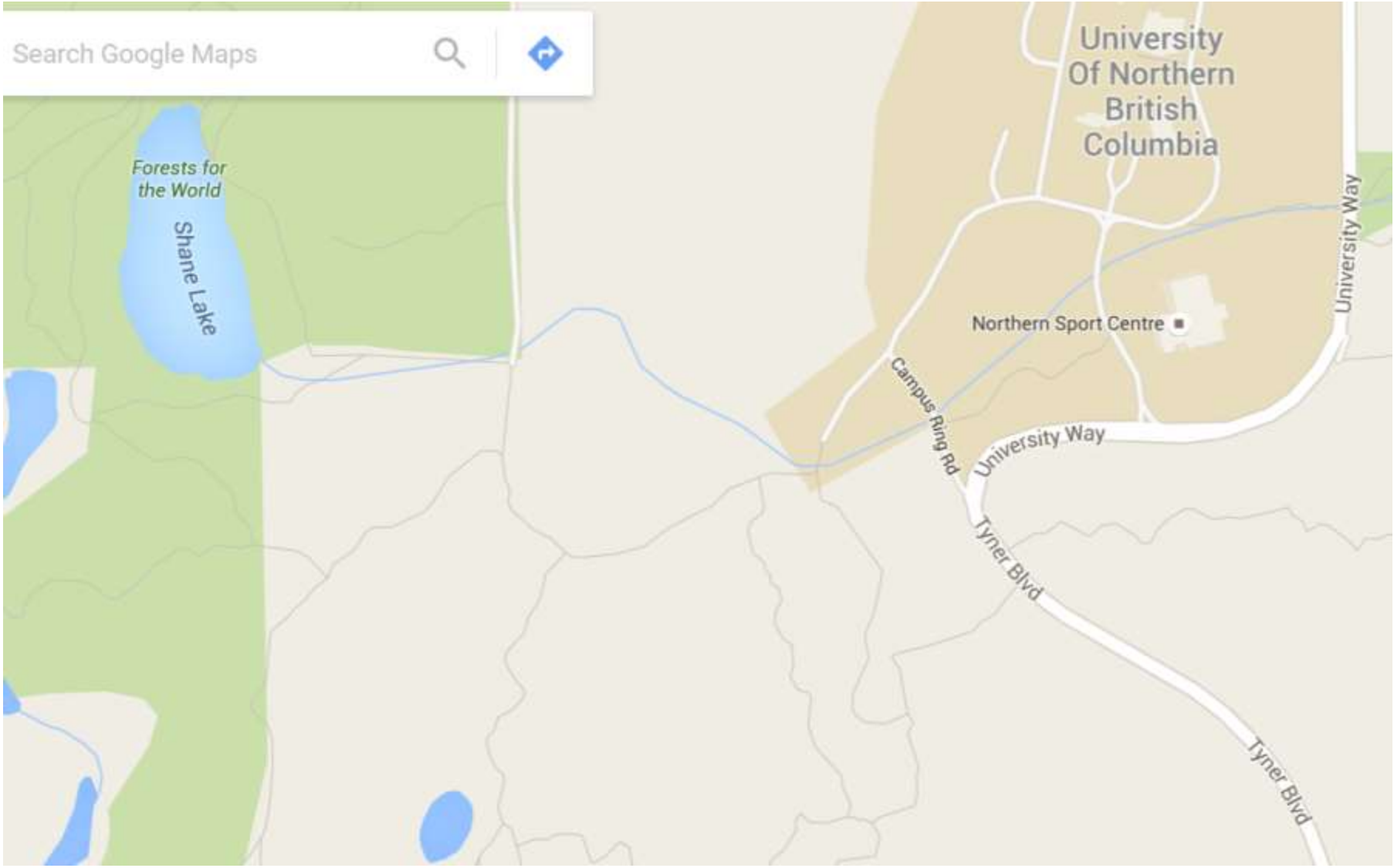


2005: online map viewers: e.g.Google Maps/Earth/ PGmap



Unprecedented access to map data and onscreen mapping

Google maps – updated regularly by local users using GPS



Also OpenStreetMaps, TrailForks etc..

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 as they are vector

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

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

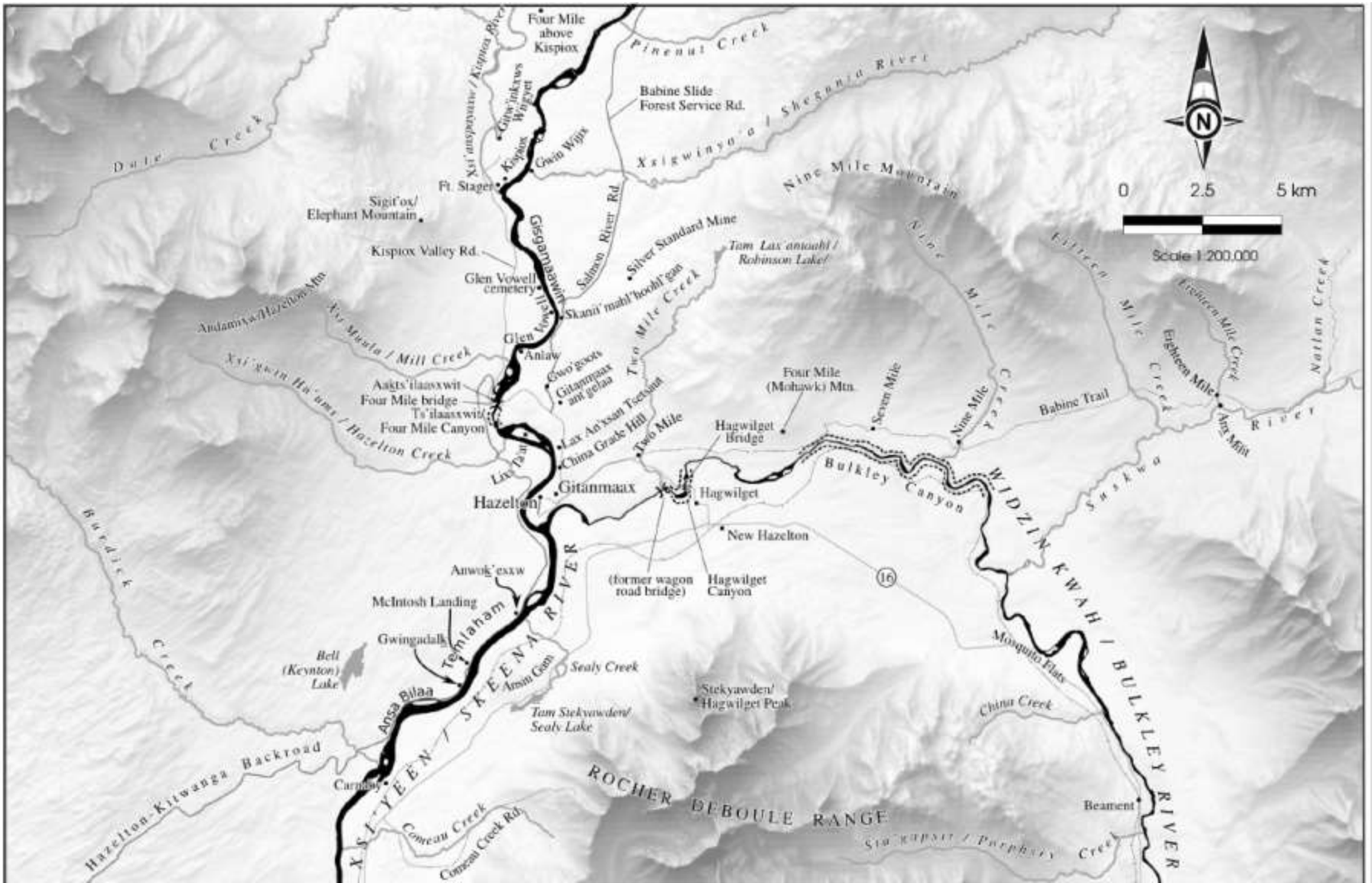
- Graphic Design programs do not address **spatial georeferencing**.
- Data layers can be overlain but do not have geographic coordinates.

Examples: Adobe Illustrator and CorelDraw - (formerly) Canadian

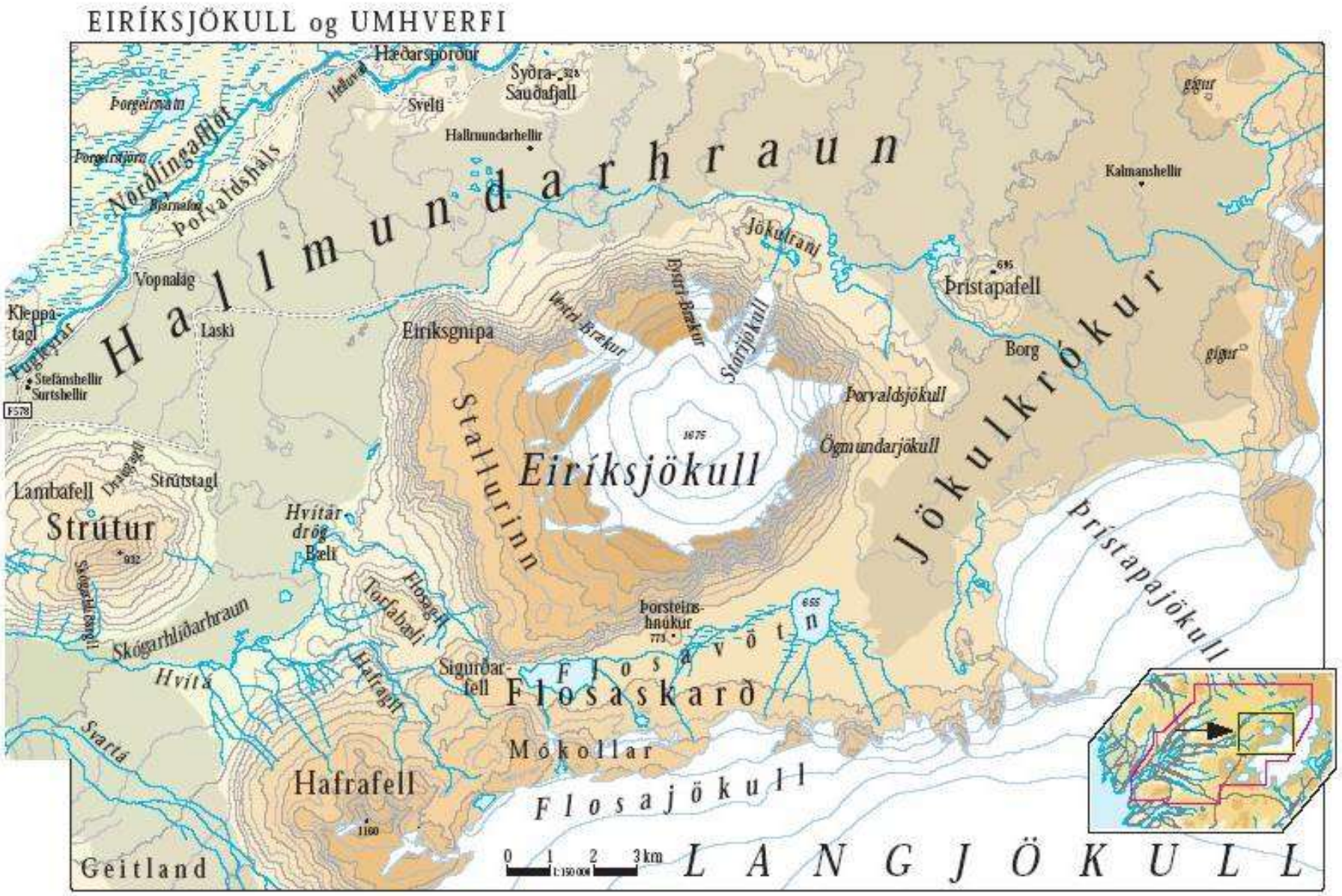
Inkscape (Linux, Macintosh, Windows) - free

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

Northern BC example, by Morgan Hite using Inkscape software – not GIS



Iceland travel map – made with Illustrator (Gudmund Ingvarsson)



c. Desktop mapping programs

developed specifically for mapping and can import geo-referenced data

Examples: Mapinfo

GPS mapping: OZIexplorer Fugawi

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

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.

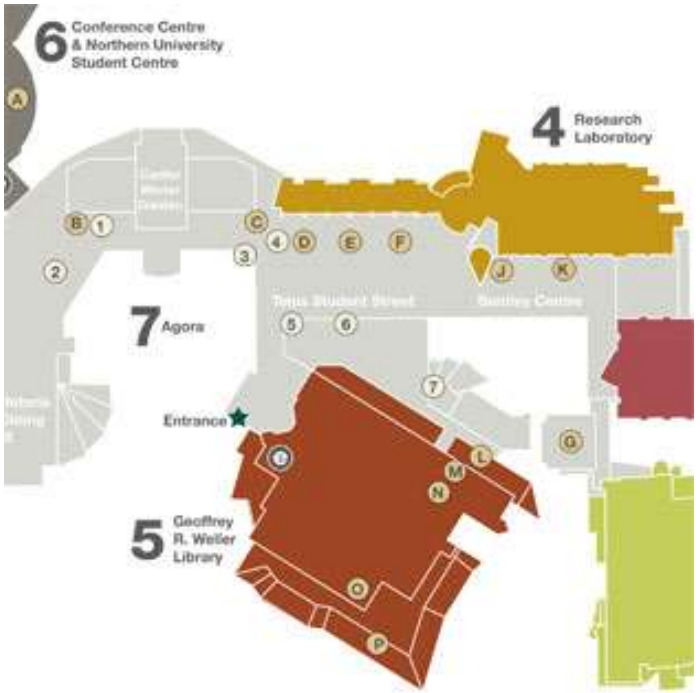
industry examples: AutoCad (architecture) and Microstation (forestry)

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

Attributes describe design not features

They can involve georeferencing

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



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

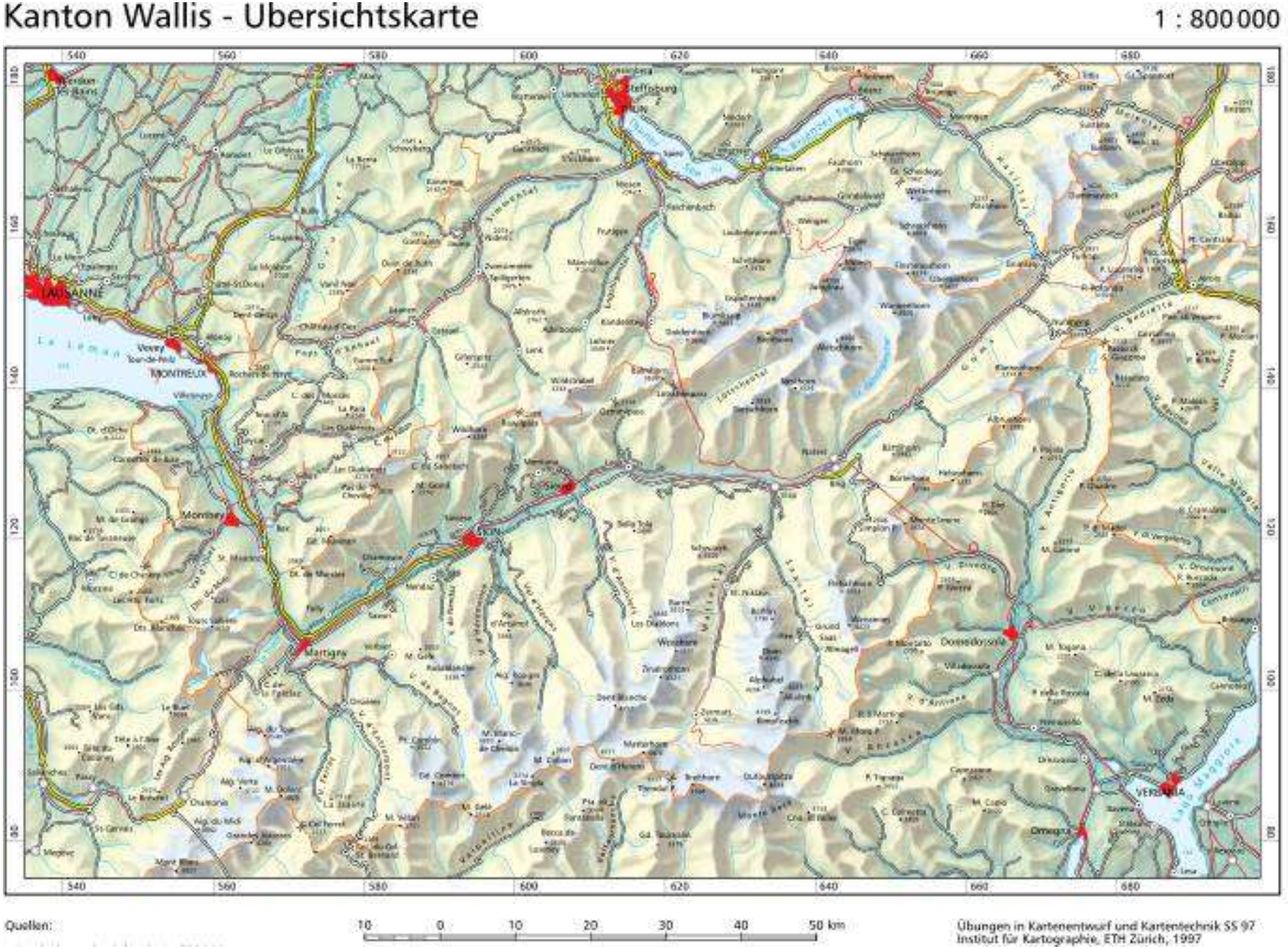
	plot_id	stand	sp1	sp2	stand_age	age_cl	stand_ht	height_cl
2	1	341	"	"	0	0	0	0
3	2	653	'S'	'AT'	140	7	32	4
4	3	461	"	"	0	0	0	0
5	4	654	'AT'	'EP'	120	6	28	3
6	5	732	"	"	0	0	0	0
7	6	653	'S'	'AT'	140	7	32	4
8	7	651	'AT'	'EP'	60	3	18	2
9	8	652	'S'	'PL'	30	2	14	2
10	9	780	'EP'	'AT'	80	4	24	3
11	10	739	'AT'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

It was common to import GIS files into graphic design programs for final output, but less now as GIS vendors have 'beefed up' options.

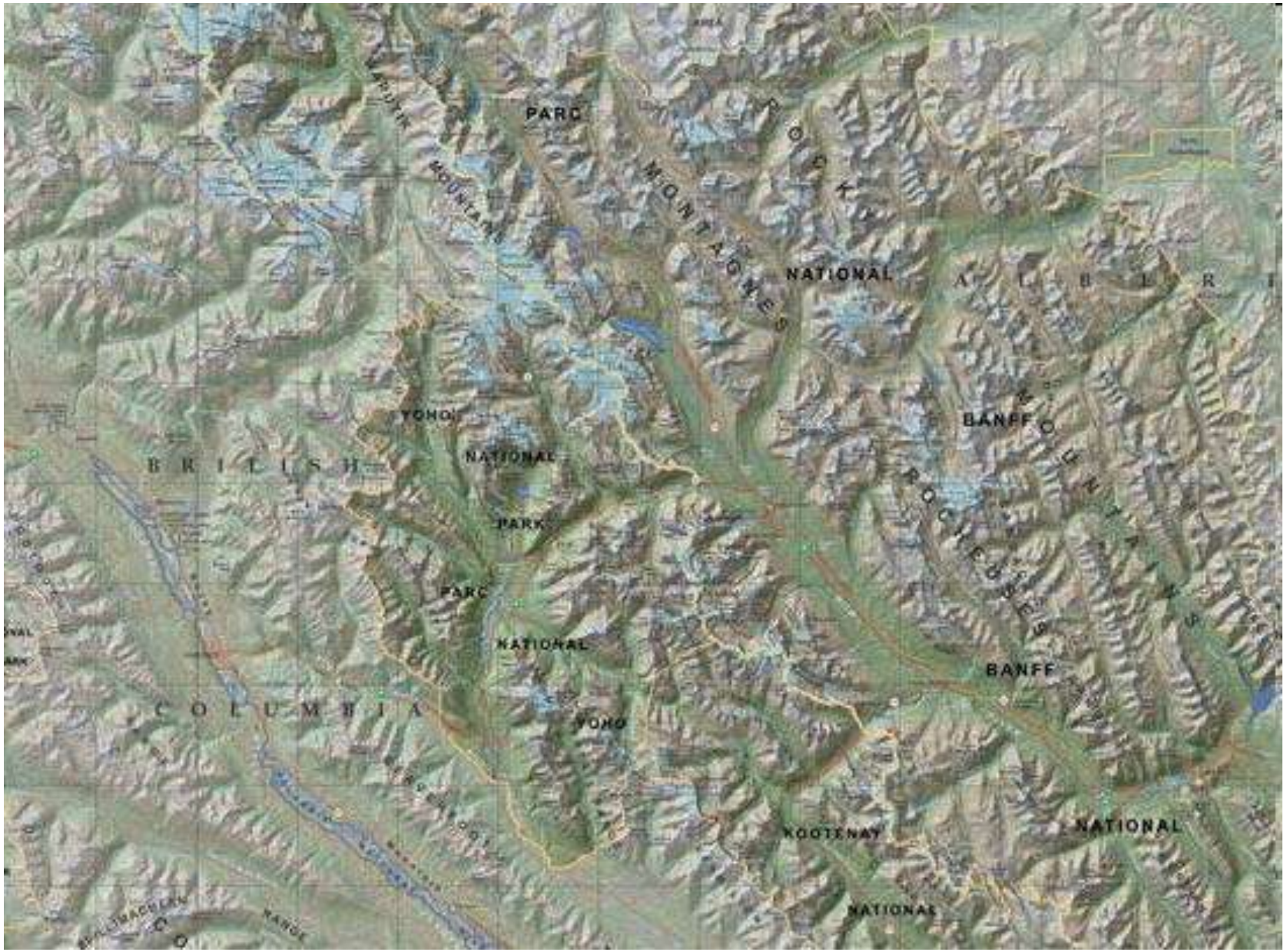
Examples below of arc/info + CorelDraw

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



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

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



f. Online web mapping

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

Online seamless maps / map viewers – zoom

e.g. Google Maps, Openstreetmap, ArcGIS online

https://www.marinetraffic.com/

Open Source examples

QGIS2Web: GIS based web mapping

Leaflet: JavaScript Library for interactive maps

GDAL: Geospatial Data Abstraction Library

OpenLayers: open sourced JavaScript

MapWindow: opensource GIS application

MapBox: online custom maps

CartoDB: cloud computing in a web browser http://bombsight.org

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 / display online
- Easy conversion of map projections
- Integration of geomatics –mapping, GPS, imagery
- Maps can be produced by anyone, not just technicians

Disadvantages of digital over manual

- Maps can be produced by anyone ?
- So much to learn -software can be complex
- Dependence on data / connections / networks
- Cost of hardware/software
- Why does this computer / software HATE ME ??

The promise of digital cartography 1975

- **Fast updating**... in theory (√?)

  Canada NTDB – roads only

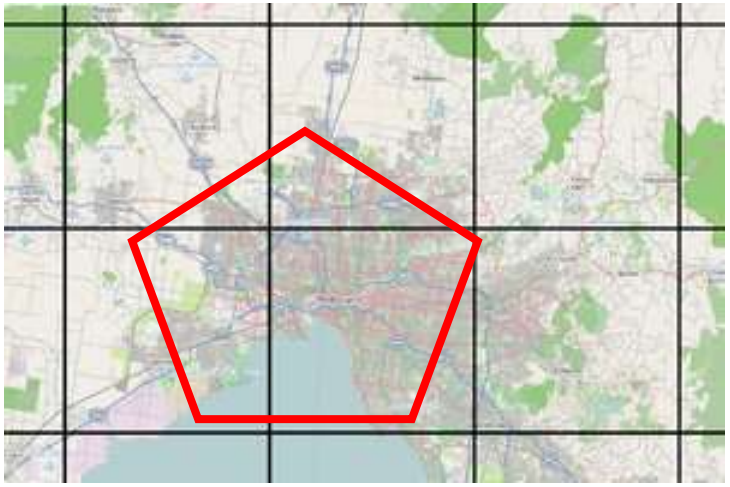
  BC TRIM (1995), not updated

  PGmap updated weekly …

- **Seamless databases** √

  Google 2005

  download NTDB by AOI 2017 (Area of interest) or map tiles



Cartography in the late 20th century

-> going digital versus the breakup of the Soviet Union