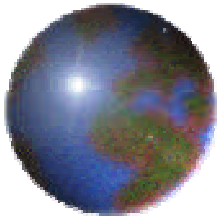

SRJC Applied Technology 54A Introduction to GIS

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techacademy
santa rosa junior college

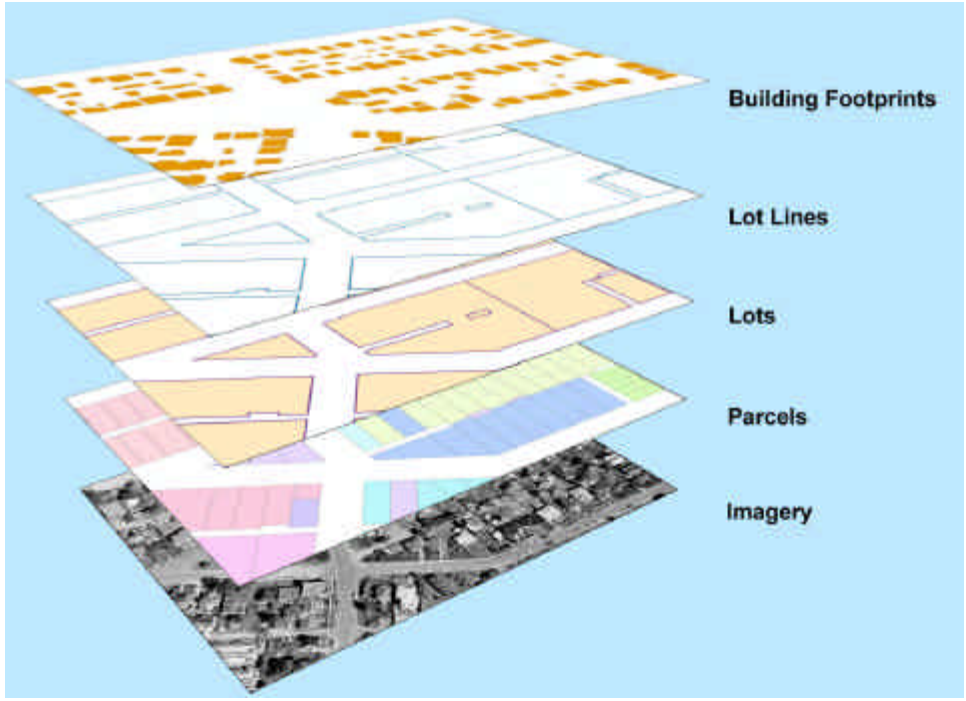
COUNTY OF SONOMA

Overview Lecture of Geographic Information Systems Fall 2004 Santa Rosa Junior College

Presented By:
Tim Pudoff, GIS Coordinator, County of Sonoma, Information Systems Department -- GIS Central, Adjunct Instructor, SRJC Applied Technology

What is a GIS?

- "A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on earth."
- GIS is a tool to aid in making decisions.
- GIS is a geographic database manager.
- GIS starts with a need to answer "spatial questions".
- GIS may be used as part of a large organization or "enterprise" database
- GIS software may be used by an individual on a single desktop computer



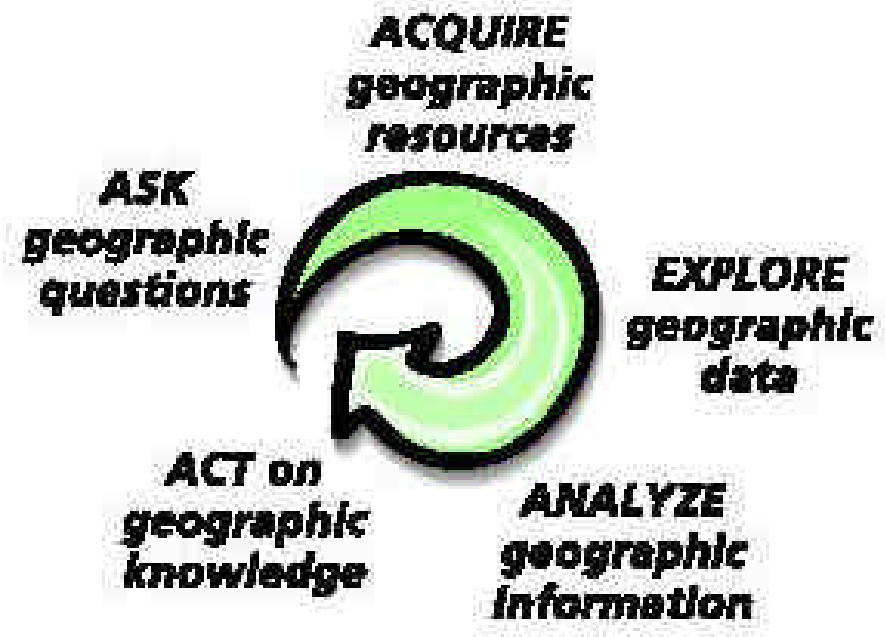
Example: GIS stores data in a database; Users build data thematically in "layers".

Components of an Organizational GIS

1. Hardware
2. Software
3. Data
4. People
5. Methods

Case Study: Identifying Immunization Sites

- **Use of GIS Technology is analogous to using the scientific method:**
  - **Where is the population concentrated? (obtain census 2000 and other GIS data)**
  - **What site criteria are needed to administer immunizations?**
  - **Which locations can accommodate these criteria (schools, vet halls)?**
  - **Prepare a map to train staff as part of a larger bio-terrorism plan.**



<u>Geographic Inquiry</u>:
The PROCESS of using GIS software

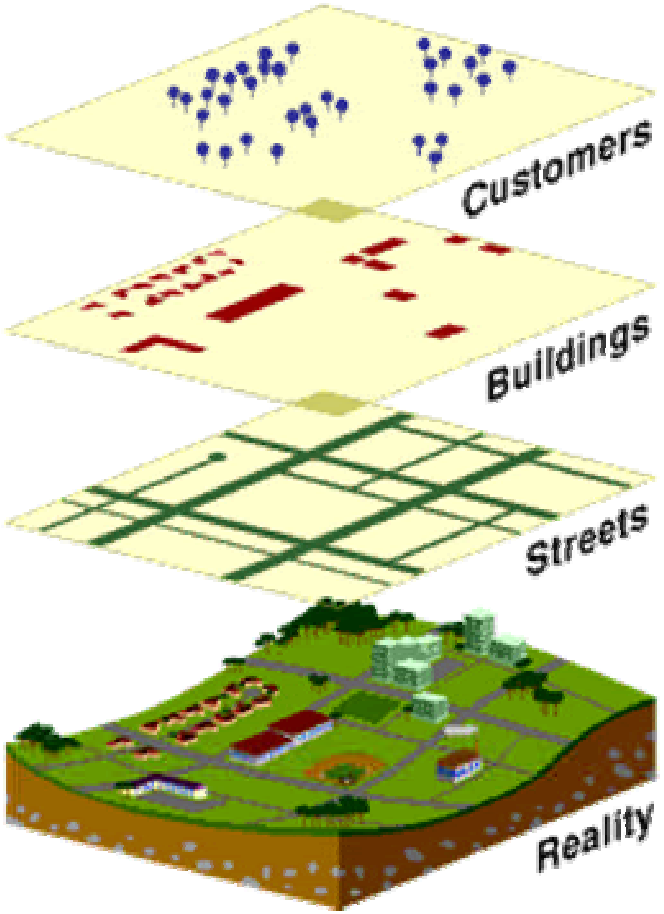
How GIS Works

1. Geographic References

Objects in the real-world are abstracted into features on maps; these are stored on individual thematic "layers" and referenced to the real world by coordinates or addresses.

A. **Explicit coordinates** (e.g., latitude/longitude; UTM grid)

B. **Implicit reference** (e.g., address, forest stand identifier, census tract)



Example: GIS as thematic "layers".

How GIS Works

2. Data Models

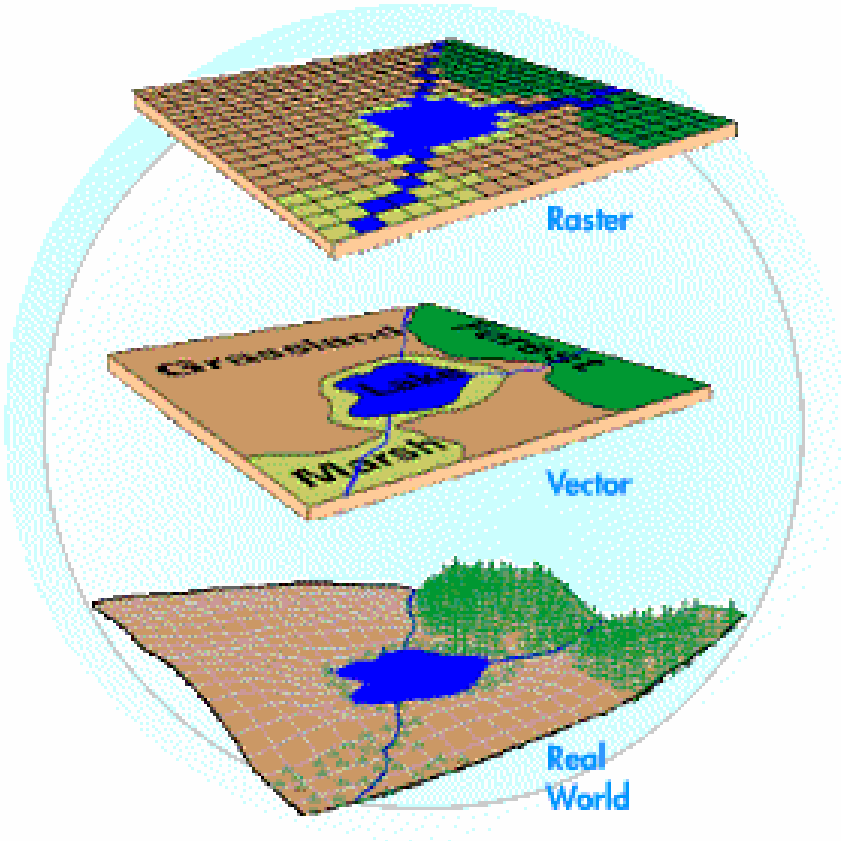
(or ***How*** data are stored in the GIS)

A. Vector Data –

Collection of x,y coordinates (discrete features; “geo-database”)

B. Raster Data –

Collection of grid cells or “pixels” (continuous features; “GRID” or image)



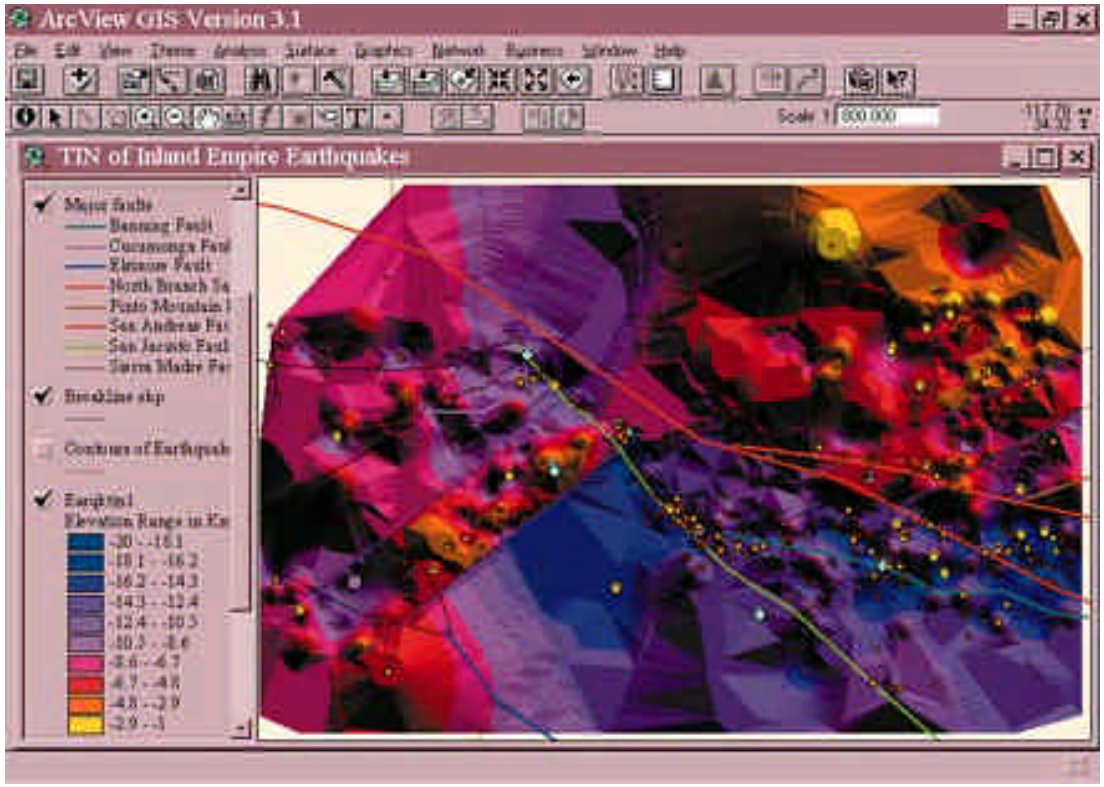
Example: How we abstract the Real World.

How GIS Works

2. Data Models
(continued)

C. 3D Surfaces –

- **DEM** (Digital Elevation Model; a raster format)
- **TIN** (Triangulated Irregular Network; a vector format)



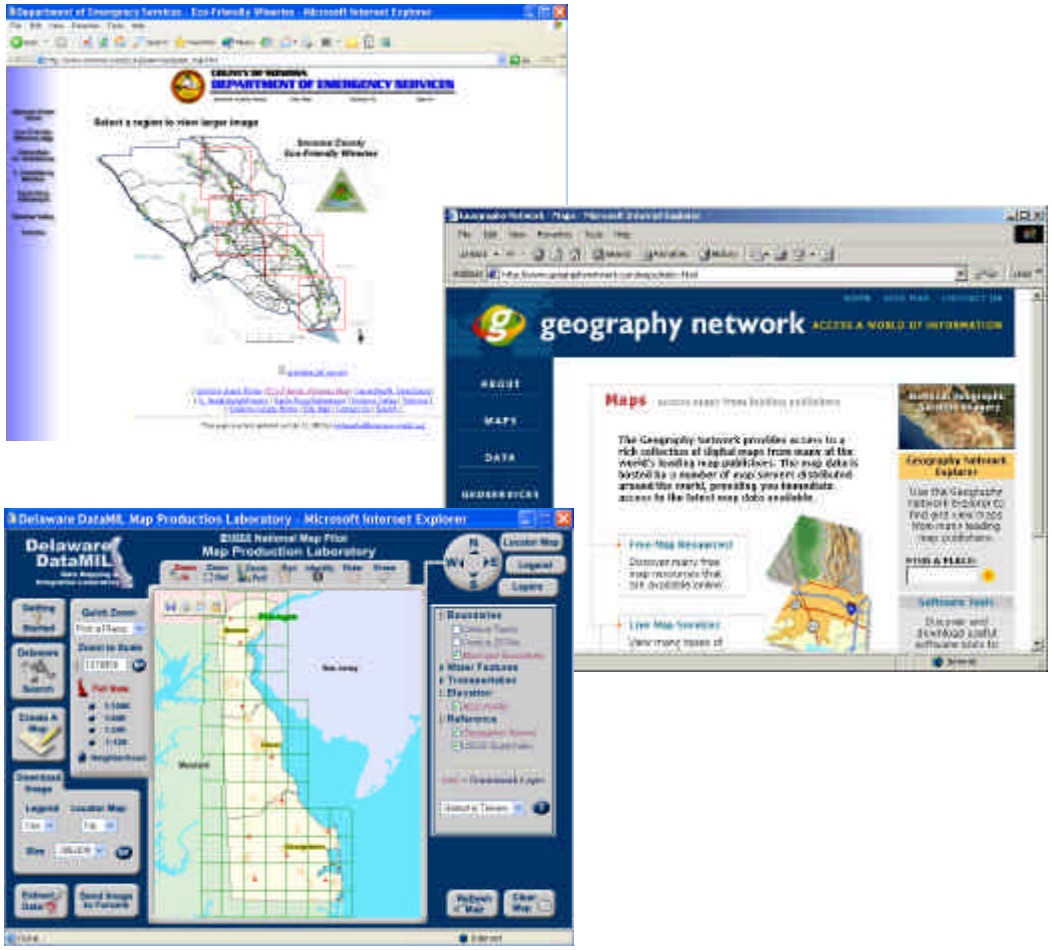
Example: ArcView 3D Analyst TIN data showing relationship between relief and earthquake occurrences.

How GIS Works

2. Data Models (continued)

D. Internet GIS –

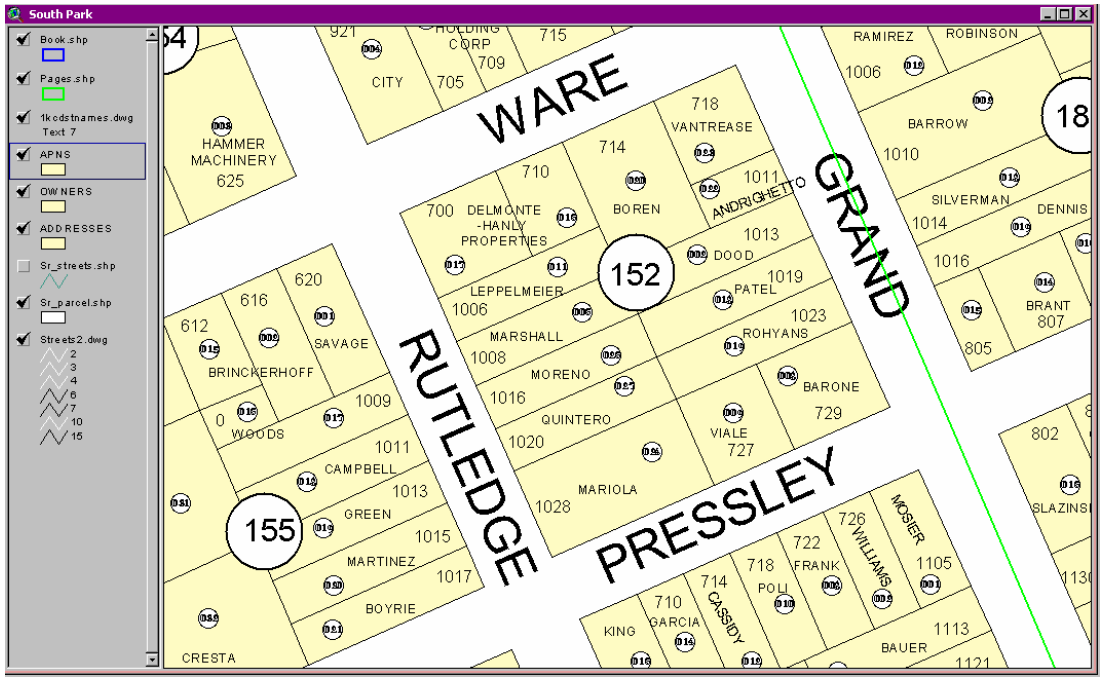
- **Static maps/graphics** (e.g., County web sites for Regional Parks and Eco-Friendly Wineries.)
- **FTP sites** (e.g., USGS Bay Area Regional Database (BARD))
- **Map Servers** (e.g., The Geography Network, Java- and ASP- powered sites)



Examples: http://www.sonoma-county.org
http://www.geographynetwork.com
http://datamil.udel.edu/nationalmappilot/

GIS Tasks

1. **Data Input**
   (GPS, imagery, digitizing or scanning)
2. **Manipulation**
   (Map scale, map projection, data topology, coordinate system, “data scrubbing”)



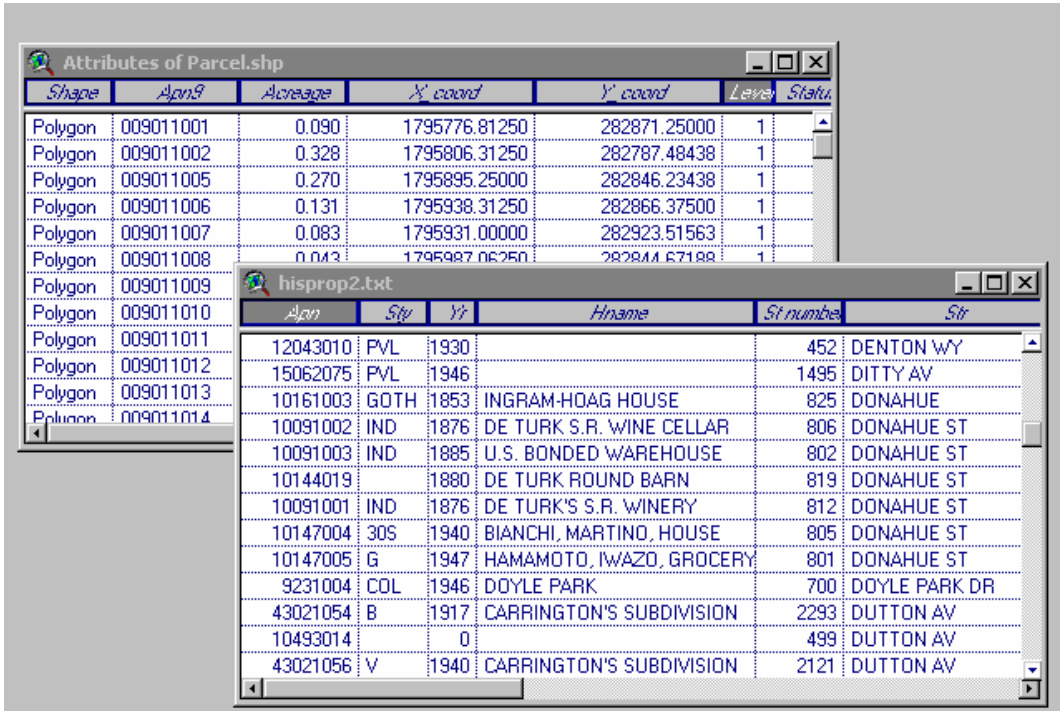
Example: Land Records Management System

City of Santa Rosa Data

GIS Tasks

3. Database Management

- Simple (Flat) Files
- Relational database management systems– RDBMS
- Data normalization (using common fields to link different tables)
- Matching features to descriptive attributes



Attributes of Parcel.shp

Shape	Apn9	Acreage	X_coord	Y_coord	Level	Statu
Polygon	009011001	0.090	1795776.81250	282871.25000	1	
Polygon	009011002	0.328	1795806.31250	282787.48438	1	
Polygon	009011005	0.270	1795895.25000	282846.23438	1	
Polygon	009011006	0.131	1795938.31250	282866.37500	1	
Polygon	009011007	0.083	1795931.00000	282923.51563	1	
Polygon	009011008	0.043	1795987.06250	282944.67188	1	
Polygon	009011009					
Polygon	009011010					
Polygon	009011011					
Polygon	009011012					
Polygon	009011013					
Polygon	009011014					

hisprop2.txt

Apn	Sty	Yr	Hname	St numbe	Str
12043010	PVL	1930		452	DENTON WY
15062075	PVL	1946		1495	DITTY AV
10161003	GOTH	1853	INGRAM-HOAG HOUSE	825	DONAHUE
10091002	IND	1876	DE TURK S.R. WINE CELLAR	806	DONAHUE ST
10091003	IND	1885	U.S. BONDED WAREHOUSE	802	DONAHUE ST
10144019		1880	DE TURK ROUND BARN	819	DONAHUE ST
10091001	IND	1876	DE TURK'S S.R. WINERY	812	DONAHUE ST
10147004	30S	1940	BIANCHI, MARTINO, HOUSE	805	DONAHUE ST
10147005	G	1947	HAMAMOTO, IWAZO, GROCERY	801	DONAHUE ST
9231004	COL	1946	DOYLE PARK	700	DOYLE PARK DR
43021054	B	1917	CARRINGTON'S SUBDIVISION	2293	DUTTON AV
10493014		0		499	DUTTON AV
43021056	V	1940	CARRINGTON'S SUBDIVISION	2121	DUTTON AV

Example: APN field is used to link the feature attributes table to an external database of historic properties information.

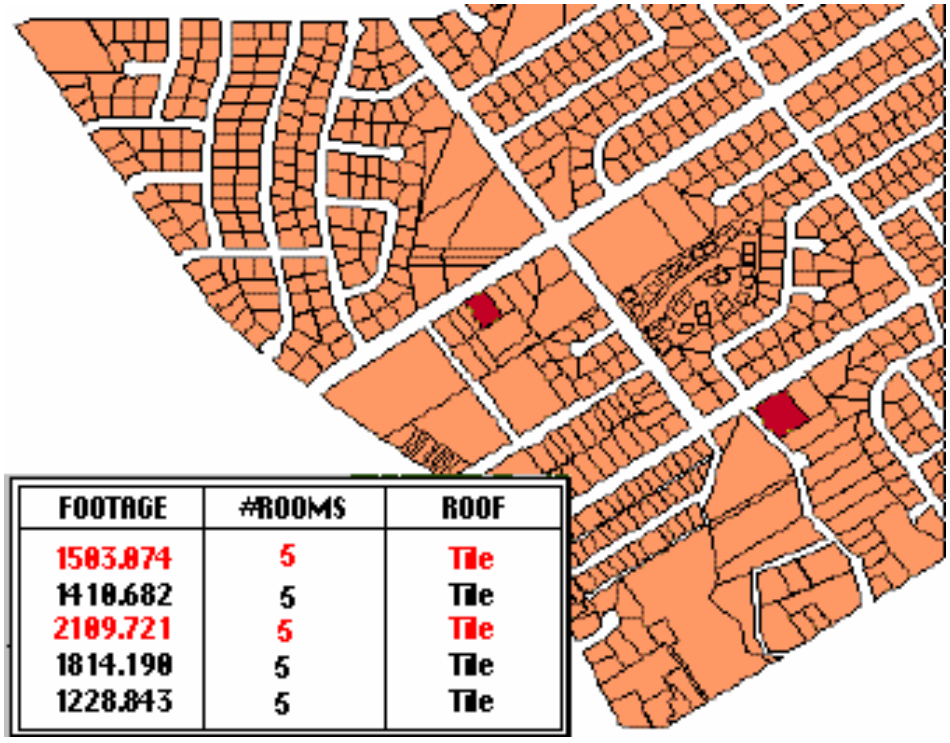
City of Santa Rosa Data

GIS Tasks

4. Query / Analysis

A. Simple point-and-click query:

(e.g., Who owns the land parcel on the corner? How far is it between two places? Where is land zoned for industrial use?



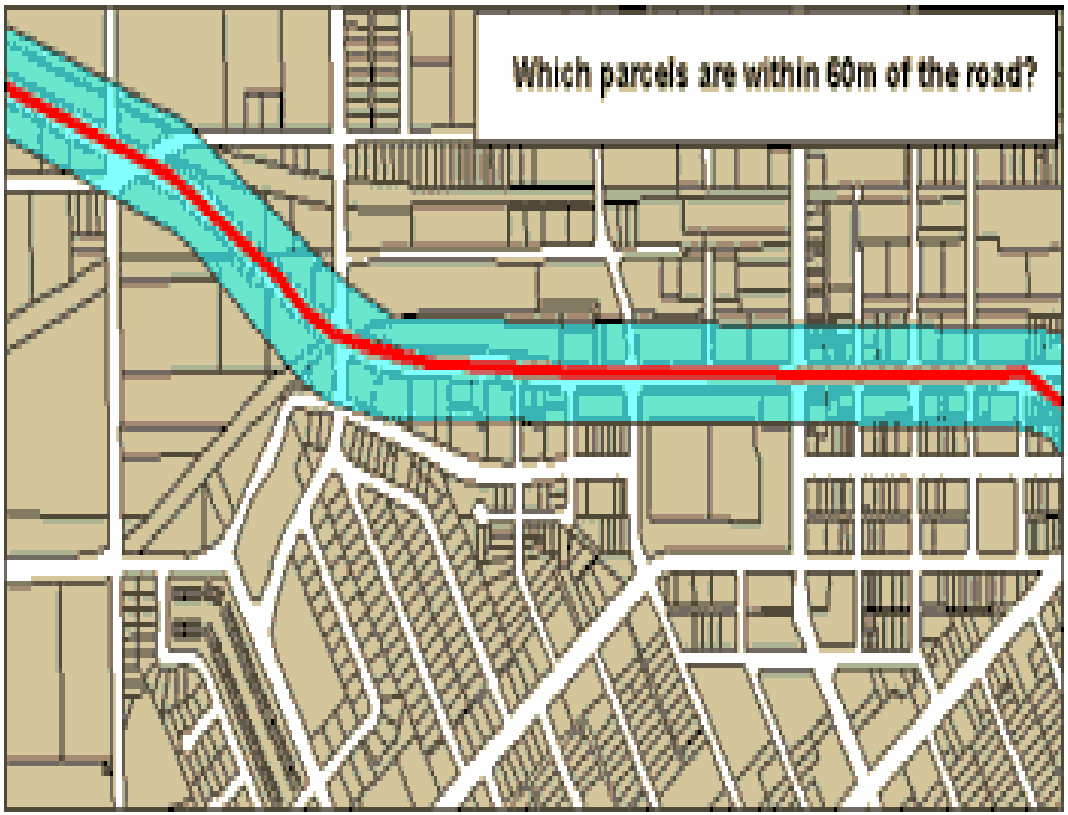
Example: The highlighted parcels meet the criteria set by the user.

GIS Tasks

4. Query / Analysis

B. Proximity Analysis

(e.g. Which parcels are within 60 m of the road? How many houses lie within 100 m of this water main? What is the total number of customers within 10 km of this store? What proportion of the alfalfa crop is within 500 m of the well?)



Example: The blue shaded areas intersect the parcels that are within 60 m of the road.

GIS Tasks

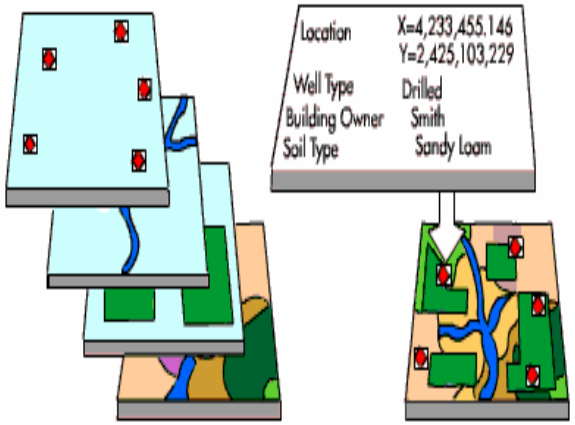
C. Overlay / Network Analyses

i) Spatial Join of two or more data "layers"

UNION (A ? B)
INTERSECT (A ? B)
IDENTITY (A ? B) in A

ii) Shortest or "least cost" pathways (Delivery, location and allocation problems)

i)



ii)

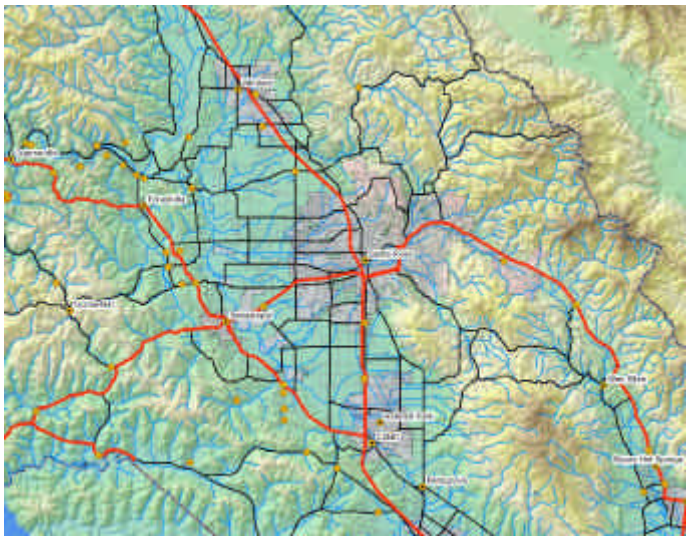
Example: i) IDENTITY of proposed sites and landcover conditions; ii) least-cost path for a delivery company.

GIS Tasks

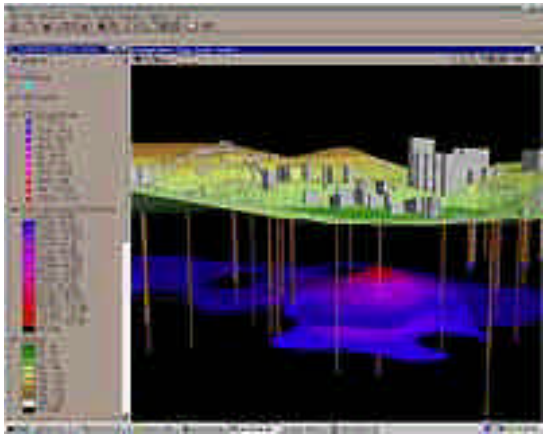
5. Visualization

- 2D (maps, graphs, images)
- 3D (e.g., Create and modify surface models - DEMs). Create 3D shapefile themes. Simple editing of TINs. Planimetric display of surfaces.
- Overlay surface & subsurface features.

A)



B)



Example: A) Digital Elevation Model (DEM) of the Santa Rosa area; B) hazardous waste plume shown relative to surface and sub-surface hydrology.

How to Build and Use a GIS

1. Define your needs – Ask a question that can be answered with a GIS (i.e., where?)
2. Educate yourself (research / software use)
3. Is there an example or model I can follow?
4. Start small (pilot project – study area)
5. Acquire data/software/hardware
6. Define success and meet your audience's expectations
7. Build on the experience of your pilot project

How Can I Learn More?

1. Questions: tpudoff@santarosa.edu
2. Go to the World Wide Web!
   A. What GIS is and how it's used – http://www.gis.com
   B. The Geography Network (GIS on the web!) (http://www.geographynetwork.com)
   C. ESRI Virtual Campus (http://campus.esri.com)
3. SRJC classes in Applied Technology, Survey Technology, Natural Resources, and Computer Science.
4. Internships with County of Sonoma and other agencies that use GIS