Geographic Information (Systems/Science)
The **first law of geography** according to Waldo Tobler:

"Everything is related to everything else, but near things are more related than distant things."

What is GIS?

Spatial representation and analysis of information (attribute data) that is positioned to correspond to the same X, Y coordinates throughout the various map layers.

Image from the US Geological Survey
Who is using GIS?

Biology, ecology, environmental sciences, forest science, geology, classics, engineering, history, archeology, anthropology, literature, political science, business, economics, public health, medicine, education, public administration, geography, agriculture, urban planning, atmospheric sciences, library and information science, journalism, veterinary medicine, social work...
Vector Data

Points, lines and polygons where position is relative to X, Y coordinate plane and intersects are possible.

Image from National Geospatial Data Agency
Vector Data: Elevation Data

Lines are fixed distance apart

Closer lines are steeper slopes

Raster Data

Pixels in a continuous string where each pixel represents actual raw data.

Image from School of Ocean and Earth Science and Technology, University of Hawaii
Raster Data: Satellite Imagery

The resolution is 30 x 30 meters for each pixel containing raw Data.

Landsat 7 image of Chicago, IL acquired on October 19, 2000
Latitude and longitude of known points can be used to rectify historical imagery with other geographic data.
Collect Your Own Data

- Geographic Positioning System (GPS)
- Address Geocoding
Joining Raster and Vector Layers
Joining Raster and Vector Layers

Added layers: roads, transportation, and buildings
Sante Fe, New Mexico in 3D with the use of a satellite image and digital elevation model (DEM)

NASA Landsat 7 perspective image of Santa Fe, NM, acquired October 14, 1999
## Attribute Data

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<tr>
<td>Etc</td>
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Some Data Formats

• .shp: ArcGIS shapefile (vector data)
• .jpg, .gif, .tiff: images (raster data)
• .dbf: database file (attribute data)
• .kml: Google Earth shapefiles (vector data)
GIS Software

• ArcGIS
• MapInfo
• GRASS
• QGIS
• Google Earth
Some GIS Data Resources

• UIUC Library Numeric and Spatial Data Services (Scholarly Commons)
  http://www.library.illinois.edu/sc/datagis/

• National Atlas http://nationalatlas.gov/pros.html

• ArcGIS Resource Center: World
  http://resources.arcgis.com/content/data-maps/10.0/world

• State of Illinois Data Portal
  https://data.illinois.gov/
Projections, Coordinates and Metadata

Projections allow spherical surface to be represented in planar format.

Coordinates are not the same from one projection to the next.

Conversions between projections allow datasets to be used together.

Metadata for the datasets will describe projections and more.

Projection image from Rice University.
Why are projections important?

Three Map Projections Centered at 39 N and 96 W

Mercator

Lambert Conformal Conic

Un-Projected Latitude and Longitude

Peter H. Dana 6/23/97
Introductory Classes and Workshops

- ATLAS: Getting Started with ArcGIS (Gives general overview of operating ArcGIS).
- ESRI Development Center: three advanced workshops about spatial analysis.
- Geography 379: Intro to GIS (thorough overview of GIS including use of ArcGIS, raster, vector, geodatabases, geocoding, statistical & spatial analysis, and modeling).
- Geography 476: Applied GIS to Environmental Studies.
- LIS 490GIG: Geographic Information Systems.
Where to get help at UIUC

• Data Services @ The University Library: consultations 2-5 M-F; also by appointment. [http://www.library.illinois.edu/sc/datagis](http://www.library.illinois.edu/sc/datagis)

• Map Library: Data sets, GIS reference, books and journals, aerial photos, paper maps. [www.library.illinois.edu/max](http://www.library.illinois.edu/max)

• ATLAS: Supports LAS research, classes in GIS & statistical software, and data sources. [www.atlas.illinois.edu](http://www.atlas.illinois.edu)

• ESRI Development Center: advanced training in using ArcGIS for spatial analysis. [http://www.inrs.illinois.edu/edc/](http://www.inrs.illinois.edu/edc/)
Online Mapping Examples

• National Atlas [http://nationalatlas.gov/mapmaker](http://nationalatlas.gov/mapmaker)
• AfricaMap [http://cga-5.hmdc.harvard.edu/africamap/](http://cga-5.hmdc.harvard.edu/africamap/)
Make a Map

• SimplyMap: From Library homepage, click on “Online Journals and Databases” and search for “simplymap”. Find median number of vehicles per household in 2010 by county for Illinois.

• National Atlas: www.nationalatlas.gov. Click on MapMaker. Find precipitation and tornadoes by county for the U.S.
Thank you!

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Please feel free to contact me for further assistance.