




What is GIS?



An introduction to Geographic
Information Systems
and
Careers in GIS

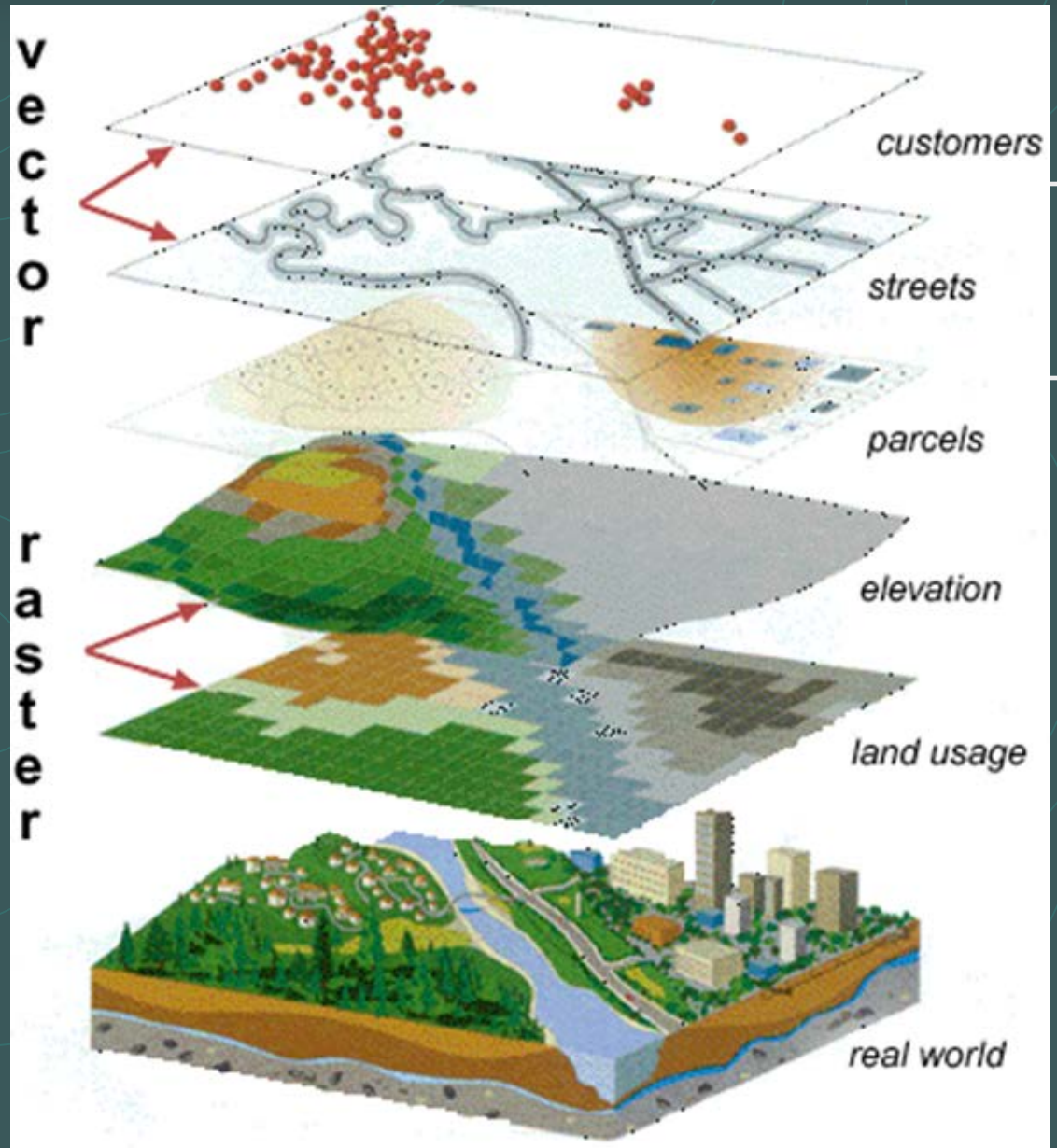
Context: Why GIS?

● Many of the issues in our world have a critical spatial component:

- Land management
- Property lines, easements, right of ways
- Data on land values, taxation, assessment
- Business site selection, advertising
- Proximity of 'our' land to other facilities (pollution, hunting, municipal, federal, state)

Enter GIS

A computer-based tool for holding, displaying, and manipulating huge amounts of spatial data.



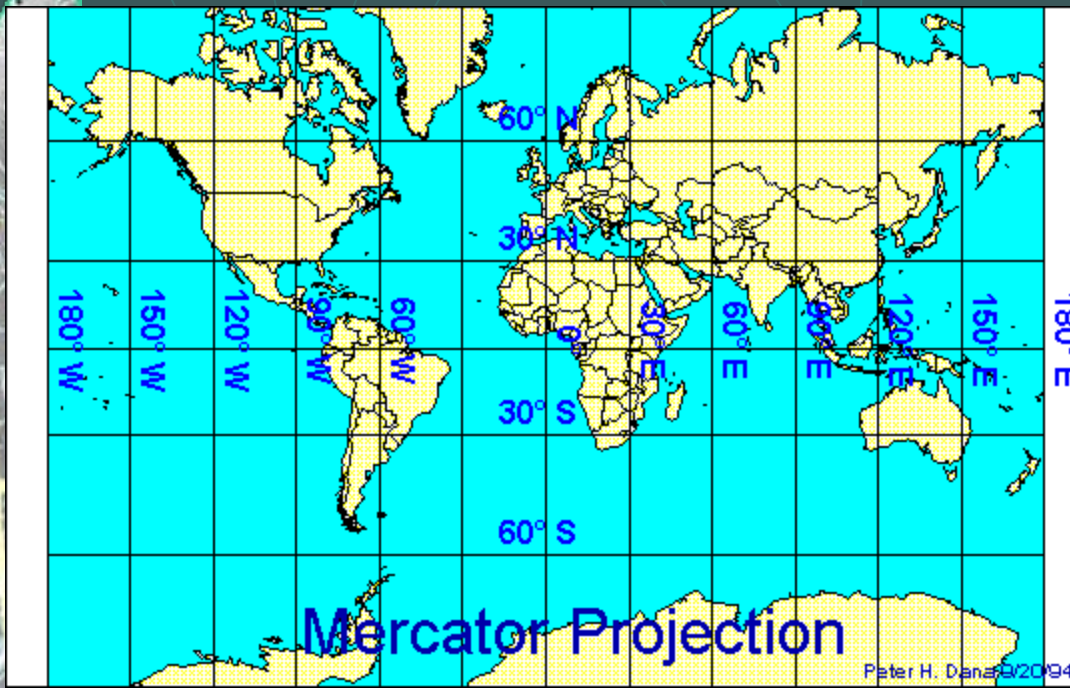


Part I: What GIS Is

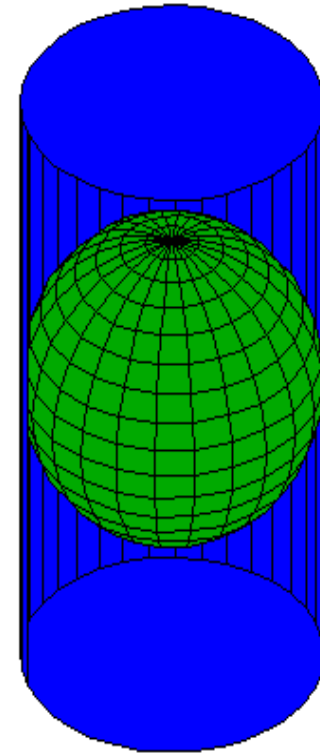
- What is a map?
 - What are some properties of maps?
 - Vector vs. raster: two digital mapping methods
- Maps reflect the databases we create
- Mapping the third dimension: examples of 3-D maps

Representing the World: Projections

3-D to 2-D:
Projections change a
round world into a flat one



Peter H. Dana 9/20/94



Cylindrical Projection Surface

Raster vs. Vector: Types of GIS map representation

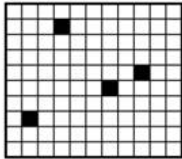

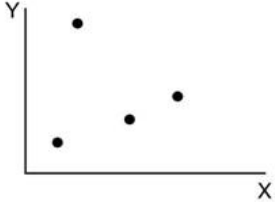
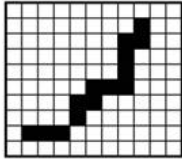


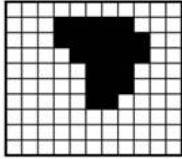
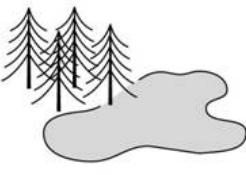
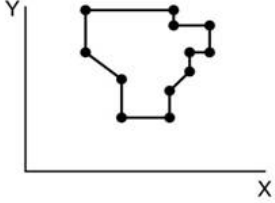
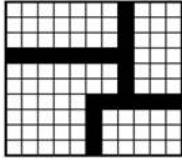
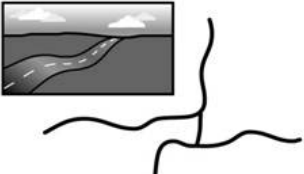
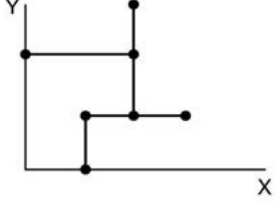
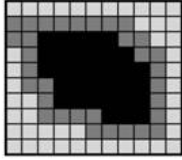

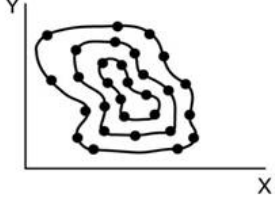
Vector vs. **Raster**:

Two basic ways
spatial data can be
represented

Raster:

Data stored as pixels
with values, in a grid

Vector: Data stored as
points, lines, polygons

The raster view of the world	Happy Valley spatial entities	The vector view of the world
	 Points: hotels	
	 Lines: ski lifts	
	 Areas: forest	
	 Network: roads	
	 Surface: elevation	

How is all this done?

GIS stores data in a **relational database structure** ('3-D spreadsheets')

e.g. employee names
linked to store number,
store number linked to
shipment arrival

any data can be linked by a
common attribute to any
other data

Example: counties by
income code

The image shows a screenshot of a GIS software interface with two tables. The top table is titled "Attributes of California Counties" and the bottom table is titled "Income.dbf". A bracket on the left side, labeled "Common Fields", points to the "Fips" column in both tables, indicating that this field is used to link data between the two tables.

Fips	County	City	Sub-region	Stat. Area
6001	1526		1 Pacific	1
6003	1384		3 Pacific	1
6005	1400		5 Pacific	1
6007	1853		7 Pacific	1
6009	1486		9 Pacific	1
6011	1139		11 Pacific	1
6013	1502		13 Pacific	0
6013	1472		13 Pacific	1
6015	156		15 Pacific	1
6017	1405		17 Pacific	1
6019	1283		19 Pacific	1
6021				

Fips	City name	Inc. p. cap
6001	Alameda	12488
6003	Alpine	11039
6005	Amador	9385
6007	Butte	9047
6009	Calaveras	9554
6011	Colusa	8731
6013	Contra Costa	14863
6013	Contra Costa	14553
6015	Del Norte	7554
6017	El Dorado	10927
6019	Fresno	9238

High End 3-D Representation

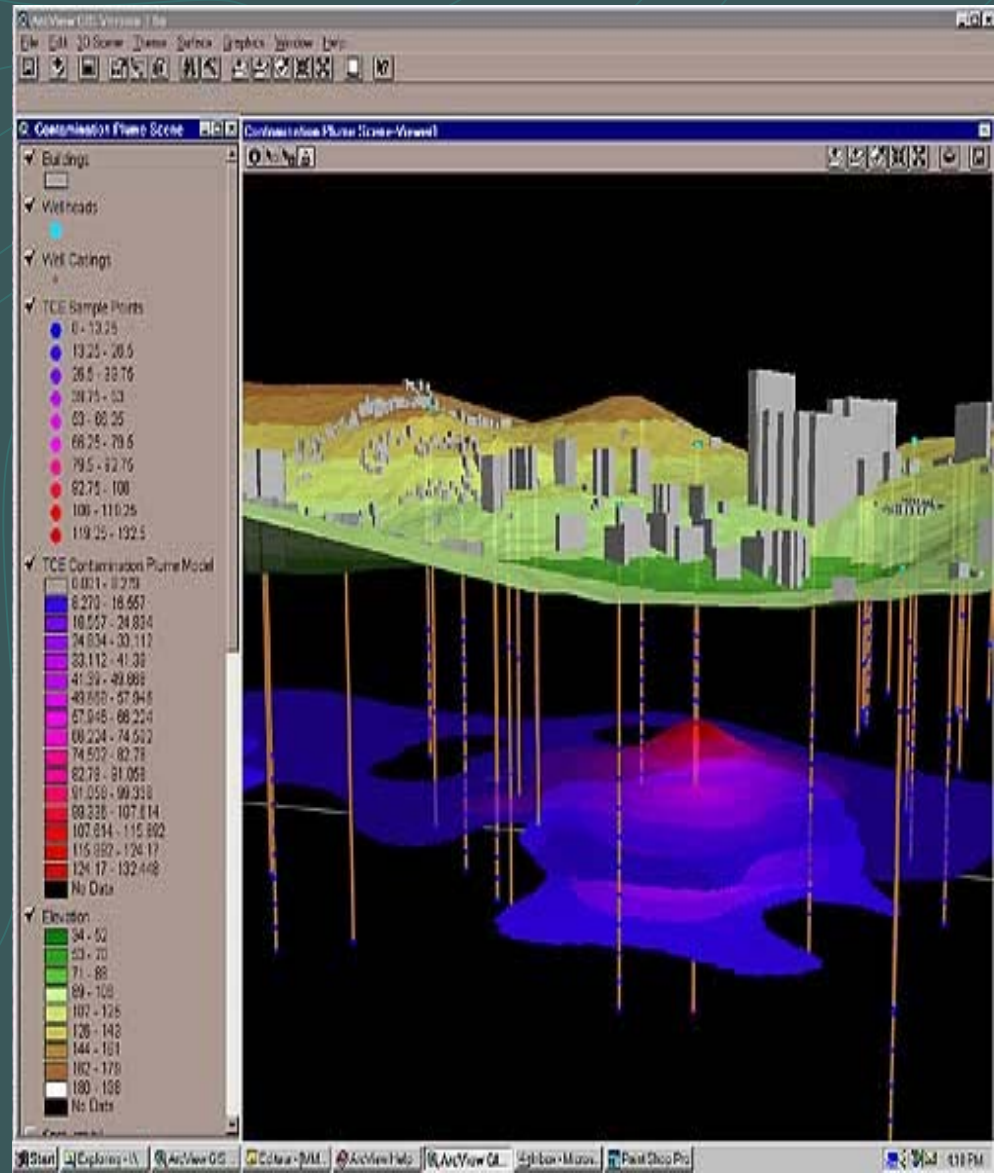
Uses:

Hydrology: surface and
underground flows

Line-of-Sight analysis

Pollution plume tracking

Soil erosion potential



3-D Rendering Example

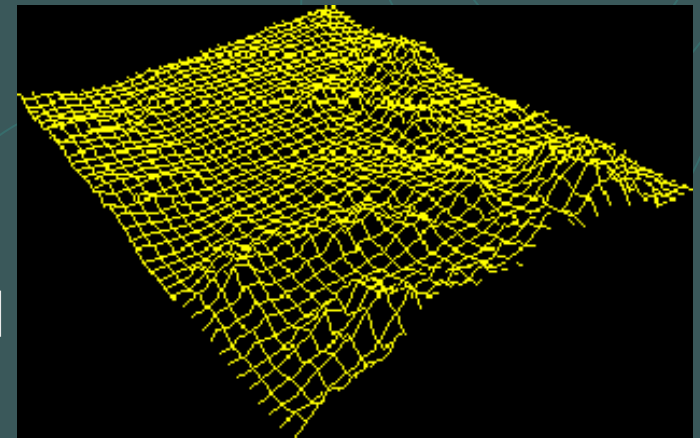
Elevation measurements can be **easily** converted to 3D

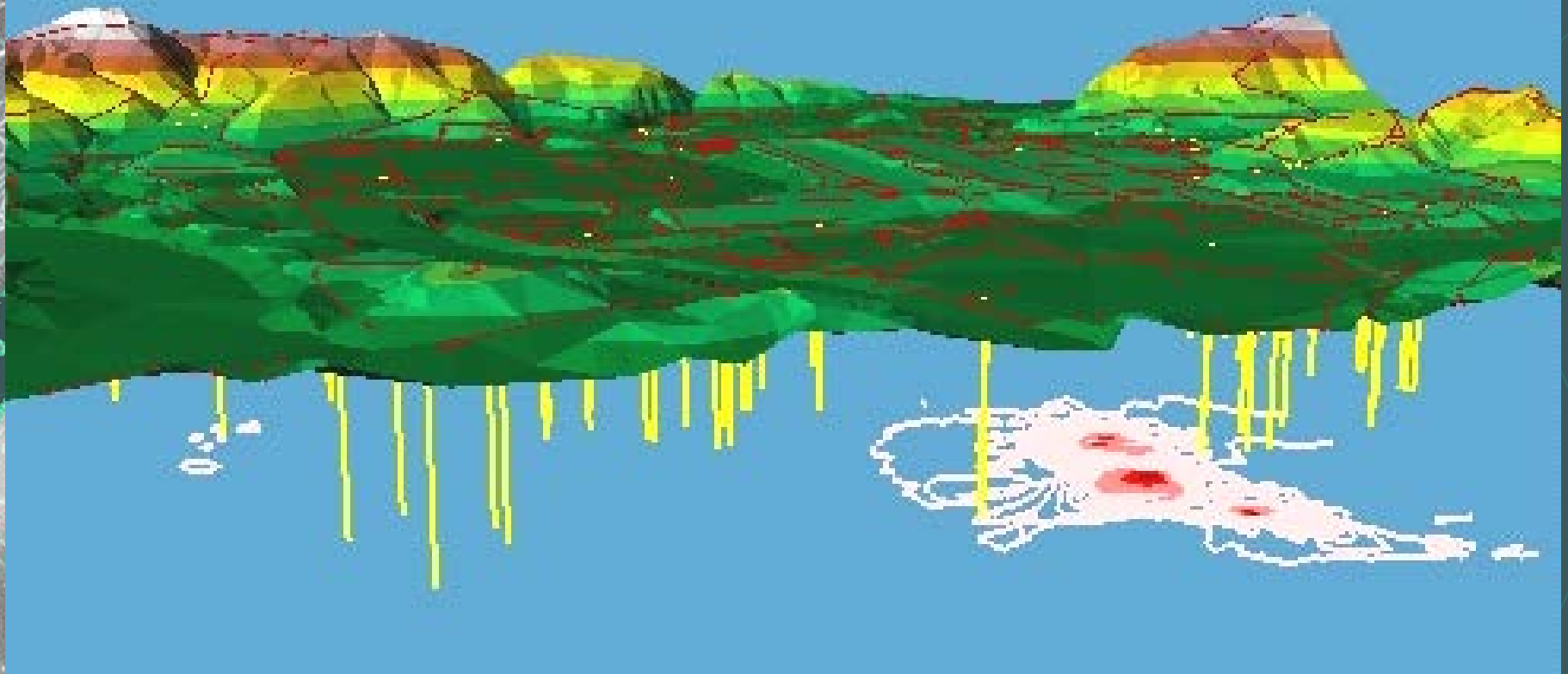
These data can be downloaded/ ordered at little or no cost.



A 3-D rendering of the terrain

USGS 7.5
Minute quad
in 3-D





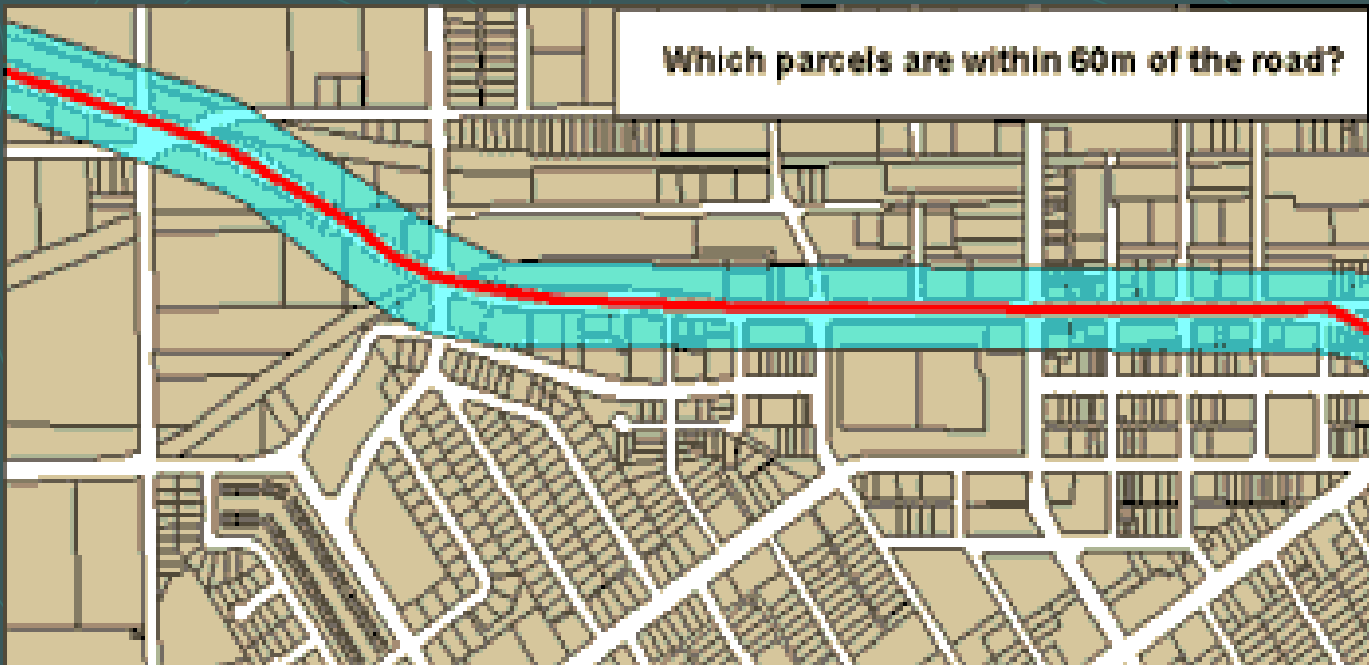
- The pattern of pollution can be seen. Location and density of wells is also clear
- Line of sight analysis: where to put a house or power plant where it could not be seen from major roads



Part II. What can GIS do?

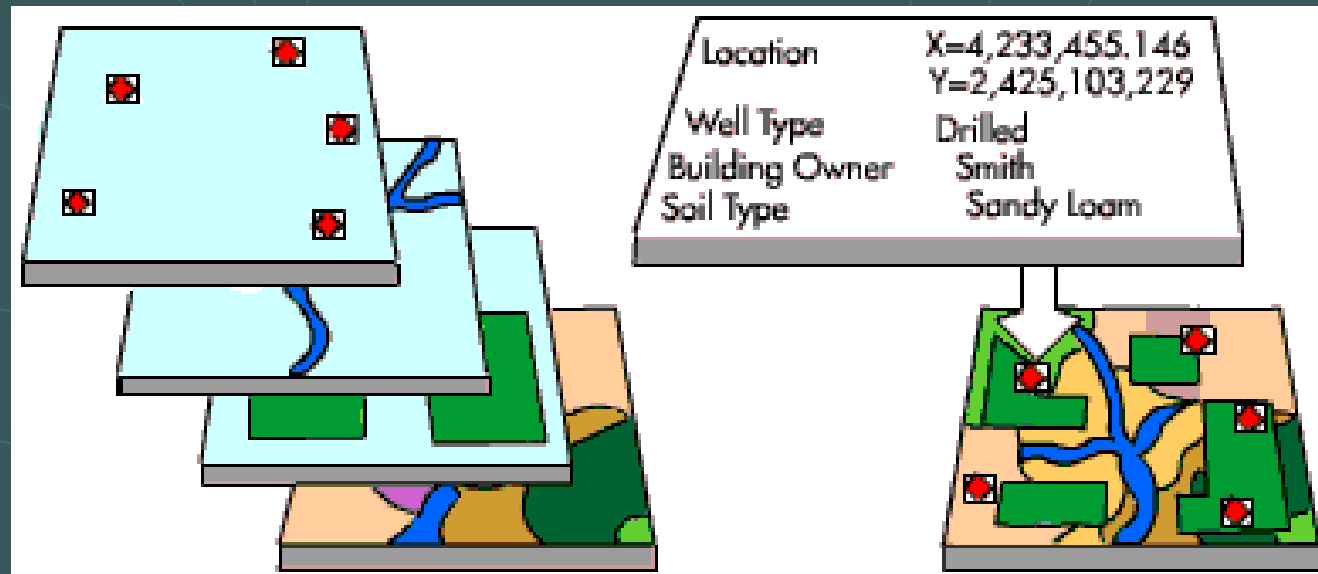
Proximity Analysis

- Two or more data layers are overlaid
- GIS creates **buffers** around features on a particular layer
- This allows analyses such as flood zone delineation and features near a route such as hotels along a bike route



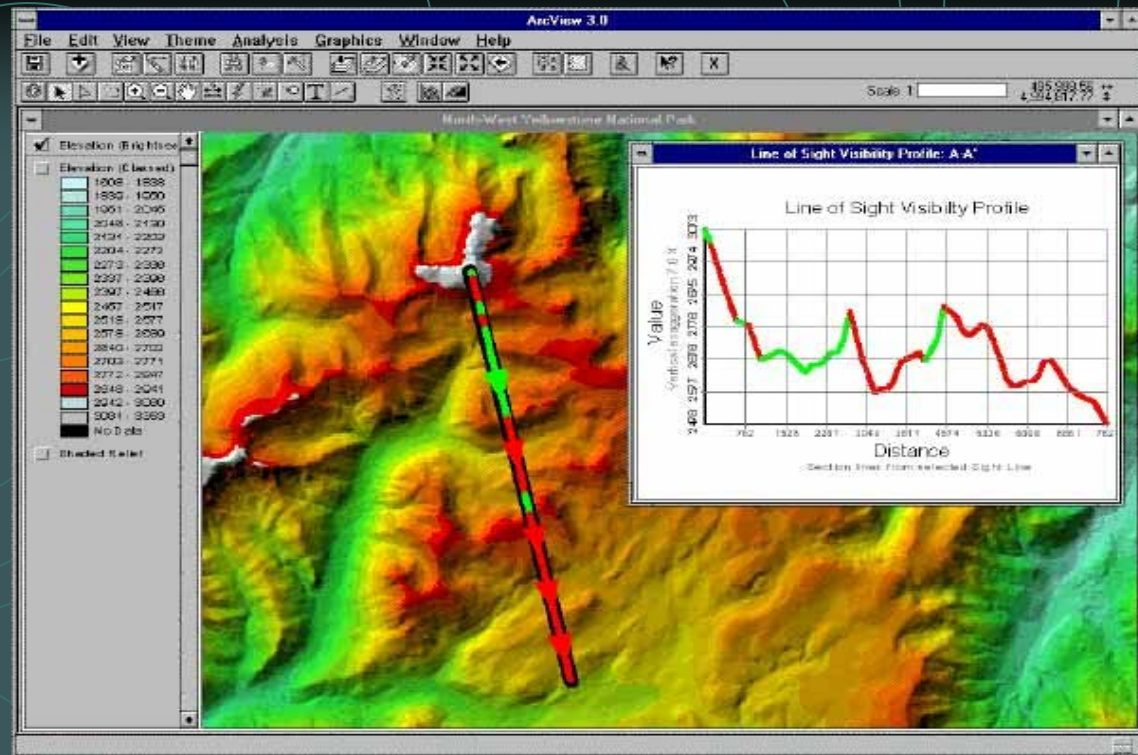
Query and Overlay Analyses

- **Query building** is a data exploration operation
 - Example statement: '([acres] > 500 AND [age] > 55)'
 - This would highlight all land parcels of greater than 500 acres owned by people older than 55 years old in a data set loaded into the GIS.



Spatial Analysis

Raster data can be used to create surfaces



Other raster data uses:

Density analysis

Proximity analysis

Least-cost paths

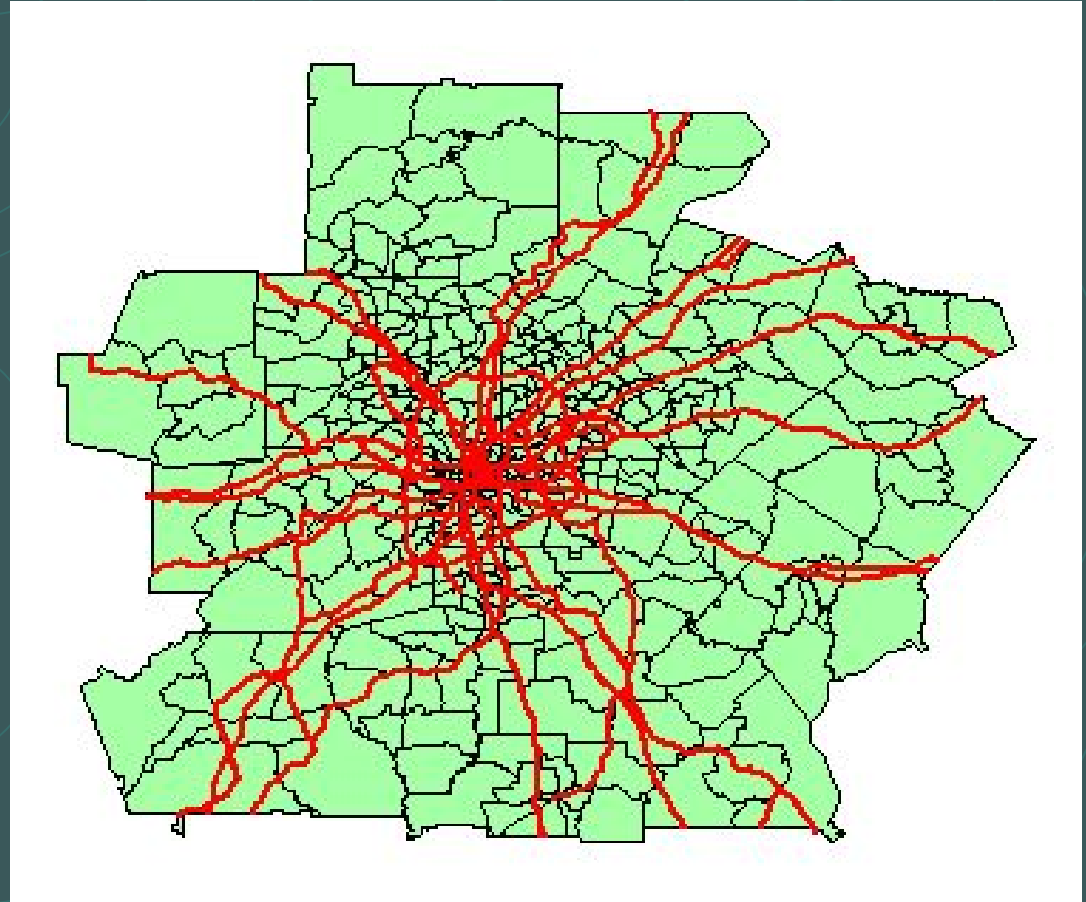
Line-of-sight

Hydrology analysis

Data Examples

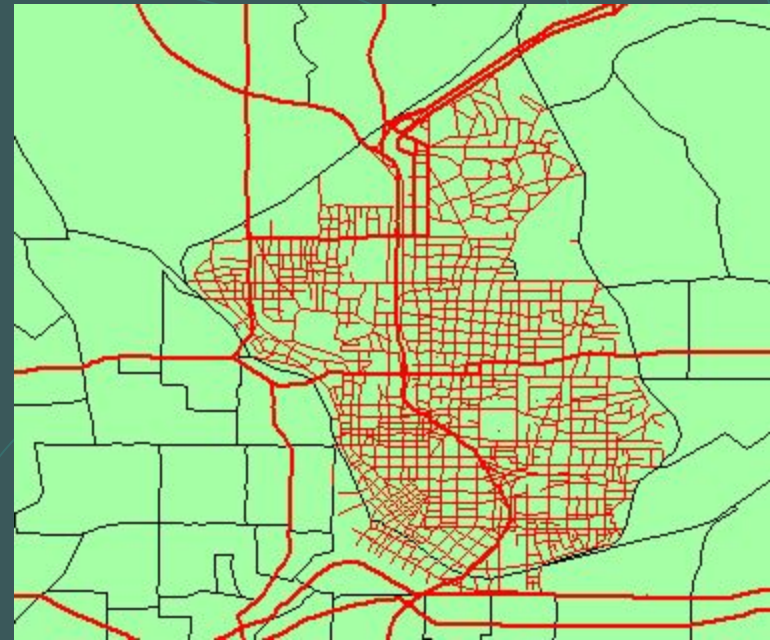
Here is Atlanta

- Highways
- Roads
- Census Tracts



Close up of downtown

- Map contains data for each street
- Each address in the city can be geocoded – that is, its location estimated in a systematic way
- GIS matches street addresses to lists that locate an address's latitude and longitude



Parcel Data

Clickable search pulls up the whole record

The screenshot shows a GIS application interface with a search panel on the left and a map on the right. The search panel is titled "Map Tasks" and includes a "Query Map Features" section with "County Search" and "State Search" tabs. The "County Search" tab is active, showing "Hardin" in a dropdown menu. Below this, there are instructions for "Step 1: Select a county," "Step 2: Input searching parameter such as owner name etc..." with "Gonzales" entered in a text box, and "Step 3: Select map feature and search type" with radio buttons for "Parcels" (selected) and "Abstracts", and sub-options "By Owner" and "By Add". "Step 4: Click Go!" is followed by a "Go" button. The "Search Results:" section lists several records for "GONZALES VICTOR" and "GONZALES MICHAEL L" with addresses and "Zoom To" links. A "1 of 6" indicator and a "Next" button are at the bottom of the results.

The map on the right shows a satellite view with a blue parcel highlighted. A tooltip over the parcel displays "Name: GONZALES VICTOR" and "Add: 5601 FM 1003 S".

An "Identify" window is open in the foreground, showing a dropdown menu set to "TX Parcel". Below the dropdown is a table of metadata for the selected parcel:

TX Parcel	
<i>name</i>	GONZALES VICTOR
<i>address</i>	5601 FM 1003 S KOUNTZE, TX 77625
<i>situs</i>	TX
<i>legal_acres</i>	53.99
<i>calc_acres</i>	0
<i>abstract</i>	117
<i>legal</i>	1058 /246 AB 117 BBB & C RR PARCEL 117-6A 53.99 ACRES
<i>land_value</i>	43190
<i>imp_value</i>	0
<i>total_value</i>	0
<i>r_number</i>	14549
<i>parcel_id</i>	117
<i>geo_id</i>	000117-000300 (14549-1/18210)
<i>owner_id</i>	18210
<i>county</i>	HARDIN



A topographic map with contour lines and a grid is visible on the left side of the slide, serving as a background for the text.

Part 3: GIS CAREERS

Public Sector: Land use and resource management, transportation, defense and intelligence, economic development and human services, public safety

Private Sector: consulting (incl. government contracts), utilities, engineering, oil and gas exploration, facilities management, logistics



TYPICAL GIS JOB RESPONSIBILITIES

- Cartographic design
- Data analysis
- Computer programming
- Database administration
- Project management
- System administration

<http://www.gislounge.com/tag/job-description/>

Typical entry level GIS requirements

- Degree in geography, geographic information systems, urban planning, or related field
- Strong experience with ArcGIS
- Strong background producing map products
- Strong background using and producing GIS data sets
- Strong data management skills
- Ability to work effectively in a team structure
- Ability to complete tasks in a timely fashion