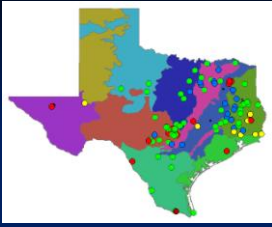


## Introduction to GIS and GPS



October 8, 2010

## Goals for Day

- Learn how GPS units and GIS systems “think”.
- See how GIS data is used in natural resources.
- Goal is not to master the GIS software or every nuance of field collection

## What is this stuff

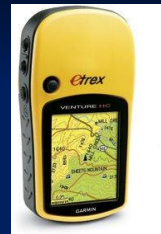
- Information with a spatial component.
- What cannot be displayed geographically?
- Current GIS allows for analysis.



Analog geographic information device from 1500's

## GPS Global Positioning System

- Tool for data collection and navigation.
- Connects a data point (or set of points) to a geographic position.
- Uses satellites to triangulate position.
- Sometimes referred to as the unit or receiver.



## GIS Geographic Information System

- Tool for the creation, manipulation, analysis, and display of information that has a geographic component.
- GIS is used in almost every field of business and is an important tool for natural resource manager.
  - Analysis
  - Documentation and monitoring.

## How do GIS and GPS systems think

- Understanding their internal logic necessary for field data collection.

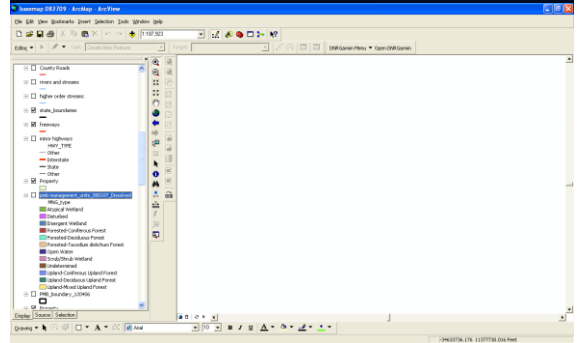


Forbidden Planet 1956

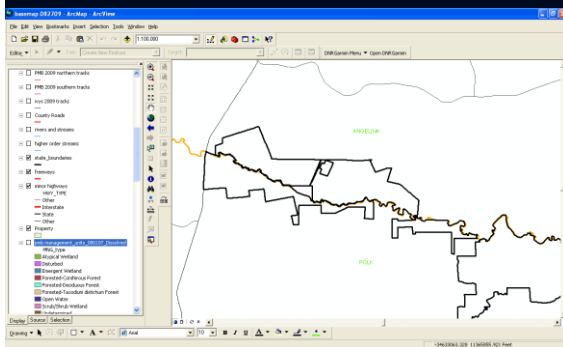
## Layers

- Think of them as transparency overlays.
- In ArcGIS they are many of the layers are known as “shapefiles”

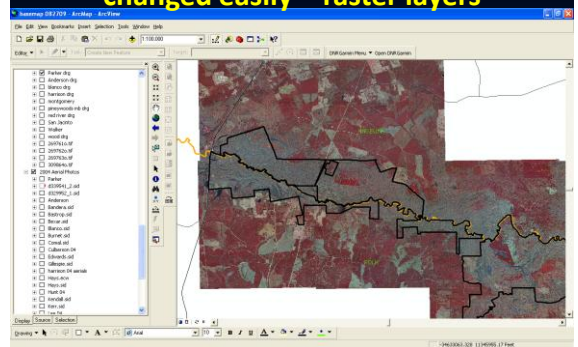
## Layers – you choose



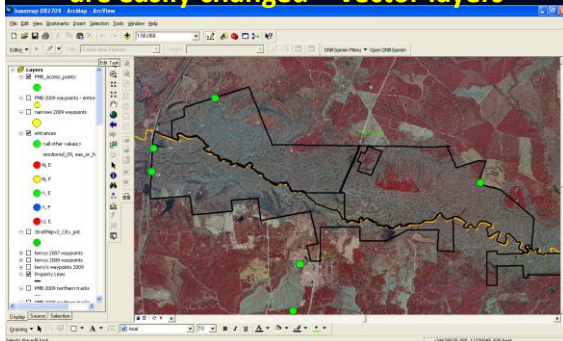
## Layers – not static



## Layers – some cannot be changed easily – raster layers



## Layers – some can be created in the field and are easily changed - vector layers



## Shapefiles

- Display as Vector layers in GIS.
- Actually multiple files that work together.
- Data collected with Garmin GPS unit can be converted to a shapefile.

## Shapefiles

- Are one of three things in ArcGIS
  - Points.
  - Lines.
  - Polygons. (closed shapes of any kind)

## Shapefiles

- Are one of three things in ArcGIS
  - **Points.**
  - Lines.
  - Polygons.



- Collect point data as a “waypoint” with Garmin.
- Can be more accurate than lines or polygons collected in the field.

## Shapefiles

- Are one of three things in ArcGIS
  - Points.
  - **Lines.**
  - Polygons.



- Collect line data as a “track” with Garmin.
- Less accurate location than waypoints.

## Shapefiles

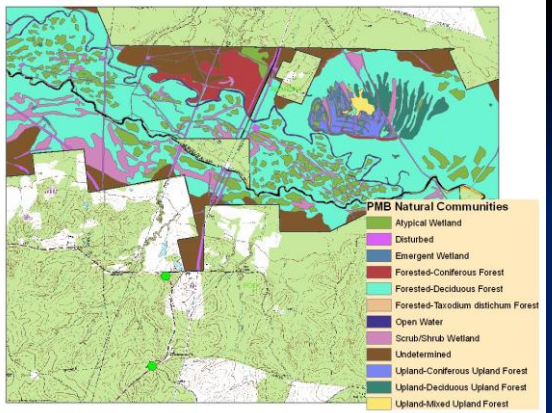
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  - Points.
  - Lines.
  - **Polygons.**



## Shapefiles

- Are one of three things in ArcGIS
  - Points.
  - Lines.
  - **Polygons.**

- Collect polygon data as a “track” with Garmin.
  - Garmin sees polygons as lines that enclose areas.



## Shapefiles

- Are one of three things in ArcGIS
  - Points.
  - Lines.
  - Polygons.
- Accuracy may dictate.
- You can always take a series of waypoints that you then join with lines at the computer.

## Shapefiles

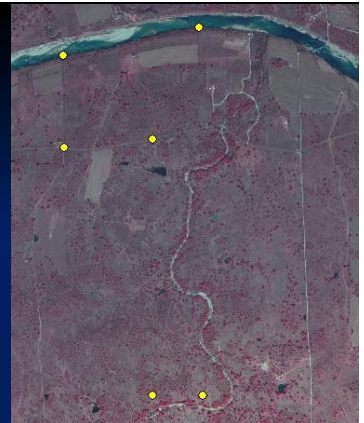
- Think about your project.
  - What do you want to display separately?
  - Does your data lend itself more to points, lines, or polygons.
  - What attribute data will you want to collect
    - Cannot be done with Garmin
    - Collected in field and then typed in later.
      - Classes vs. descriptive.

## Site Analysis

- Problem: New conservation easement must have a 5 acre building envelope. Where should it go?

### Boundaries

- Waypoints taken at corners.
- Most units will "average" multiple points for a more accurate reading.

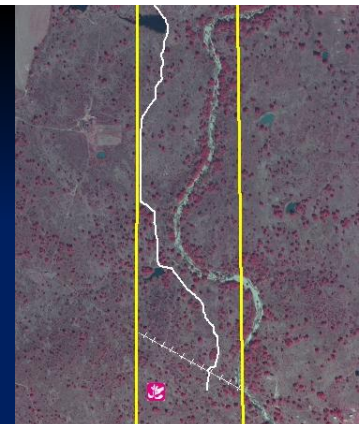


### Boundaries

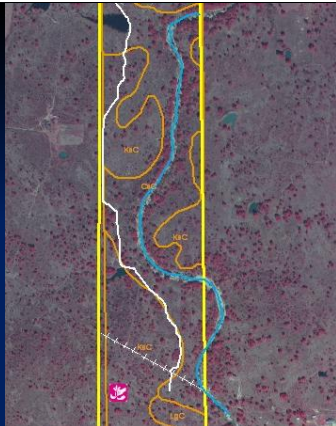
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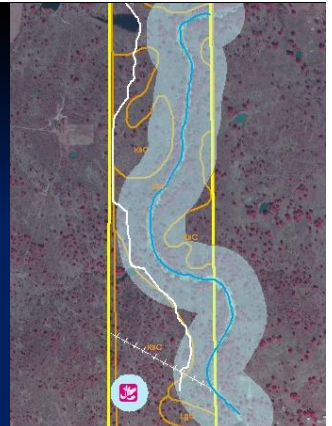
### Infrastructure



## Natural Features

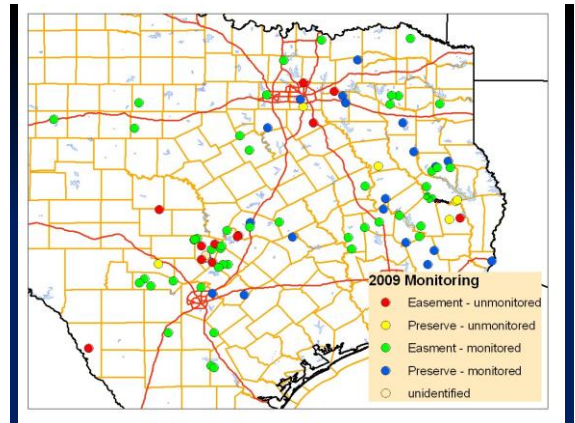


## Buffering of Sensitive Areas



## Documentation

- Recording land management.
- Locating important features.
  - Rare plant communities.
  - Infrastructure.
- Monitoring locations.



Keep your end goals in mind



## Some Common Definitions

Definitions below copied from ArcGIS glossary, Wikipedia, and the Wildlife Society, with some edits.

DOQQ	Acronym for digital orthophoto quarter quadrangle. A digital orthophoto quadrangle (DOQ) divided into four quadrants. This is an aerial photo that has been georeferenced so that it can be displayed in a GIS program.
GIS	Acronym for geographic information system. An integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes. A GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analyzed.
GPS	Global Positioning System. A receiver that calculates its absolute geographic position by determining its relative position to a set of at least three satellites.
Latitude	Measures distance north or south from the equator (0 degrees) to the poles (90 degrees). Lat lines run east and west, but measure degrees north of the equator. The latitude number increases as one goes north.
Layer	A distinct map theme. Usually a separate GIS file. To be specific, the visual representation of a geographic dataset in any digital map environment. Conceptually, a layer is a slice or stratum of the geographic reality in a particular area, and is more or less equivalent to a legend item on a paper map. On a road map, for example, roads, national parks, political boundaries, and rivers
Longitude	Measures distance east and west from the prime meridian (0 degrees) to the international date line (180 degrees). Long lines run north to south but, in this hemisphere, measure the degrees west of the prime meridian. (The prime meridian is the meridian (or longitudinal line) that passes through Greenwich England that was chosen to be 0 degrees since the British ruled things when this system was created).
mxid file	In ArcMap, the file that contains one map, its layout, and its associated layers, tables, charts, and reports. Map documents can be printed or embedded in other documents. Map document files have a .mxid extension.
PDOP	Acronym for percent dilution of precision. An indicator of satellite geometry for a constellation of satellites used to determine a position. Positions with a lower DOP value generally constitute better measurement results than those with higher DOP.
Shapefile	A vector data storage format for storing the location, shape, and attributes of geographic features. A shapefile is stored in a set of related files and contains one feature class. A shapefile is a collection of files that work together to store the shape, attributes, and display properties of a given feature.
Topographic Map	A type of map characterized by large-scale detail and quantitative representation of relief, usually using contour lines.
Track	A track is the actual path followed by a moving body. For GPS units, they are a collection of points (each one with a latitude and longitude) that are connected together by a single attribute and which display as a line.
Waypoint	Waypoints are sets of coordinates that identify a point in physical space. These coordinates usually include longitude and latitude, and sometimes altitude

## Field Data Collection Tips

For the most part, how to collect data in the field is covered concisely and clearly in the Garmin GPS owner's manual and you should consult your manual on the nuts and bolts on how to use your unit. What follows are a few tips that are not covered in the manual that may be helpful in the field or when trying to download the data into an ArcGIS file.

### General observations

- *When you arrive at the site, turn your unit on and leave it on until you are leaving the site.* It may take a few minutes for the unit to “find” the satellites when first starting the unit. If you turn the unit off in between collection points, you will be delayed in your data collection.
- *If you will be working in a woodland or deep valley, turn the unit on when in an open, flat area outside of the work area.* The unit has trouble “finding” satellites when in woods, but if you enter the woods with the satellites already being tracked, the unit is able to keep them locked in. It is able to do to this because, once the satellite has been found, the unit “knows” where the satellite should be and can make adjustments to temporary signal disruptions.
- *If you the unit is having trouble finding or maintaining contact with the satellites, try changing the batteries.* Even batteries which are at half strength may cause signal disruption in some environmental conditions.
- *Always take extra batteries with you into the field.*
- *If you are working far from roads or in an unfamiliar area, always take a compass with you into the field.* GPS units augment maps and compasses, they do not replace them.

### Waypoints

Be sure to bring a field notebook with you to record any data which you may want associated with a particular waypoint. Do not assume that you will remember. As you take a waypoint, write down the name of the waypoint and any notes you want associated with it. For example, “Point 25, geocache spot focusing on insects, contains magnifying glasses  
Point 26, blooming prairie larkspur, marked it with orange flagging, come back in late Sept to collect seeds.”

### Tracks

You can take steps in the field to that make your processing of them in the GIS program much smoother. Because the waypoints are discrete items, and tracks are collections of points that are linked together, care should be taken to make sure that the correct points are linked.

1. The most easy way to deal with tracks, is to only have the track log turned on when you are collecting data, and then to save the track log when you finish one feature. Then clear the track log and begin collecting data for the next feature. See below.
2. When arriving at the site, go to the main menu and select Tracks as described in the owner's manual.
3. If you are not going to be collecting track data right away, make sure that the track log is set to "off" at the top of the display.
4. Using the rocker, highlight the "Clear" button and then press enter.
5. When arriving at the feature you wish to document (perhaps the trailhead of a trail you wish to GPS), go to the Track page described in number 2 above, and set the track log to "on" at the top of the display.
6. Walk the area you wish to document (the trail if it is a trail, the boundary of a seeding area if that is what you wish to do, etc.)
7. Using the rocker, highlight the "Save" button and then press enter.
8. You will be asked if you wish to save the entire track log. If you did not turn on the track log until you began to record your feature (as described above), hit "yes". If you do not want to save the entire track log, but only a certain segment of it, hit "no" and follow the instructions on the unit for selecting the starting and stopping point of the track.
9. Be sure to name the track.
10. Be sure to use your field notebook to record any details about the saved track ...see the section on Waypoints above.