Introduction to GIS

ArcGIS Online

McMaster University sits on the traditional territories of the Mississauga and Haudenosaunee Nations, and within the lands protected by the Dish With One Spoon wampum agreement.

Overview

- Intro to GIS
  - What is it?
  - Data types
  - Representing Data on a Map
  - Coordinate Systems
- Spatial Data Sources
  - McMaster University Library
  - Scholars GeoPortal
  - Open data
- GIS Software
  - Esri / ArcGIS
  - Site license
  - ArcGIS Online
- Activity
- Q & A

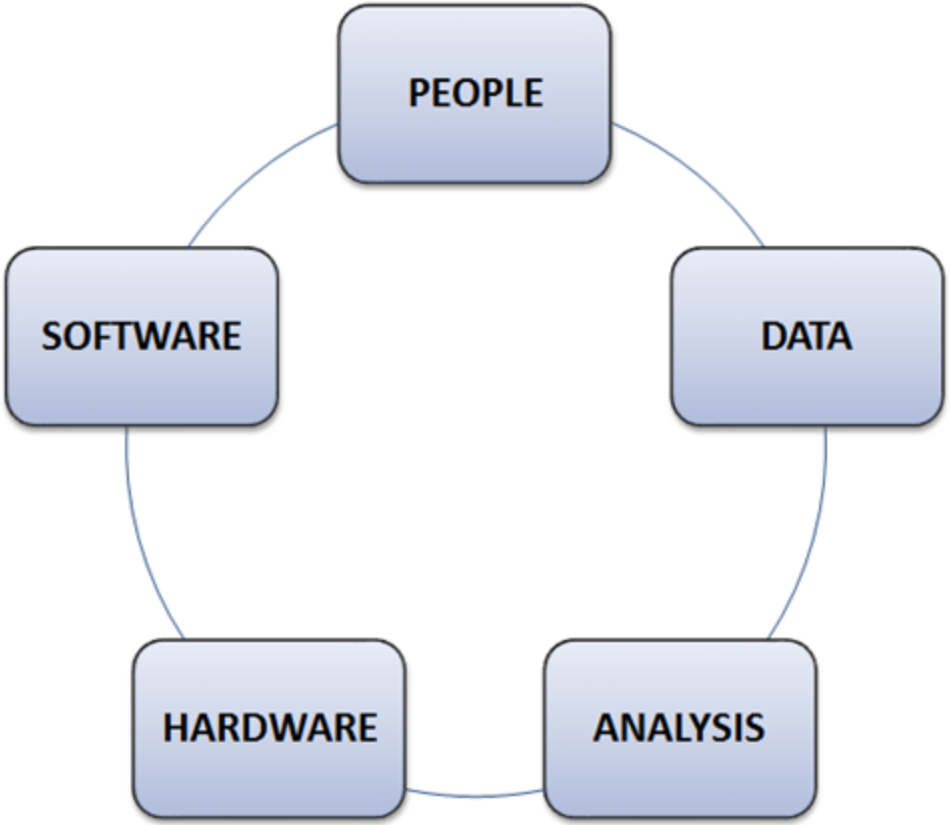
Learning Objectives

- Have a better understanding of what GIS is and how it can be used
- Become familiar with common sources of geospatial data
- Learn the ArcGIS Online interface and be able to create a simple map
- Know where you can get additional help and resources

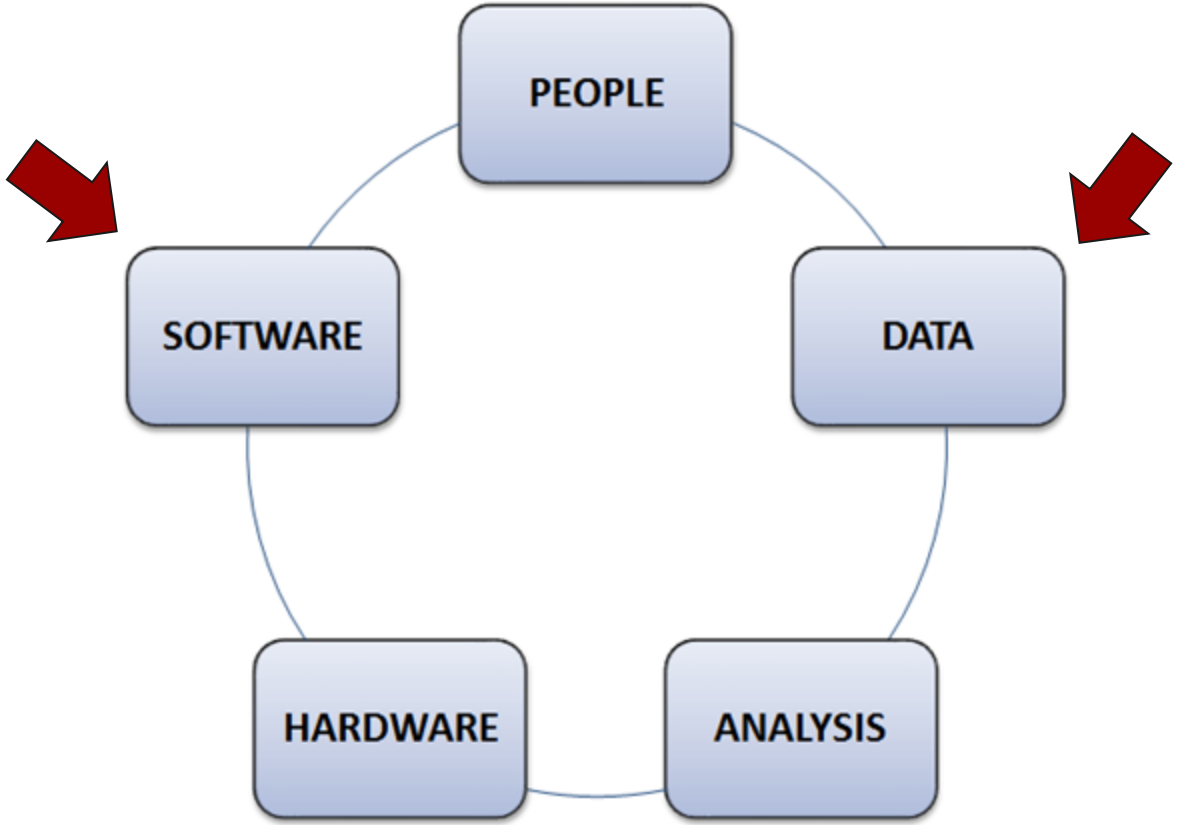
What is GIS?

- **G**eographic **I**nformation **S**ystems
- Digital or computer-based mapping
- A system to assemble, store, manipulate, analyze, and present ***geographically referenced data***
  - Data associated with, or identified by, their location
- A digital representation of real-world geographic attributes:
  - Location
  - Attributes
  - Spatial relationships
- Allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends

Components



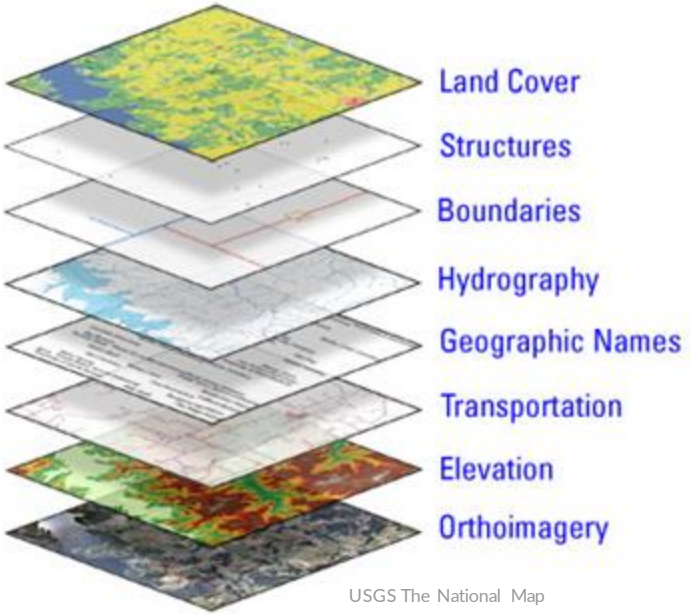
Components



Spatial Data

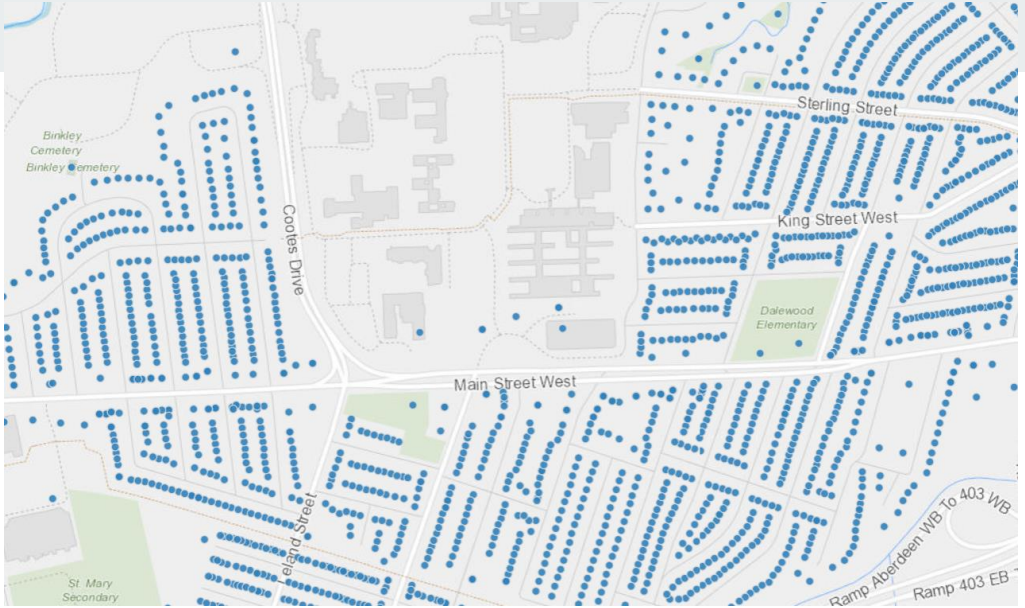
Spatial data

- Vector and raster data models used to represent the real world
- Data collection - GPS units, surveys, tablets, phones, crowdsourced
- Multiple datasets are stacked or joined together in GIS software
- Maps can be printed or made available online, resulting in rapid information and knowledge dissemination



Vector data

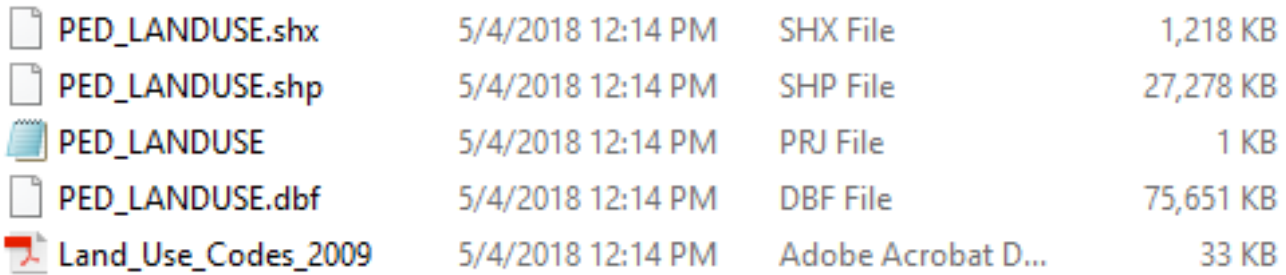
- **Points**
  - X / Y locations
- **Line**
  - Connected X / Y locations
- **Polygon** (area)
  - Connected X / Y locations forming a closed figure
- Good for representing clearly defined objects



Open Hamilton

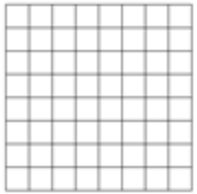
Vector data

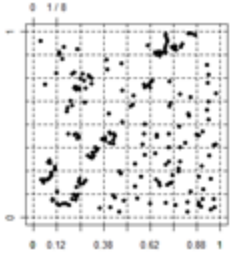
- **Format** - shapefile (.shp)



PED_LANDUSE.shx	5/4/2018 12:14 PM	SHX File	1,218 KB
PED_LANDUSE.shp	5/4/2018 12:14 PM	SHP File	27,278 KB
PED_LANDUSE	5/4/2018 12:14 PM	PRJ File	1 KB
PED_LANDUSE.dbf	5/4/2018 12:14 PM	DBF File	75,651 KB
Land_Use_Codes_2009	5/4/2018 12:14 PM	Adobe Acrobat D...	33 KB

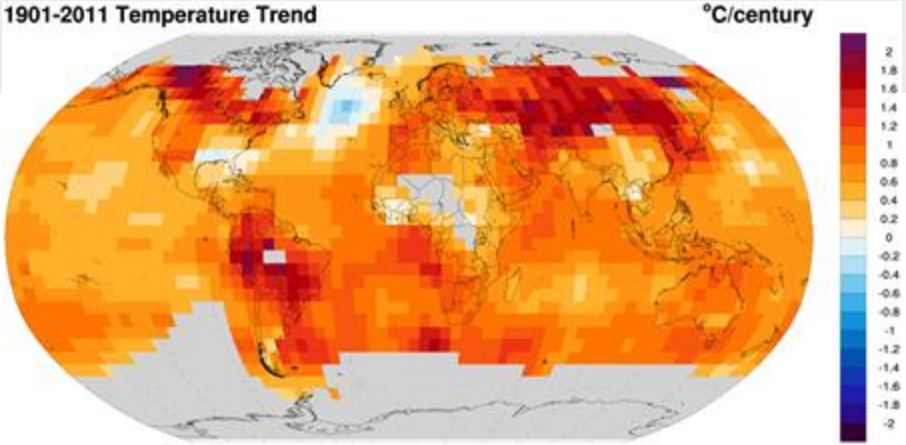
Raster data





Wikimedia

- Grid of cells
- Numbers assigned to each cell representing data
  - Categorical - Land use, e.g.
  - Continuous - Temperature, elevation, e.g.
- Good for representing continuously changing attributes

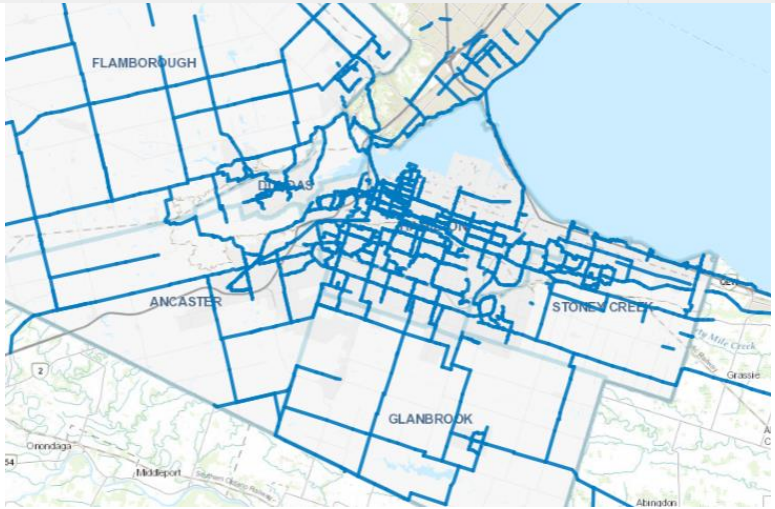


Wikimedia

Attribute data

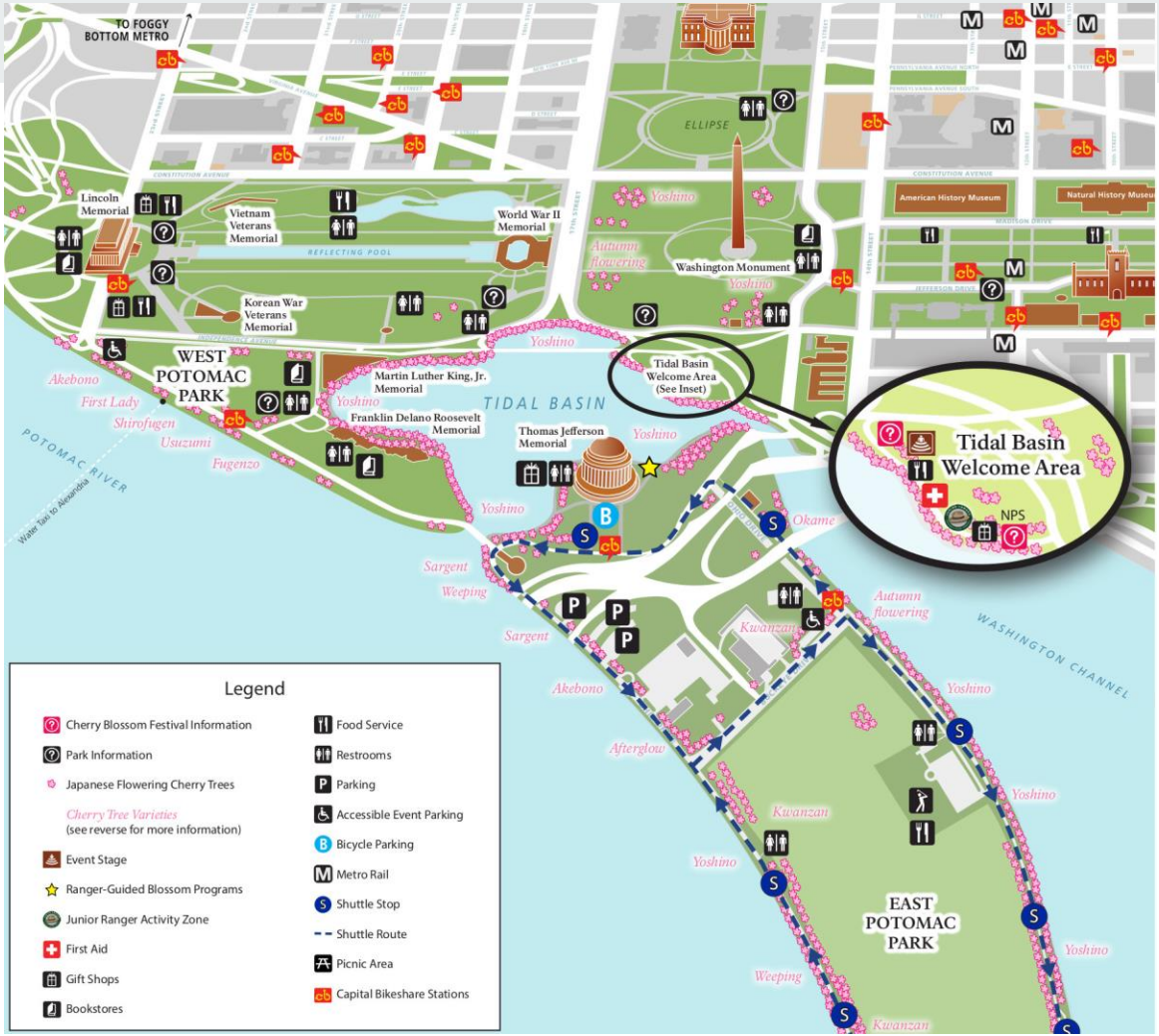
- Tabular data appended to spatial data providing contextual information
- The spatial data is the where, and the attribute data is the *what*, *where*, and *why* (GIS Lounge)

NAME	WARD	STATUS	LENGTH_IN_METRES	NEW_UPGRADE	TYPE
Upper Paradise Rd	14	Existing	3.9709000000000003		Bicycle Lane
Upper Paradise Rd	14	Existing	6.9205000000000005		Bicycle Lane
Upper Paradise Rd	14	Existing	121.26650000000001		Bicycle Lane
Upper Paradise Rd	14	Existing	130.7387		Bicycle Lane
Upper Paradise	14	Existing	155.2564	Bicycle Lane	Medium Auto Volume S
Upper Paradise	14	Existing	191.5346	Bicycle Lane	Medium Auto Volume S
Cannon St E	3	Existing	72.6759		Bicycle Lane
Hunter St E	2	Existing	78.5475		Bicycle Lane
Upper Paradise Rd	14	Existing	51.3935		Bicycle Lane
Hunter St E	2	Existing	181.5093		Bicycle Lane
Young St	2	Existing	85.6721		Bicycle Lane
Young St	2	Existing	44.297000000000004		Bicycle Lane

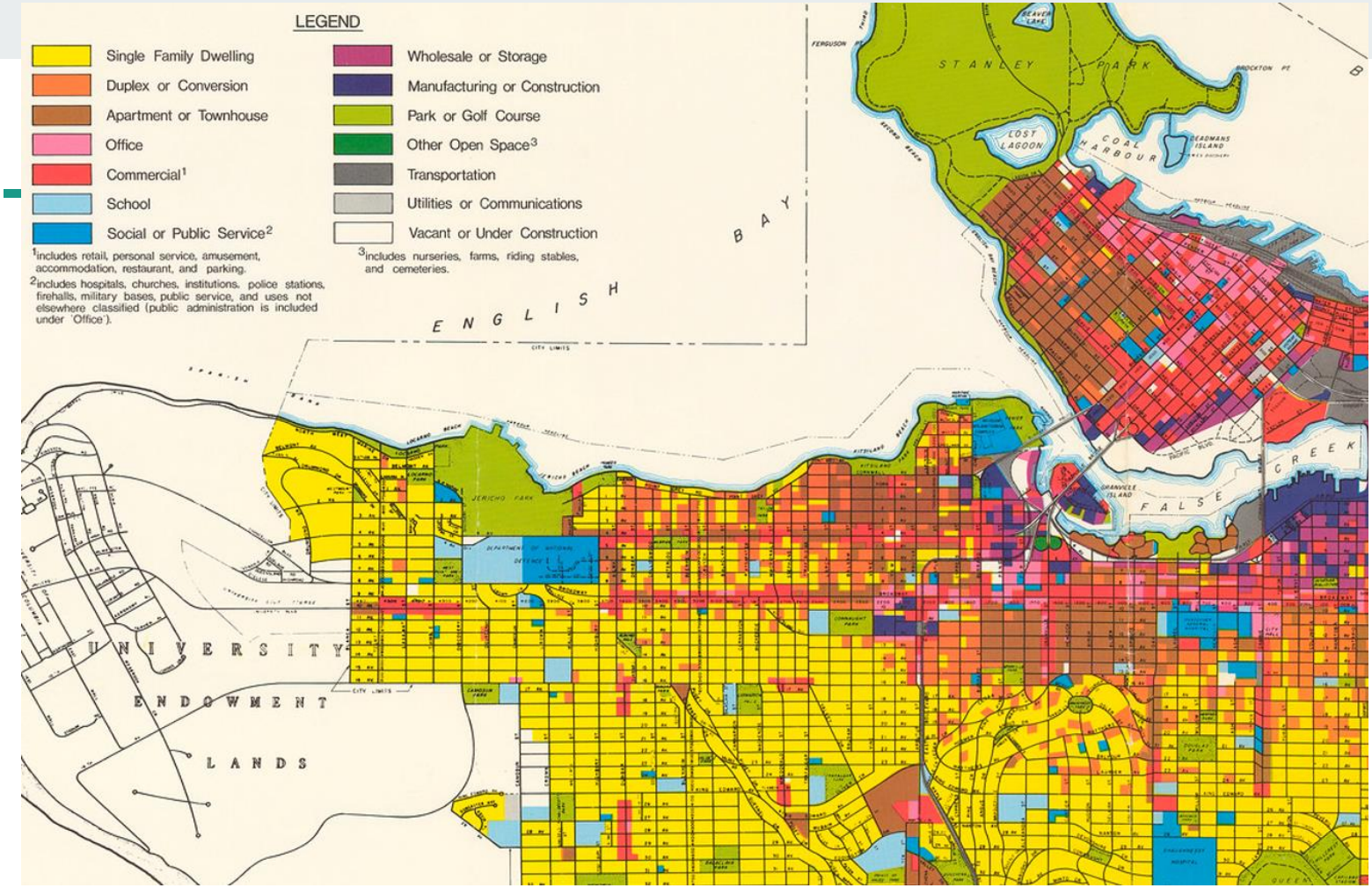


Open Hamilton

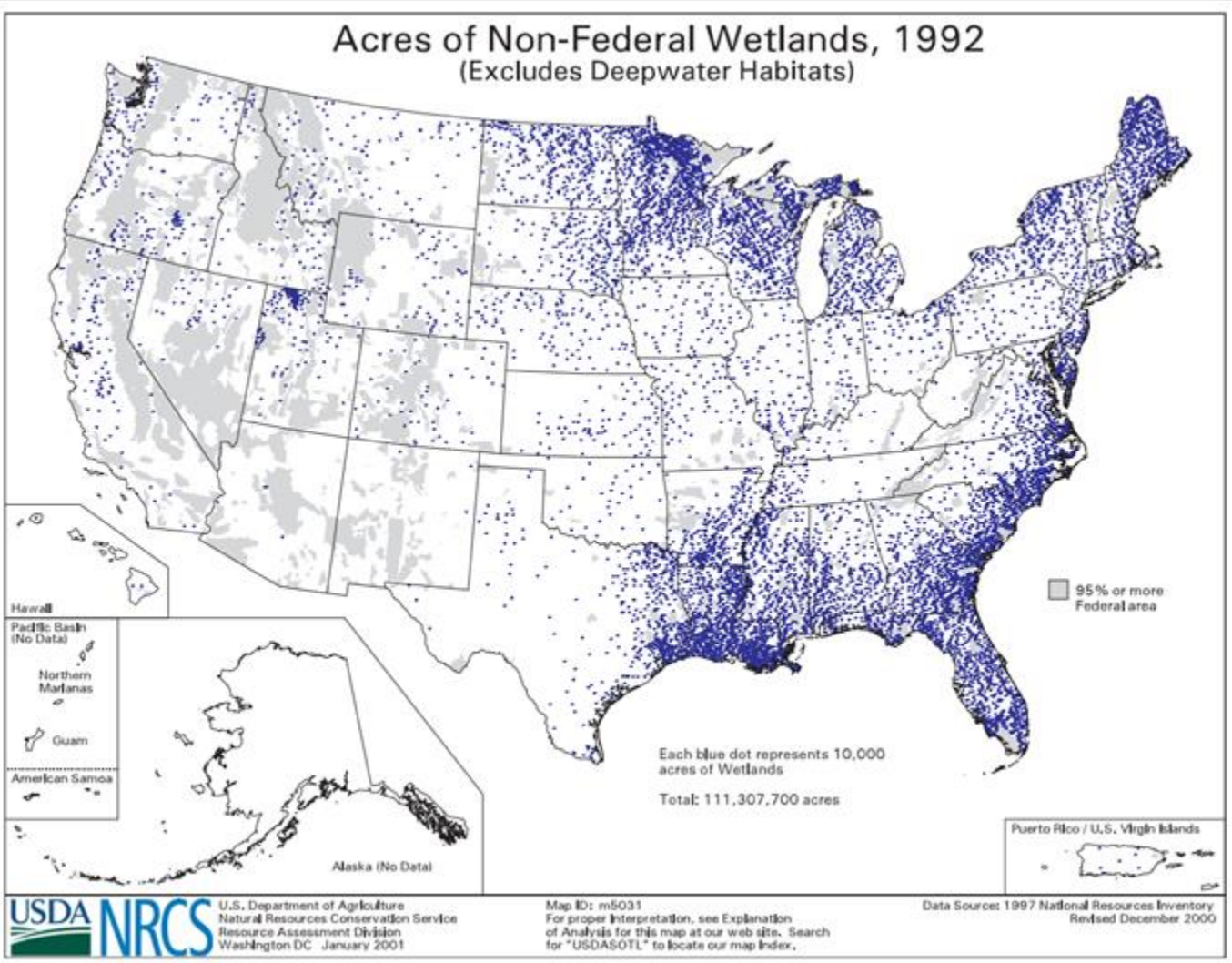
Representing Data on a Map

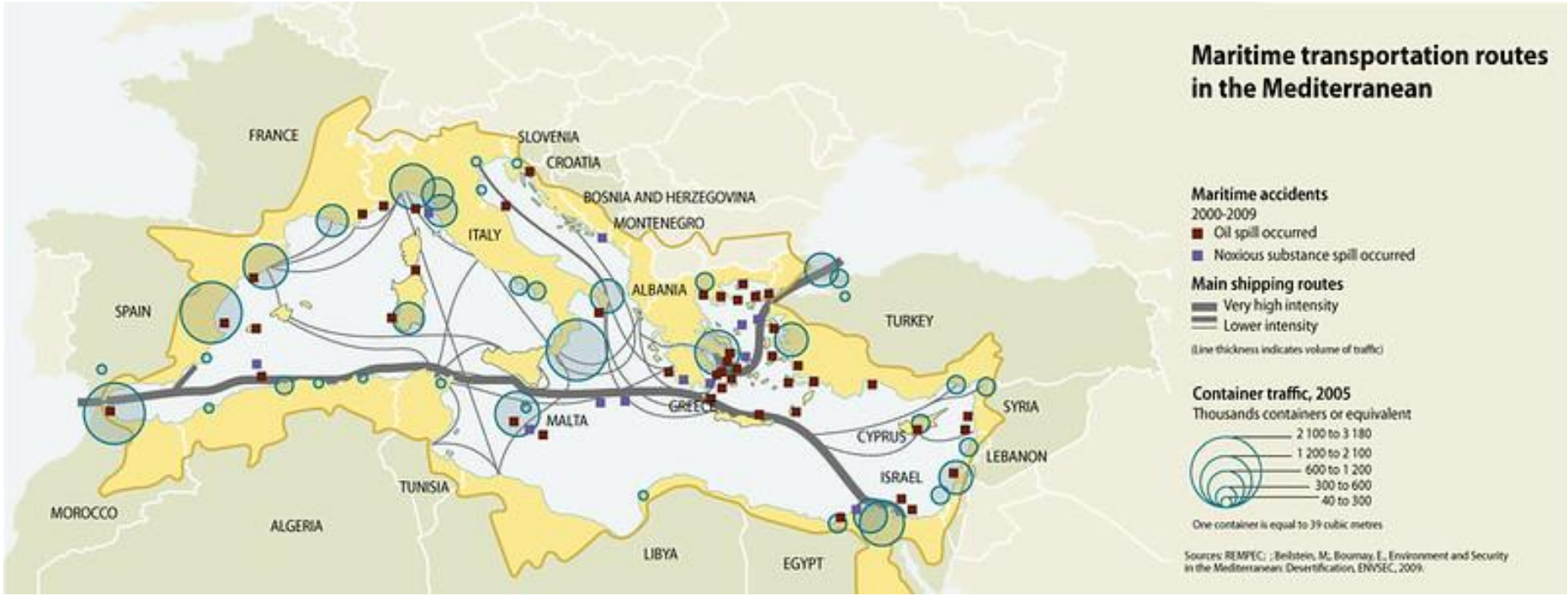


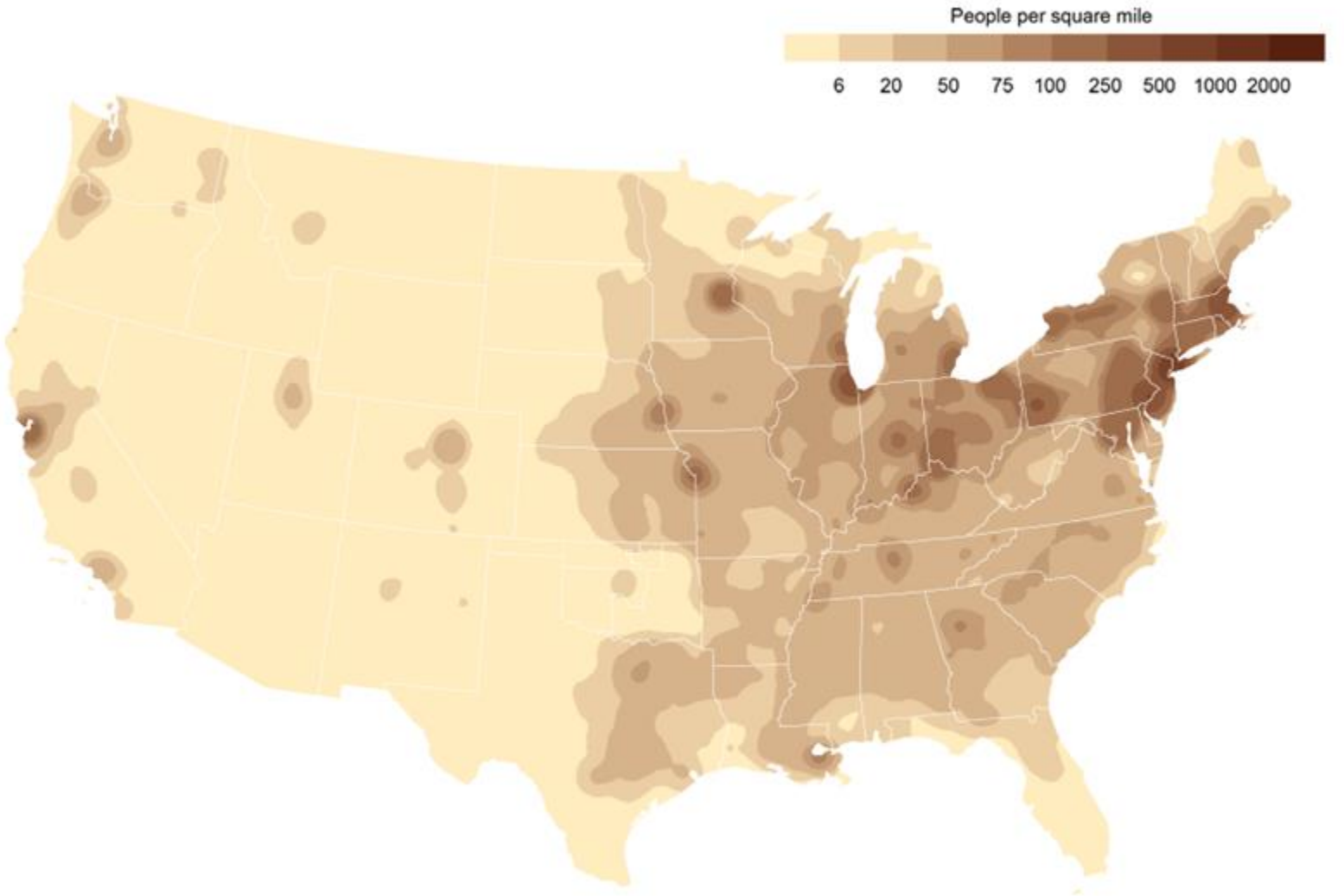
Source:
U.S. National Park Service



Source: City of Vancouver Archives, Flickr


Acres of Non-Federal Wetlands, 1992
(Excludes Deepwater Habitats)
95% or more Federal area
Each blue dot represents 10,000 acres of Wetlands
Total: 111,307,700 acres
Hawaii
Pacific Basin (No Data)
Northern Marianas
Guam
American Samoa
Alaska (No Data)
Puerto Rico / U.S. Virgin Islands
USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service
Resource Assessment Division
Washington DC January 2001
Map ID: m5031
For proper interpretation, see Explanation of Analysis for this map at our web site. Search for "USDASOTL" to locate our map index.
Data Source: 1997 National Resources Inventory
Revised December 2000

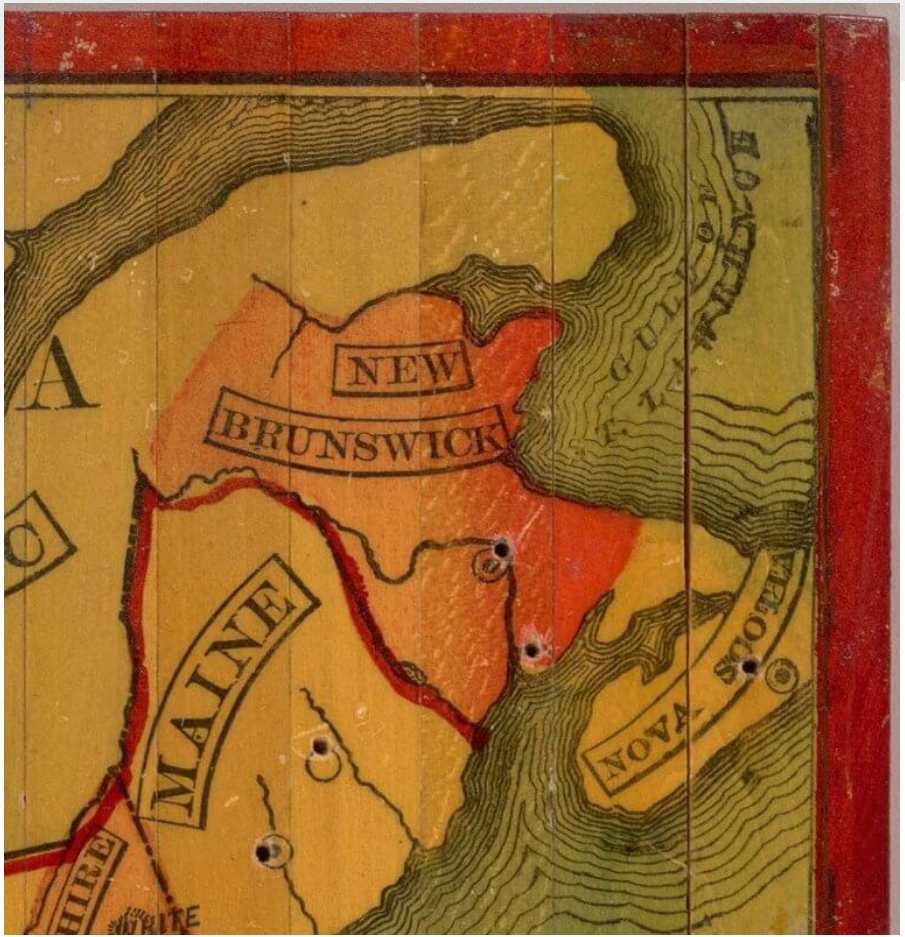

Maritime transportation routes in the Mediterranean
FRANCE
SLOVENIA
CROATIA
BOSNIA AND HERZEGOVINA
MONTENEGRO
ITALY
ALBANIA
SPAIN
TURKEY
GREECE
MALTA
CYPRUS
SYRIA
LEBANON
ISRAEL
TUNISIA
MOROCCO
ALGERIA
LIBYA
EGYPT
Maritime accidents
2000-2009
Oil spill occurred
Noxious substance spill occurred
Main shipping routes
Very high intensity
Lower intensity
(Line thickness indicates volume of traffic)
Container traffic, 2005
Thousands containers or equivalent
2 100 to 3 180
1 200 to 2 100
600 to 1 200
300 to 600
40 to 300
One container is equal to 39 cubic metres
Sources: REMPEC; ; Beilstein, M., Boumay, E., Environment and Security in the Mediterranean: Desertification, ENVSEC, 2009.



Source: Census.gov

Considerations

- What message are you trying to convey? Is it clear to the reader?
- Symbology, labels, map elements
- Generalization
- Is the data readily available?
- What map projection should you use?



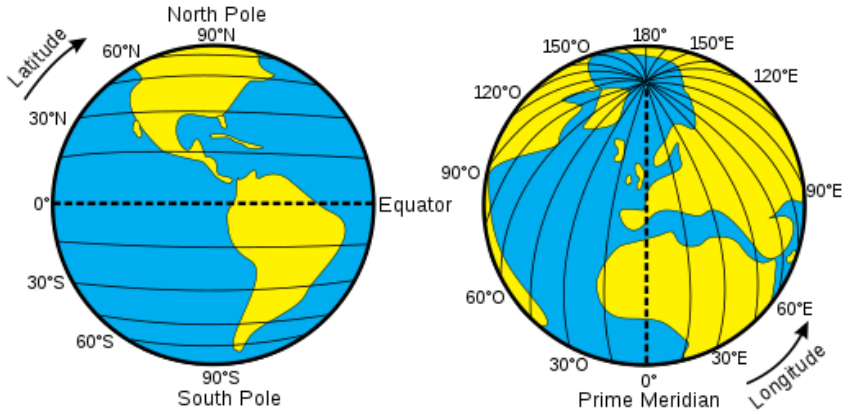
Source: David Rumsey Map Collection, Confederation Centre of the Arts

Coordinate Reference Systems (CRS)

Coordinate Reference Systems (CRS)

- Referencing the location of features on the earth's surface
- Two methods - **Geographic** Coordinate Systems or **Projected** Coordinate Systems

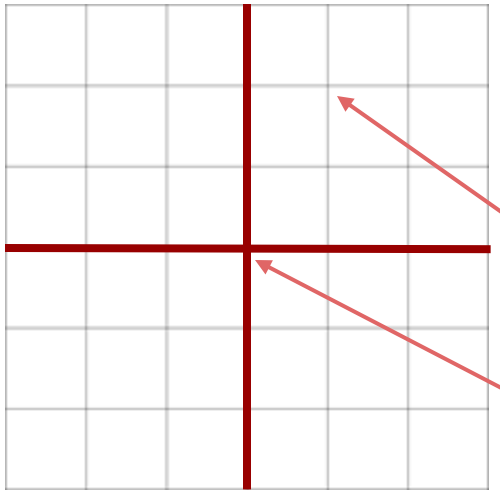
Geographic Coordinate Systems



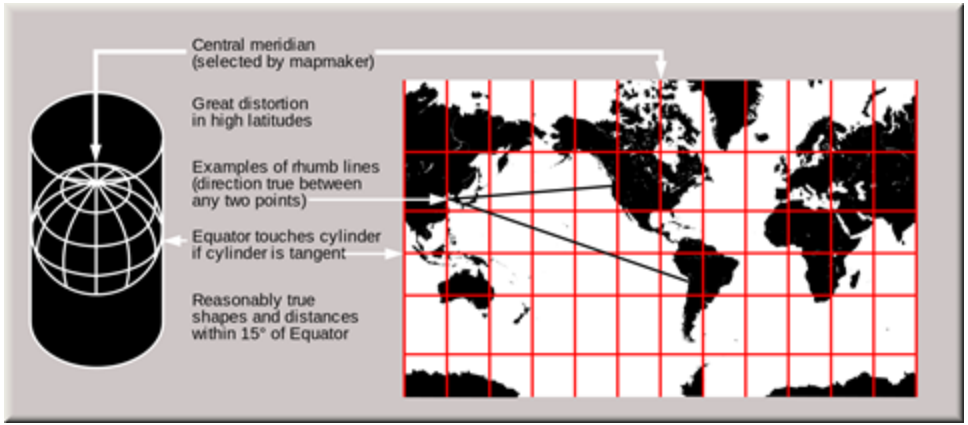
Wikimedia

- Locations expressed as angles from a point
- Network or intersecting lines - meridians (longitude), parallels (latitude)
- Reference system for a curved earth based on a geodetic datum
- Many datums exist - World Geodetic System (WGS) 84, North American Datum (NAD) 83

Projected Coordinate Systems

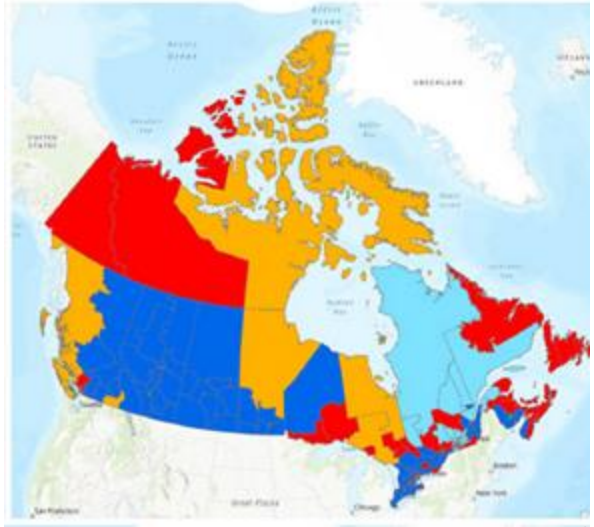


- Projecting the round earth onto a flat surface
- Representing the earth in two dimensions causes distortion
- Different projections preserve shape (*conformal*), area (*equal area*), distance (*equidistant*), or direction (*true direction*)
- Locations are referenced as distance from reference point

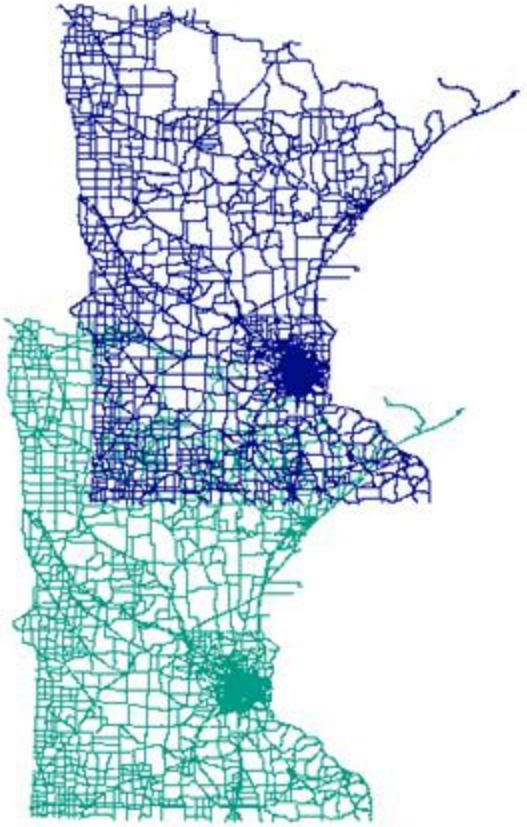


Wikimedia

Why is this important?



Esri



Penn State

Spatial data sources

Where can I get data?

- McMaster University Library
  - https://library.mcmaster.ca/collections/geospatial-data
- Scholars GeoPortal
  - http://geo.scholarsportal.info/
- City of Hamilton
  - http://open.hamilton.ca/
- Ontario GeoHub
  - https://geohub.lio.gov.on.ca/
- Canada's Open Government Portal
  - https://open.canada.ca/en/open-data

GIS Software

GIS Software

- Many, MANY types of software
- Different tools for different purposes
  - Full-featured vs. specialized
  - Open-source vs. commercial
  - User-friendly vs. technical
  - Web-based vs. desktop

Esri / ArcGIS

- Available free of charge to *current* students, staff, and faculty at McMaster University.

- Products (incomplete list):
  - Desktop – ArcMap; ArcGIS Pro
  - Specialized – Business Analyst Online; Community Analyst Online
  - Web-based – ArcGIS Online
  - App development – App Studio; Experience Builder; Storymaps

- https://library.mcmaster.ca/services/gis

Questions about GIS and Geospatial Data?

EMAIL US →

libgis@mcmaster.ca

ArcGIS Tutorials and Resources

Esri Canada Education and Research Resources - https://hed.esri.ca/resourcefinder/

Learn ArcGIS - https://learn-arcgis-learngis.hub.arcgis.com/

libgis@mcmaster.ca

Exercise

Mapping average market rent in Hamilton over time

Sign up for a free "public account":

- Go to arcgis.com
- Click "Sign In" > Create an account > Create an ArcGIS Public Account
- Complete the form and verify your account

Questions?

Thank you!

Christine Homuth

Spatial Information Specialist
libgis@mcmaster.ca