Introduction to Spatial data in R

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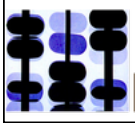
Plan for today

- Coordinate Systems
- Geocoding
- Types of spatial data
- Big data solutions
- Running some code

Materials we will be using

- Code and files in github:
  - https://github.com/YaraRAA/RSpatial
- Map of Canada:
  - https://www12.statcan.gc.ca/census-recensement/2011/geo/bound-limit/bound-limit-2011-eng.cfm



Locating a point on earth

- I need:
  - Longitude (x coordinate)
  - Latitude (y coordinate)
  - Elevation (sometimes provided = z coordinate)

Units	
Minutes and seconds (up to 60)	Decimal degrees
Latitude: 40 degrees, 42 minutes, 51 seconds N	Latitude: 40.714
Longitude: 74 degrees, 0 minutes, 21 seconds W	Longitude: -74.006

Longitude (x coordinates)

range from 180 to -180 degrees

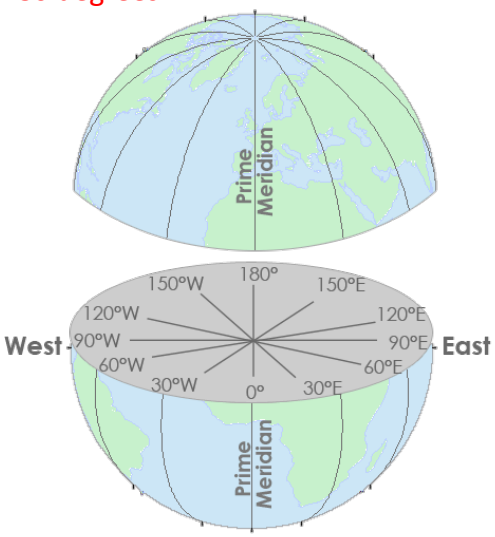


Image source: https://gisgeography.com/latitude-longitude-coordinates/

Latitude (y coordinates)

range from 90 to − 90 degrees

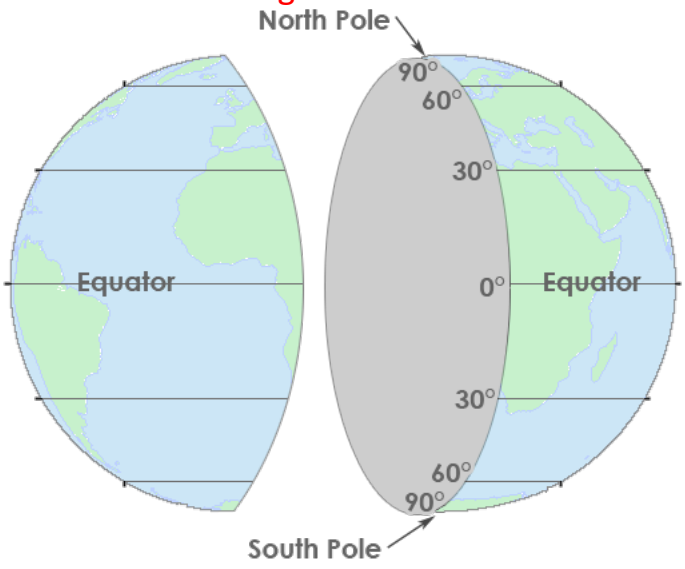


Image source: https://gisgeography.com/latitude-longitude-coordinates/

Geographic coordinate systems

Longitude and Latitude are *Geographic* Coordinate Systems. Two common geographic coordinate systems are: WGS 1984 & NAD 1983

What if you need to calculate distances/ areas?

Need to turn a sphere into a flat surface

Image credit: Julian Pardoe

Projected Coordinate Systems

- Have units: i.e. km, miles
- Examples:
  - Albers Equal Area Conic projection
  - Universal Transverse Mercator

Do your research before picking one as some are made for smaller geographic areas and others for larger regions.

-> Go to R code: Creating_list_of_coordinate_systems.R

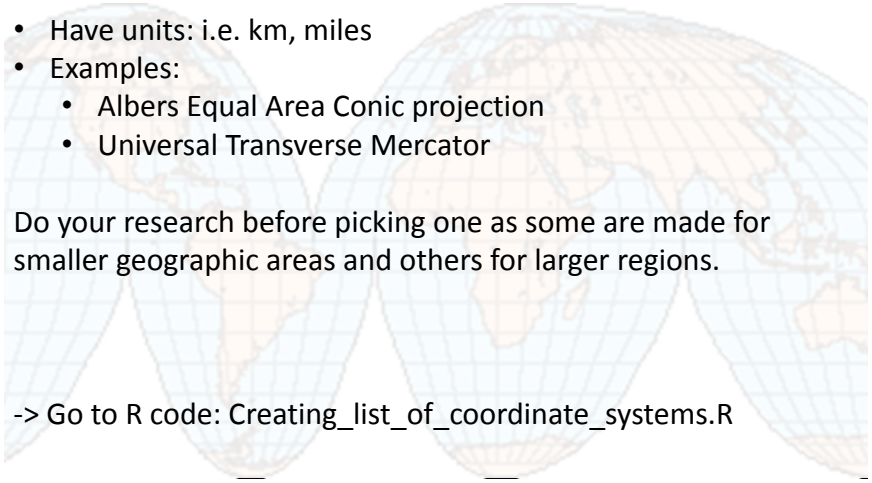
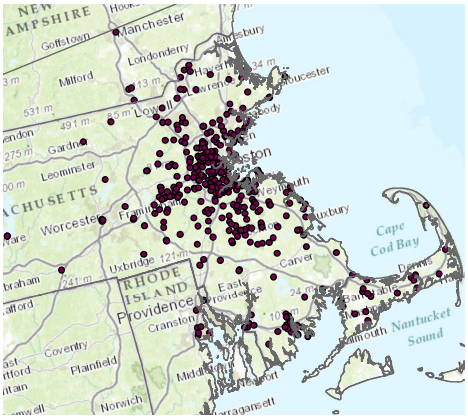


Image source: http://gis.humboldt.edu/OLM/Lessons/GIS/03%20Projections/ProjectionFamilies3.html

Geocoding

- Converting an address to latitude and longitude
- How?
  - Using commercially available software like ArcGIS
  - Python, R, OpenStreetmap, R (ggmap – now requires an API key : https://cloud.google.com/maps-platform/#get-started)
- Today we will be using photon

Types of Spatial Data



- Shapefiles: lines, points and polygons
  - Associated with an attribute table
  - Made up of multiple files
  - Have the .shp extension in ArcGIS

Types of Spatial Data

- Rasters: image with grids

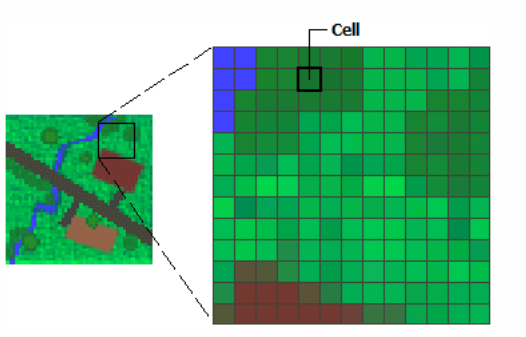


Image source: http://desktop.arcgis.com/en/arcmap/10.3/manage-data/raster-and-images/what-is-raster-data.htm

Example of a big data solution in R

- 1.5 million addresses in MA, USA
- Split into 2000 chunks
- Code run on Cluster
- Run example in R

On to Current R Example

- Script: RSpatial_code.R