Introduction to Geographic Information Systems

And Agricultural Applications

USAIN 2008

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Plan For The Day – USAIN Pre-Conference GIS Workshop

• Welcome and Introductions	8:00 – 8:15
• The fundamentals of GIS	8:15 – 9:15
• Data sources and Web Mapping Services	9:15 – 10:00
• Break	10:00 – 10:30
• Demos and Exercise	10:30 – 11:30
• Agricultural Applications	11:30 – 11:45
• Questions/final thoughts/wrap up	11:45 – 12:00

Introduction to Geographic Information Systems: Basic Elements and Concepts

What is GIS?

A collection of computer hardware, software, data, methods and people used to capture, store, manage, manipulate, analyze, and display all forms of geographically referenced information.

Geographic Information Systems (GIS) Elements and Concepts

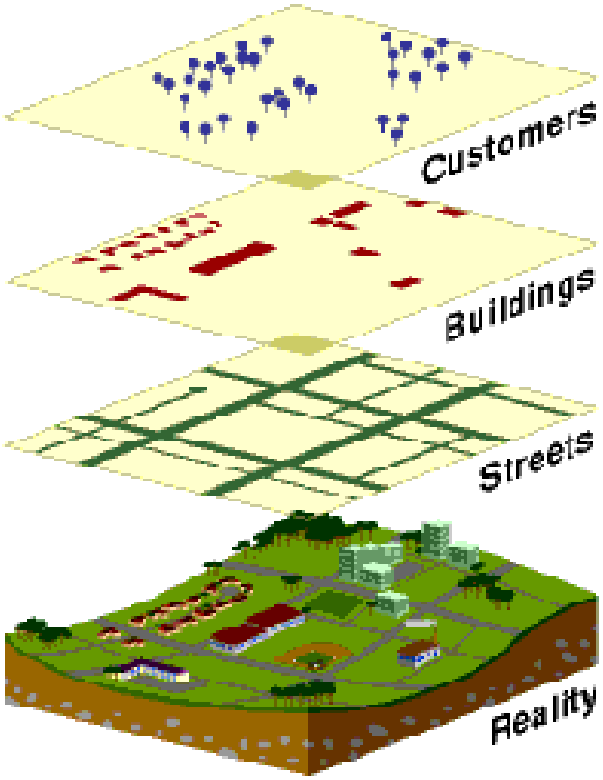
A GIS combines layers of information about a place to enable a better understanding of that place.

Customers

Buildings

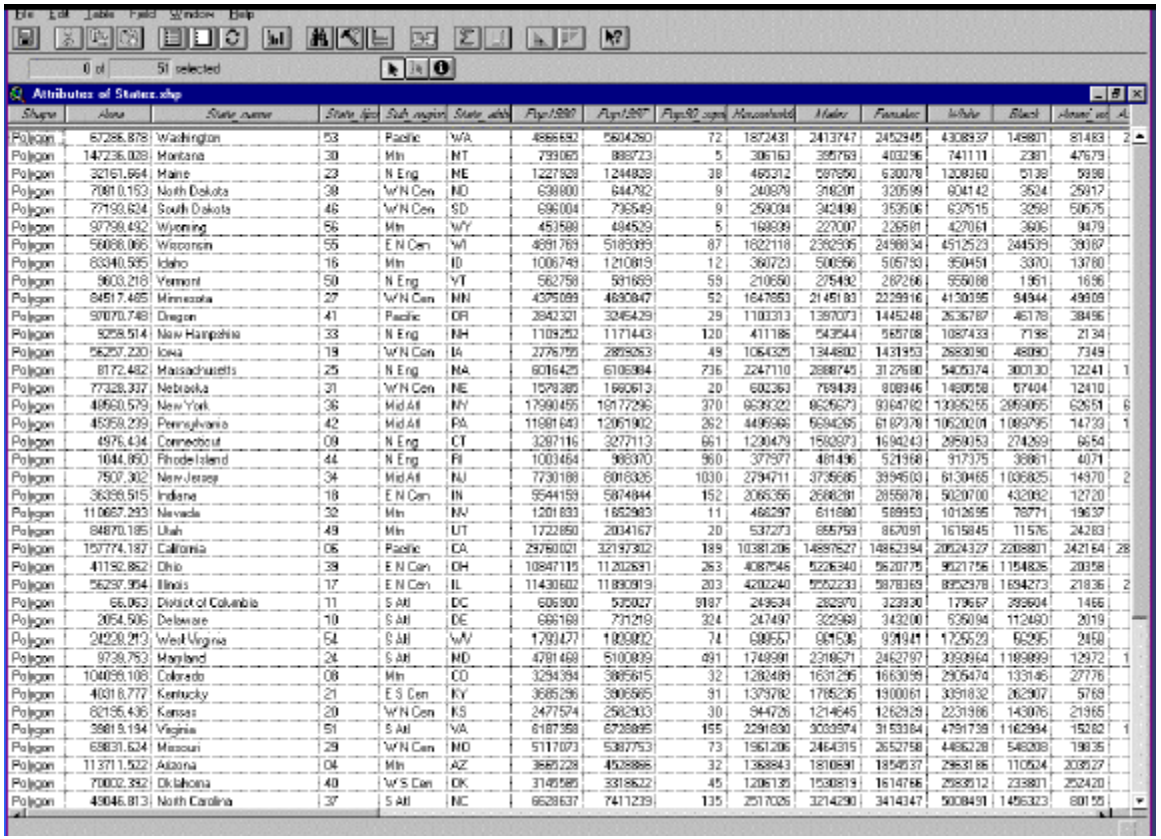
Streets

3D Reality



How a GIS Works

Database: Not easy to interpret

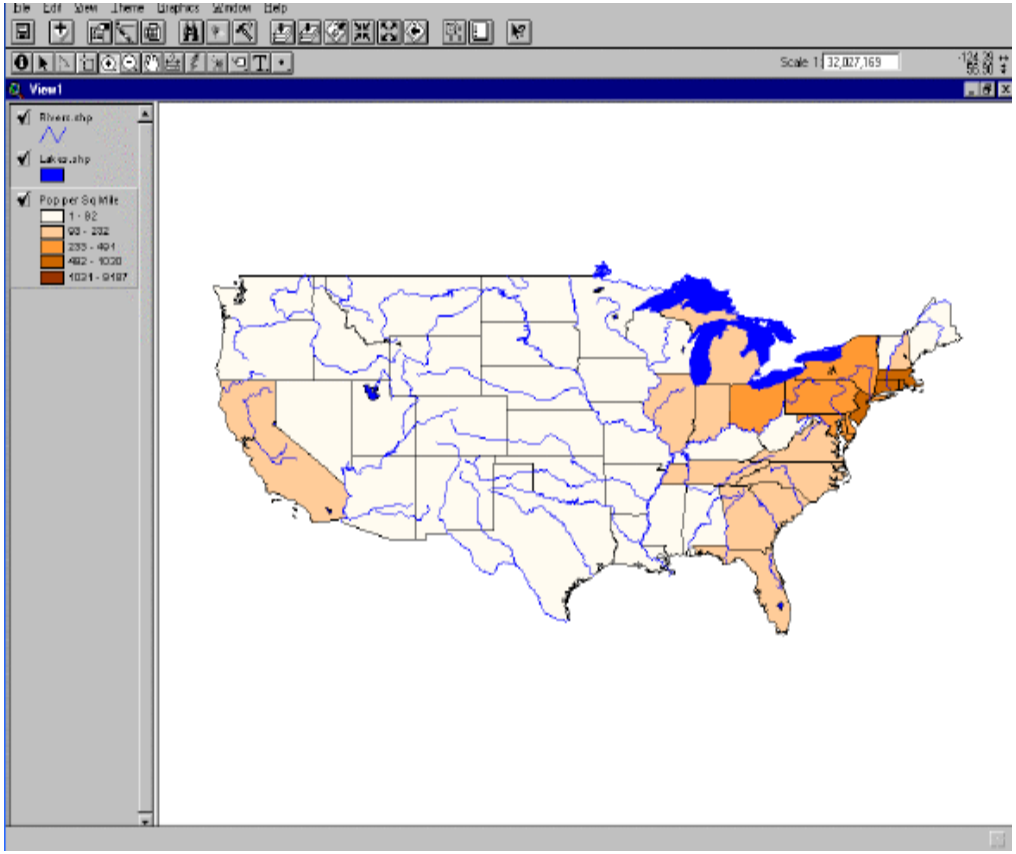


Attributes of States.shp

Shape	Area	State_name	State_fips	Sub_region	State_abbr	Pop1990	Pop1997	Pop92_sqmi	Households	Males	Females	White	Black	Amer_ind	A
Polygon	67288.878	Washington	53	Pacific	WA	4866692	5604260	72	1872431	2413747	2452945	4308937	149801	81483	2
Polygon	147238.028	Montana	30	Mtn	MT	799065	888723	5	306163	395769	403296	741111	2381	47679	
Polygon	32161.664	Maine	23	N Eng	ME	1227928	1244828	38	460312	597650	630078	1208360	5138	5998	
Polygon	70810.163	North Dakota	38	W N Cen	ND	638800	644792	9	240979	318201	320599	604142	3524	25917	
Polygon	77199.624	South Dakota	46	W N Cen	SD	696004	736549	9	259034	342499	353906	637515	3259	50675	
Polygon	97798.492	Wyoming	56	Mtn	WY	453588	494529	5	169809	227007	226581	427061	3606	9479	
Polygon	56068.066	Wisconsin	55	E N Cen	WI	4891769	5183099	87	1822118	2362595	2498634	4512523	244539	39167	
Polygon	83340.595	Idaho	16	Mtn	ID	1006749	1210819	12	360723	500556	505793	950451	3370	13780	
Polygon	9603.218	Vermont	50	N Eng	VT	562758	591669	59	210650	275492	287266	556088	1951	1696	
Polygon	84517.485	Minnesota	27	W N Cen	MN	4375099	4630847	52	1647893	2145183	2229916	4130095	94944	49909	
Polygon	97070.748	Oregon	41	Pacific	OR	2842321	3245429	29	1100313	1397073	1445248	2636787	46178	38496	
Polygon	9258.514	New Hampshire	33	N Eng	NH	1109252	1171443	120	411188	543544	565708	1087433	7198	2134	
Polygon	56257.220	Iowa	19	W N Cen	IA	2776755	2885263	49	1064325	1344802	1431953	2883090	48090	7349	
Polygon	8172.482	Massachusetts	25	N Eng	MA	6016425	6105994	736	2247110	2888745	3127688	5405374	300130	12241	1
Polygon	77328.337	Nebraska	31	W N Cen	NE	1578385	1660613	20	602363	769439	808946	1609558	57404	12410	
Polygon	48959.579	New York	36	Mid Atl	NY	17990455	18177296	370	6639322	8626679	9364792	13995255	2959065	62651	6
Polygon	45958.239	Pennsylvania	42	Mid Atl	PA	11881643	12051902	262	4496966	5694285	6187378	10620201	1089795	14739	1
Polygon	4976.434	Connecticut	09	N Eng	CT	3287116	3277113	661	1230479	1593973	1694243	2959053	274269	6654	
Polygon	1044.850	Rhode Island	44	N Eng	RI	1003464	988370	960	377977	481496	521968	917375	39881	4071	
Polygon	7507.302	New Jersey	34	Mid Atl	NJ	7730188	8018305	1030	2794711	3736685	3994503	6130465	1036825	14970	2
Polygon	36356.515	Indiana	18	E N Cen	IN	5544159	5874844	152	2066366	2698281	2855878	5020700	432082	12720	
Polygon	110667.293	Nevada	32	Mtn	NV	1201833	1652993	11	466297	611880	589953	1012695	78771	19637	
Polygon	84870.185	Utah	49	Mtn	UT	1722850	2034167	20	537273	855759	867091	1615845	11576	24283	
Polygon	157774.187	California	06	Pacific	CA	29760021	32197932	189	10381206	14897527	14862394	20524327	2208881	242164	28
Polygon	41132.862	Ohio	39	E N Cen	OH	10847115	11202691	263	4087546	5226340	5620775	9521756	1154826	20358	
Polygon	56237.904	Illinois	17	E N Cen	IL	11430602	11830919	203	4202240	5552233	5878369	8952978	1694273	21836	2
Polygon	66.063	District of Columbia	11	S Atl	DC	606900	535027	9187	249634	282970	323930	179657	399604	1466	
Polygon	2054.506	Delaware	10	S Atl	DE	666168	731219	324	247497	322968	343200	536094	112480	2019	
Polygon	24229.919	West Virginia	54	S Atl	WV	1793477	1803992	74	690557	901598	941941	1725529	56295	2459	
Polygon	9739.753	Maryland	24	S Atl	MD	4781468	5100899	491	1749991	2318571	2462797	3390964	1189899	12972	1
Polygon	104659.108	Colorado	08	Mtn	CO	3294394	3885615	32	1262489	1631295	1663099	2905474	133146	27776	
Polygon	40318.777	Kentucky	21	E S Cen	KY	3685296	3905565	91	1379782	1785235	1900061	3391832	262907	5768	
Polygon	82195.436	Kansas	20	W N Cen	KS	2477574	2582933	30	944726	1214645	1262929	2231986	143076	21965	
Polygon	39819.194	Virginia	51	S Atl	VA	6187358	6728895	155	2291830	3033574	3153384	4791739	1162994	15282	1
Polygon	69831.624	Missouri	29	W N Cen	MO	5117073	5387753	73	1961206	2464315	2652758	4486228	548098	19835	
Polygon	113711.522	Arizona	04	Mtn	AZ	3665228	4528886	32	1368843	1810891	1854537	2963186	110524	203527	
Polygon	70002.382	Oklahoma	40	W S Cen	OK	3145585	3318622	45	1206136	1530819	1614766	2588512	233881	252420	
Polygon	49046.813	North Carolina	37	S Atl	NC	6628637	7411239	135	2517026	3214290	3414347	5008491	1456323	80155	

How a GIS Works

Visualization: “Worth a thousand words”



What is NOT GIS?

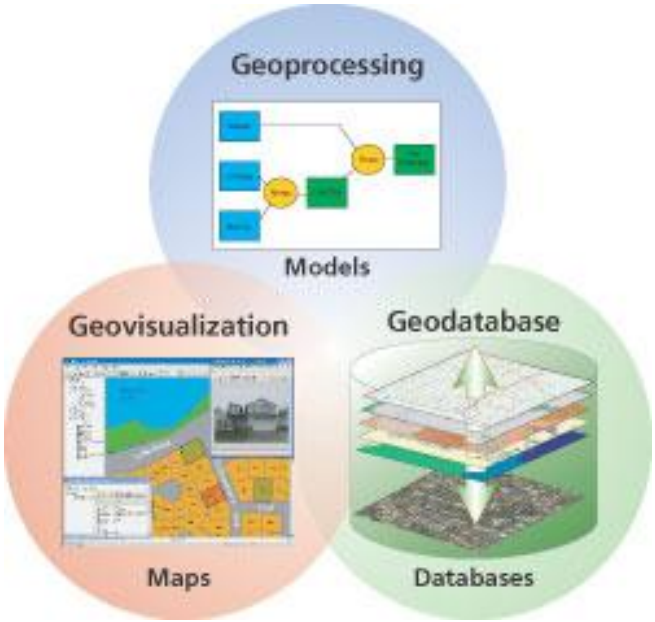
- GPS (Global Positioning System)
- A Map (paper or digital)
  - Maps are often a product of a GIS
  - A way to visualize the *analysis*
- A **software** package

Three Views of GIS

1) **Database View:** database for storing and managing information.

2) **Analysis View:** a tool for finding answers to questions.

3) **Visualization View:** a tool for creating maps.



GIS Functions

Capture: "Getting the data in". Digitizing hardcopy, integrating GPS points, import from vendors, clearinghouses or government sources.

Store: Raster and Vector formats

Query: Ability to extract info about features — either directly on the map (by clicking) or by querying the database table for a value (ex: counties with a population > 1 million) with a simple SQL statement.

Analyze: 3 groups of analysis

1. **Proximity**: how close or far one feature is to another.

2. **Overlay**: different layers of information and how they interact/relate.

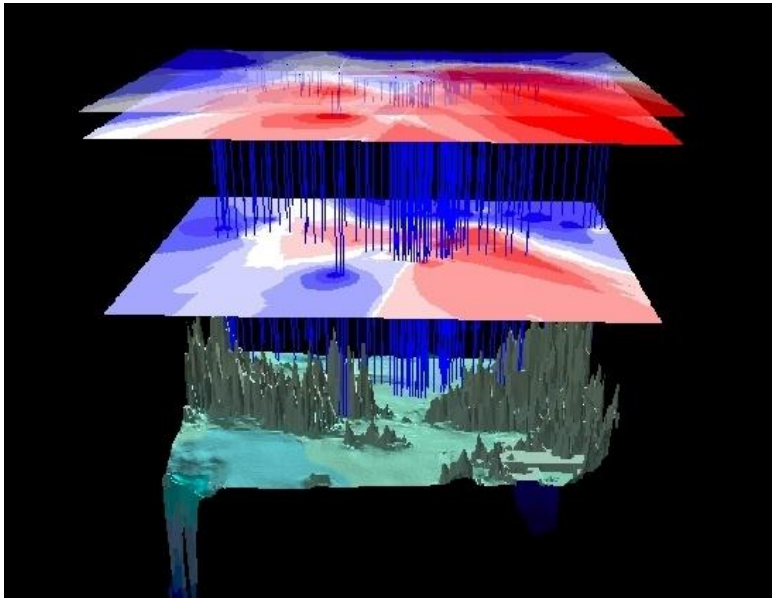
3. **Network**: Finding the best route from point A to point B.

Display: Show results visually! The ability to view tabular data in graphical form (on a map).

Output: Multiple output formats for sharing data and information: new derived data, images, paper maps, web mapping services, reports, map files (.mxd's to share from desktop to desktop).

How to use a GIS (6 ways)

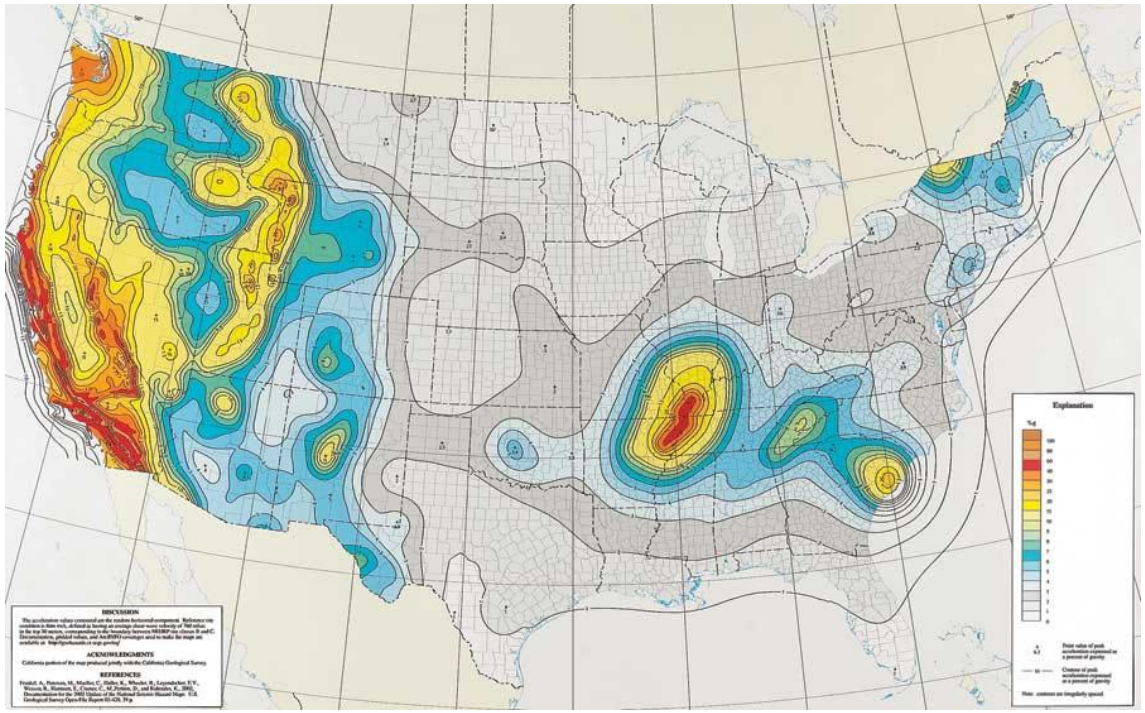
1. Mapping where things are
2. Mapping quantities
3. Mapping densities
4. Finding what's inside
5. Finding what's nearby
6. Mapping change



Mapping where things are

Mapping where things are lets you find places that have the features you are looking for.

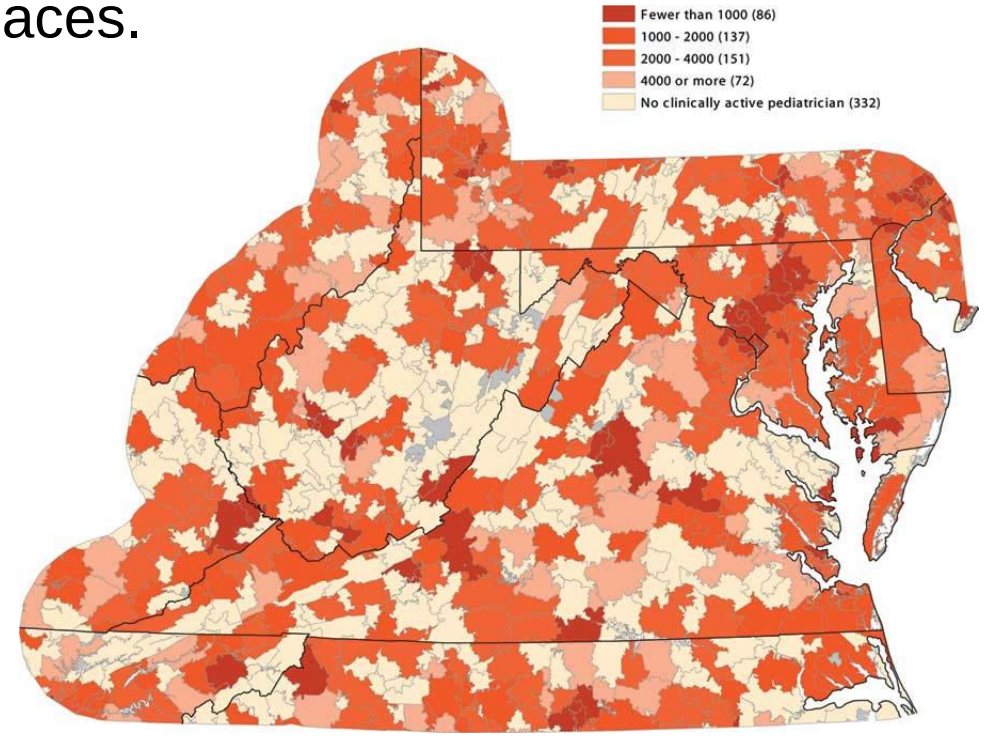
- Find Features
- Find Patterns



Map of the locations of earthquake shaking hazards: This information is essential to create and update building codes used in the United States.

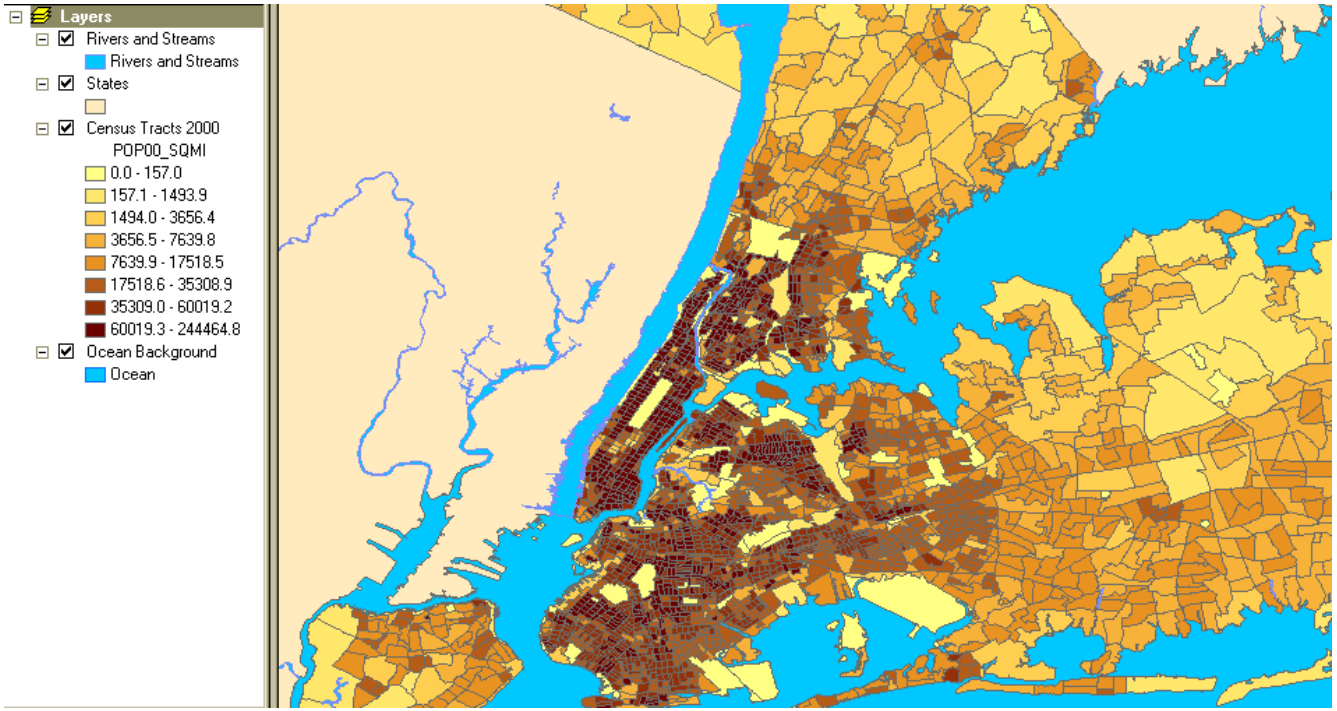
Mapping quantities

People map quantities, such as where the most and least are, to find places that meet their criteria or to see the relationships between places.



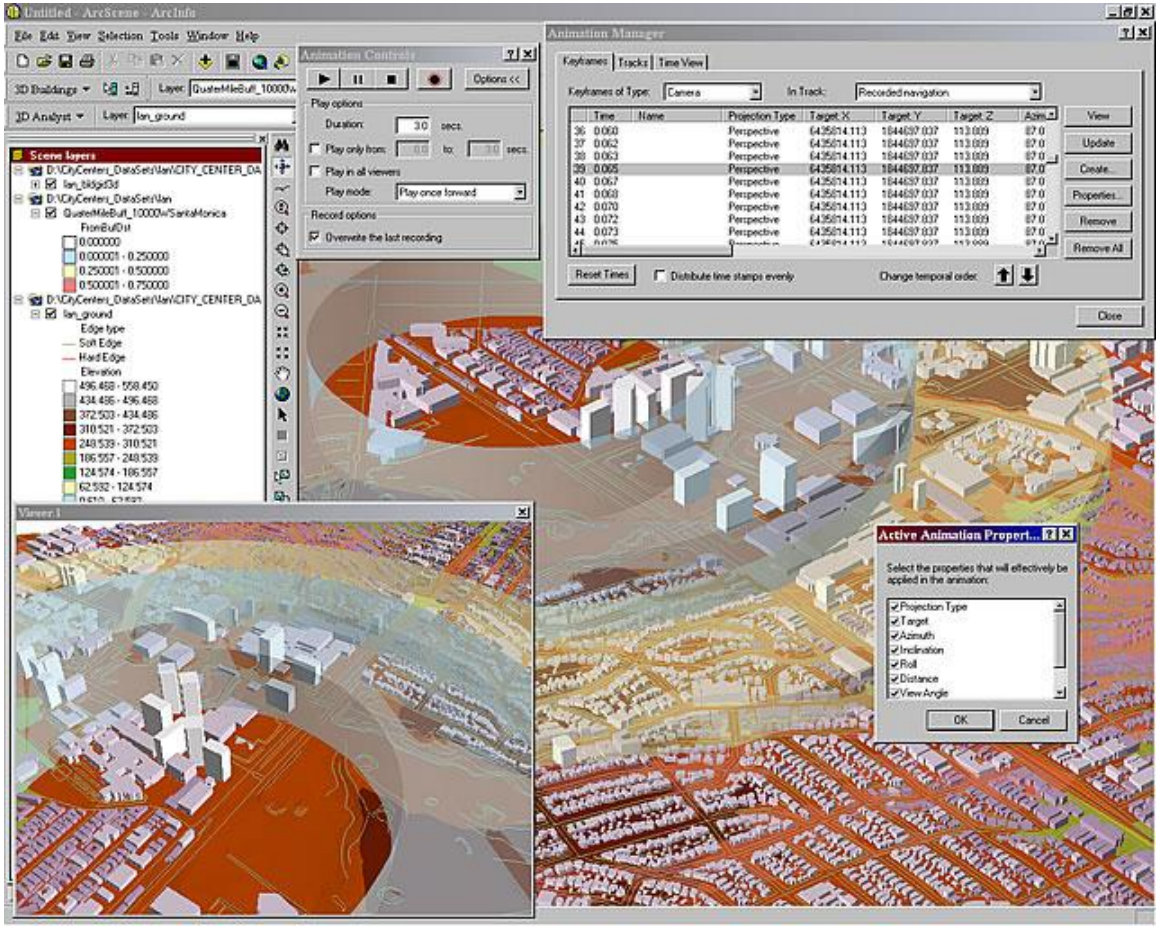
Mapping densities

While you can see concentrations by simply mapping the locations of features, in areas with many features it may be difficult to see which areas have a higher concentration than others.



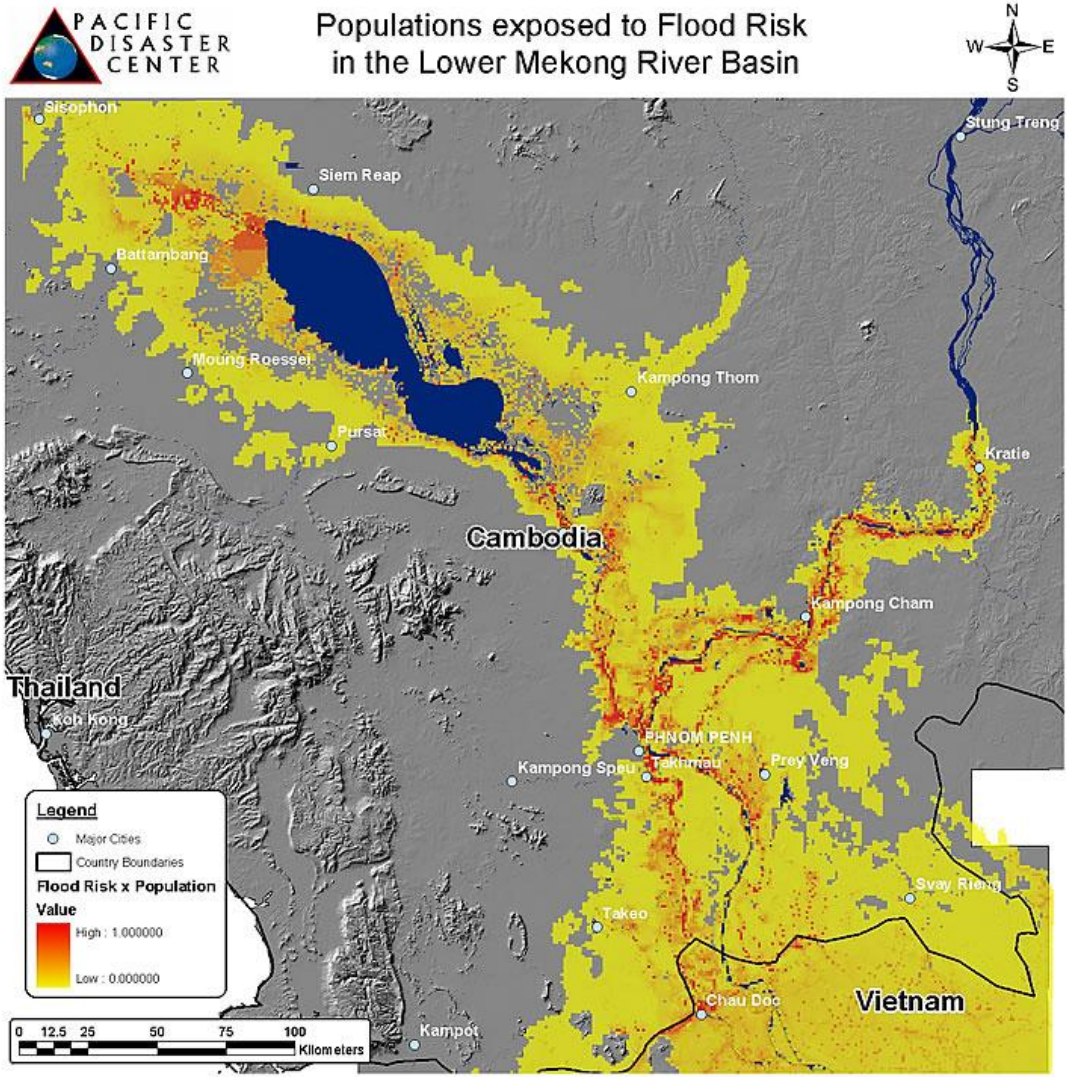
Finding what's inside

Use GIS to monitor what is happening by mapping what is inside a specific area.



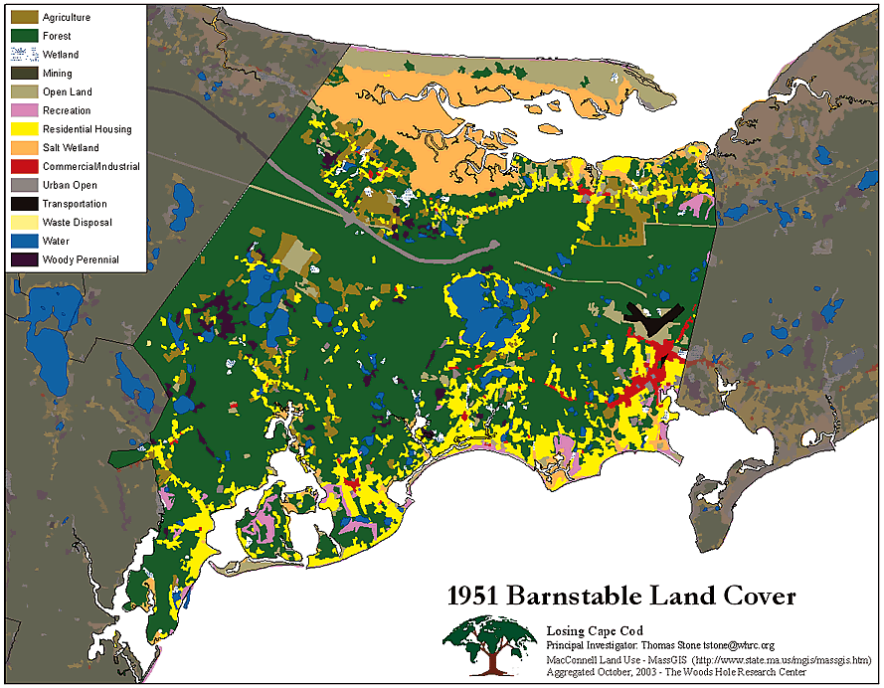
Finding what's nearby

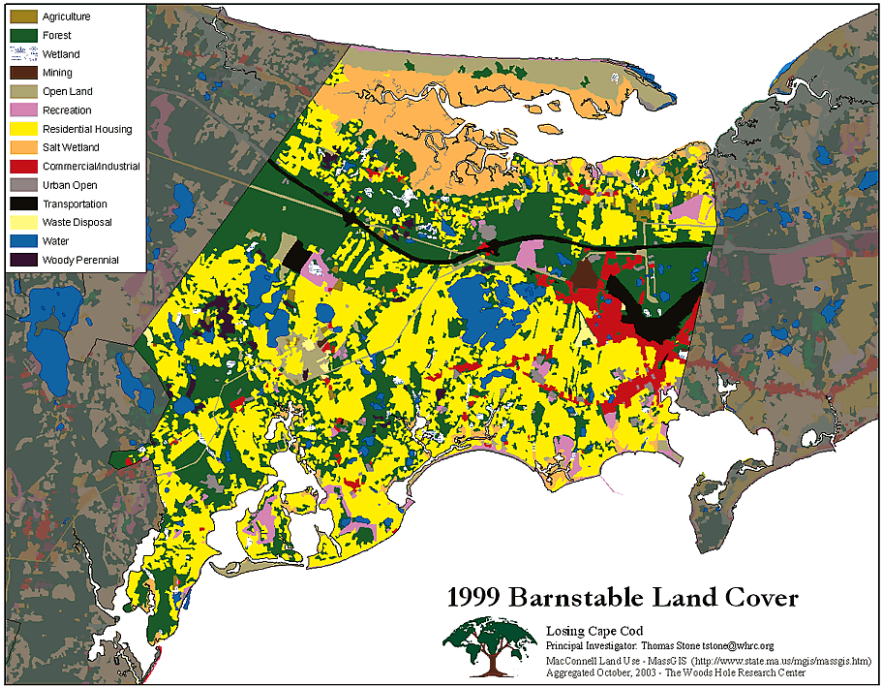
Find out what is occurring within a set distance of a feature by mapping what is nearby.



Mapping change

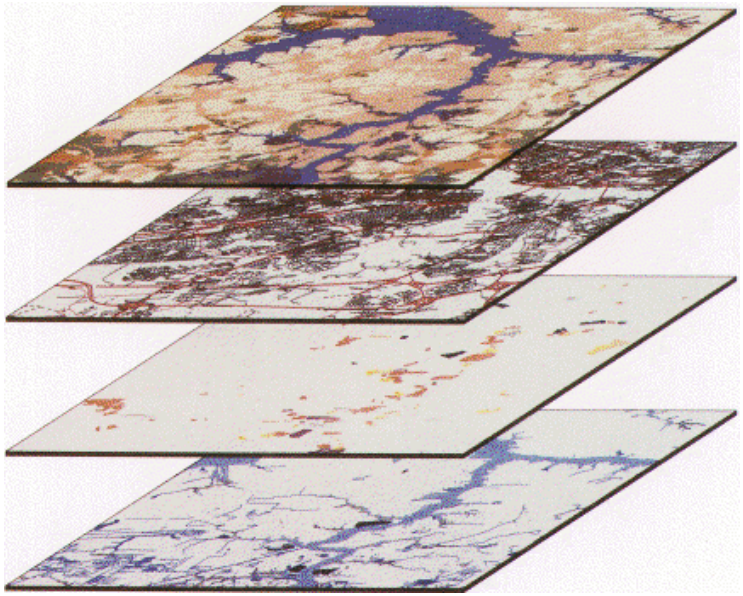
Map the change in an area to anticipate future conditions, decide on a course of action, or to evaluate the results of an action or policy.





Estimates are that 80% of all data has a *spatial* component

- Data from most sciences can be analyzed “spatially”



Geospatial Data Are …

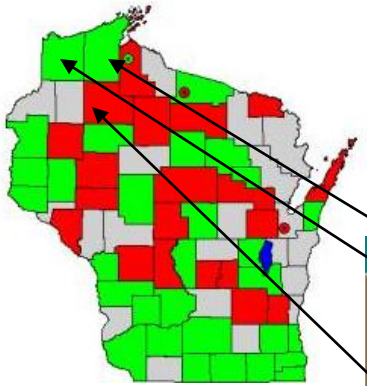
Digital representations of real-world features that:

- describe objects and relations among them
- include spatial reference information
- contain both geometric and thematic data
- come in many different formats
- support a wide range of applications
- offer more flexibility than hardcopy maps

Spatial and Attribute Data

The basic data types in a GIS reflect traditional data found on a map. GIS technology utilizes two basic types of data.

- **Spatial data:** describes the absolute and relative location of geographic features.



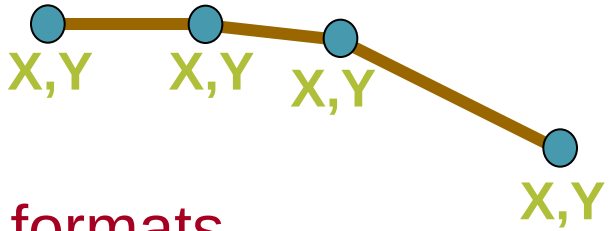
Attributes of dtl_cnty

ObjectID	NAME	STATE_NAME	FIPS
4718592	Bayfield	Wisconsin	55007
4718593	Douglas	Wisconsin	55031
4718594	Ashland	Wisconsin	55003
4718595	Iron	Wisconsin	55051
4718596	Vilas	Wisconsin	55125
4718597	Washburn	Wisconsin	55129
4718598	Sawyer	Wisconsin	55113
4718599	Burnett	Wisconsin	55013
4718600	Forest	Wisconsin	55041
4718601	Florence	Wisconsin	55037
4718602	Price	Wisconsin	55099
4718603	Oneida	Wisconsin	55085
4718604	Marinette	Wisconsin	55075

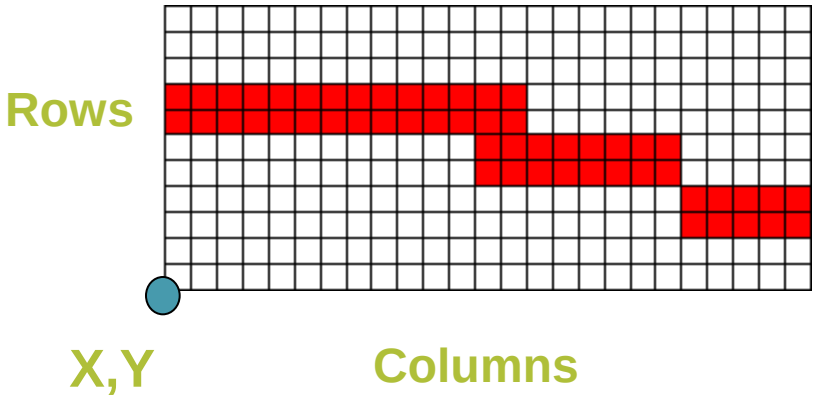
- **Attribute data:** Describes characteristics of the spatial features. These characteristics can be quantitative and/or qualitative in nature. Attribute data is often referred to as tabular data.

Formats: Raster and Vector

- Vector formats
  - Discrete representations of reality



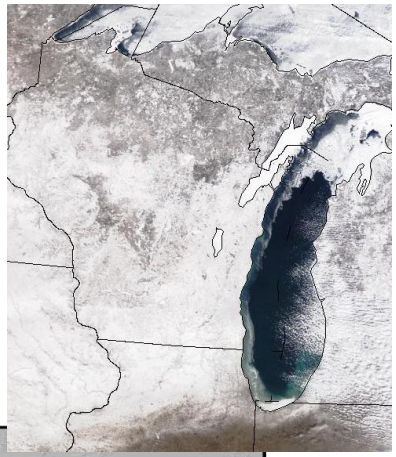
- Raster formats
  - Use square cells to model reality

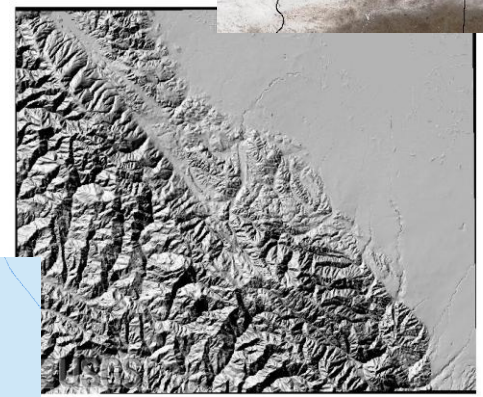


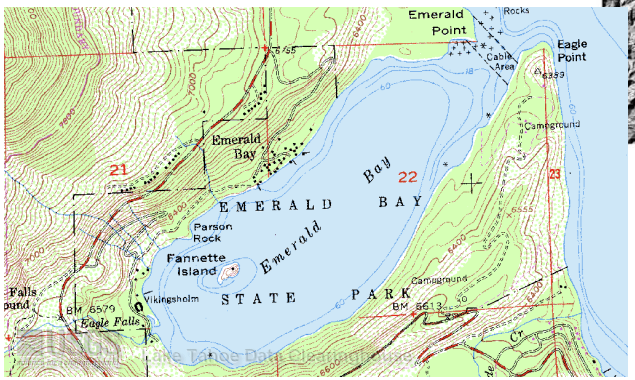
Reality
(A highway)

Raster examples

- Orthophotography
- Digital elevation models (DEM)
- Digital raster graphics (DRG)
- Satellite imagery
- Grid (ArcGIS)

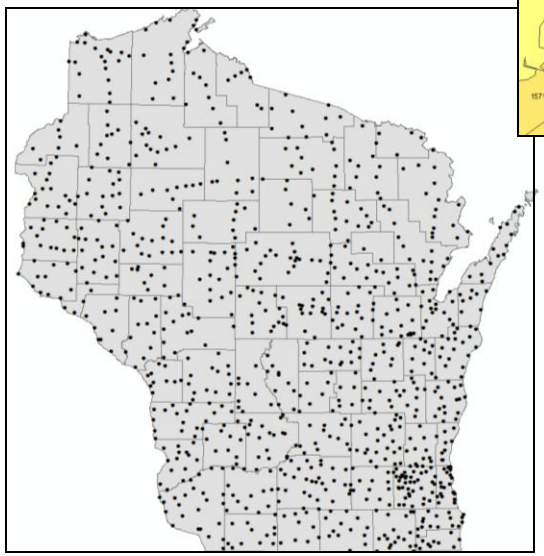


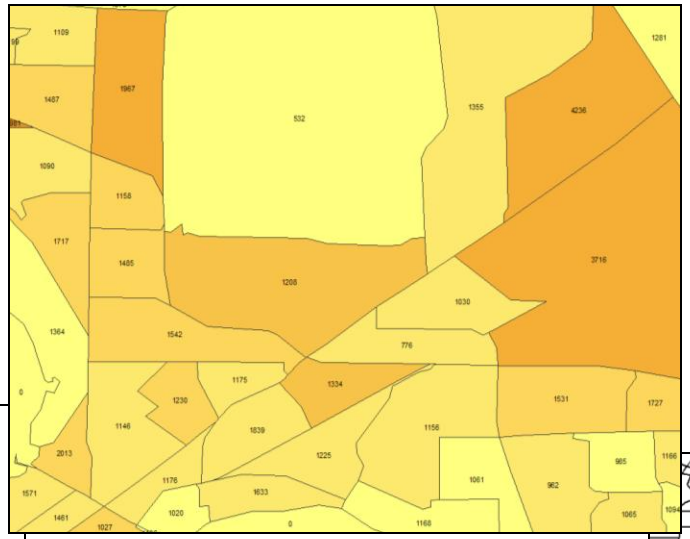




Vector examples

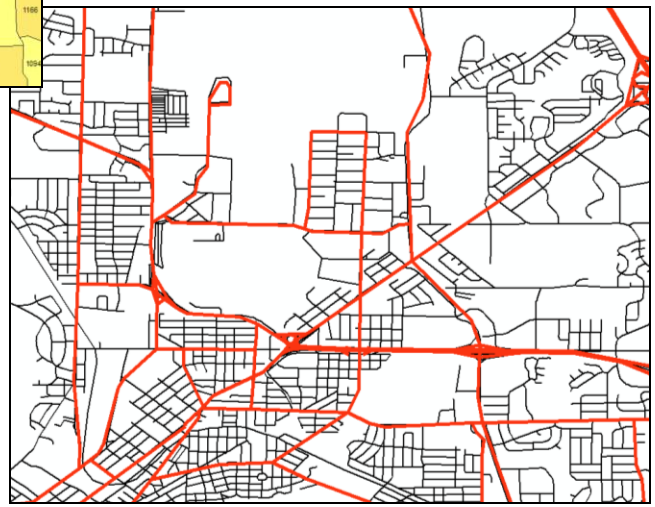
Cities (points)





Census Block Group boundaries (polygons)

Roads (lines)



Common GIS files

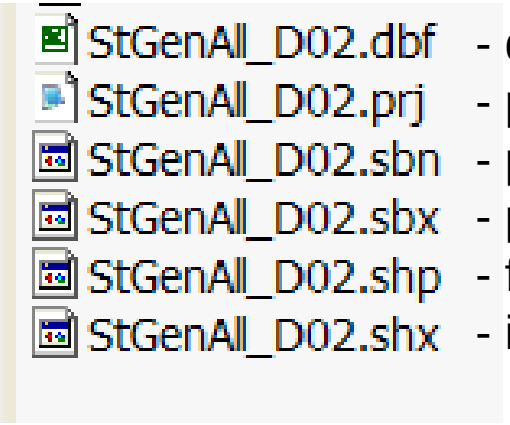
.shp – Shapefile (ESRI)
.mif – MapInfo
.dwg – AutoCAD drawing
.dxf – AutoCAD exchange
.dgn – Bentley Microstation
.e00 – ArcINFO export (ESRI) (ESRI coverage)

.tif (TIFF/GeoTIFF)
.dem (Digital Elevation Model)
SDTS (Spatial Data Transfer Standard)

File Geodatabase (.gdb)
Personal Geodatabase (.mdb)

Geospatial Data Types and Formats

The Shapefile (an open format)



The essential 3 needed to draw the shapefile correctly: .shp; .shx; .dbf

Projections and Coordinate Systems

Projections

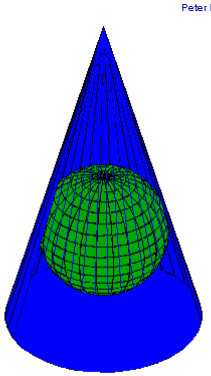
- The best model of the earth would be a 3-dimensional solid in the same shape as the earth. (i.e. a globe).

- Globes have several drawbacks:
  - Globes are large and cumbersome.
  - They are generally of a scale unsuitable to the purposes for which most maps are used.
  - Usually we want to see more detail than is possible to be shown on a globe.

- Standard measurement equipment (rulers, protractors, planimeters, dot grids, etc.) cannot be used to measure distance, angle, area, or shape on a sphere, as these tools have been constructed for use in planar models.

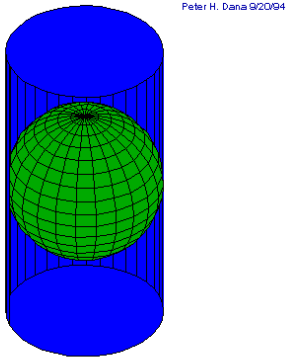
Projections and Coordinate Systems

Projection surfaces (i.e., cylinders, cones, and planes) form the basic types of projections



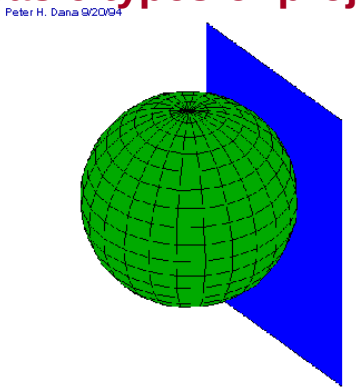
Conical Projection Surface

1. Standard parallels are where the cone touches or slices through the globe.
2. The central meridian is opposite the edge where the cone is sliced open.
3. Conic projections are used frequently for mapping large areas (e.g., states, large countries, or continents).



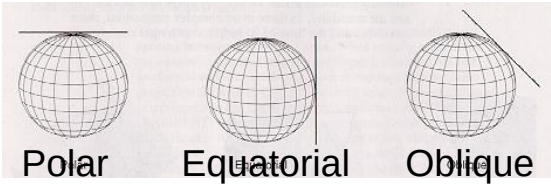
Cylindrical Projection Surface

1. The most common cylindrical projection is the Mercator projection, which is the basis of the UTM (Universal Transverse Mercator) system.



Planar Projection Surface

1. Different orthographic projection parameters:



Projections and Coordinate Systems

Although many different map projections exist, they all introduce distortion in one or more of the following measurement properties:

- Shape
- Distance
- True Direction
- Area

There are names for the different classes of projections that minimize distortion:

- Those that minimize distortion in shape are called **conformal**.
- Those that minimize distortion in distance are known as **equidistant**.
- Those that minimize distortion in area are known as **equal-area**.
- Those minimizing distortion in direction are called **true-direction** projections.

Projections and Coordinate Systems

- Once map data are projected onto a planar surface, features must be referenced by a planar coordinate system.

- The geographic system (latitude-longitude), which is based on angles measured on a sphere, is not valid for measurements on a plane.

- A Cartesian coordinate system is used, where the origin (0, 0) is toward the lower left of the planar section.

- Coordinates in the GIS are measured from the origin point. However, **false eastings** and **false northings** are frequently used, which effectively offset the origin to a different place on the coordinate plane. This is done in order to achieve several purposes:

  - Minimize the possibility of using negative coordinate values (to make calculations of distance and area easier).

  - Lower the absolute value of the coordinates (to make the values easier to read, transcribe, calculate, etc.).

Projections and Coordinate Systems

The two most common coordinate/projection systems in the USA are:

- **State Plane**

- The state plane system includes different projections for each state, and frequently different projections for different areas *within* each state.

-The State Plane system was developed in the 1930s to simplify and codify the different coordinate and projection system for different states within the USA.

- **Universal Transverse Mercator (UTM)**

- A particular subset of the transverse Mercator is the Universal Transverse Mercator (UTM) which was adopted originally by the US Army for large-scale military maps.

- In the UTM system, the globe is divided into 60 zones between 84 S and 84 N, most of which are 6 wide. Each UTM zone has its own central meridian and spans 3 west and 3 east from the center of the zone.

Geospatial Metadata

GIS metadata Standards

- Purpose:
  - Describe the content, quality, condition
  - Help users locate and understand data
- Use:
  - Maintain organization's investment
  - Provide information to clearinghouses
  - Provide information for data transfer

Geospatial Metadata – sample FGDC record

Dane County (WI) Digital Orthophotography

Metadata also available as - [Questions & Answers] - [Parseable text] - [XML]

Metadata:

- Identification_Information
- Data_Quality_Information
- Spatial_Data_Organization_Information
- Spatial_Reference_Information
- Entity_and_Attribute_Information
- Distribution_Information
- Metadata_Reference_Information

Identification_Information:

Citation:
Citation_Information:
Originator: Dane County Land Information Office
Publication_Date: 1995
Title: Dane County (WI) Digital Orthophotography
Publication_Information:
Publication_Place: Madison, WI
Publisher: Dane County Land Information Office

Description:
Abstract:
The orthophotos are a raster data set derived from 1:31,680 scale aerial photography that was flown in the spring of 1995. It was flown to provide full 1-meter coverage of the county, replacing the 2-meter USGS digital orthophoto quarterquad mapping that covered only part of the county. The data are divided into 35 township-based data sets.

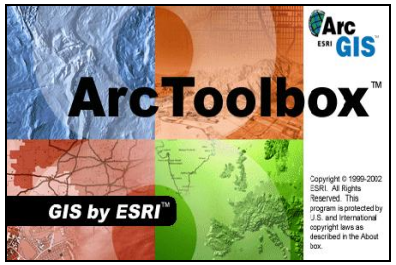
ArcGIS

- One suite with three applications
- ArcGIS capabilities vary depending on license type -ArcView, ArcEditor, ArcInfo

GIS Software

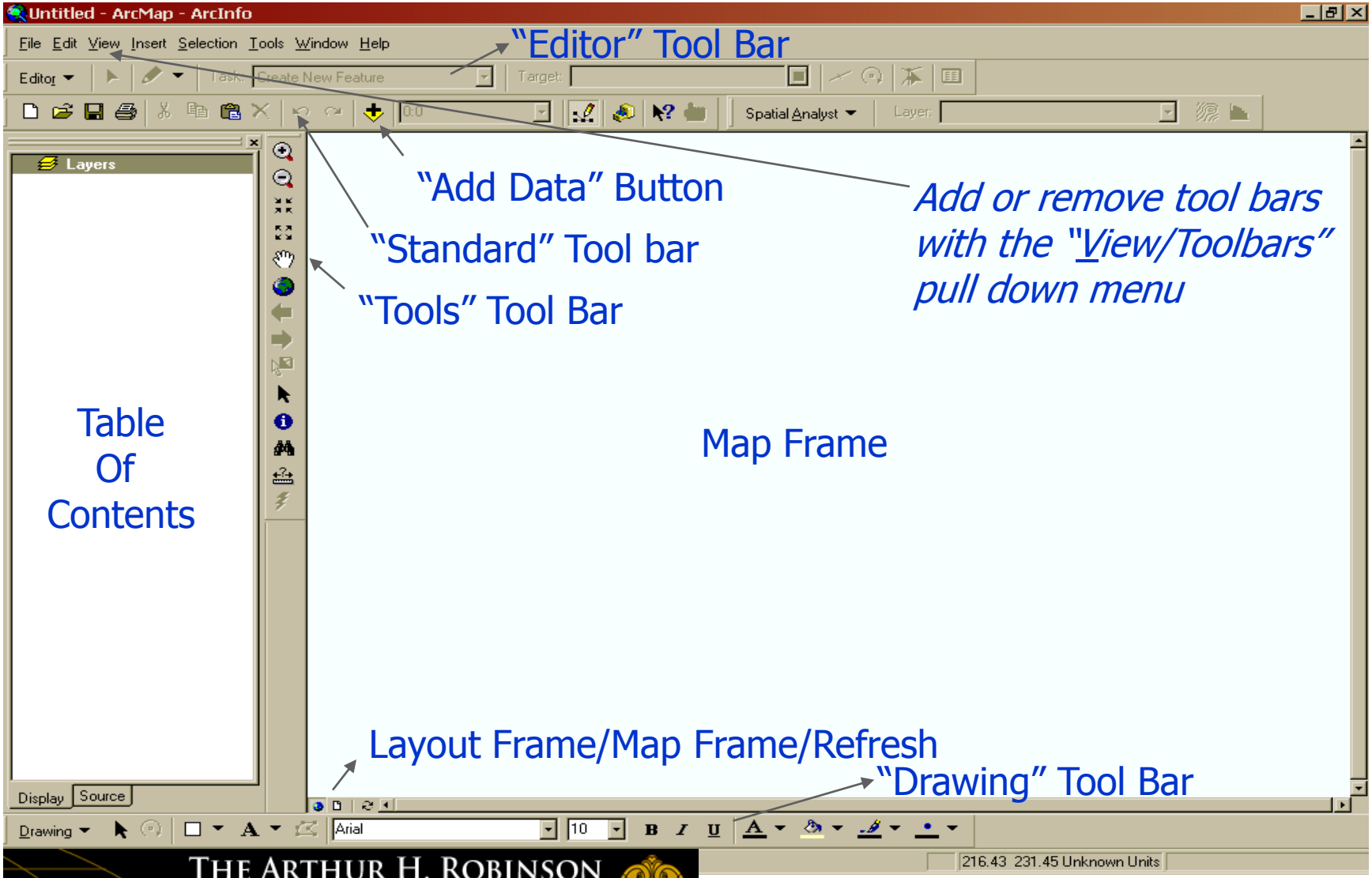
With **ArcCatalog**, you can view GIS data holdings, preview geographic information, view and edit metadata, and work with tables.

ArcMap is the desktop application for all map-based tasks including cartography, map analysis, and editing. ArcMap allows you to: Visualize data, Create maps, Solve problems, Present analysis & Develop results



ArcToolbox is an application containing many GIS tools used for geoprocessing as well as file conversion, manipulation, and editing.

GIS Software



Geographic Information Systems:
Agricultural Applications

Part I: Data Sources and Web Mapping Services

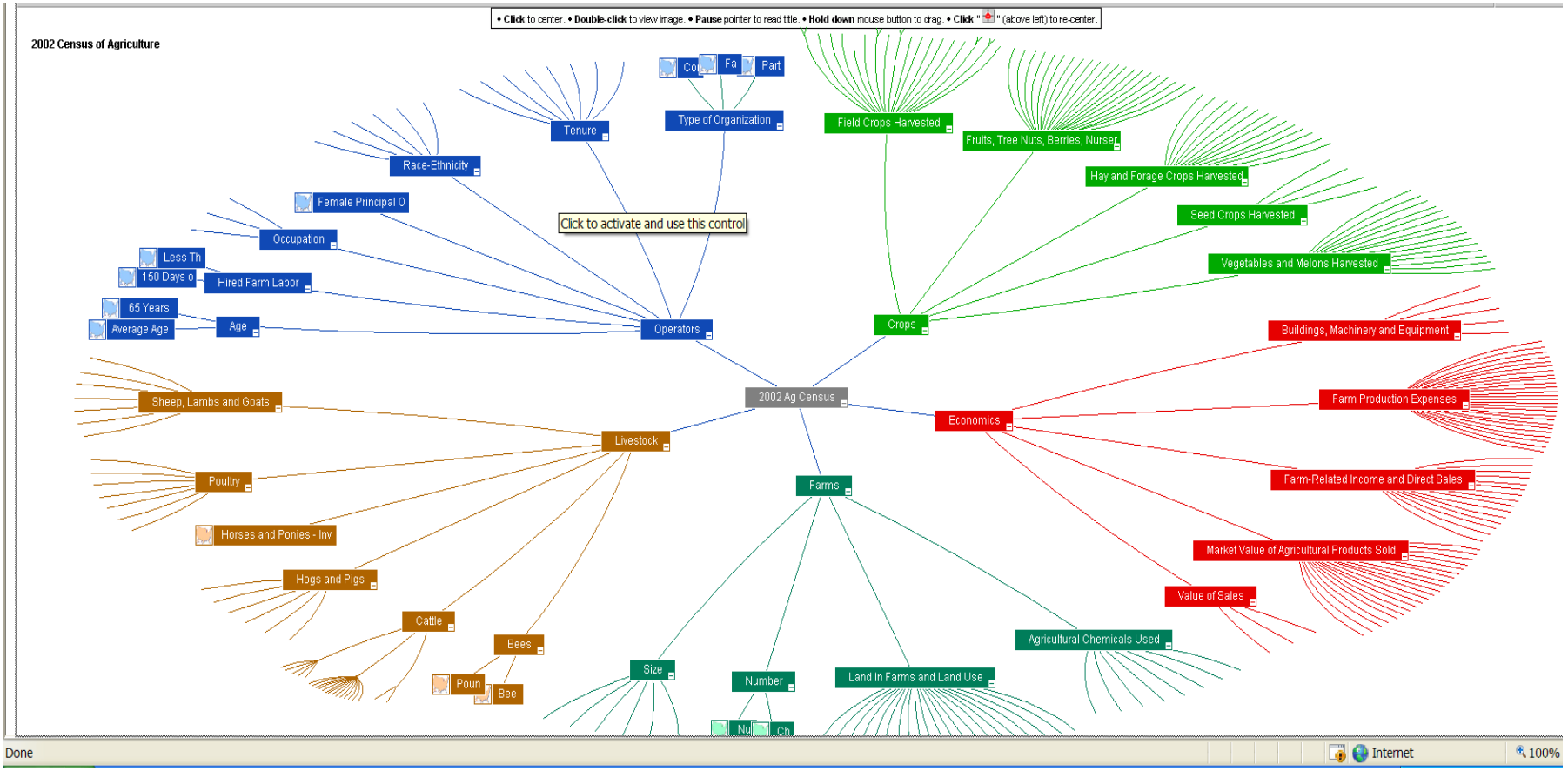
Agricultural Applications – Part I: Data Sources and WMS

USDA – Census of Agriculture:
http://www.agcensus.usda.gov/Publications/2002/index.asp

Agricultural Applications – Part I: Data Sources and WMS

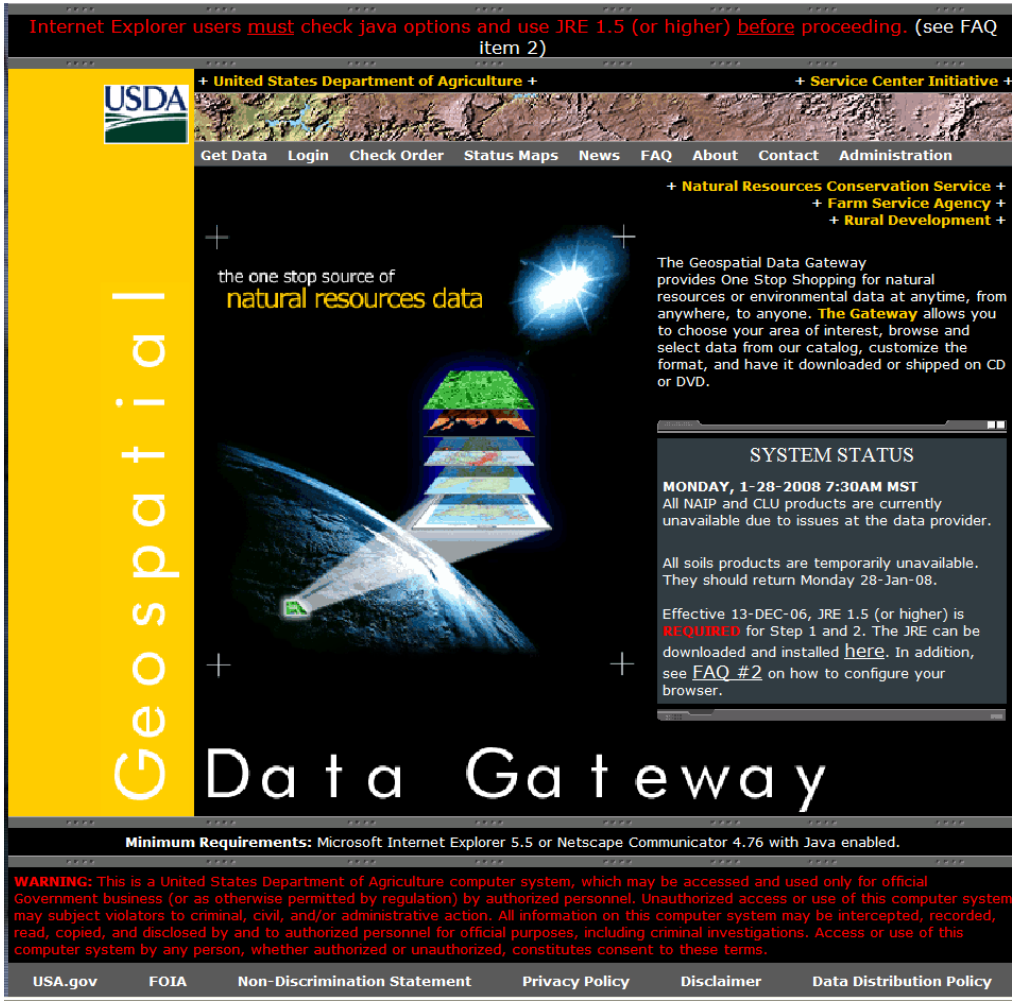
USDA – Census of Agriculture

http://www.nass.usda.gov/research/atlas02/atlas-info.html



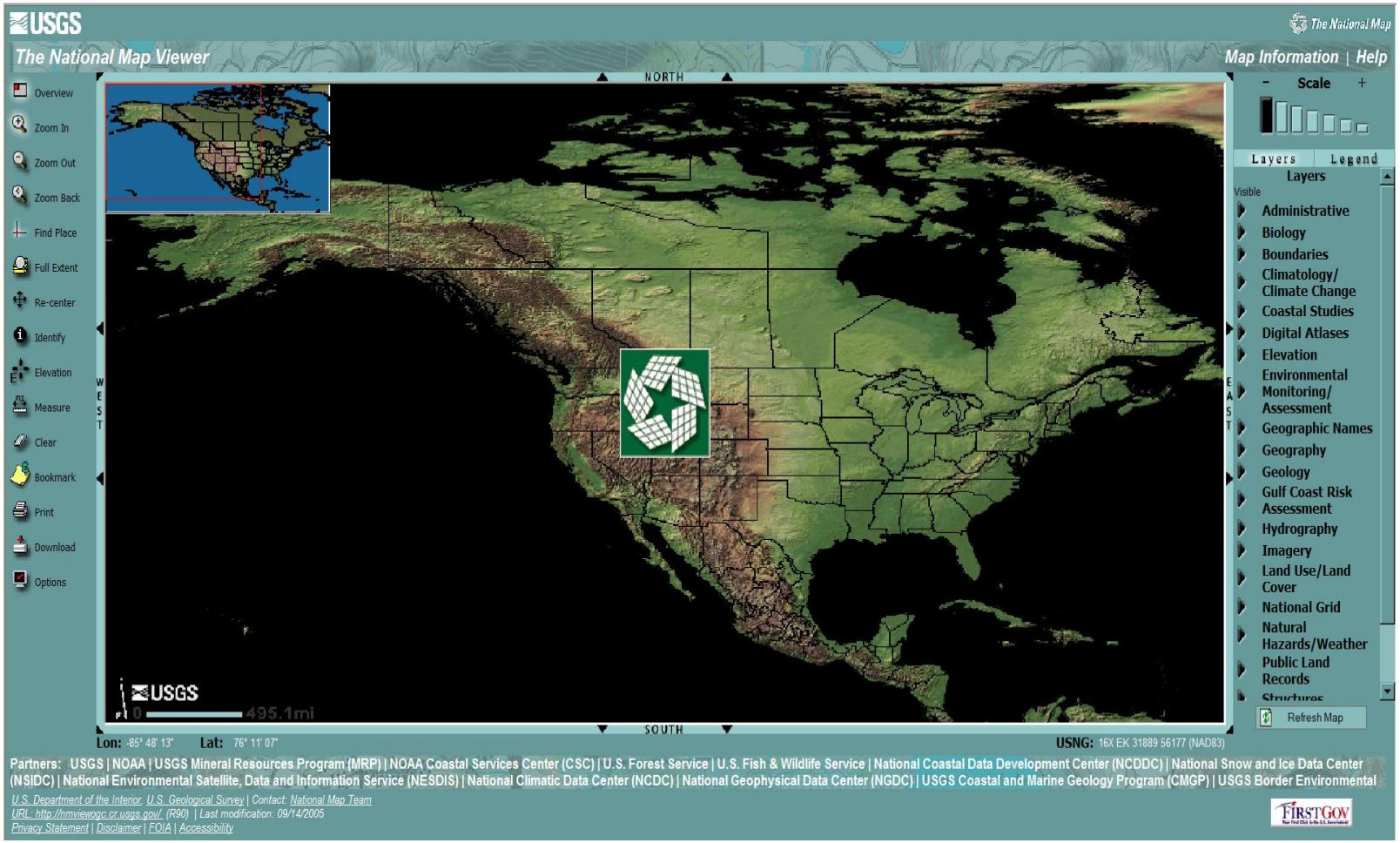
Agricultural Applications – Part I: Data Sources and WMS

NRCS Geospatial Data Gateway: http://datagateway.nrcs.usda.gov/



Agricultural Applications – Part I: Data Sources and WMS

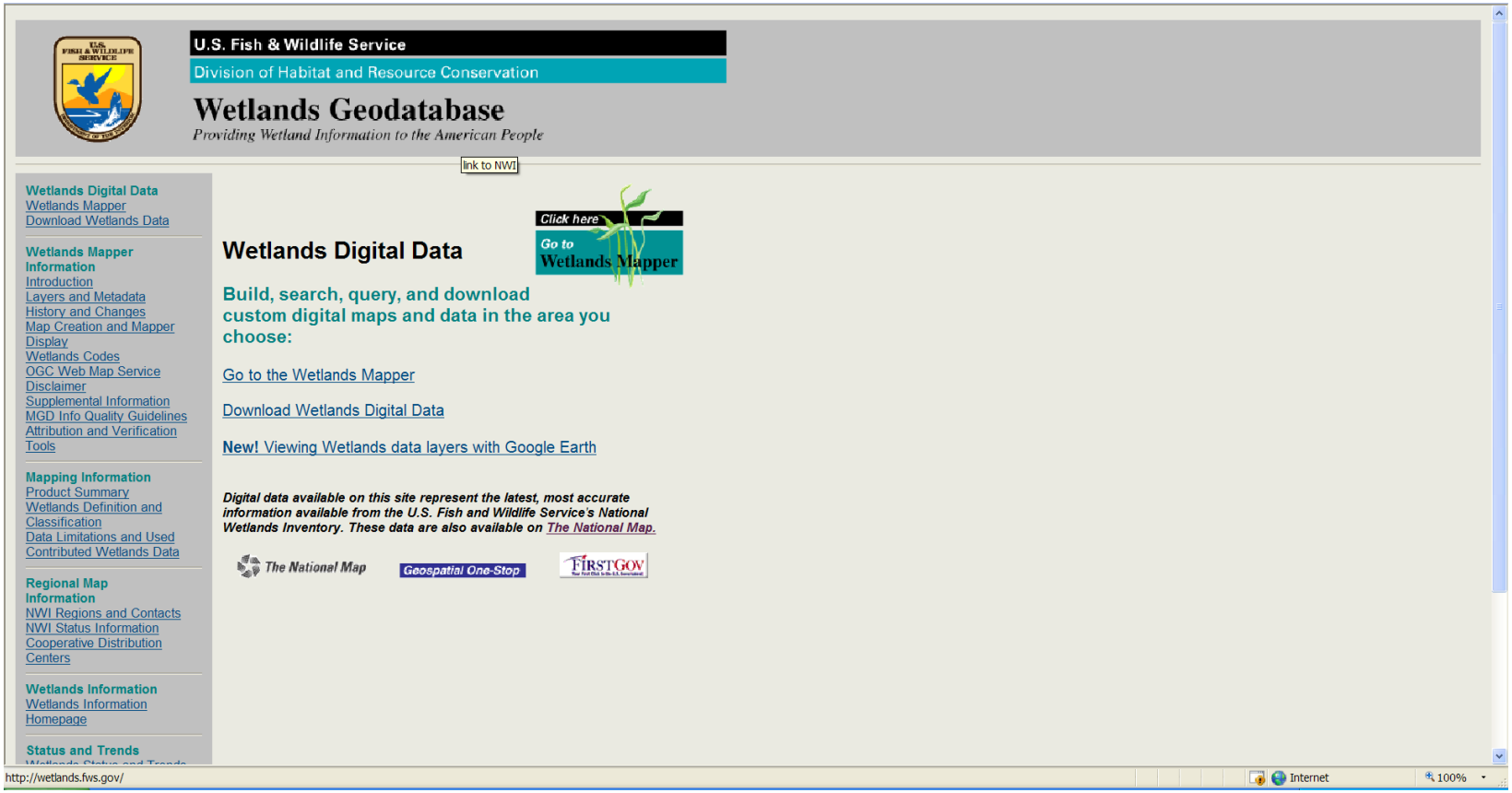
USGS – The National Map http://nationalmap.gov/



Agricultural Applications – Part I: Data Sources and WMS

The National Wetlands Inventory "Wetlands Mapper"

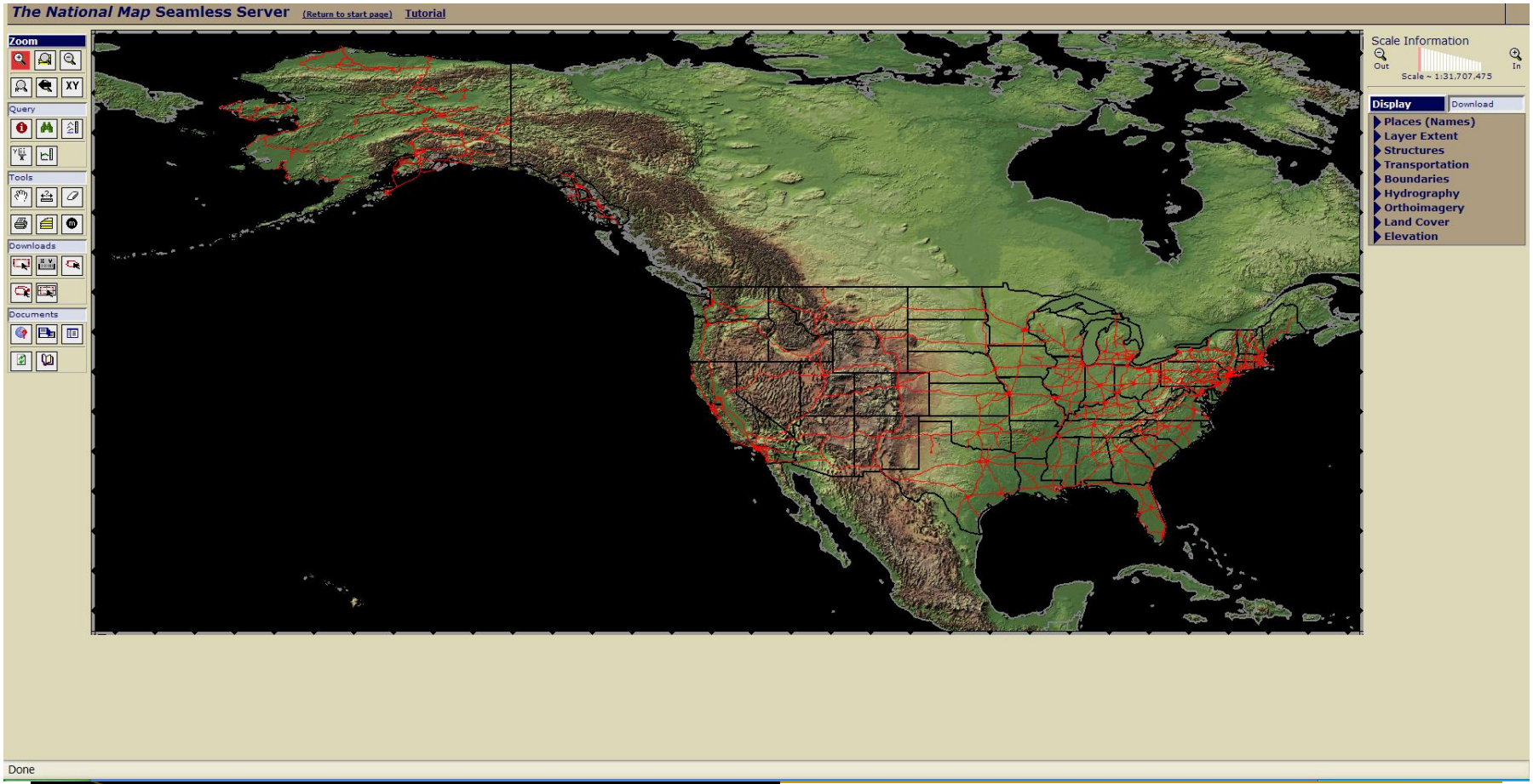
http://wetlandsfws.er.usgs.gov/NWI/index.html



Agricultural Applications – Part I: Data Sources and WMS

USGS – Seamless Data Distribution System

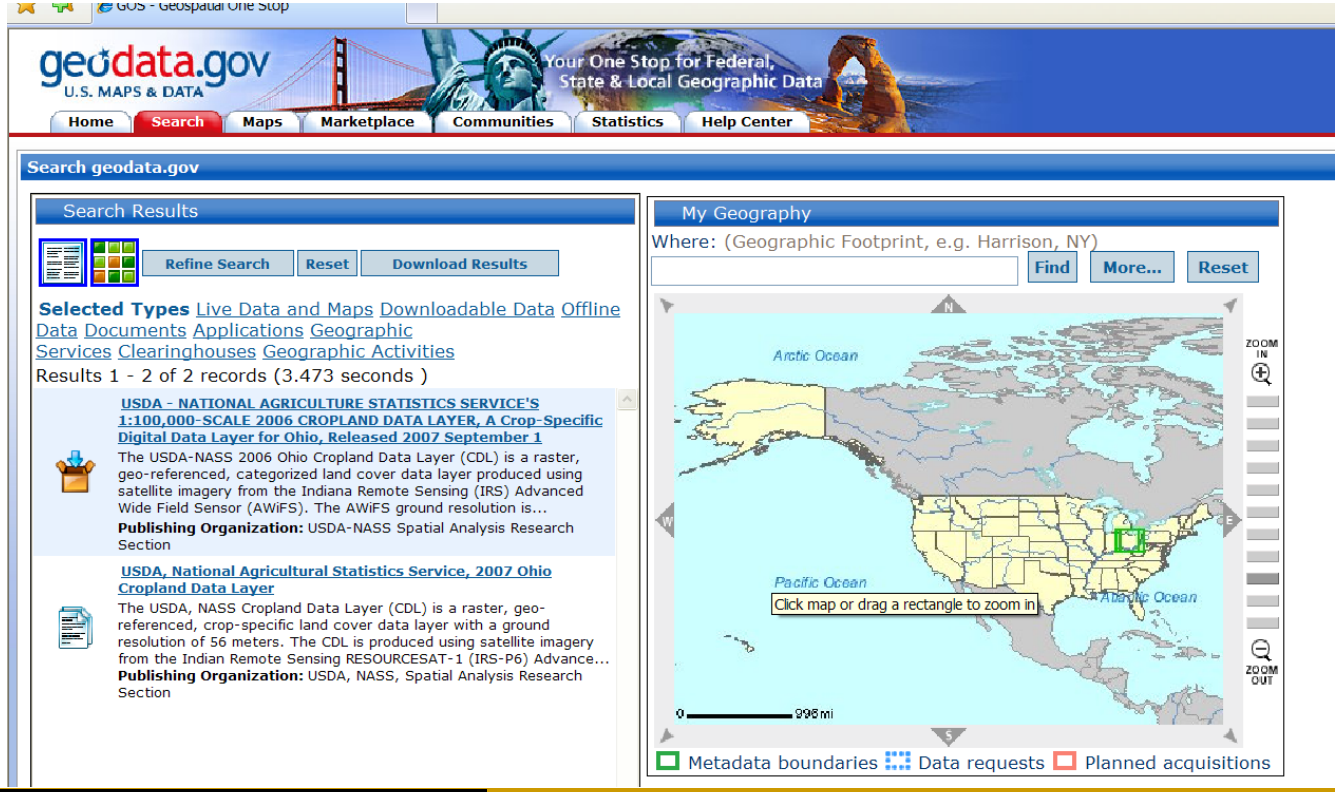
http://seamless.usgs.gov/website/Seamless/



Agricultural Applications – Part I: Data Sources and WMS

Geodata.gov – Multi-agency geospatial data clearinghouse (Federal Geographic Data Committee) http://gos2.geodata.gov/wps/portal/gos
(Also called "Geospatial One-Stop" or "GOS Portal")

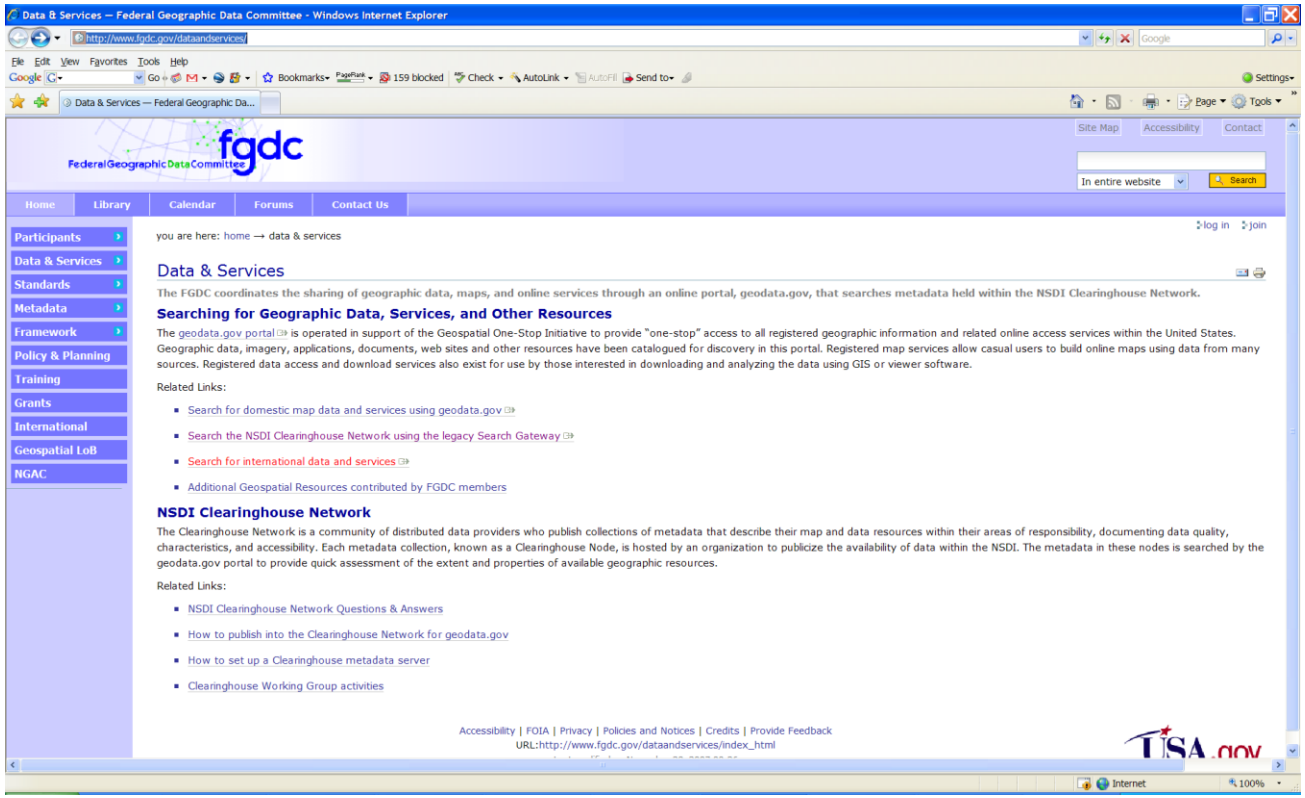
- Data from federal, state and local agencies is published here in a variety of formats from downloadable data to web mapping services



Agricultural Applications – Part I: Data Sources and WMS

Federal Geographic Data Committee – National Spatial Data Infrastructure (NSDI Clearinghouse) – The "Legacy" search interface ("replaced" by the GOS portal)

http://www.fgdc.gov/dataandservices/



Agricultural Applications – Part I: Data Sources and WMS

USDA APFO (NAIP Imagery): http://www.fsa.usda.gov/
2006 2m resolution aerial photography available in map viewer

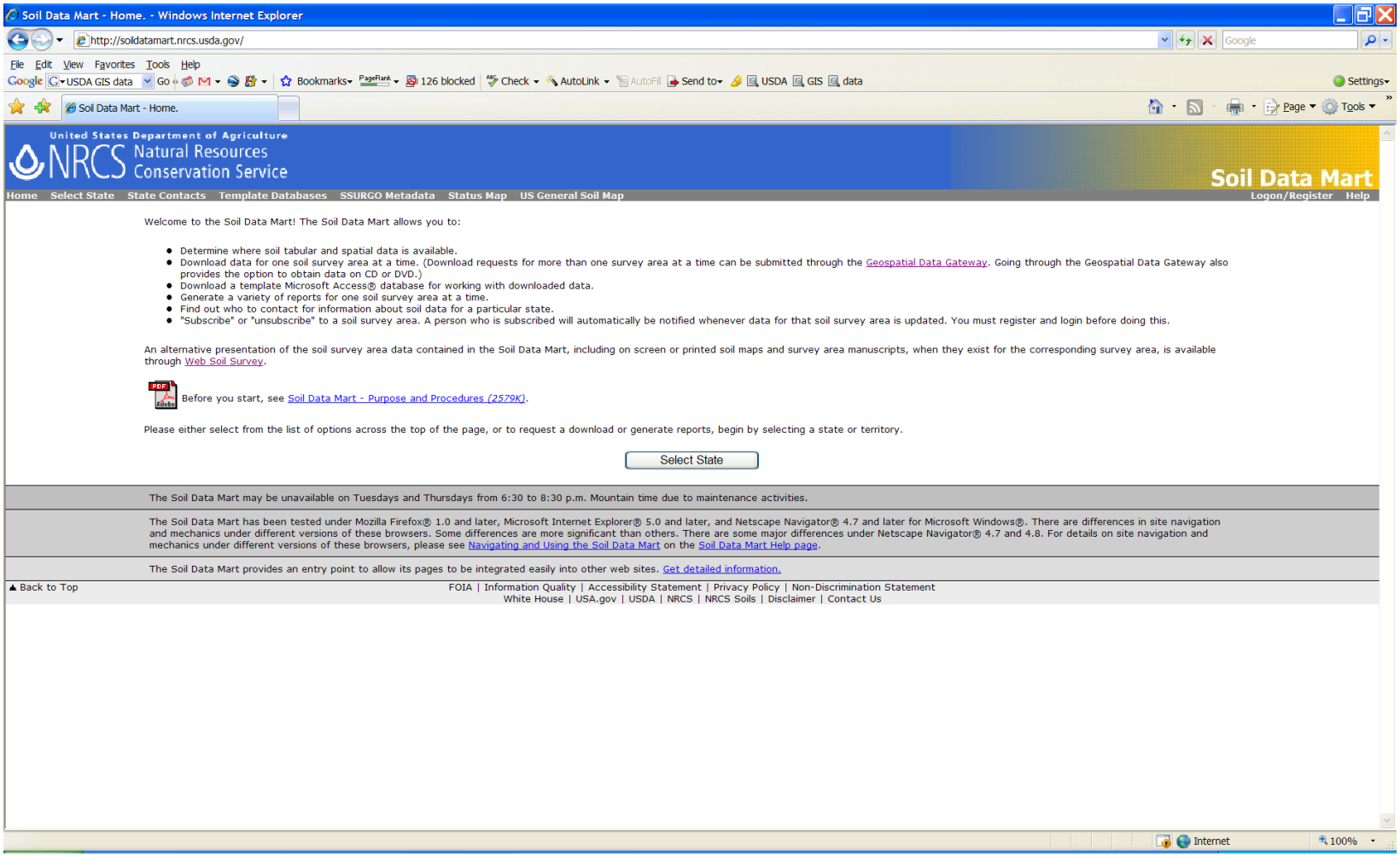
Other sources of NAIP photography may be at a local level: (2005-2006)
For example: **WisconsinView** http://www.wisconsinview.org/

Agricultural Applications – Part I: Data Sources and WMS

NRCS – Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/

Agricultural Applications – Part I: Data Sources and WMS

NRCS – Soil Data Mart (direct download tabular and spatial soils data)



Agricultural Applications – Part I: Data Sources and WMS

Local Resources – Who is producing GIS data in your state?

Government agencies and some non-profit organizations across the country produce geospatial datasets focused on local regions, state, county or municipality

Example: Wisconsin DNR
http://www.dnr.state.wi.us/maps/gis/applist.html

Example: Dane County, WI
http://dcimap.co.dane.wi.us/dcimap/index.htm

Example: University of Wisconsin Extension
http://www.uwex.edu/

Wisconsin Land Trusts:
http://www.gatheringwaters.org/

Streaming Web Mapping Services into ArcMap - DEMO

- Image services/Feature services
- “Add GIS Servers” option in ArcMap
- Choose ‘ArcIMS Service’ in most cases

National Map: http://nmviewogc.cr.usgs.gov

National Wetlands Inventory: http://wetlandsfws.er.usgs.gov

Wisconsin Department of Natural Resources: http://dnrmaps.wisconsin.gov/

Agricultural Applications – Part I: Data Sources and WMS

30 Minute Break

Agricultural Applications – Part I: Data Sources and WMS

NRCS – Soil Data Mart (direct download tabular and spatial soils data)
http://soildatamart.nrcs.usda.gov/

Soil Data Viewer Demonstration

http://soildataviewer.nrcs.usda.gov/

Demonstrations:

ArcGIS Explorer
&
Google StreetView

http://maps.google.com/

ArcGIS 9.2 Exercise

Thematic Mapping:
2002 Census of Agriculture

Geographic Information Systems: Agricultural Applications

Part II: GIS in the Field

Agricultural Applications – Part II: GIS in the Field

Field Data Collection

- Hand-held GIS units in the field become the modern day shirt-pocket notebook

- Farmers have the ability to look at images of their fields while they are actually standing in them

Agricultural Applications – Part II: GIS in the Field

Farm Management

GIS Applications include:

- the ability to estimate crop yields
- the remote estimation of areas within a field that are suffering a form of stress caused by a specific pest
- the identification of areas of land suffering from soil erosion

Agricultural Applications – Part II: GIS in the Field

Creating Data

- Data interpolation: the process of taking many single points and creating a complete surface, the gaps being filled based on the spatial statistics of the original points.

- Point data might include crop yields collected from a combine harvester, soil samples collected manually throughout a farm, or water quality information collected from watering points or wells

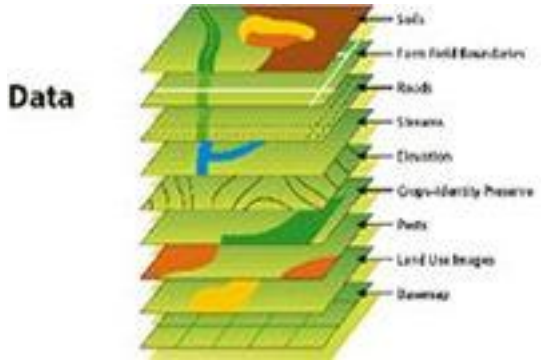
- Example: the yield monitor data maps indicate an area with unusually low yields. Geospatial analysis lets the user discover relationships in the same farm field geography that may be the cause of low yields such as slope, moisture, fertility, or poor pesticide performance.

Agricultural Applications – Part II: GIS in the Field

Interpreting Results

- A landscape is made up of many interconnected parts, and it is within a GIS that an attempt is made to re-create this complexity within the less complicated structure of a computing environment.

- If the data layers exist at the farm level, calculations can be made to show the total land areas under different crops, the value of cropland for insurance purposes, and the degree of risk associated with different crops should various weather events occur.



Agricultural Applications – Part II: GIS in the Field

Maps and Reports

- There are benefits to having all of the farm data readily available as a series of maps, each one telling a specific story to a specialized audience.

- One of the most obvious and immediate outputs from a farm GIS is maps that provide you with new insight.

- Planning applications, filing tax returns, and claiming crop subsidies either require mapped information or are greatly assisted by it.

Agricultural Applications – Part II: GIS in the Field

Precision Farming

- Precision farming (PF) and variable rate technologies (VRT) use spatial databases within field environmental and management variables with the aim of evening the application of field inputs while maximizing production across a field. Data is collected in a variety of ways, from handheld GPS units to mobile georeferenced sampling hardware such as tractors and combine harvesters

- Once mapped, this data, which can include soil characteristics, pest locations, drainage systems, and previous harvest yields, can be used to formulate a location-based prescription for the field management in the coming year.

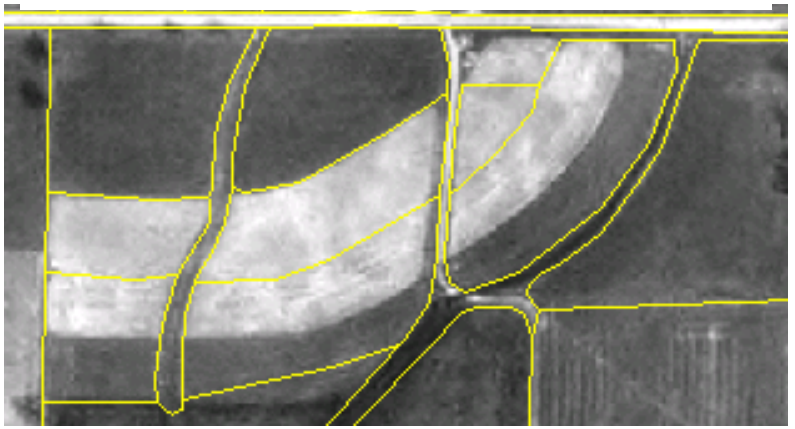
Geographic Information Systems: Agricultural Applications

Part III: FSA and GIS methods

Agricultural Applications – Part III: FSA and GIS methods

More Accurate and Consistent Crop Acreage Measurement

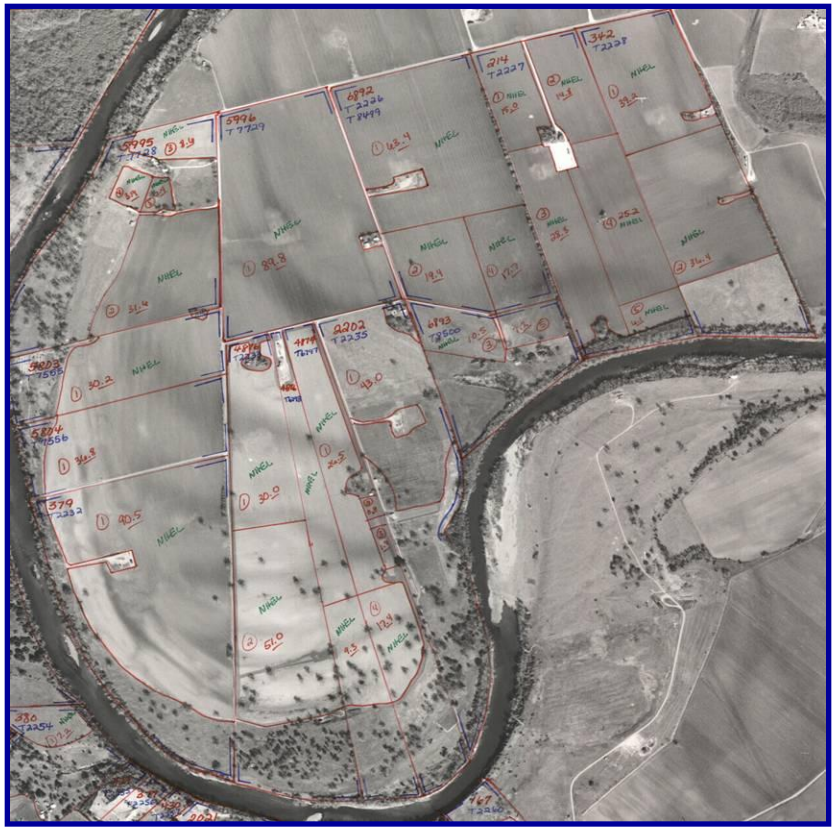
Orthophotography - CLU



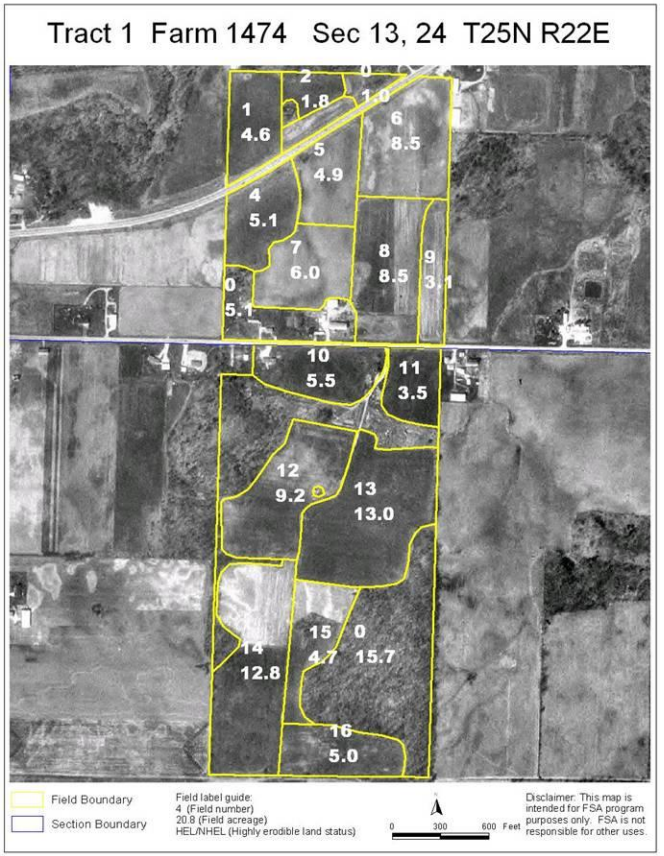
Agricultural Applications – Part III: FSA and GIS methods

Better Mapping Products

Old method: Photocopy of Photo Enlargement



GIS: Custom, color map



Agricultural Applications – Part III: FSA and GIS methods

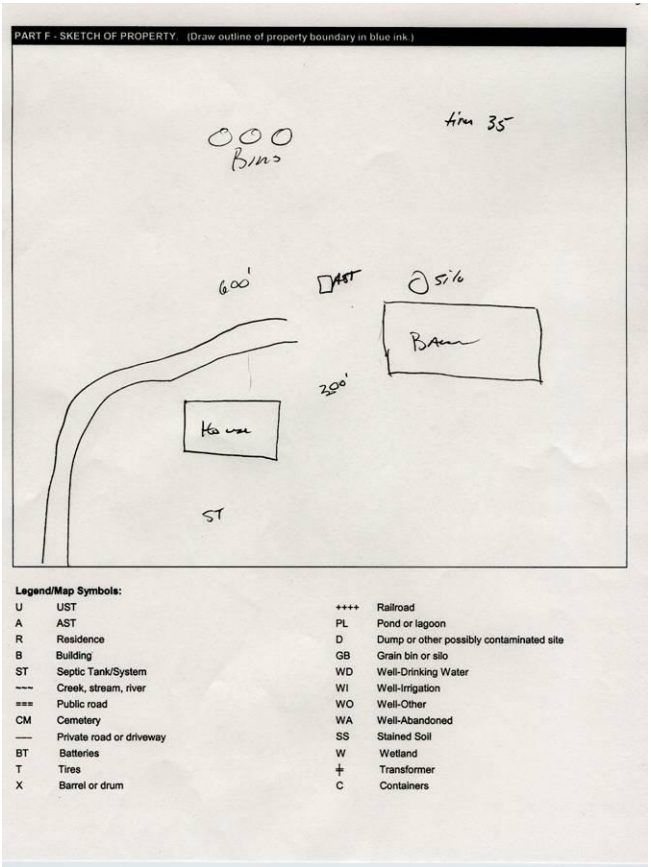
Ability to Change Scale

Agricultural Applications – Part III: FSA and GIS methods

Farm Appraisals

Source: MN FSA

Sketch Map


PART F - SKETCH OF PROPERTY. (Draw outline of property boundary in blue ink.)

Legend/Map Symbols:

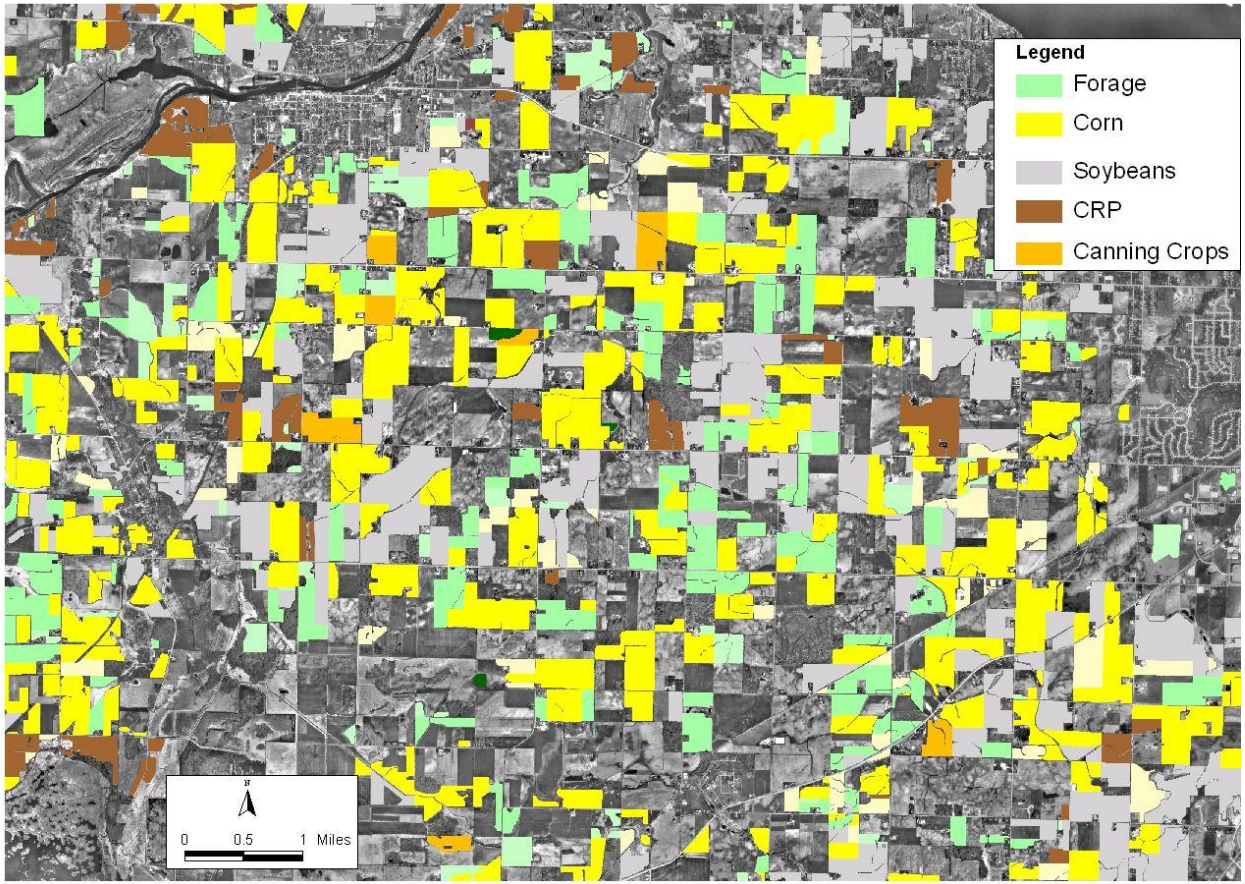
U	UST	++++	Railroad
A	AST	PL	Pond or lagoon
R	Residence	D	Dump or other possibly contaminated site
B	Building	GB	Grain bin or silo
ST	Septic Tank/System	WD	Well-Drinking Water
~~	Creek, stream, river	WI	Well-Irrigation
===	Public road	WO	Well-Other
CM	Cemetery	WA	Well-Abandoned
----	Private road or driveway	SS	Stained Soil
BT	Batteries	W	Wetland
T	Tires	⏚	Transformer
X	Barrel or drum	C	Containers

GIS Map – with GPS linked photos

Agricultural Applications – Part III: FSA and GIS methods

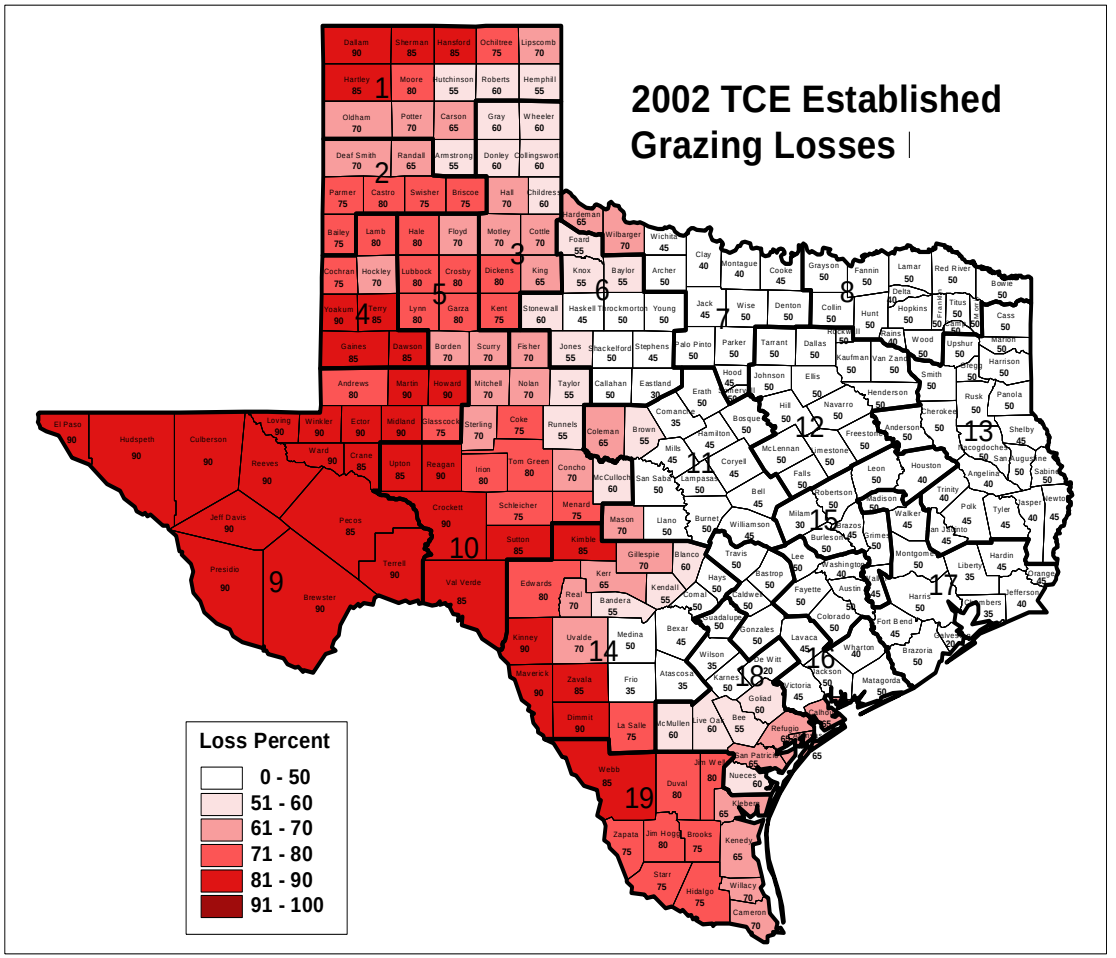
Cropping History: Linking crop reporting information to the CLU

2003 Reported Crops - Winnebago County



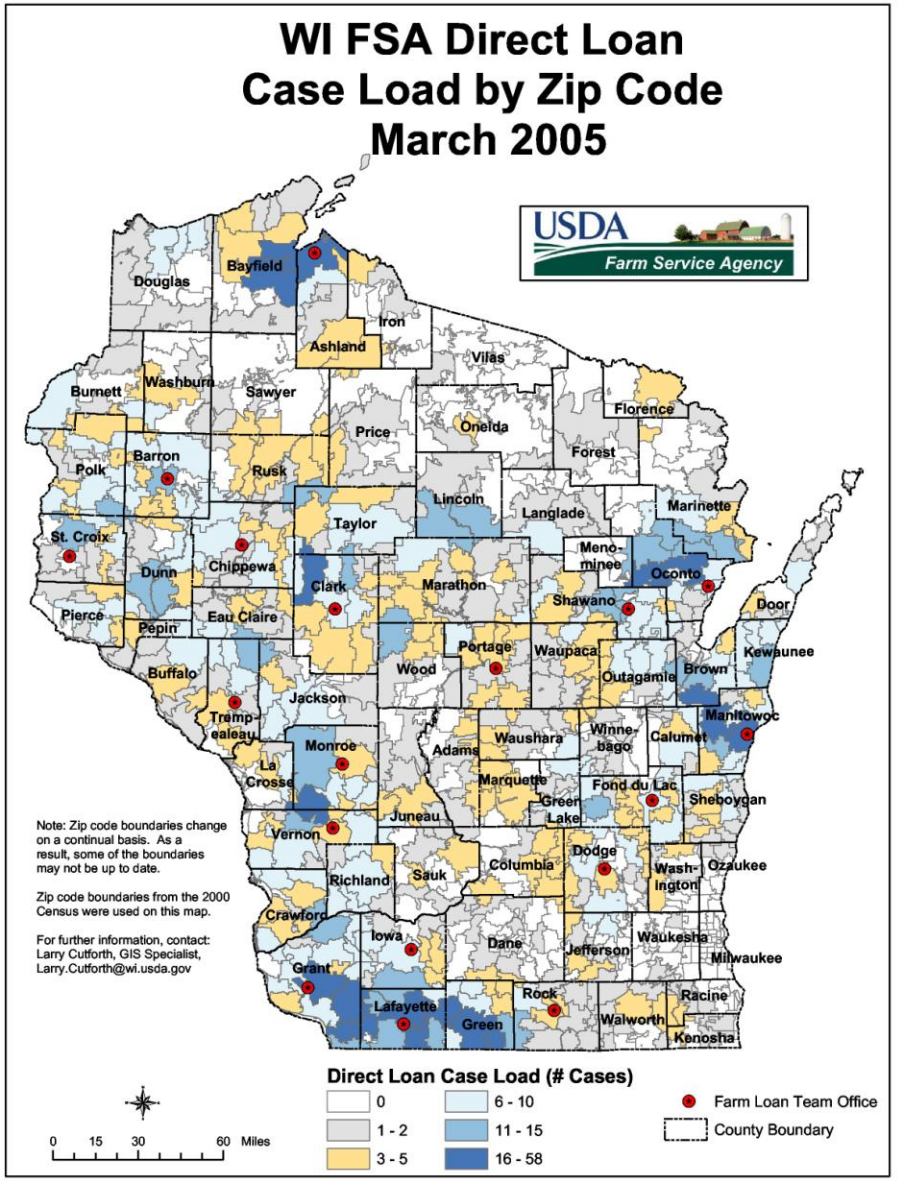
Agricultural Applications – Part III: FSA and GIS methods

Visualize Patterns



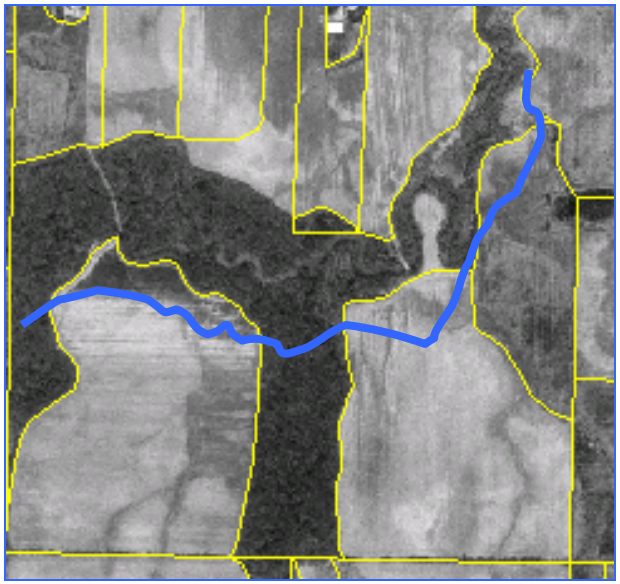
Agricultural Applications – Part III: FSA and GIS methods

Visualizing Patterns



Integrating and Analyzing Spatial Data

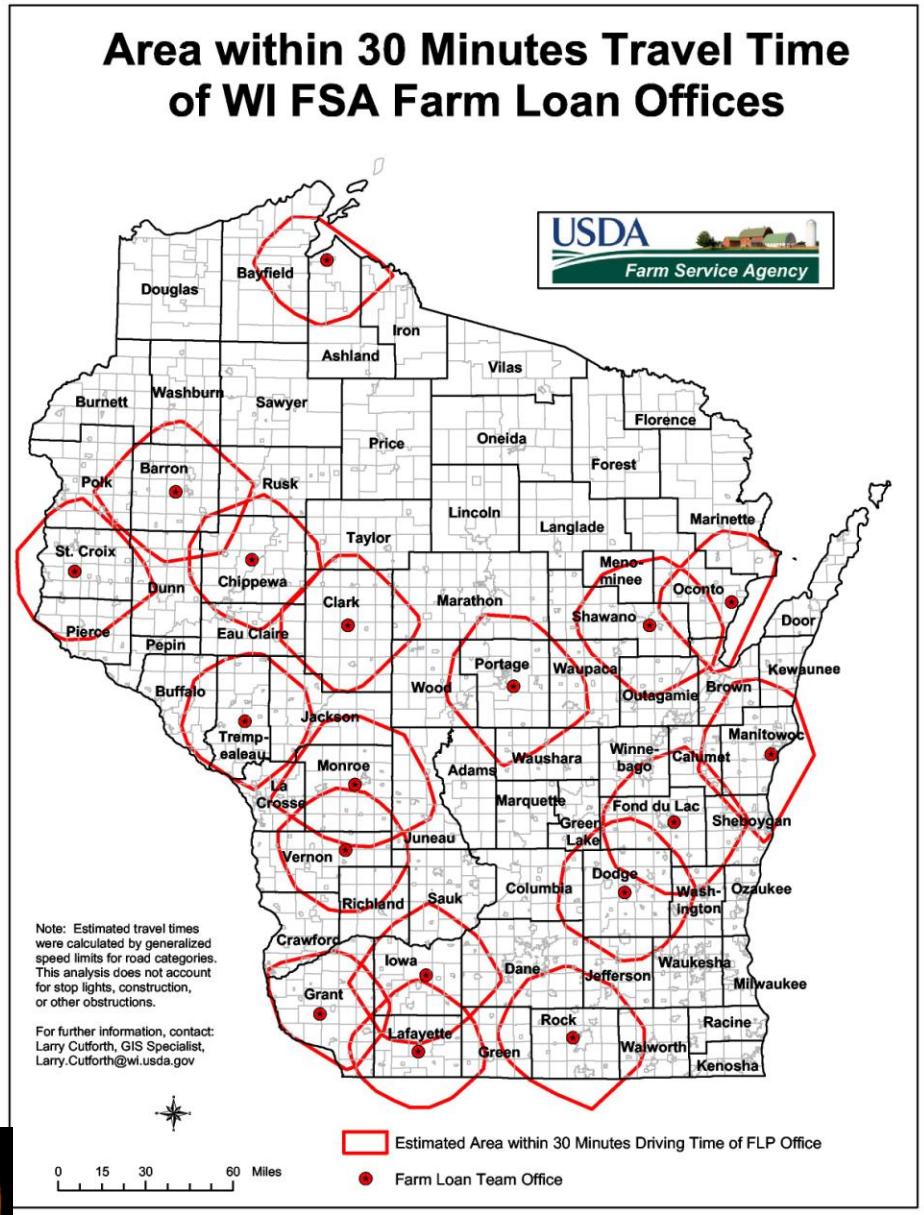
- Application: Contacting landowners for CREP signup.
- Identify all tracts adjacent or bisected by a stream
- Mail maps to tract owners.



Analysis that integrates CLU with SCIMs and hydrological data.

Agricultural Applications – Part III: FSA and GIS methods

GIS Benefits: Travel Time



Agricultural Applications – Part III: FSA and GIS methods

Integrating Other Data Sources

- Using remote sensing imagery to estimate the extent of tornado damage

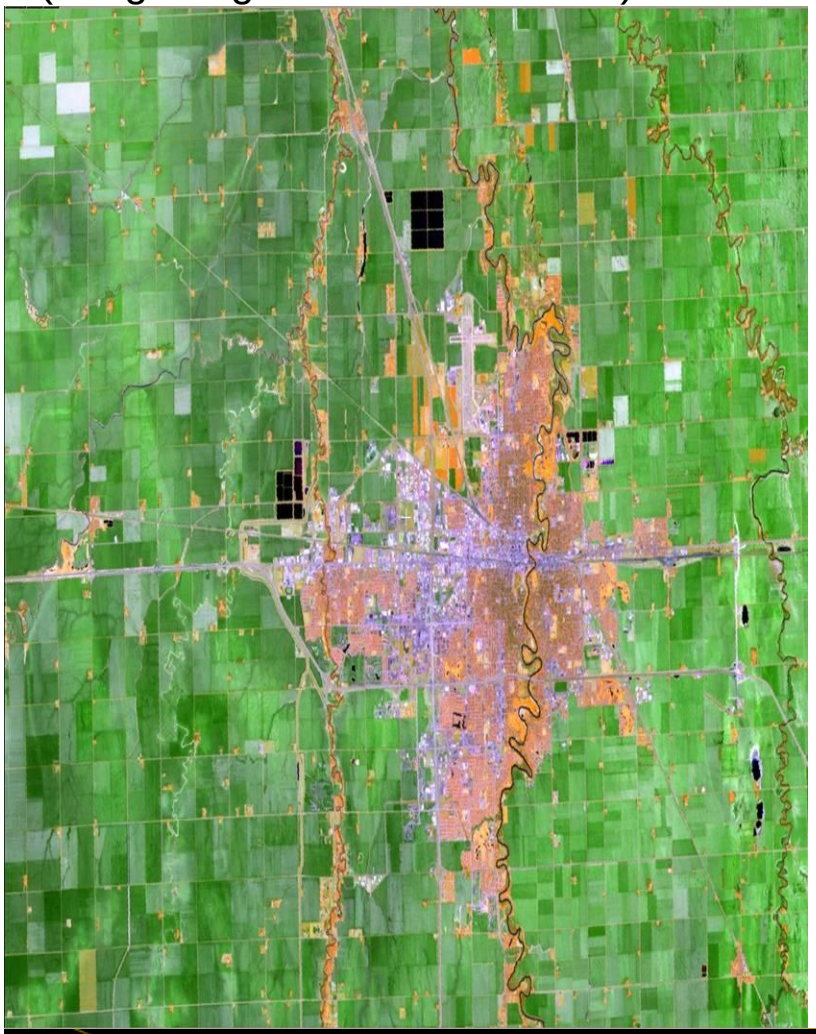
Siren Tornado

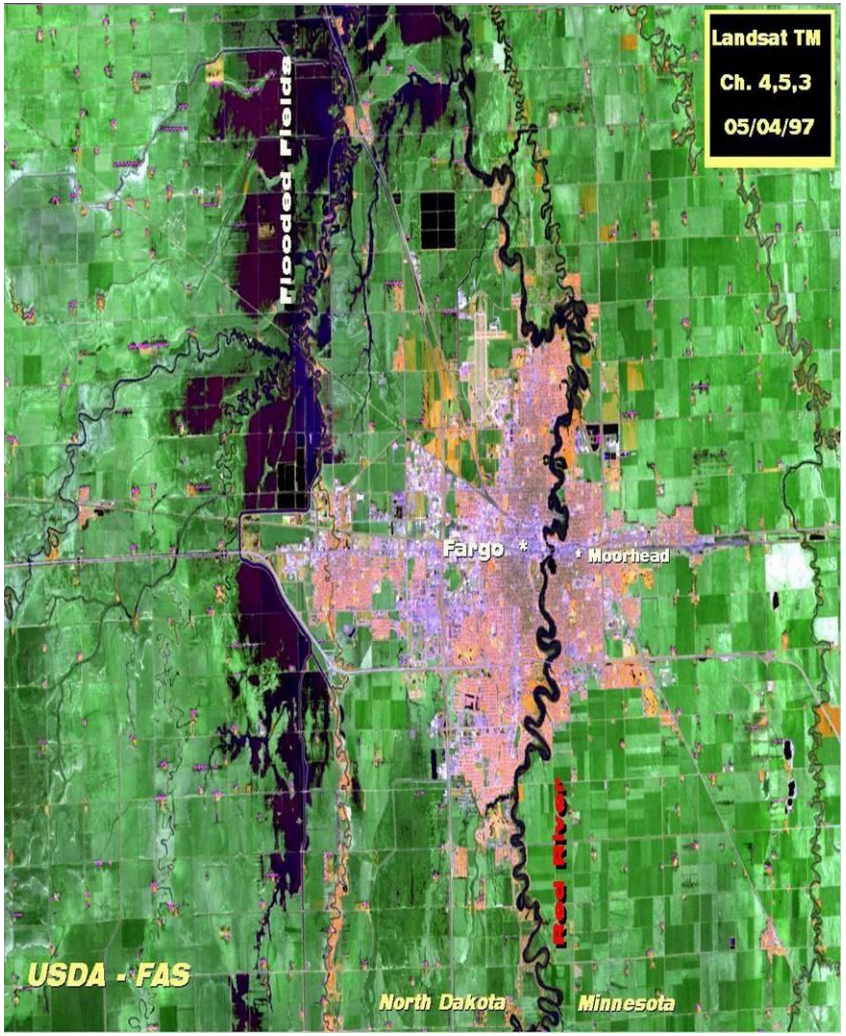
Source:

UW-Madison Environmental Remote Sensing Center

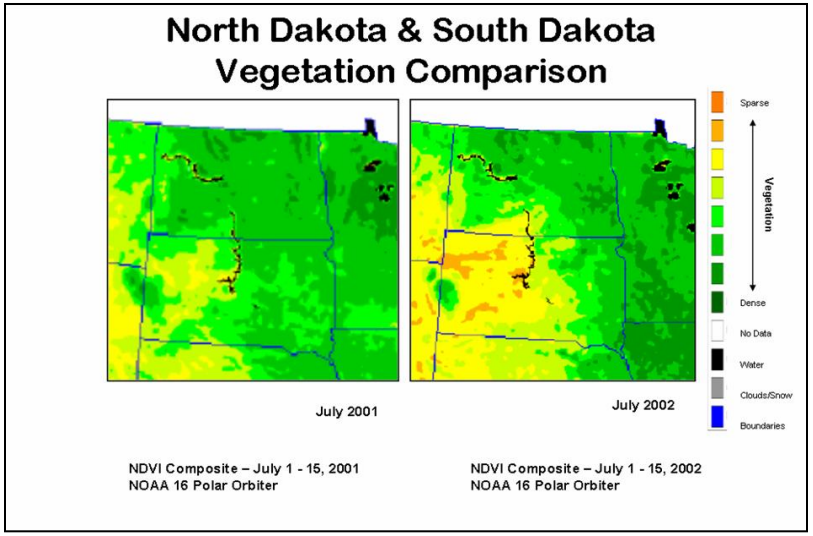
Agricultural Applications – Part III: FSA and GIS methods

Disaster Area Determination: Fargo flood, 2001
(Integrating other data sources)

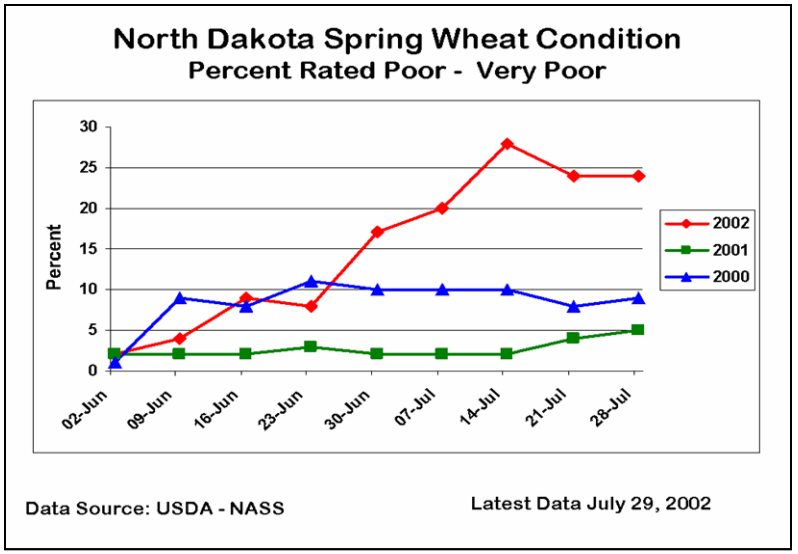


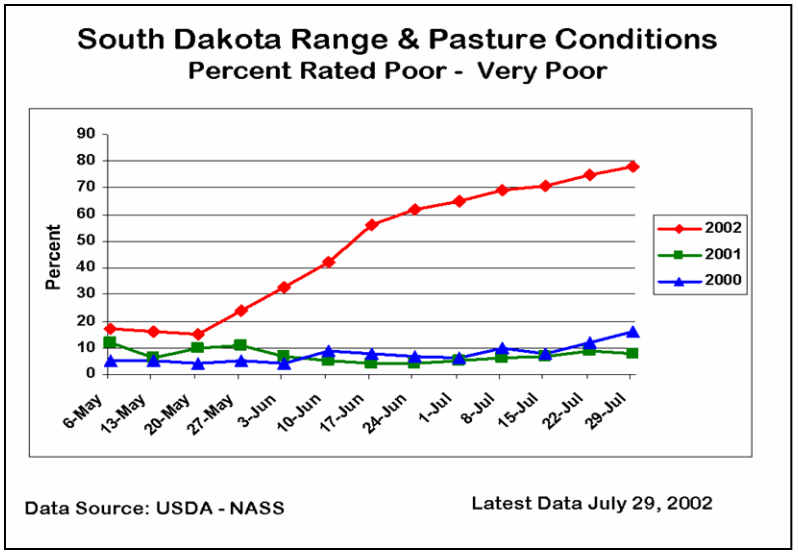


Agricultural Applications – Part III: FSA and GIS methods



Crop Conditions





GIS Workshop Wrap Up…

Questions?
Comments?

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