An Introduction to Geographical Data for NRCS Users

Johnny Chism, Resource Conservationist, Harrison, Arkansas and Pam Cooper, Cartographer, Little Rock, Arkansas

A proficient GIS (Geographical Information System) has several components. Generally they can be divided into 4 divisions. They are:
Hardware
Software
Geographical Data
User

The **hardware** is the computer and peripheral components to actually run the system. Things like storage space and memory are important for the system to operate properly.
The **software** is the computer program to run the GIS system. Some examples are ArcView and ArcMap.
The largest, most powerful computer and top of the line GIS software are useless without the proper **geographical data**. Some examples of data are digital orthophotography, digital topographic maps and digitized feature data such as streams and roads.
Probably the most important part of the system, and the point at which many GIS systems fail, is a *properly trained* **user**.

Hardware

All NRCS offices are using CCE approved computers. These computers were configured with adequate resources to run the designated GIS software (ArcMap).

Software

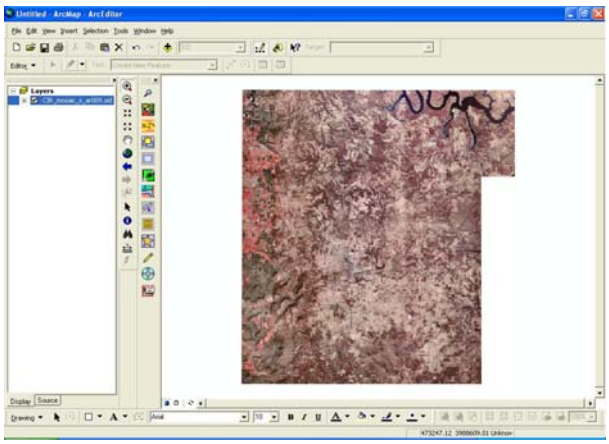
ESRI ArcMap 8.3 is the approved GIS software for use in NRCS offices. Customer Service Toolkit (CST) also is installed and runs with ArcMap. The older ArcView 3.3 software is also installed on all field office computers, but will not run with CST.

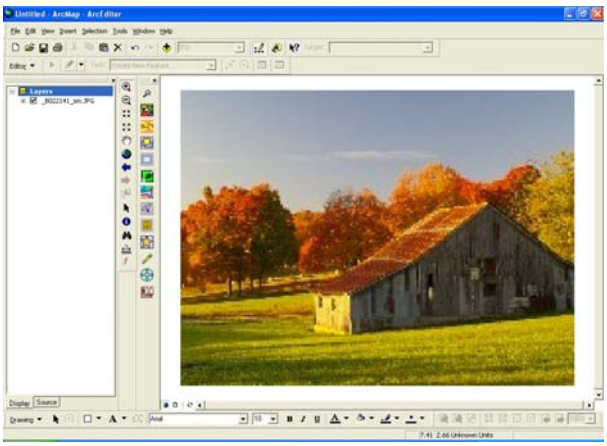
Geographical Data

It is important that you have a better understanding of Geographical data. The following information is designed to be a detailed description of the data NRCS will use for our GIS systems. All NRCS computers and the GIS software on those computers are generally “created equal.” Your objective in reading this document or attending this training is for you to become a properly trained user.

Geo-referenced Data

GIS software allows the user to view and analyze geo-referenced data. The key element of useful GIS data is that all data must be referenced to some common reference. In the case of Geographical data it must be referenced to points on the surface of the earth. If all data has the same reference, then the data can be viewed together and will “line up” properly. There is a problem with referencing two dimension data (maps-flat) to a three dimension object (earth-round). Hopefully most of you will accept the fact that the earth is not flat! Try this experiment: wrap a sheet of paper around a basketball with no wrinkles, folds or overlaps. Difficult? Impossible? To correct this problem we have mathematical calculations called projections. Projections allow us to take our round (actually slightly egg shaped) earth and display it on flat surfaces such as paper maps and computer screens without the gaps and overlaps. Projections allow us to make correct geographical measurements on a flat surface. Luckily most of our data is projected with one model: UTM NAD83 and in Arkansas Zone 15, so you don’t have to worry a lot about projections but just be aware of what they do.





The examples above show ArcMap as an image viewer. The image on the left is of a geo-referenced MrSID image of Boone County Arkansas. The image on the right is a JPEG image of a barn, it is not geo-referenced. I could add other geo-referenced images or features to the image on the left and they would “line up” in relation to the earth’s surface. I could not add other data to the image on the right and ever get the images to “line up” because they would not have a common reference.

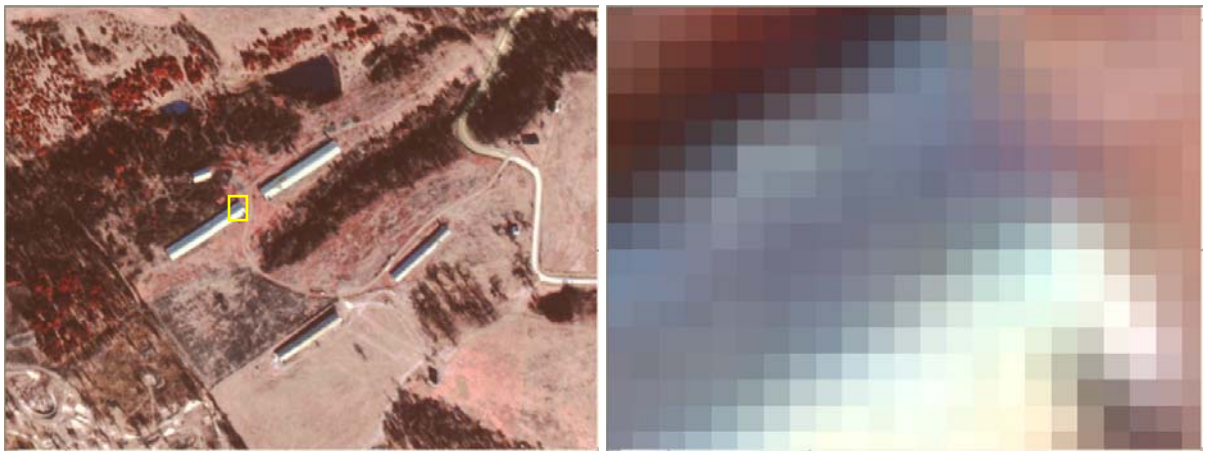
Types of Data

Generally GIS systems use two types of data: Raster (image) and Vector (feature).

Raster (image)

Raster data is usually some type of image. Raster data is simply data that is stored in rows of individual cells, called pixels. Each individual cell has some attribute data, in the case of aerial photography a color value. The data also has a resolution which is the size of the individual pixel sometimes described as pixels per inch or as a geo-referenced distance (for example for an image with a 1 meter resolution, 1 pixel in the image represents 1 square meter on the surface of the earth). There are many types of image file formats including BMP, (bit-mapped images), TIFF (tagged image file format), JPEG (Joint Photographic Experts Group) and MrSID (Multi-resolution Seamless Image

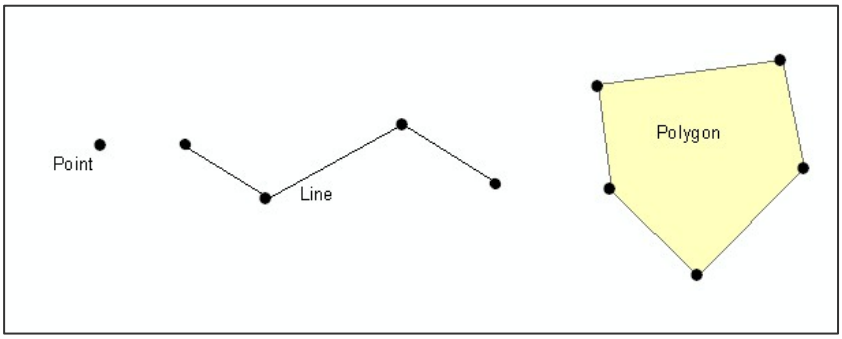
Database). Compressed images such as JPEG and MrSID are images that have had some details removed to reduce the file size. Generally image data is opaque (some GIS software including ArcMap can render the layers semi-transparent) which limits the user to one image viewed at a time. You can usually determine if the file is raster data by looking at the file extension. Files with extensions such as .sid, .tif, .bmp, and .jpg are raster (image) files.



Images showing a MrSID image enlarged to show the rows of individual pixels. The original resolution of the image is 1 meter.

Vector (feature)

Vector or feature data is of three types: points, lines or polygons. Point data is the simplest type of data and consists of one or more points. Line data consists of points called vertices and the lines connecting those points. Polygon data consists of an area enclosed by points and lines. Both ArcView and ArcMap allow the user to create or edit feature data.



Examples of the different types of feature data.

Most files with feature data that is used by NRCS is shapefile format. Shapefiles are files that were developed for ArcView. The term shapefile actually refers to a set of several files. The files usually have the extensions .shp, .shx, .dbf, .prj and sometimes .sbn. The first part of the filename will be the same for all the files in the set. For example a shapefile of the soils of Boone County, Arkansas will contain all of the

following files: soilmu_a_ar009.dbf, soilmu_a_ar009.prj, soilmu_a_ar009.shp and soilmu_a_ar009.shx.

Data Storage

The data necessary for the normal operations of the field office is stored on the field office server. This data is stored on the F: drive of the server under the geodata folder. There are subfolders in the geodata folder where different types of data are stored. Data in the Geodata folder must follow a prescribed naming convention and follow prescribed data restrictions. For these reasons the data in the geodata folder is restricted to read only (no changes can be made) for normal users. Only the state Geodata Coordinator has full access to this folder. Some of the subfolders do not presently contain data (ND). The subfolders and examples of types of the data stored in each, is as follows:

-air_quality	(ND)
-cadastral	Public Land survey (sec, T, R) data
-census	Demographic data tabulated by census geography (ND)
-climate	
-precipitation	Annual and Monthly precipitation boundaries (ND)
-temperature	(ND)
-clu_temp	Un-certified CLU boundaries
-common_land_unit	
-fsa_clu	CLU Farm Boundaries, CRP data linked to CLU (ND)
-conservation_practices	Aggregated planned and applied conservation practice data (ND)
-cultural_resources	Archeological, state historic sites, etc (ND)
-elevation	USGS National Elevation Dataset (NED) & Digital Elevation Models (DEM) (ND)
-endangered_habitat	(ND)
-environmental_easements	Aggregated WRP easement boundaries (ND)
-geographic_names	Geographic Names Information Systems (GNIS) point data (ND)
-government_units	State and county boundary polygon data
-hydrography	National Inventory of Dams point data, FEMA polygon data, etc. (ND)
-hydrologic_units	Hydrologic Unit polygon data
-imagery	Other imagery files such as satellite or non-standard imagery (ND)
-land_use_land_cover	USGS Land Use Land Cover polygons (ND)
-map_indexes	1:24,000 USGS quad boundaries
-ortho_imagery	Orthophotography
-plants	
-project_data	Local data
-fsa	
-nrcs	
-soils	Soils maps and databases
-topographic_images	Topographic images
-transportation	Highways, etc.
-wetlands	USFWS National Wetland Inventory polygons (ND)
-wildlife	
-zoning	

It is possible for some of the data that consists of large size files (such as ortho imagery) to be copied from the F: drive to the Local Hard drive (C:\geodata). The folder structure on the C: drive should be set up to match the folder structure on the F: drive. Copying the data to the local hard drive, cuts down on the time to load and draw the

data in ArcMap and also allows for laptop computers to be mobile. However, it should be noted that updates to data will only be transferred to the F:\Geodata folder. It is the responsibility of the user to make sure the data that they use is the most up to date data. (Note: The soils information is frequently updated. If it is copied to the local hard drive, users should update their data frequently). When data is updated on the FSC server, the geodata administrator will notify the field office.

Filenames

Data stored in the geodata folder will use a standard naming convention. An example of the naming convention is as follows:

soilmu_a_ar009.shp

File Extension- see next page

Location-County FIP code or state code

Feature type- a code indicating the type of data contained in the file.

- p-point
- l-line
- a-area
- t-table
- e-enhanced
- d-database
- s-scanned

Theme Name- can be the full name, a short version, or an acronym used to represent the business name of the data set.

The above example is a one of the files that make up a shapefile of soil map unit polygons (area) of Boone County, Arkansas.

What do the following represent?

cra_a_ar.shp
One of the files that make up a shapefile of the Common Resource Area polygons of Arkansas, also includes cra_a_ar.shx, cra_a_ar.dbf, and cra_a_ar.prj

soil_d_ar009.mdb
NOT A MAP- Access database of soil survey attribute data in the current SSURGO structure format for Boone County, Arkansas

DRG_S_AR009.SID
A scanned Digital Raster Graphic (topo map) MrSID compressed image of Boone County, Arkansas.

AHTD_s_ar101.tif
A scanned TIF image of the Arkansas Highway and Transportation Dept. county road map for Newton County, Arkansas

File Extensions

By looking at the extension (the part of the file after the dot) you can usually determine the type of file. Some common extensions are listed below, not all of these will appear in the geodata folder:

.**shp, .shx, .dbf, .prj** – Shapefile
.sid, .aux, .sdw – MrSID compressed image including header information
.jpg, .jpeg – Joint Photographic Experts Group compressed image
.tif, .tiff – Tagged Image Format image (may also include .tfw, .rrd and .aux)
.bmp – Bit Mapped image
.html, .htm, HyperText Markup Language (webpage) and **.xml** Extensible Markup Language. In the geodata folder it usually contains metadata (data about the data!)
.txt – Plain Text
.doc – Microsoft Word document
.xls – Microsoft Excel spreadsheet
.mdb – Microsoft Access database
.dbf – Dbase database
.pdf – Adobe Acrobat

.aux (image) and **.prj** (shapefile) contain projection information that allows the geographic files to display correctly in the software.