

# **Georeferencing with QGIS**

**Susan Powell, GIS & Map Librarian**

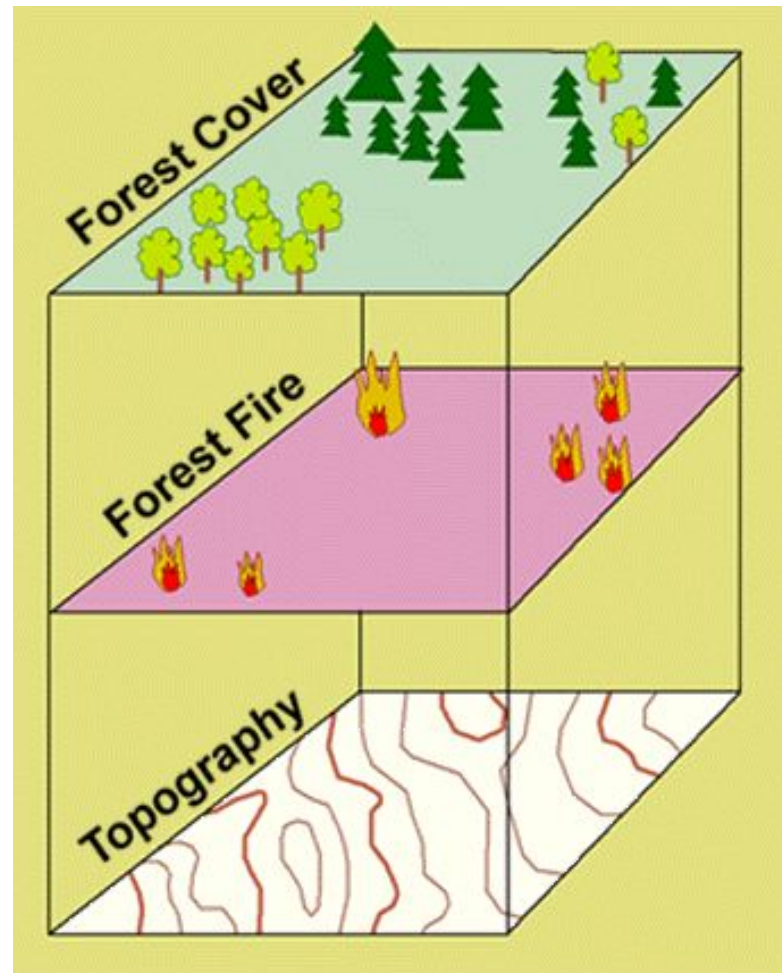
# Road “map”

- Introduction to geospatial concepts
- Theory of georeferencing
- Sources for data
- Ready, set, georeference!

# Introduction

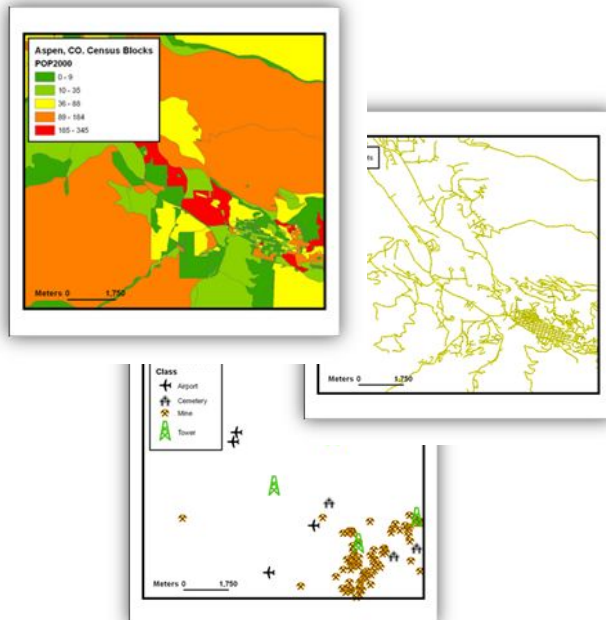
What is GIS?

**G**eographic  
**I**nformation  
**S**ystem/Science

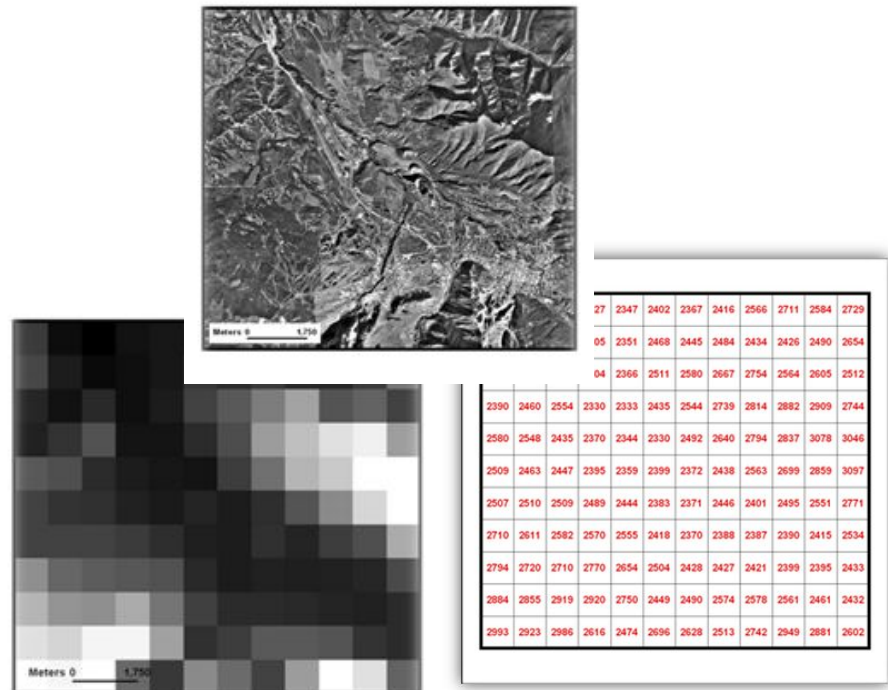


# Types of data

## VECTOR

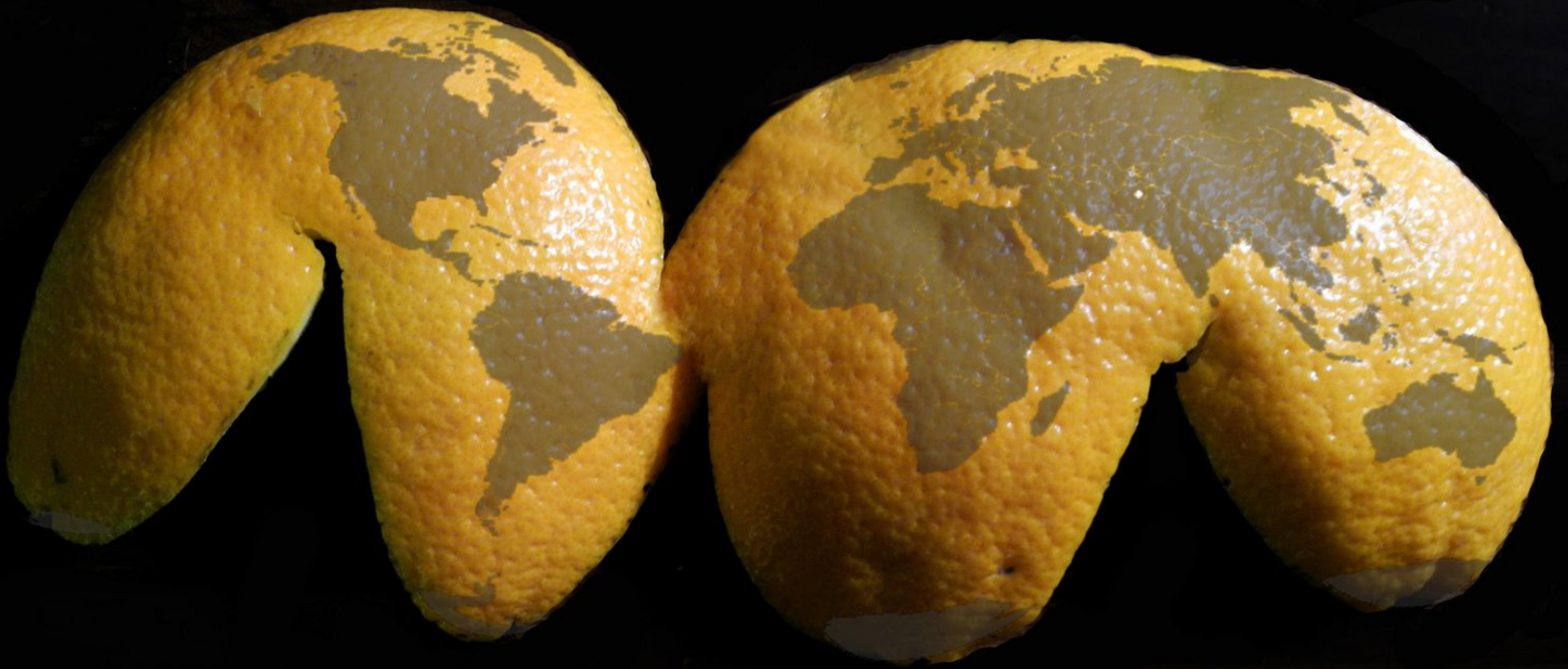


## RASTER



# Spatial reference system

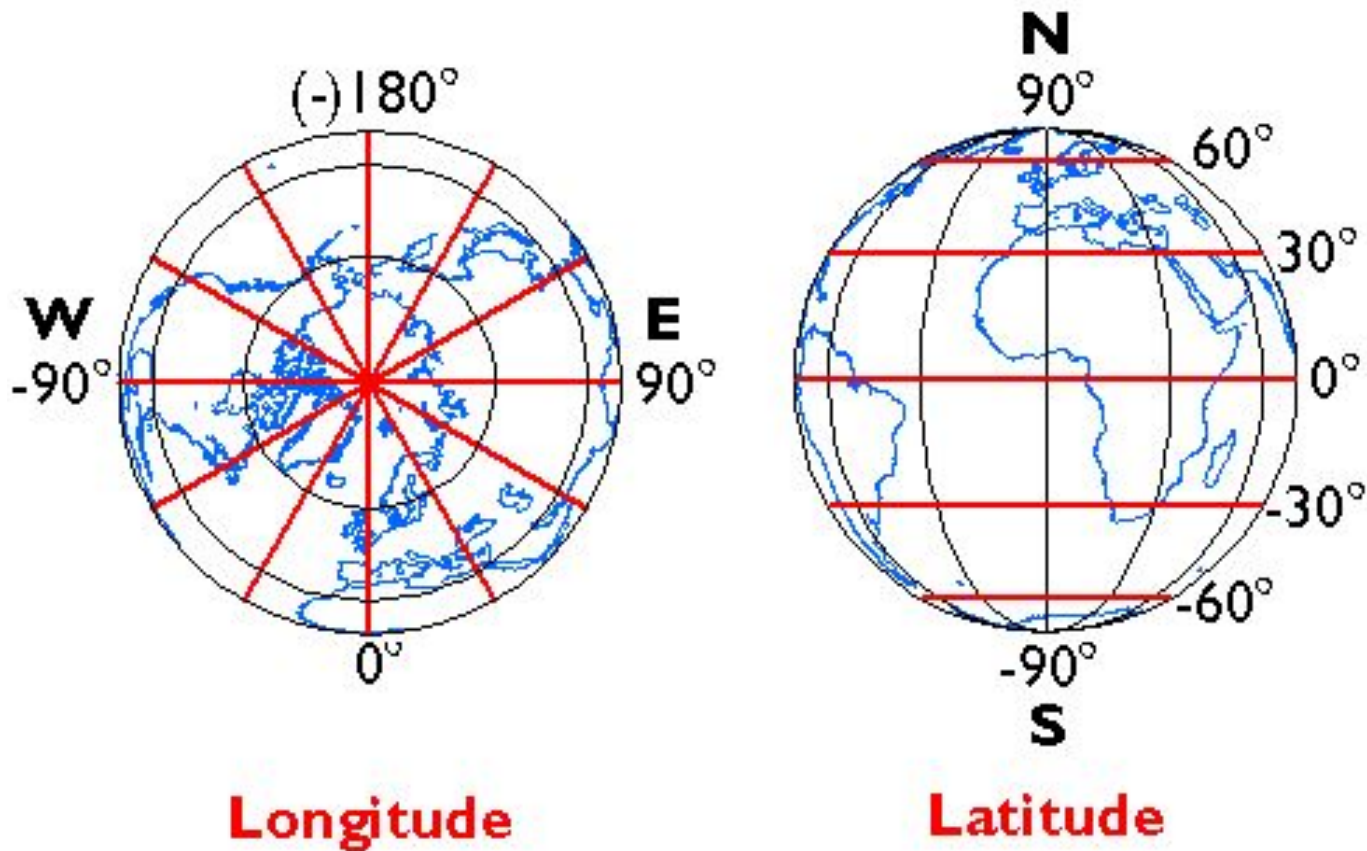
ORANGE PEEL CONTINENTAL GOODE HOMOLOGINE



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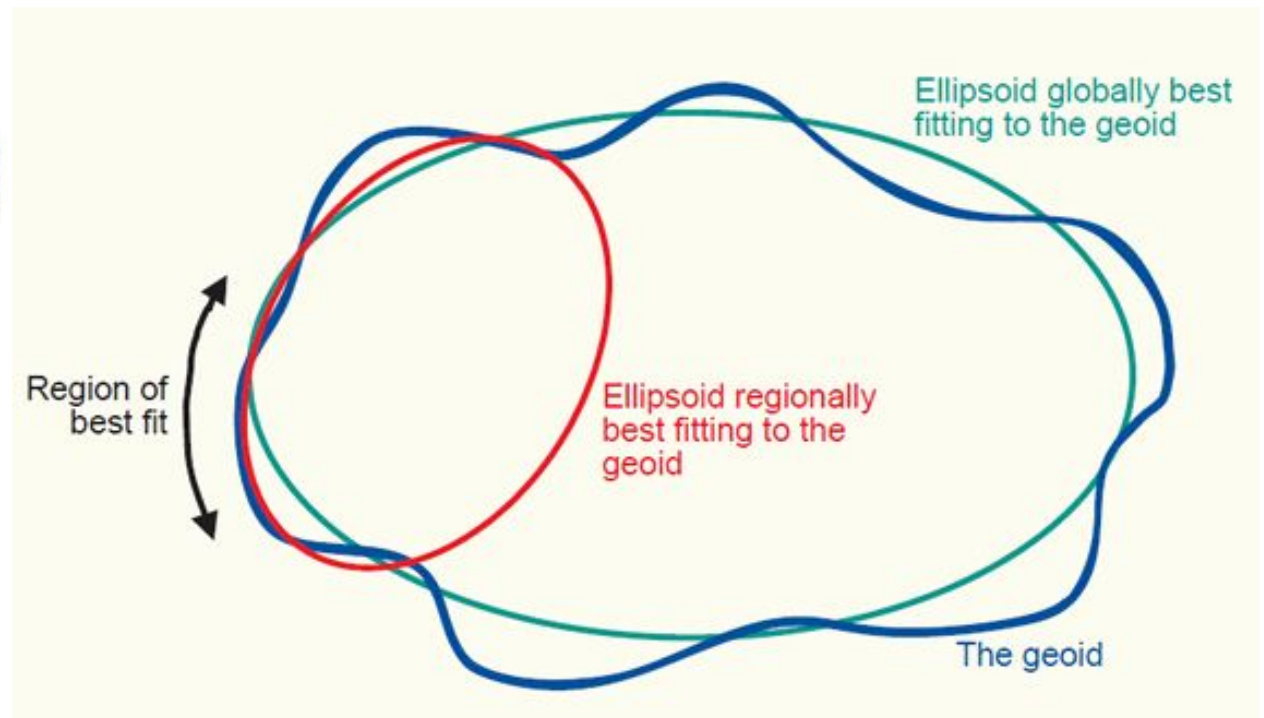
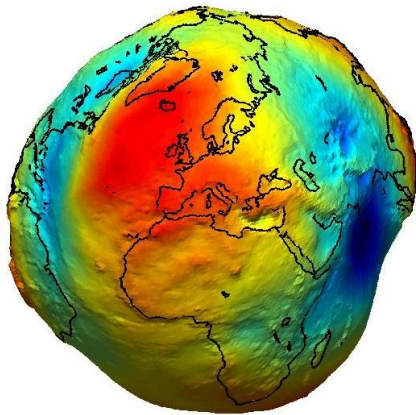
2012.05.15

# Geographic coordinate systems

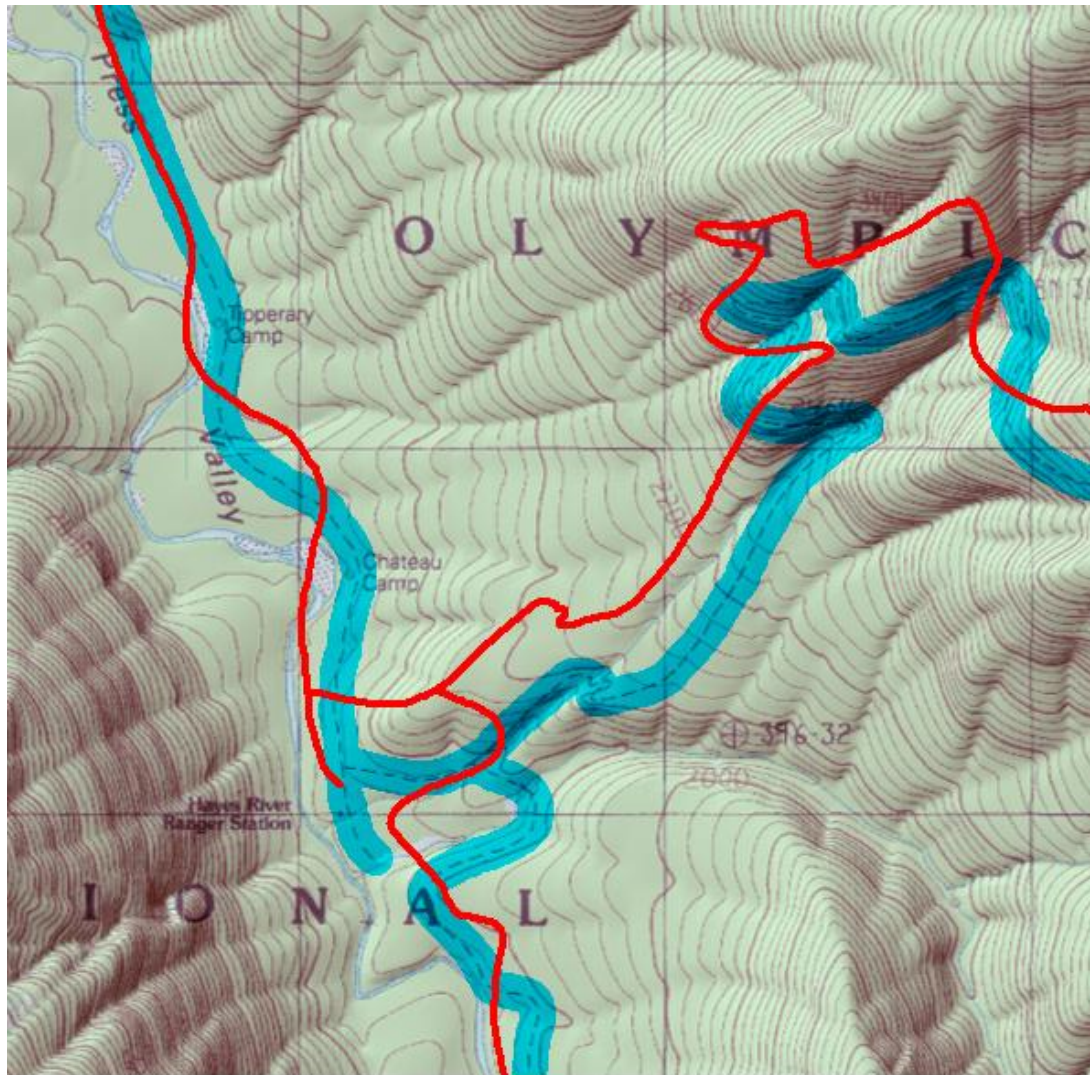




# Geographic coordinate systems



geoids, ellipsoids, & datums, oh my!

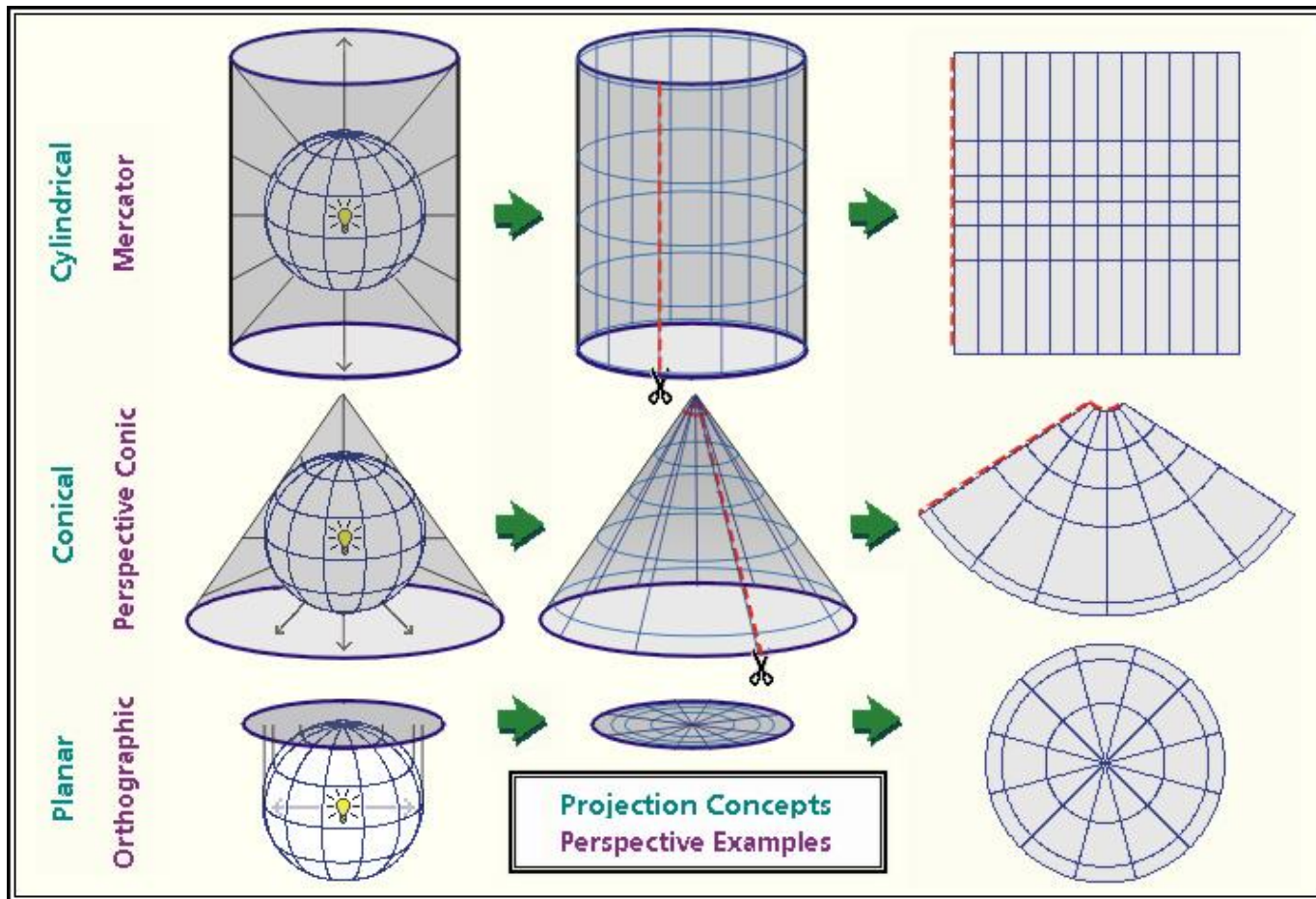


Offset of WGS84 (red line) on a NAD27 map

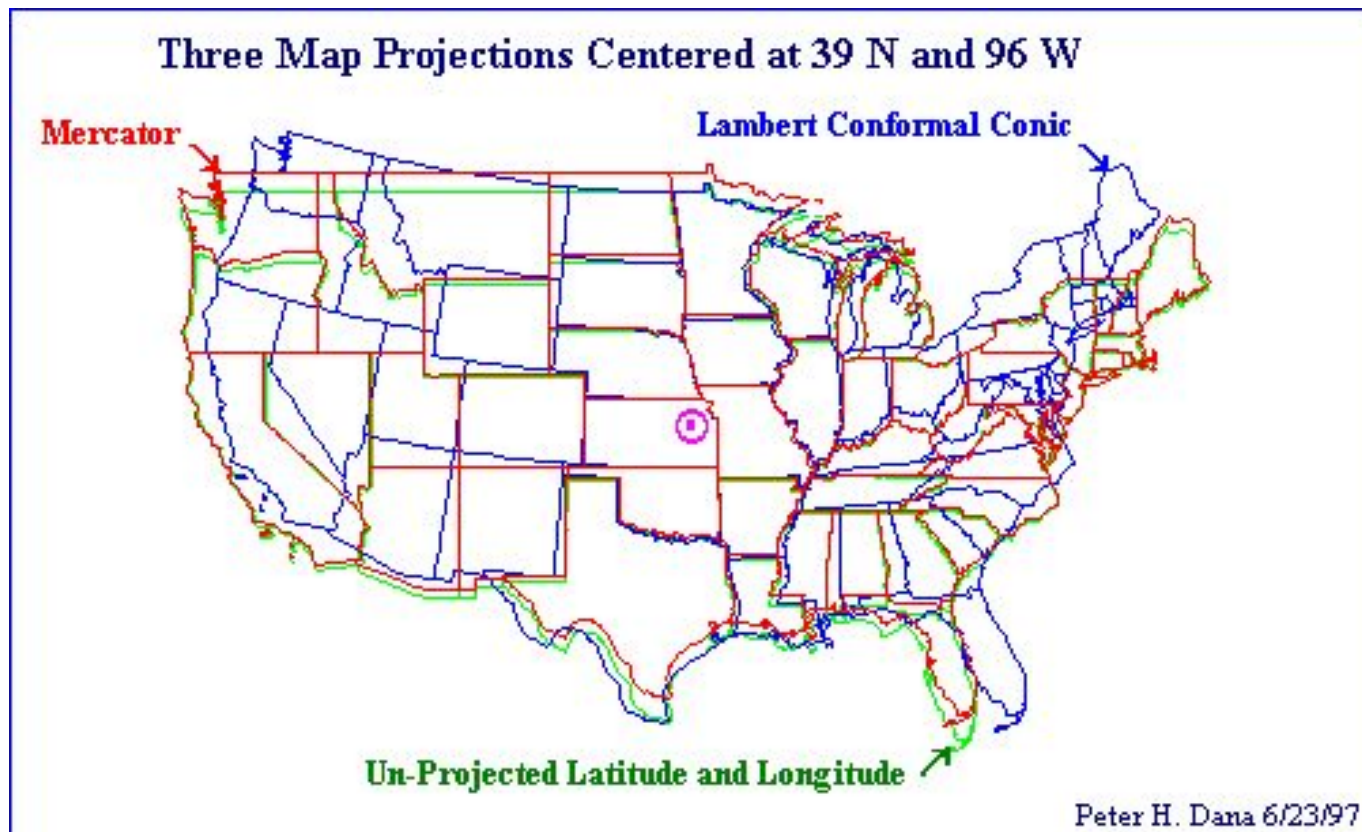
## Datum errors



# Projected coordinate systems



# Projected coordinate systems



# Geo-referencing



# Fun examples

[Photogrammar](#)

[Atlas of the Historical Geography of the US](#)

[T-RACES](#)

[HistoryPin PPIE](#)



# Essential components

- GIS software program
- Spatial reference system
- Un-referenced map or image
- Reference layer (or control points)



# Sources for Scanned Maps

- David Rumsey (~48,000 maps)
  - <http://www.davidrumsey.com/>
- NYPL Map Warper (~20,000 out of copyright)
  - <http://maps.nypl.org/warper/>
- Hipkiss' Scanned Old Maps (from books)
  - <http://www.hipkiss.org/data/maps.html>
- Old Maps Online (search across collections)
  - <http://www.oldmapsonline.org/>

# Basic steps

1. Identify geospatial reference system of map
2. Load un-referenced map and reference layer
3. Create ground control points (GCPs)
  - a. Drop point on map
  - b. Drop corresponding point on reference layer or enter map coordinates
4. Choose output options

## Crop non-spatial parts of scanned map



# Considerations

Choice of  
reference layer

USA Railroads



OPEN ▼

# Sources for Reference Layers

- GeoData@Berkeley
  - <http://gis.lib.berkeley.edu/>
- National Map Viewer
  - <http://nationalmap.gov/viewer.html>
- Natural Earth
  - <http://www.naturalearthdata.com/>

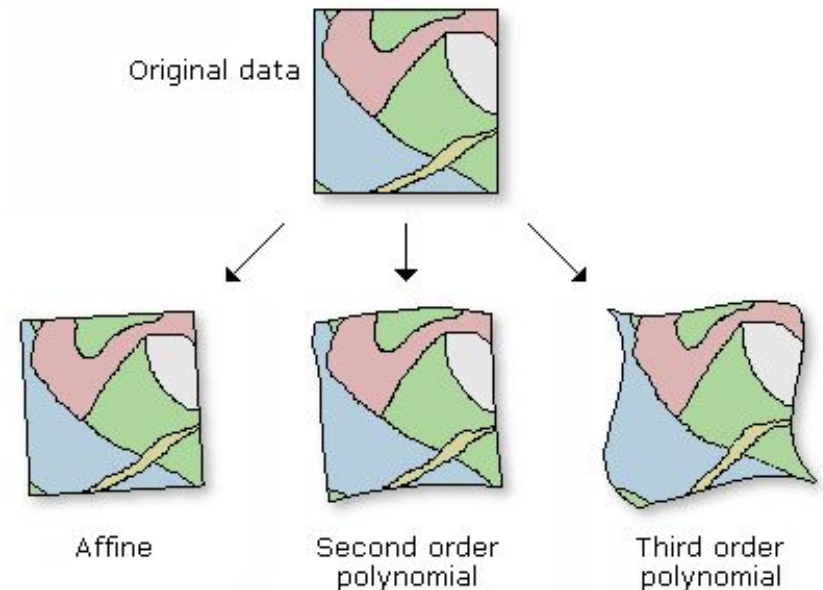


# Placement of GCPs

- Look for stable, identifiable landmarks
  - Road intersections, property boundaries, buildings  
(depending on scale)
- Aim for equal distribution
- Use trial and error

# Transformation types

- Polynomials
  - 1st-order (Affine):  
Stretch, scale, rotate
  - 2nd-order: Some global curvature
  - 3rd-order: Local warping, more distortion
- Spline: Privileges absoluteness of GCPs
- Linear: Simple, does not transform file itself



# Re-sampling methods

- Nearest Neighbor
  - For discrete data
- Bilinear Interpolation
  - For continuous data, smoothing effect
- Cubic Convolution
  - For continuous data, sharpening effect

# Ready, Set, Georeference!

## *Review...*

1. Identify geospatial reference system
2. Load un-referenced map and reference layer
3. Create ground control points (GCPs)
  - a. Drop point on map
  - b. Drop corresponding point on reference layer or enter map coordinates
4. Choose output options

# Ready, Set, Georeference!

*Do More!*

*Publish your map online.*

*Digitize features.*



# Ready, Set, Georeference!

Download materials for  
“Georeferencing with QGIS” from:

[guides.lib.berkeley.edu/gis/training](https://guides.lib.berkeley.edu/gis/training)