On-line GIS Data Sources

RLIS & CCGIS (`I:\Students\data\GIS`)

http://web.pdx.edu/~jduh/gis_datalinks.php

Basic GIS Concepts

GIS and GISci

- Geography
- Information systems/science

Geography

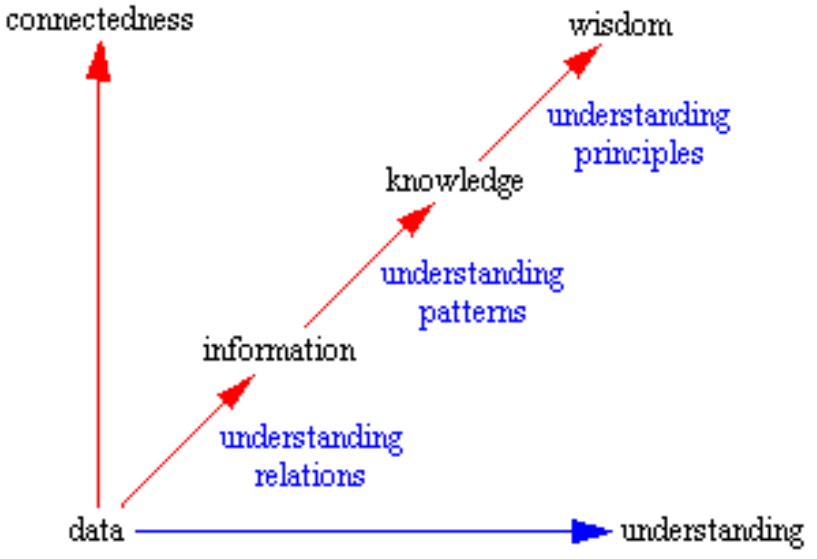
Geography - the studies of spatial (geographical):

- Components (heterogeneity)
- Relationships (structures / interaction / dependence / spatial autocorrelation)
- Process
- Long-term welfare (sustainability) of human society

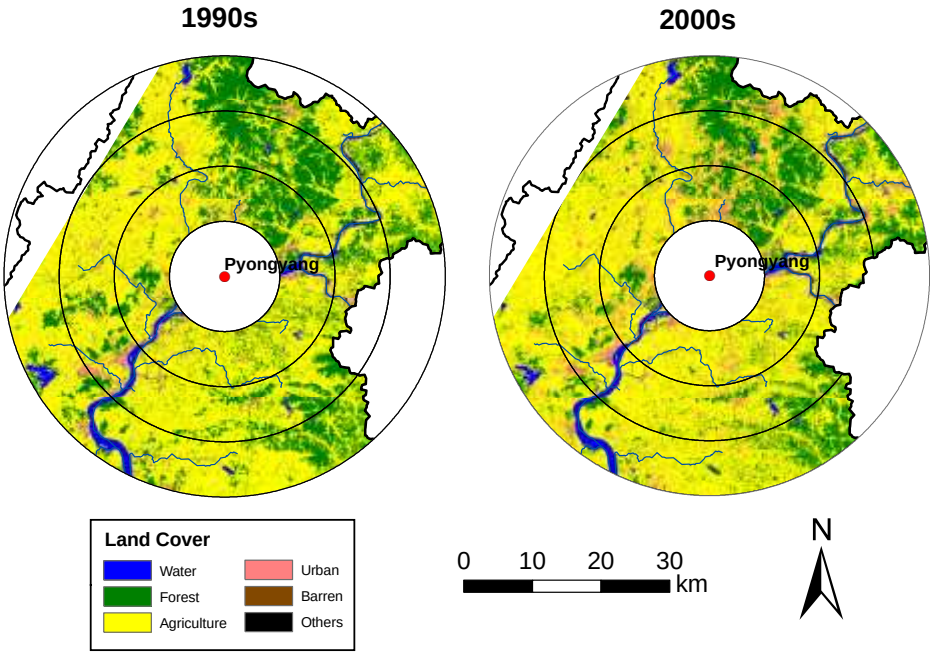
Purposes of applying geographic knowledge

- Generating new knowledge
- Solving problems

GIS – A powerful tool for geographic applications



Russell Ackoff's DIKW hierarchy
Source: http://www.systems-thinking.org/dikw/dikw.htm



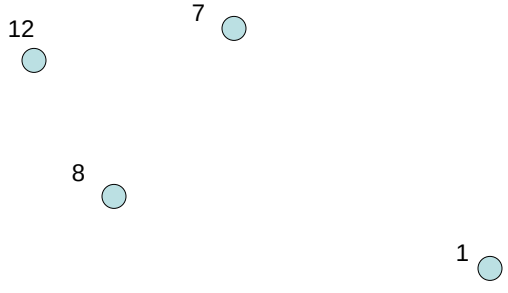
GIS Applications

Use of analytical GIS tools to:

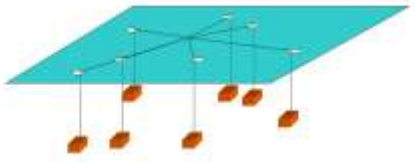
- Describe
- Explain
- Predict
- Support decision-making

Descriptions

- Qualitative descriptors: Topological relationships (within, contain, overlap)
- 1-Point: mean, scatterplots, histograms
- 2-Point: centroid (center of mass), point of minimum aggregate travel (MAT), dispersion, Moran's I, semivariogram
- Multi-Point: shape, size, patch fragmentation



- Point of minimum aggregate travel (MAT)
- Varignon (more in week 8)



1-median problem

Explanation

- Queries and visualization
- Data transformation
  - Buffering
  - Point in polygon
  - Overlay
- Exploratory data mining
- Spatial inference/modeling

Prediction

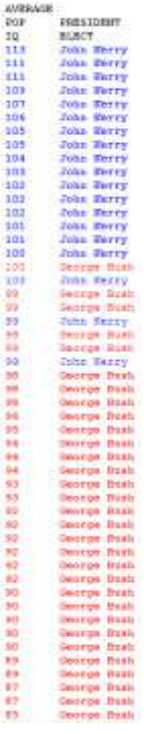
- Spatial interpolation (Week 7)
  - Inverse distance weighting
  - Kriging
  - Density estimation
- Spatial modeling
  - Spatial regression models (Week 5)
  - Spatial process models
  - Agent-based models (Week 7)

Spatial Decision Support

- Map communication
- Spatial data integration
- Location-allocation
- Optimization
- Routing (shortest path, TSP)

Limitation/Consideration

- Spatial heterogeneity
- Spatial autocorrelation
- Ecological fallacy
- MAUP – Scale and zonal effects
- Uncertainty and error
  - Conception
  - Measurement and representation
  - Analysis



AVERAGE IQ	PRESIDENT ELECT
113	John Kerry
111	John Kerry
111	John Kerry
109	John Kerry
107	John Kerry
106	John Kerry
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103	John Kerry
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87	George Bush
85	George Bush

Average IQ & Candidate Preference in 2004 Election

Ecological Fallacy

- Inferring individual characteristics from aggregate population data.

GIS and GISci

– Geography

– **Information systems/science**

Information Systems / Science

- Hardware/Software
- Software
  - (G)UI, Tools, DBMS, Data
- GIS data models and Database Management Systems (DBMS)
  - CAD, graphical, image
  - Raster
  - Vector

Vector Data Model

- Point, polyline, polygon
- Topology
- Network
- TIN (Terrain)
- Object data model

GIS Data Structure

- Geometry & attributes
- ArcInfo: Coverages + Info tables
- ArcView: Shapefiles + dbf tables
- ArcGIS: Geodatabase
  - Feature, feature class, feature dataset

GIS Data Automation

- Remote sensing / photogrammetry
- Survey / COGO
- Geocoding
- GPS
- Scanner
- Manual digitizing

Pay Attention to Data!!!

Levels of Measurement

Level	***Examples***	***Considerations***
Nominal	•Land-cover types •Names of cities •FIPS code of census units	•Use only categorical symb
Ordinal	•Flat, Medium, Steep •Neutral, agree, strongly agree	•Use categorical or quantities symb
Interval	•Calendar Years •Time tags •Temperature in degree-C	•Arbitrary zero •Use only quantities symb
Ratio	•Time lapses •Distance •Energy	•True zero •Use only quantities symb
Derived	•Per capita income •Population density	•Based on ratio •Limited in transformation

Guidelines for GIS Projects

- Creating 1st-hand data is expensive (use existing data when possible)
- Conform project data (projected coordinate systems, attribute data type, file structure, file naming convention)
- Check the output of each geoprocessing step
- Keep a backup copy of your data
- Check hardware's capacity (disk space, R/W access privilege, network bandwidth,…)
- Know the software limitations/features (no space for in your file path and file name, 2GB size limit for personal GDB, info goes with coverage, layer files vs feature classes, file lock, …)
- Know that software can never be bug-free (so what?)
- Be resourceful in solving problems (online help, user forum, your peers…)
- Know when to ask for help
- Learn new things on your own
- …

ArcGIS Dos and Don’ts

Purpose	Dos	Don’ts
Cartographic	• Use layer file to manage symbology • Use mxd to save map layouts • Maintain a well-structured data folder	• Move your data around regularly
Analytical	• Convert data to the same coordinate system	• Use layer files • Rely on mxd to manage your data • Use space in your folder names