

GEOGRAPHIC INFORMATION SYSTEMS

4-H Round-Up Community Transitions Workshop

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Goals of the Workshop

- Answer the question: “What is GIS?”
- Uses of GIS.
- Some of the Common Terminology used in GIS.
- Basic Operations and Applications of GIS Software.

What is GIS?

- GIS (geographic information system) is a computer system capable of assembling, storing, manipulating, analyzing, and displaying geographically referenced information, i.e. data identified according to their locations.
- A geographic information system (GIS) integrates computer technologies, people, and detailed information about location that lets you visualize relationships, patterns, and trends in maps for better decisions.

Components of GIS

□ Computer Hardware and Software

- Hardware is the computer on which a GIS operates.
- GIS software (ArcGIS, ArcMap, i.e.) provides functions and tools needed to input and store geographic information and display in the form of maps or reports..

□ Data

- Geographic data, which is comprised of geographic features and their corresponding attribute information, is entered into a GIS using a technique called **digitizing**.
- Digitizing involves digitally encoding geographic features, such as buildings, roads, or county boundaries. The process is done by tracing the location, path or boundary of geographic features either on a computer screen or paper map.

□ People

- The real power of a GIS comes from the people who use them.

Uses of GIS

- ❑ Police use GIS to solve crimes.
- ❑ Emergency 911 operators use GIS to send emergency personnel to a person in distress.
- ❑ Biologists use GIS to protect plant and animal species.
- ❑ Teachers use GIS to teach lessons in geography, history, or engineering.
- ❑ Agriculture engineers use GIS for water conservation and management.
- ❑ Researchers and Economists use GIS to display food availability by service type (fast food, convenience stores, grocery stores) and the correlation to poverty level.

Industries Using GIS

- ❑ Archeology
- ❑ Geography
- ❑ Land Surveying
- ❑ Environmental and Natural Resource Engineers
- ❑ Health
- ❑ Real Estate Professionals
- ❑ Transportation
- ❑ Agriculture
- ❑ Urban Planning and Market Developers
- ❑ Emergency Management and Response Organizations
- ❑ Local, State and Federal Government
- ❑ Others

GIS Composition and Terminology

- ArcGIS is a suite that contains many applications. For instance, ArcScene, allows you to view GIS data in three dimensions by reading height information from feature geometry, feature attributes, layer properties, or a defined 3D surface. ArcPad can be used on handheld GPS devices. For this workshop, we are going to be discussing the two most commonly used ArcGIS applications - ArcMap, and ArcCatalog.
- GIS maps are the composition of data about particular kinds of geographic features, and other information, such as tables, legends, charts, and scales. For example you may want to create a map to show U.S. House election returns, whereby you might want different layers for states and Congressional districts.
- Layers are where data about geographic features are contained (i.e. states, districts, cities, rivers, roads, etc.).

GIS Composition and Terminology Continued

- Feature is each geographic object in a layer. Features have locations and each location is defined by a pair of x,y coordinates. Features can also be linked to information beyond just their shape and location. For example, you might link districts to the percentage of the vote received by the Democratic House candidate and the Republican House candidate. Features share a spatial relationship, and GIS coordinates can be used to compare the locations of various features on a map. The GIS uses the coordinates of features to compare their locations and answer questions about spatial relationships.
- Attribute Table is a table within each given layer that contains information about each feature and links that particular feature to a position on the geographical image on a map and a record. Each column of the table contains a variable or attribute (ex. Democrat Election Returns) and each row is an observation (example: Texas's 9th District).

Types of Data Used in GIS

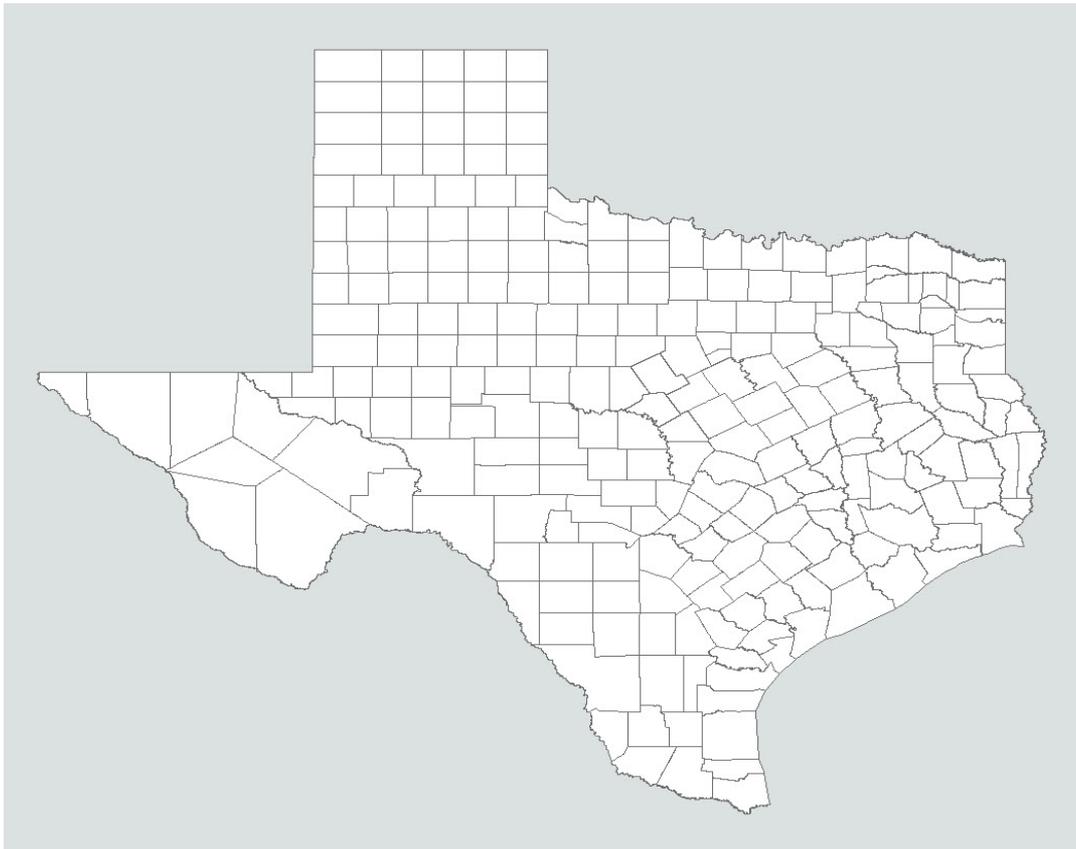
□ Vector Data

- Polygons: Features large enough to have boundaries and require at least three coordinates defining an area (ex: counties, lakes).
- Lines: Features too narrow to be polygon and need at least two pairs of coordinates – one at the beginning of the line and another at the end (ex. rivers, roads, railroads).
- Points: Features too small to be polygons and require a pair of coordinates (ex. cities, schools).

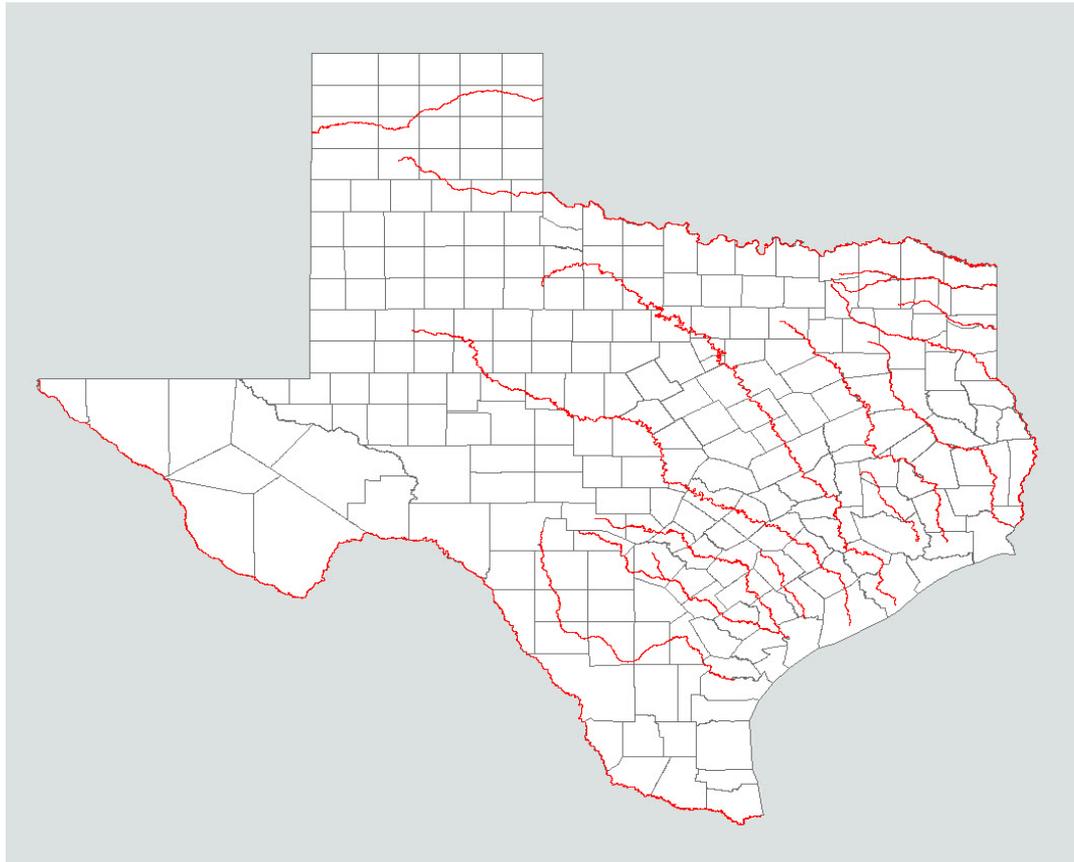
□ Raster Data

- A raster is a matrix of identically sized square cells or a cell-based representation of map features (not geographic objects).
- Each cell represents a unit of surface areas, and contains a measurement associated with that location.
- Examples of raster data include satellite images, aerial photography, and scanned images.

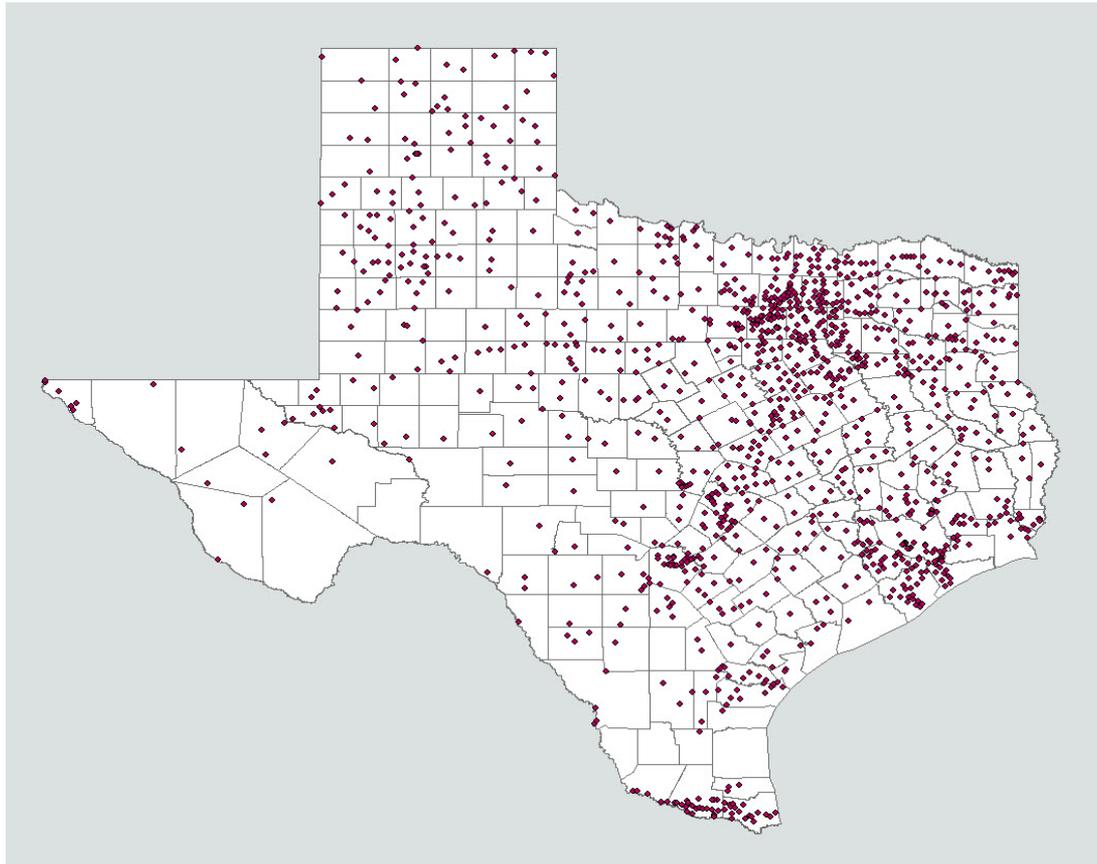
Example of Polygon – Map of the Counties of Texas



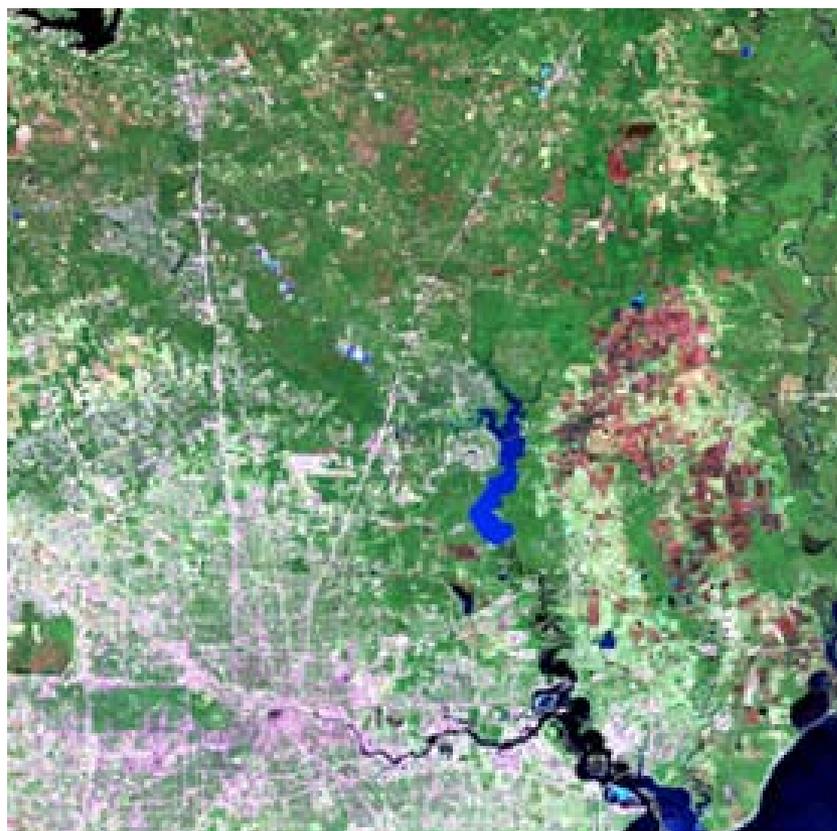
Example of Lines – Rivers of Texas



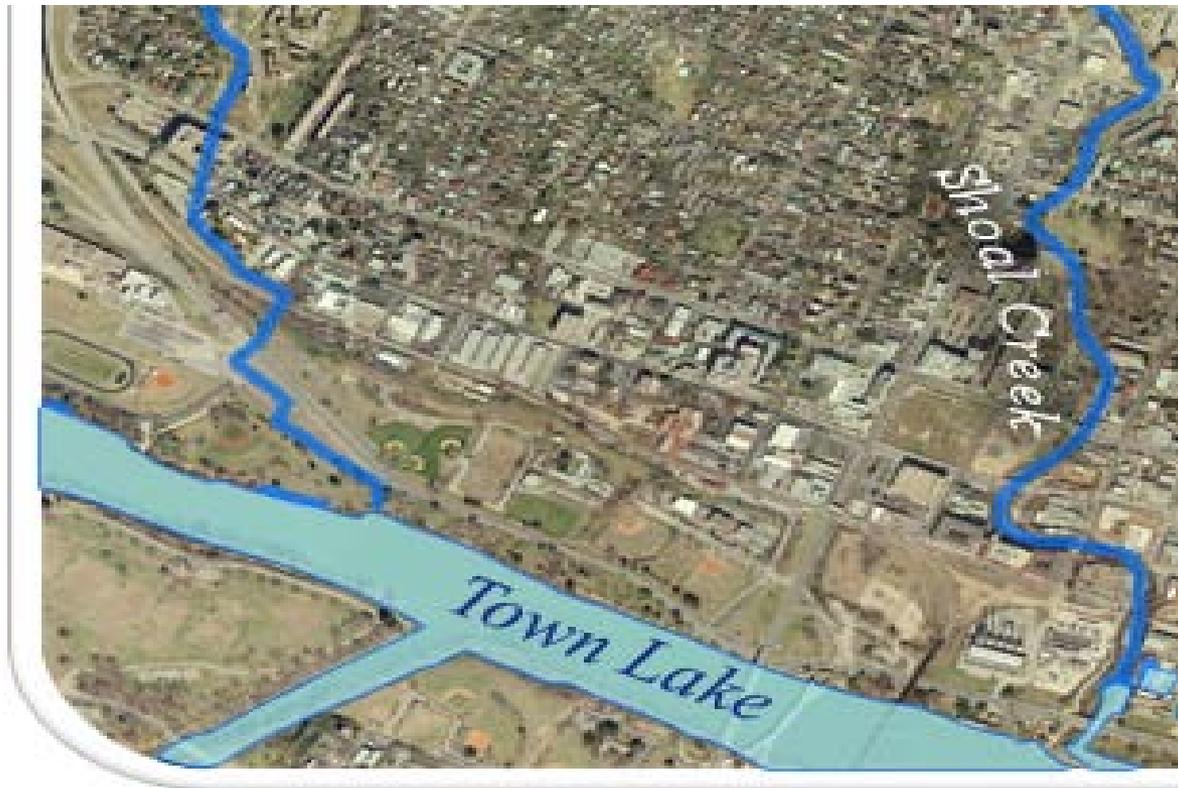
Example of Points – Cities in Texas



Example of Raster - Satellite Imagery



Example of Raster - Digital Imagery – National Hydrography Dataset



Example of Raster - Digital Imagery – National Agriculture Imagery Program (NAIP)



Example of Raster - Digital Imagery – Stratamap Statewide Dataset



Example of Raster - Aerial Photos – Houston Ship Channel

Houston Ship Channel



1969



2005

GIS File Structures

- Geodata is often stored in several files with the same name but different endings. These differing data structures provide information that the computer requires to reconstruct a spatial data model in digital form.
- Two types of information are recorded in GIS data files:
 - *Data*: Consists of spatial data (coordinates, georeferencing, feature types, topology, etc.) and attribute values.
 - *Metadata*: Consists of information about the data (origin, quality, accuracy, etc.). This is also called documentation of data files.
- **Shapefiles** store primitive geometrical data types of polygons, lines and points. A shapefile is actually a set of several files and it is highly important that these files share the same name.



Basic GIS Software Applications

- Demonstration of GIS operations.

Conclusion

Thank you!

Questions, Comments, Ideas pertaining to the GIS Workshop.

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