INTRODUCTION TO GIS FOR SOCIAL SCIENCE

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OUTLINE

1. Introduction
2. Data Sources
3. Basics of GIS
4. How to Bring the Data into GIS
5. Intro to Spatial Analysis
6. Resources to Follow-up

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INTRODUCTION

- **Background**
- **Goal**
  1. Explain how place and space are important and can be analyzed with GIS in social science.
  2. Find and download appropriate census data for use.
  3. Analyze the patterns of features and predict future conditions.
- **Workshop Evaluation:**

http://maps.lib.purdue.edu/workshop/

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INTRODUCTION

- **What is GIS?**
  - **"G": Where**
    - Information about people and places is location based. Street address, zip or area code, census block, x,y coordinates, latitude and longitude, etc.
  - **"I": What**
    - Data from survey, interview, observation, existing database, in different format.
    - Extending the "I": Allows the incorporation of video, audio, photos and text.
  - **Another Component: When**
    - Time animation
    - Spatial Temporal analysis
  - **"S": System**
    - Hardware, software, data model

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INTRODUCTION

- **Why GIS in social science:**
  Allows for the integration and comparison of contextual data from social as well as environmental or physical standpoint.
  Researchers need to identify where the differences, similarities, correlations, and interactions exist. GIS can accommodate both qualitative and quantitative variables into a study.
- **What can GIS do for your research?**
  - Visualization: https://www.lib.umn.edu/apps/campushistory/
  - Pattern Analysis:
  - Spatial Relationships:
  - Others:
- **Examples:**
  ArtI@s project, **ISEE project**,

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The London Cholera Epidemic, 1854

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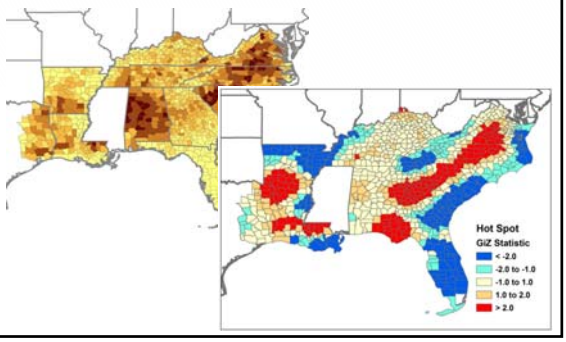
❖Percentage of plot in the county with invasive plants



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OTHER DATA SOURCES

- **Data collected in the field.**
  - Smart phones, GPS devices.
- **Base maps of study area.**
  - Library map collection.
  - Public domain maps.
  - Hard copy maps.
- **Anything else.**
  - Place names.
  - Crowd sourcing.

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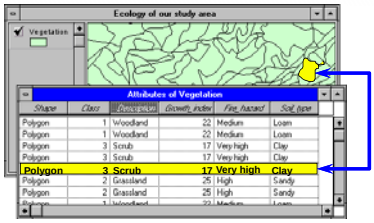
BASICS OF GIS

GIS stores information about the world as a collection of thematic layers that can be linked together by geography.

Map + Information



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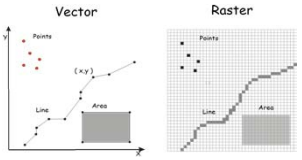
BASICS OF GIS

Two fundamental types of data

- **Vector**
  - A series of x,y coordinates
  - For discrete data represented as points, lines, polygons
- **Raster**
  - Grid and cells
  - For continuous data such as elevation, slope, surfaces



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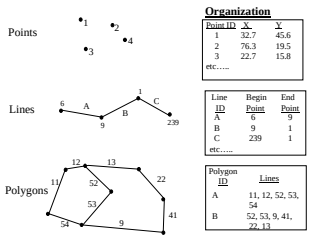
BASICS OF GIS

Vector data model:

Best for representing discrete objects with defined shapes and boundaries.



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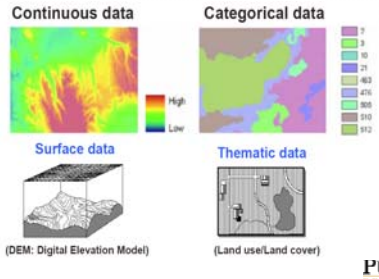
BASICS OF GIS

Raster data model:



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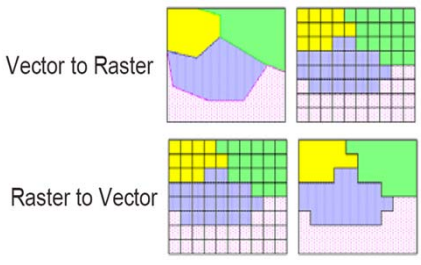
BASICS OF GIS

Vector and Raster Conversion



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BASICS OF GIS

Common GIS file format:

- **Vector:**
  - ESRI Shapefiles (*.shp, *.dbf, *.prj, *.sbn, *.sbx, *.shp.xml).
  - Geodatabase (feature class).
  - Kml (kmz) file.
  - Spread sheet with lat/long.
- **Raster:**
  - Geotiff, geodatabase, mosaic dataset, dem, etc.

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BASICS OF GIS

Popular software:

- **ArcGIS (ESRI Inc.):**
  - ArcMap Desktop application
  - ArcGIS Online
  - ArcGIS for Office
- **QGIS:**
- **Google Earth:**
- **Web GIS:**
  - ArcGIS Server.
  - Google map API.
  - Open Layers.
  - Leaflet.
  - GeoCommons.

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BASICS OF GIS

Basic functions in GIS:

- Open a map
- Add layers
- Attribute table
- Map customization (symbology)
- Selection
- Edit data
- Make a map

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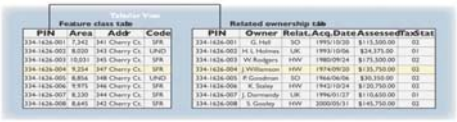
BRING YOUR DATA INTO GIS

Spatial vs. Non-Spatial Data

The connection between spatial and non-spatial data are made through database tables



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BRING YOUR DATA INTO GIS

Tables:

Descriptive information about features

Each feature class has an associated table

One row for each geographic feature

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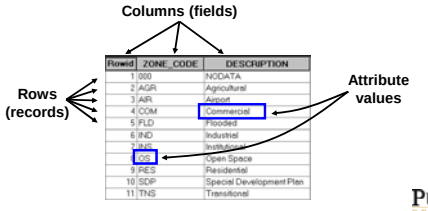
BRING YOUR DATA INTO GIS

Basic table properties:

- Records/rows and fields/columns
- Column types can store numbers, text, dates
- Unique column names



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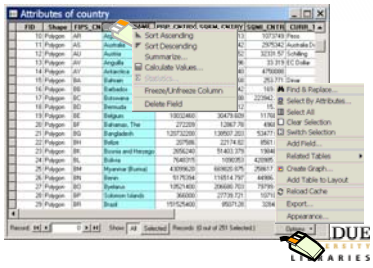
BRING YOUR DATA INTO GIS

Table Manipulation:

- ❑ Sort ascending or descending
- ❑ Freeze/unfreeze columns
- ❑ Statistics
- ❑ Select records
- ❑ Add field
- ❑ Modify table values



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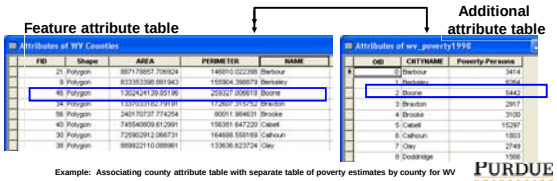
Associate Tables:

Associate tables with common column key values

- Must be same data field types

Must know table relationships (cardinality)



Example: Associating county attribute table with separate table of poverty estimates by county for WV

TABLE RELATIONSHIPS

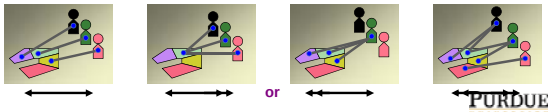
How many A objects are related to B objects?

Types of cardinality

- One-to-one, one-to-many or many-to-one, and many-to-many

Must know cardinality before connecting tables

One parcel has one owner	One parcel has many owners	Many parcels have one owner	Many parcels have many owners



JOINS AND RELATES

Two methods to associate tables in ArcMap based on a common field

Join appends the attributes from one onto the other

- Label or symbolize features using joined attributes

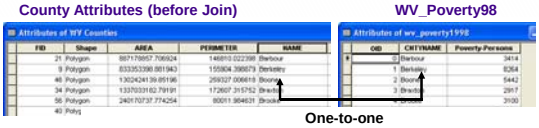
Relate defines a relationship between two tables

CONNECTING TABLES WITH JOINS

Appends the attributes of two tables

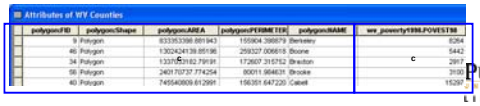
Assumes one-to-one or many-to-one cardinality

County Attributes (before Join) **WV_Poverty98**



One-to-one

County Attributes with joined poverty data (virtual table after Join)



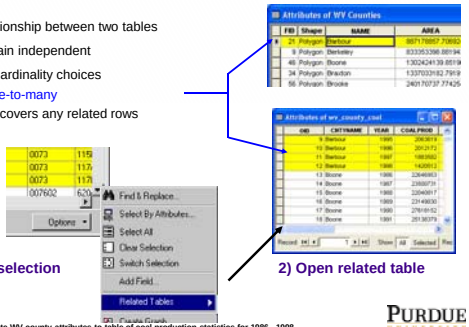
CONNECTING TABLES WITH RELATES

Define relationship between two tables

Tables remain independent

Additional cardinality choices

- One-to-many
- Discovers any related rows



1) Make selection

2) Open related table

Example: Relate WV county attributes to table of coal production statistics for 1986 - 1998

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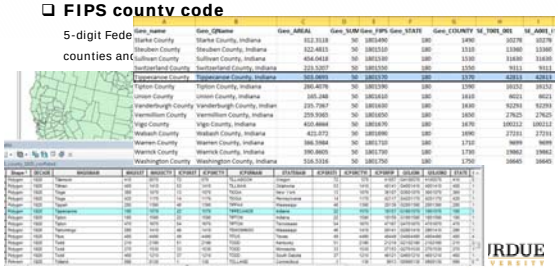
BRING YOUR DATA INTO GIS

Linkages between Census Data and Map

- **FIPS county code**

5-digit Fede
counties an



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BRING YOUR DATA INTO GIS

Other linkages:

- Location Names:
- Unique identifiers:

Point data conversion:

- Geocoding: Convert place names, street addresses into X,Y coordinates on the map.
  - Google Geocoding API.
  - ArcGIS Online geocoding service, including ESRI Office.
  - Self constructed geocoding function.

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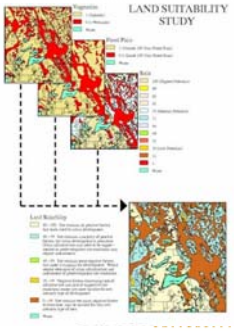
INTRO TO SPATIAL ANALYSIS

1. Spatial Overlay:

Spatial overlay is accomplished by joining and viewing together separate data sets that share all or part of the same area.

The result of this combination is a new data set that identifies the spatial relationships.

Example:
http://geosocialfootprint.com/



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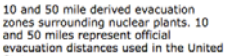
INTRO TO SPATIAL ANALYSIS

2. Buffer analysis: identifying areas surrounding geographic features



10 and 50 mile derived evacuation zones surrounding nuclear plants. 10 and 50 miles represent official evacuation distances used in the United States.

Driving distance buffer:
http://developers.arcgis.com/javascript/samples/fl_selection/

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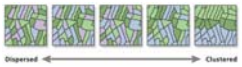
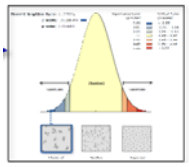
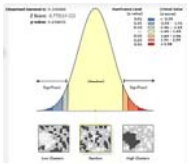
INTRO TO SPATIAL ANALYSIS

3. Analyze patterns: Is there any spatial cluster?





Clustered vs. Dispersed
(Average Nearest Neighbor)



Low cluster vs. High cluster
(High/Low Clustering)

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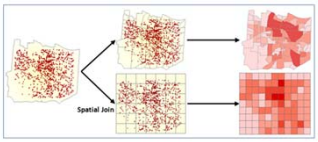
INTRO TO SPATIAL ANALYSIS

4. Mapping Clusters: Where are the clusters?

Hotspot analysis
(Getis-Ord Gi*)

Input fields



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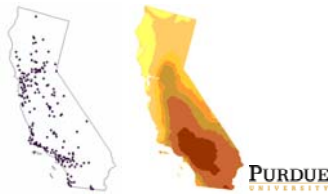
INTRO TO SPATIAL ANALYSIS

5. Spatial Interpolation:

Use those sample points to predict values of variable of interest at all other unsampled locations.

Various interpolation methods

Select the one based on your need



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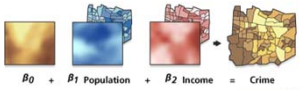
INTRO TO SPATIAL ANALYSIS

6. Spatial Relationship: Geographically Weighted Regression (GWR)

A local form of linear regression used to model spatially varying relationships.



Exploratory Regression

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LEARNING RESOURCES

- **GIS classes offered at Purdue:**
- **ESRI virtual campus classes:**

http://www.esri.com/training/

Contact Nicole Kong (kongn@purdue.edu) for course code.

- **ESRI Live Training Seminars :**
- **Libraries Book Collection:**
- **Library Support:**

geohelp@purdue.edu, or kongn@purdue.edu

- **GIS community at Purdue:**

(https://engineering.purdue.edu/ECN/mailman/listinfo/purduegis)

- **ESRI forum:**

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SOFTWARE RESOURCES

- **ESRI educational license:**

ArcGIS Desktop, all extensions (including spatial analysis, 3D analysis, geostatistics, etc.), ArcGIS Server, ArcSDE database, ArcPad, CityEngine, etc.

- **ESRI free student 1 year license:**

Contact Nicole Kong (kongn@purdue.edu) for license.

- **ArcGIS Online, geocoding, ArcGIS for office:**
- **Free products: QGIS, Google Earth.**
- **Google Earth Pro.**
- **GeoServer.**

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DATA RESOURCES

- **GIS data LibGuide:**
  - Data by Theme
  - Data by State
- **Databases:**
  - SimplyMap
  - Proquest Statistical Dataset
  - Reference USA
- **Geodata Portal:**
  - Geodata @ Purdue (in construction)

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LIBRARY SUPPORT

- **Technical support:**
- **Data access:**
- **Data sharing:**
- **Data collection strategies:**
- **Project planning:**
- **Web GIS and mobile GIS development:**

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- **Workshop Evaluation:**

http://maps.lib.purdue.edu/workshop/

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