

G I S

The diagram shows the letters 'G', 'I', and 'S' in a pink serif font. A black curved arrow points from the letter 'S' to the letter 'I'. Above the arrow, the word 'Analysis' is written in a smaller, orange sans-serif font.

Geographic Information System

## What is GIS?

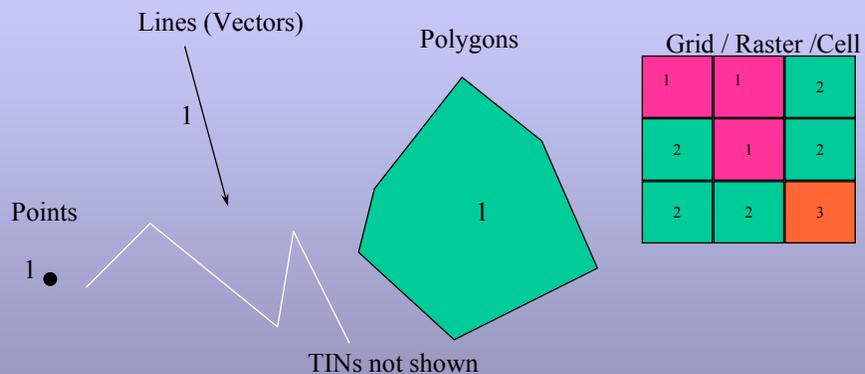
### Geographic Information Systems

- A system comprised of hardware, software, data, people and processes for managing and analyzing spatial data
- Objective: to improve decision making

## What is a GIS (the RD details)?

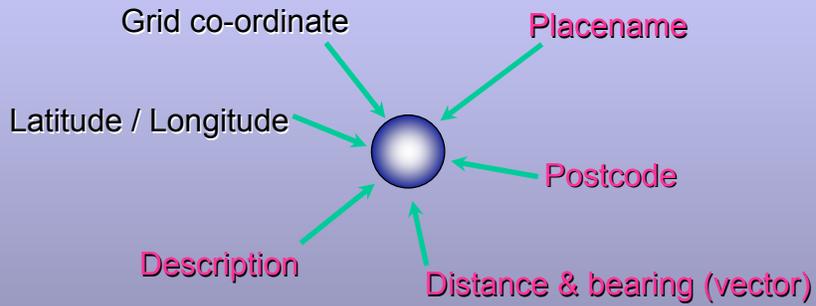
- **people** Agency loan specialists, managers, GIS professionals
- **data** Project information, databases, images, raster, map layers
- **hardware** PCs, hard drives, tape drives, portable drives, GPS units, servers
- **Software** ESRI products- ArcGIS, Arc Explorer, ArcIMS, SDE, ArcServer, : UNIX, Windows, Linux
- **Procedures** Scripts, step-by step instructions, “path directions”

## The Elements of a GIS



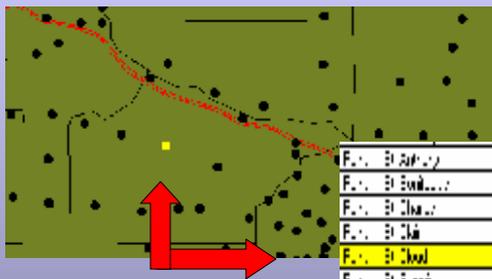
Key	Type	Disaster_title	Assistance
1601	Tropical Storm	Tropical Storm Cindy	ABCDEFGF
1595	Hurricane	Hurricane Dennis	ABCDEFGF

# What makes Data Spatial?



## Spatial to Tabular Link

Spatial Component:  
Polygons, Lines, or Points



Tabular Component:  
A Database with  
Records and Fields

F... St...	...	H1	27	2222	30	5	1
F... St...	...	H1	27	2222	418	5	4
F... St...	...	H1	27	2222	1037	2242	5
F... St...	...	H1	27	2222	234	222	3
F... St...	...	H1	27	2222	18828	4224	6
F... St...	...	H1	27	2222	800	2222	5
F... St...	...	H1	27	2222	130	222	5
F... St...	...	H1	27	2222	1881	4224	5
F... St...	...	H1	27	2222	779	2224	5

## Attributes/Tabular

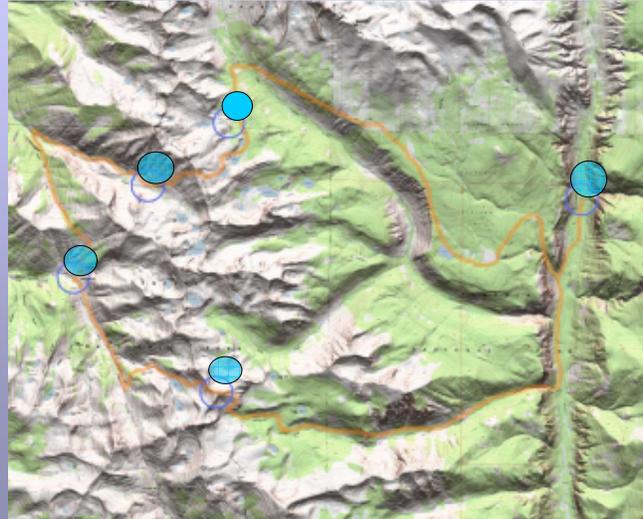
- **Tabular data—adding information to map's tabular data is information describing a map feature. For example, a map of customer locations may be linked to demographic information about those customers.**

## Examples of Data Layers

- |           |   |
|-----------|---|
| •points   | •Borrowers, facilities, substations, poles                |
| •lines    | •roads, streams, utility transmission lines               |
| •polygons | •Urban Areas, Service Area, habitat, watersheds           |
| •raster   | •DRGs, DOQQs, satellite imagery<br>Elevation grids (DEMs) |

## Vector on Image Data

Service Area  
Mapping



## Digital Image Terminology

DOQ's - Digital Ortho Quadrangles

DOQQ's - Digital Ortho Quarter Quadrangles

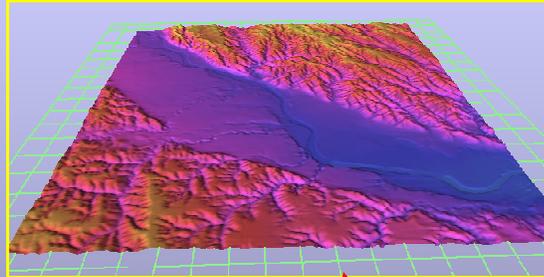


### What is a DOQ and DOQQ?

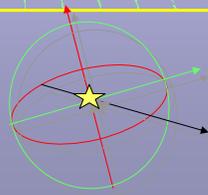
A **DOQ** and a **DOQQ** are comprised of a series of scanned aerial images that have been mosaicked, **tone-matched** and **projected** to an electronic representation of the earth's surface to form a product that has the same amount of geographic accuracy in the **center** of the imagery as the **exterior** edges. Each **DOQQ** is one-fourth of a **DOQ** (7 1/2' Geographic Grid.) Therefore, each **DOQQ** is divided into four (4) 3 3/4' by 3 3/4' quadrants. Thus the term, **quarter** quadrangle refers to a quarter of a full-quadrangle of geographic space.

# Digital Image Technology

## DEM's - Digital Elevation Models



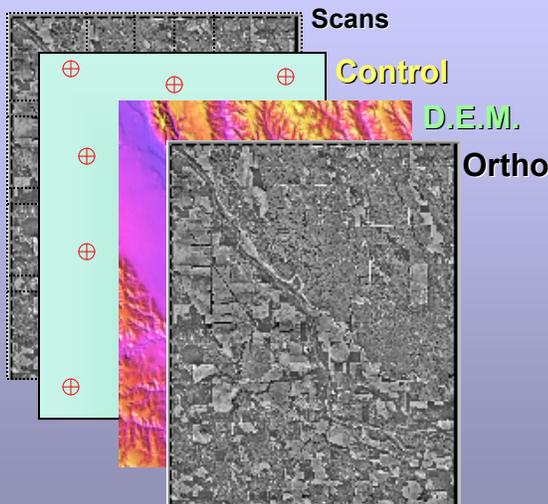
**X:** Easting  
**Y:** Northing  
**Z:** Elevation



Digital Elevation Models or **DEM's** are raster data that represent the terrain or slope of a given area in a mathematical model where readings are gathered in a uniform manner. **DEM's** are registered to the ground through a geographic projection. **DEM's** have three coordinate readings;

**X, Y, Z.**

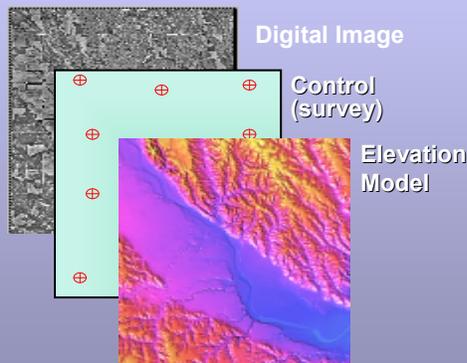
## How Digital Ortho Images Are Created:



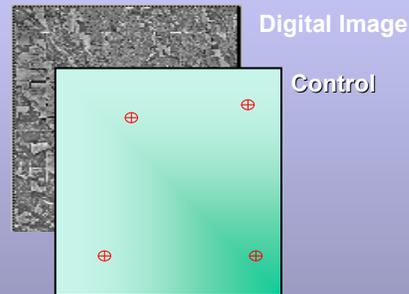
Digital Ortho Imagery is created by taking scanned images (i.e. NAPP Film), incorporating control points derived from GPS or from digital/paper topographic maps. By draping the imagery over a Digital Elevation Model (DEM), the software then projects the control points, DEM, and imagery and creates a Digital Ortho Photograph.

# Definitions

## Ortho Rectified



## Rectified



## How does a GIS Function?

- GIS functions in layers
- A GIS functions with a spatial element (the layers) and a tabular element (the attributes), together providing quality output maps with meaningful information
- The spatial element of GIS are layers comprised of points, lines and polygons, which make-up the map
- The tabular element of GIS is a tabular database filled with attributes for the points lines and polygon.
- These attributes store meaningful information about the spatial features

## Layers



## What do you do with GIS?

- Analysis Assignment of borrowers to agent,
- Build spatial databases Borrower location, eligibility, disaster areas
- Create overlays soils on slope soils on streams buffers
- Numerical reports Area, per capita income, demographic information
- Print maps base maps, incident snapshots

## **In general: What can a GIS Do for You?**

- ❑ **Perform Geographic Queries and Analysis**
- ❑ **Improve Organizational Integration**
  - **Improved management of resources**
  - **Interdepartmental information sharing and communication**
- ❑ **Maps, Modeling, and Analysis**
  - **Geographic visualization of corporate assets**
  - **Digital continuous and scale-free cartographic GIS database**
- ❑ **Make Better Decisions and Create Better Solutions**
  - **Tools to query, analyze, and map data in support of the decision-making process**
  - **Reports, have hard and soft-copy reports of spatial data activity**

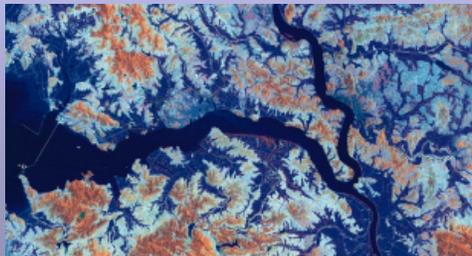
## **Analysis Examples**

- Line      Shortest distribution line to customer given impediments such as wetlands are in path
- Point     Distance to nearest substation
- Polygon   Change in rural house densities over time
- Raster    Line of sight-who will see this tower

## **How GIS Operates!**

- Computer-based tool for mapping and analyzing features that exist and events that happen on earth
  - **Integration of common database operations with visualization and geographic analysis**
  - **Create maps and visualize aspatial and spatial data together**
    - **Visualize scenarios**
    - **Develop planning strategies**
    - **Predict outcomes**
    - **Solve complicated problems**
    - **Present powerful ideas**
    - **Develop effective solutions**

**Everything in USDA is linked by geography.**



## ***Before GIS we had maps***

### **What Are Maps?**

Maps are tools that provide us with information about the world in which we live. Maps have three principle uses:



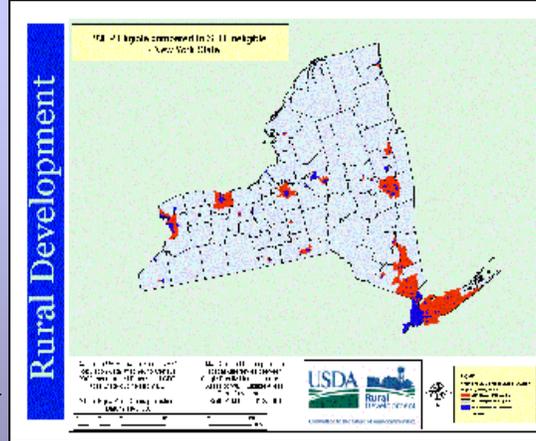
12th Century map of the Mediterranean

- To **locate** places on the surface of the earth
- To show **patterns of distribution** of natural and man-made features
- To **compare** and **contrast** map information and thereby discover relationships between different phenomena

**A MAP IS A MODEL OF THE REAL WORLD**

## **Why does RD use GIS?**

- Supporting loan applications
  - funding eligibility determinations
  - funding allocation
  - decision making
  - environmental review
  - engineering review
- Analyzing RD Data Warehouse Data for Program Efficacy
  - Responding to OMB's Program Assessment Rating Tool (PART)
  - Trend analysis
  - Certify program compliance
  - Assess Data Quality
- Monitoring and modifying changing urban-rural definitions
- Managing State Office Resources
- Tracking customers
- Enhancing reporting capability
- Enhancing training capability



## Our benefits of GIS include:

- Better information management
- Higher quality analysis
- Ability to carry out “what if?” scenarios
- Improve project efficiency
- Easy reproduction of our maps to allow working/use copies

## GIS Integrates All the Parts



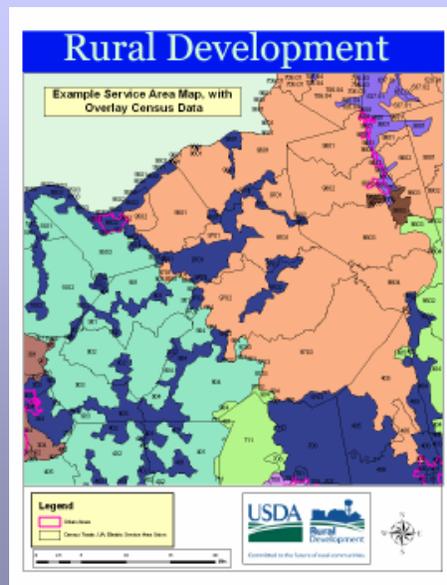
## GIS Business Payoffs

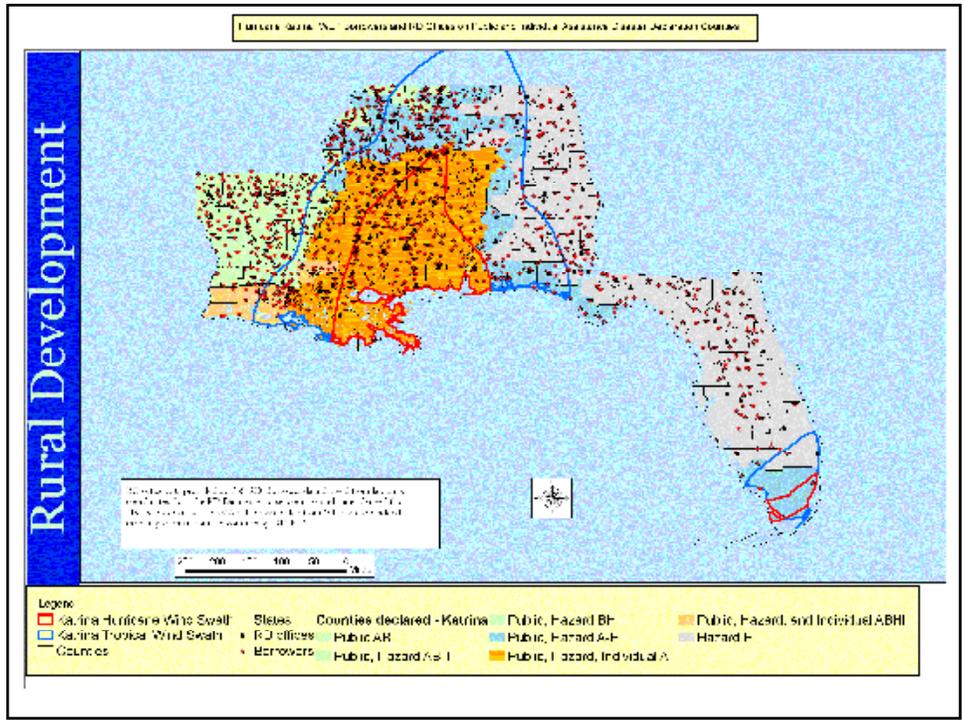
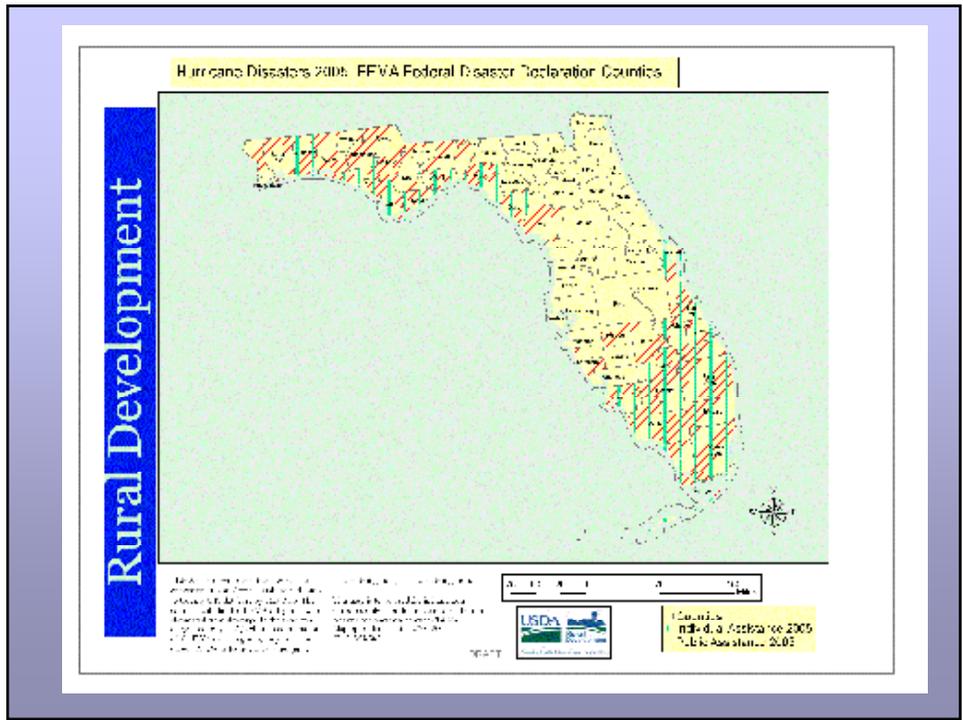
- **Accurate and timely information for decision-making and other analytical tools**
- **Faster flow of information when linked to existing systems (90% of business data has a geographic component)**
- **Easy access to project related information**
- **Enterprise (RD) wide availability**

# National GIS Function

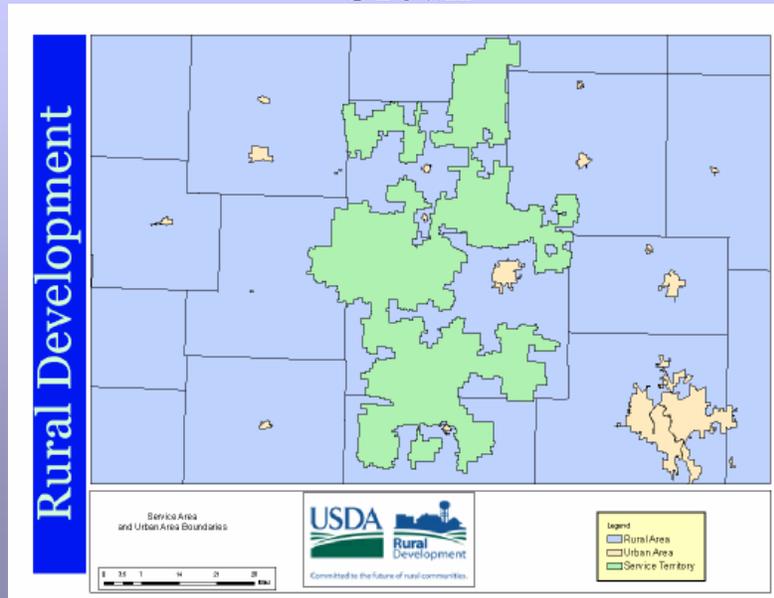
- Analysis Eligibility comparisons
- Data Development WEP borrowers, Hurricane supplemental
- Procedure Development FEMA import,
- Technical Support Training, program advice
- Development Standard maps for WEP, templates special use maps, procedure development
- Application prototyping Eligibility locator, FEMA disaster counties, RD location browser
- GIS Program Analysis Needs lists, system architectural and software application needs

## Example of Service Territory map



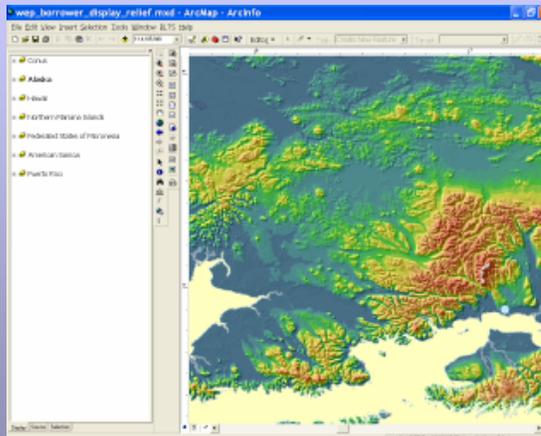


## Example Service Area compared to Urban



## CCE Approved Software

- ArcGIS Software
- Data Viewers
- ArcGIS Extension Tools
- Web-enabled options



## GIS Project Model

- Define your problem
- Determine your data requirements
- Build or Acquire your database
- Design process or model to obtain results
- Run model
- Produce your output

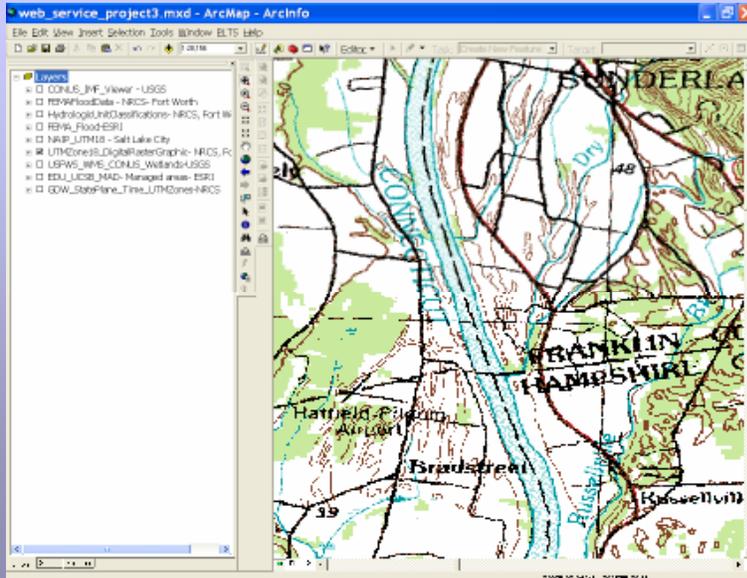
## Data Web Services

Data sources not stored locally but obtained on the fly from other servers

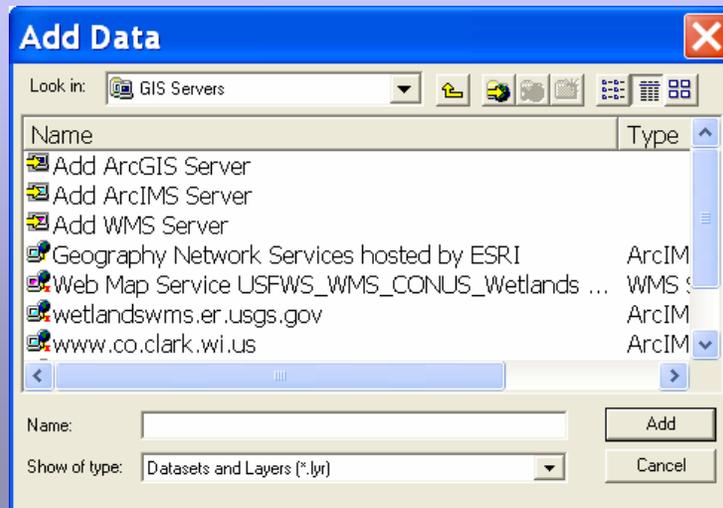
This allows:

- Getting current data from an authoritative source
- Avoid data development and maintenance
- Avoid data related costs

# Web Service Example



# “Consuming” Web Services in ArcGIS



## Data Resources

- **Aerial Photography Field Office-  
Salt Lake City, UT**  
Web Services-<http://gdw.apfo.usda.gov>
- **National Cartography Geospatial Center-  
Fort Worth, TX**  
Web Services-<http://wms.ftw.nrcs.usda.gov/>
- **US Census:**  
<http://www.census.gov/geo/www/cob/index.html>
- **United States Geological Survey**  
<http://nationalmap.gov/>  
<http://eros.usgs.gov>  
Web Services-<http://wetlandswms.er.usgs.gov>

<http://www.usda.gov/nas/electric>

### GIS Resource Portal Link

**Welcome** to the Electric Programs GIS Resource Portal Link. This site provides a link to the United States Department of Agriculture's Geospatial Data Gateway to enable quick and easy access to GIS maps, their associated data, and other GIS related information. The other site below is a link to Geodata.gov, which is a portal site known as the Geospatial One-Stop (GOS) public gateway for improved access to geospatial information data under the E-Government initiative. The GIS Resource Portal Link is designed to facilitate communication and sharing of geographic data and resources. These links include a catalog of geospatial information containing thousands of metadata records (information about the data). These URL links enable the user to search the database of geographic Metadata, downloadable data sets, images, map files, and more. The Electric Programs are providing these links to GIS services to enable the public to access authoritative and timely GIS data.

#### USDA Geospatial Data Gateway (NRCS, FSA, RD)

The Geospatial Data Gateway provides One Stop Shopping for natural resources or environmental data at anytime, from anywhere, to anyone. The Gateway allows the user to choose an area of interest, browse and select data from the catalog, customize the format, and have it downloaded or shipped on CD:

<http://datagateway.nrcs.usda.gov/>

#### Geodata.gov

Geodata.gov is a geographic information system (GIS) portal, also known as the Geospatial One-Stop (GOS), which serves as a public gateway for improving access to geospatial information and data under the GOS E-Government initiative. Geospatial One-Stop is one of 24 E-Government initiatives sponsored by the Federal Office of Management and Budget (OMB) to enhance government efficiency and to improve citizen services:

<http://gos2.geodata.gov/nas/portal/gos>

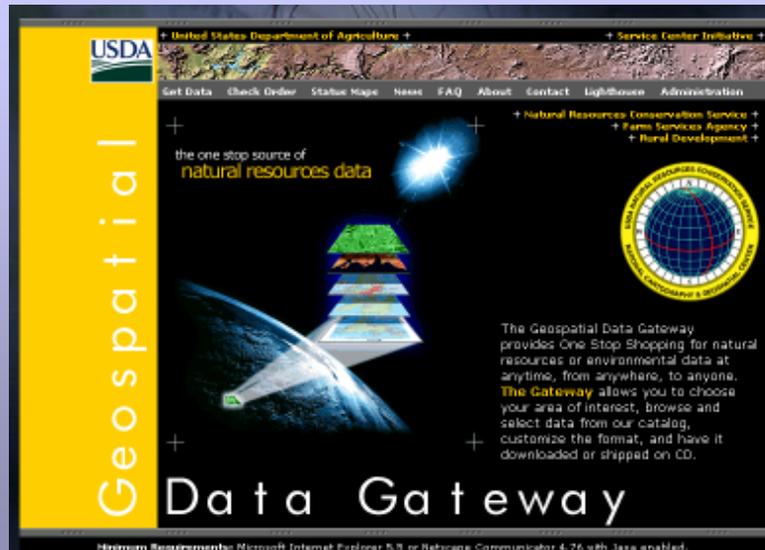
#### US Census Files:

<http://www.census.gov/geo/www/cob/index.html>

United States Geological Survey files

<http://seamless.usgs.gov/>

<http://datagateway.nrcs.usda.gov/>



## Contact

Keith Mitchell

USDA, Rural Development, Utilities Programs

Engineering and Environmental Staff

Washington, DC

[keith.mitchell@wdc.usda.gov](mailto:keith.mitchell@wdc.usda.gov)

202-720-7817