Lecture 3a

Database Management and Geodatabases

Lecture 3: Outline

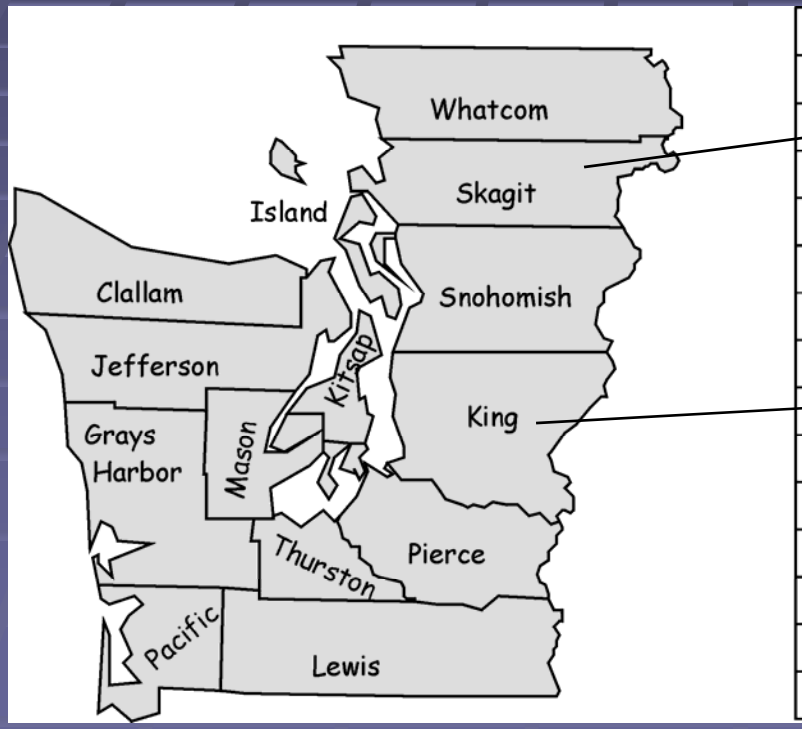
I. Databases
    A. Attribute Data
    B. Types of Databases
        A. Relational vs. Non-Relational
II. Table Relationships
        A. Preparing Tables
        B. Joins and Relates
III. Geodatabases
    A. Types
    B. Structure and Creation
    C. Geodatabase Behavior
        A. Schemas and Domains
        B. Topology
    D. Creating and Editing Data
    E. Geodatabase Annotation

Attribute Data

- Use to capture non-spatial aspects of an entity.
- Most often contained in a table
- Attributes can be categorized as:
  - **Nominal:** Provide descriptive info. Ex. Color, names, types of soil. No implied order, size of quantity.
  - **Ordinal:** Imply rank order or scale. Does not represent differences in scale. Ex. Descriptive (short, medium, long) or numeric (1-100).
  - **Interval/Ratio:** Where both order and absolute differences in magnitude are represented. Ex. Length, weight, height or depth.

I. Database Components

DBMS (Database Management System): A specialized computer program for organizing and manipulating data.



Name	FIPS	Pop90	Area	PopDn
Whatcom	53073	128	2170	59
Skagit	53057	80	1765	45
Clallam	53009	56	1779	32
Snohomish	53061	466	2102	222
Island	53029	60	231	261
Jefferson	53031	20	1773	11
Kitsap	53035	190	391	485
King	53033	1507	2164	696
Mason	53045	38	904	42
Gray Harbor	53027	64	1917	33
Pierce	53053	586	1651	355
Thurston	53067	161	698	231
Pacific	53049	19	945	20
Lewis	53041	59	2479	24

Note: A database is the organized collection of data, often created or manipulated with the help of a DBMS. The terms Database and DBMS should *not* be used interchangeably.

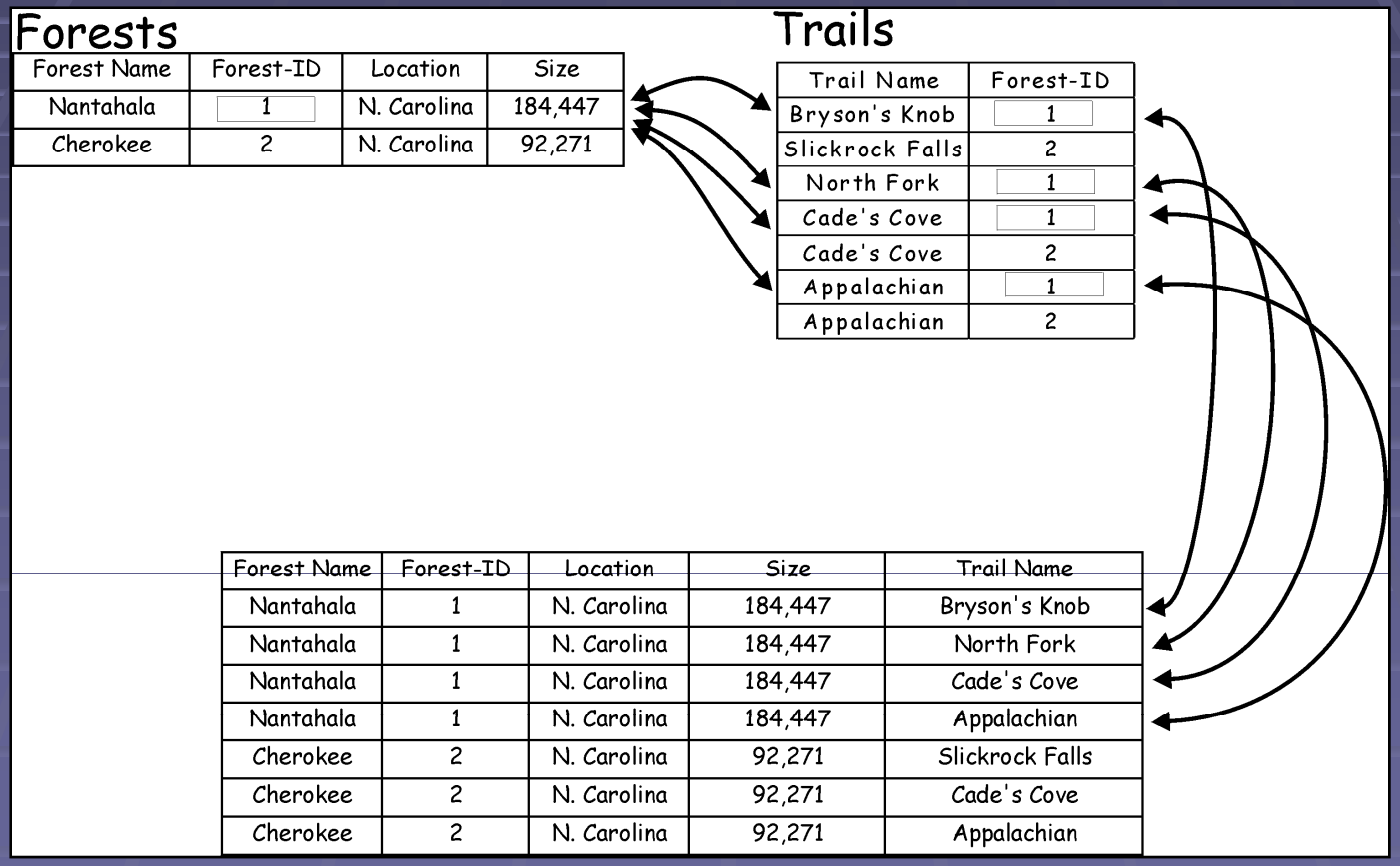
III. Non-Relational Databases
Flat Files

Flat File Structure

Tax No.	Street Address	Subdiv.	Block/Lot	Owner 1	Owner 2	Improved	GC Warbler
234	10 Lone Oak	RobRoy	A/116	Verdi, G.	Rossini, G.	Yes	No
235	12 Lone Oak	RobRoy	A/118	Wagner, R.	Weber, C.	No	Yes
236	101 Madrone	LiveOak	B/14	Hendrix, J.	Morrison, J.	Yes	Yes

All individual property data is in one file. The Tax No. is required to search the database.

IV. Relational Databases



Preparing Tables for ArcGIS

1. In Excel:
   - Prepare your table.
   - Define the data ‘range’ by doing the following….
     - Select all the populated cells in the table
     - Go to Insert → Name → Define…
     - Type a name (i.e. ‘database’).
     - Save Excel file

2a. **Excel 2003** (and older versions):
   - Click File →Save As… provide a name and choose the drop-down arrow next to “Save As Type:”
     - Choose ‘DBF 4 (dBASE IV)’

2b. **Excel 2007**
   - In Excel 2007, save the table as, 'Excel 97-2003 Workbook' (.xls format).
   - Navigate to the .xls table location through ArcCatalog, and expand (double-click) the file to view the worksheets.
   - Right-click on the worksheet representing the table. Select Export > To dBase (single).

http://support.esri.com/index.cfm?fa=knowledgebase.techArticles.articleShow&d=30727

- Using Excel Spreadsheets in ArcGIS:

http://support.esri.com/index.cfm?fa=knowledgebase.techArticles.articleShow&d=31793

Fields

Field Types:

- Make sure you consider the appropriate field type, size and properties in advance. Ex. Text, integer, double…
- Spaces and certain characters are not supported in field names.
- Eliminate anything that is not alphanumeric or an underscore.
- Limit number of characters
  - Features classes < 64 characters
  - .dbf files <10 characters

Field Creation:

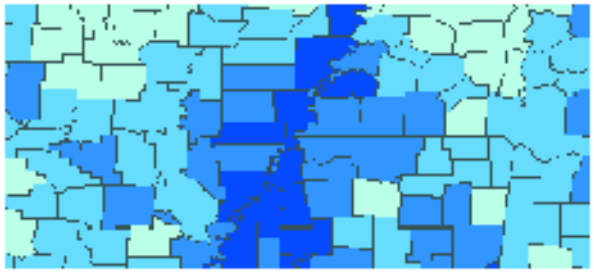
- Make sure you are not editing the data or accessing the data in any other applications.
- In ArcCatalog
  - Right-click on layer and select “Layer Properties”
- In Arcmap
  - *Stop editing*, open the attribute table and go to *Options* → Add Field.

V. Table Relationships

One-to-One Relationship

Shape	FID	County
Polygon	1	Atoka
Polygon	2	Kiowa
Polygon	3	Nowata

County	Rain	Total
Atoka	1.80	10.16
Kiowa	2.34	13.67
Nowata	1.62	11.90



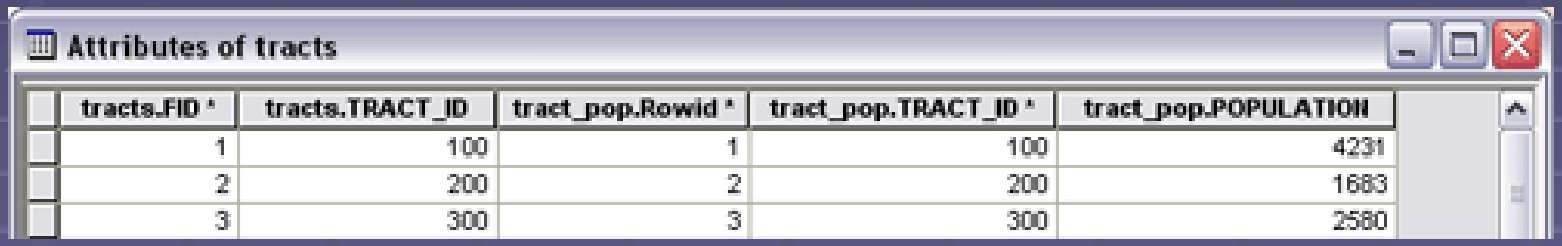
One-to-Many & Many-to-One Relationship

Shape	FID	LU_Code
Polygon	1	2
Polygon	2	1
Polygon	3	1

LU-Code	Description
1	Single Family
2	Agriculture
3	Commercial

V. Joining and Relating Tables

- **Joining Tables:** *Appends* the attributes from one table onto another based on a field (key) common to both.



tracts.FID *	tracts.TRACT_ID	tract_pop.Rowid *	tract_pop.TRACT_ID *	tract_pop.POPULATION
1	100	1	100	4231
2	200	2	200	1683
3	300	3	300	2580

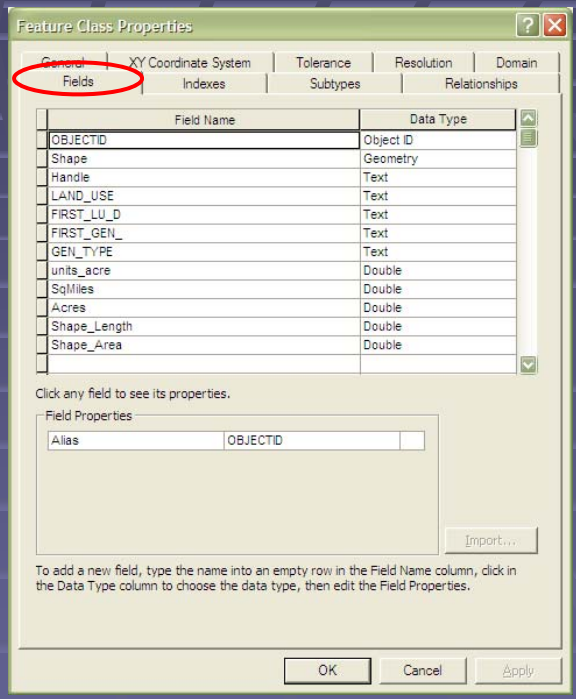
- **Relating Tables:** Defines a relationship between two tables - also based on a common field (key) - but *doesn't append* the attributes of one table to the other. Instead, you can access the related data when necessary.

V. Joining and Relating Tables

- Tables are linked through *Keys*.
- Keys are items or fields that meet certain requirements (data format and length) and are used to index the records.
- Note: Misspelling or spaces in key *values* can create problems with your join or relate process.
  - Ex. Northridge vs Nothridge or NewMexico vs New Mexico.

V. Joining and Relating Tables

- To obtain info about a *key* field, go to *Layer Properties* and click on the **Fields** tab.

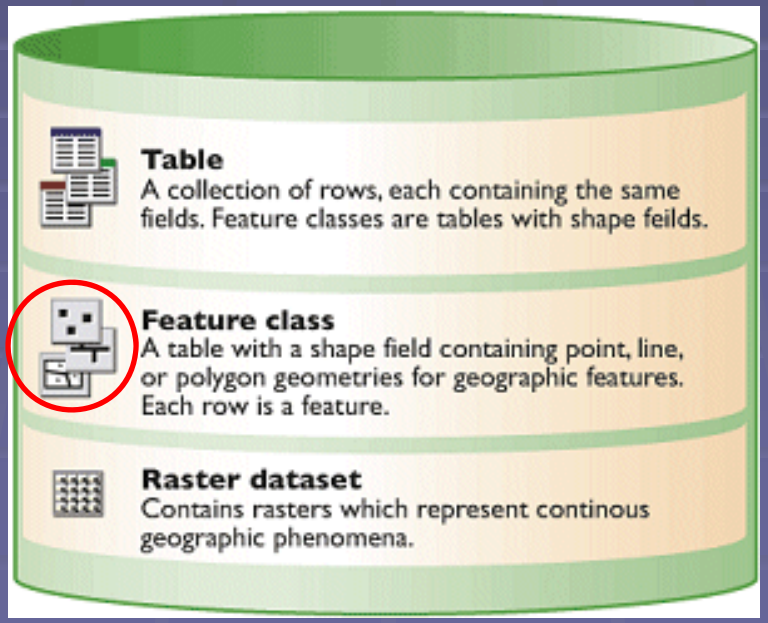


- After joining a table, you can *preserve* the join by right-clicking on the shapefile or feature class and selecting Data…Export Data.

Geodatabases

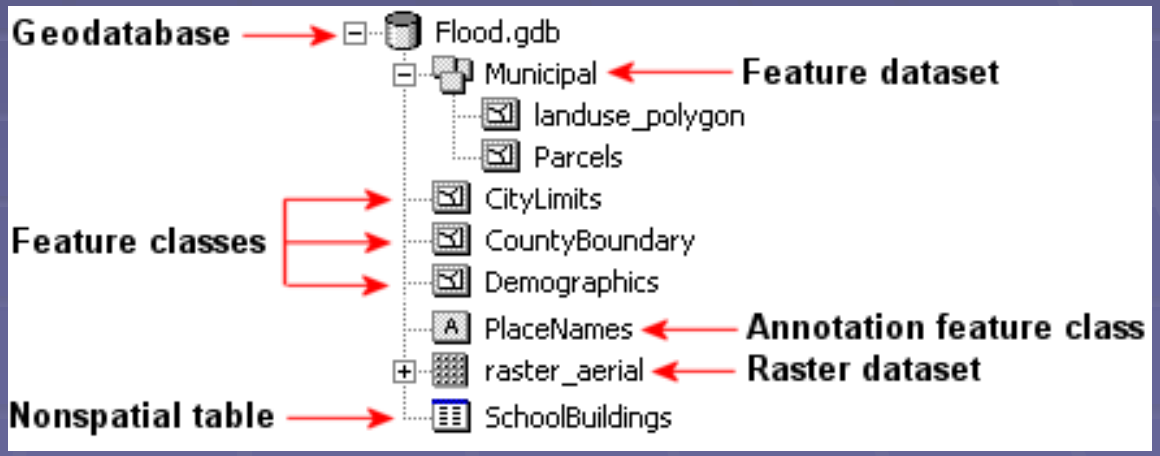
- The geodatabase is a container for storing spatial and attribute data and the relationships that exist among them
- Format introduced by ESRI with ArcGIS® software
- Primary format we will be working with in this class.

Icons identify feature types



Geodatabases and Data Organization

- Geodatabases can consist of:
  - Feature Datasets
  - Feature Classes
  - Annotation Feature Classes
  - Raster Datasets
  - Nonspatial Tables



Types of Geodatabases

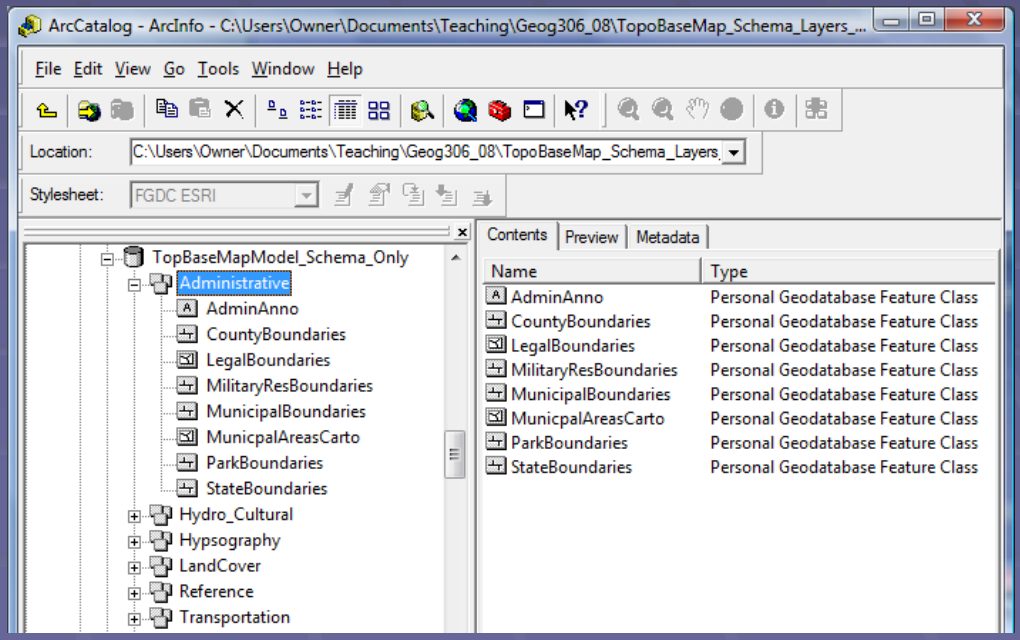
- Scalable Functionality
- 3 Types:
  - **File Geodatabases:** Stored as folders in a file system. Each *dataset* holds up to 1 TB of data. Fast performance, less restrictive editing locks and supported by many platforms.
  - **Personal Geodatabases:** Stored within Microsoft Access. Holds up to 2 GB of data.
  - **ArcSDE Geodatabases:** Stored in a relational database using Oracle, Microsoft SQL Server, IBM DB2, or IBM Informix. Requires the use of ArcSDE software. Unlimited in size and numbers of users.

Creating Geodatabases

- In ArcCatalog:
  - Navigate to the folder you want to create the GDB in.
  - Right click and select New…
  - Select either *File* or *Personal* Geodatabase.
  - Right-click on or in the GDB to create new feature datasets, classes or tables.

Geodatabase Behavior Schemas

- A schema defines the physical structure of the geodatabase along with the rules, relationships, and properties of each dataset in the geodatabase.
- Users often share their schemas with others.
- Data model templates (schemas) exist for many GIS applications. For example, ESRI publishes a series of ArcGIS data models for the user community. See http://support.esri.com/datamodels.



Geodatabase Behavior Domains

- A list or range of valid attributes for an attribute that limits values. Helps to limit user error.
- Range Domains
  - Ex. Pipe diameter (range = 1-5 feet)
- Coded Value Domains
  - Ex. Vegetation Type (Tree, Scrub or Grass).