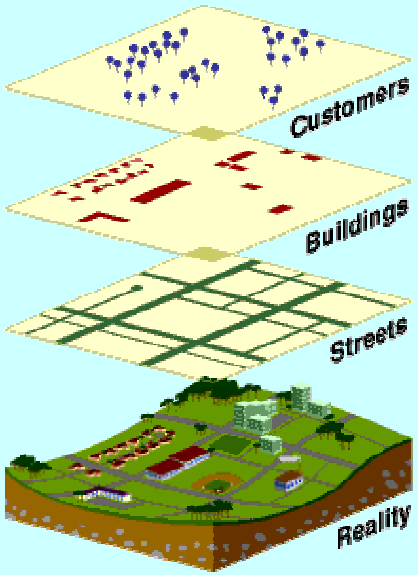
Using Geographic Information Systems for Health and Medical Research

What is GIS?

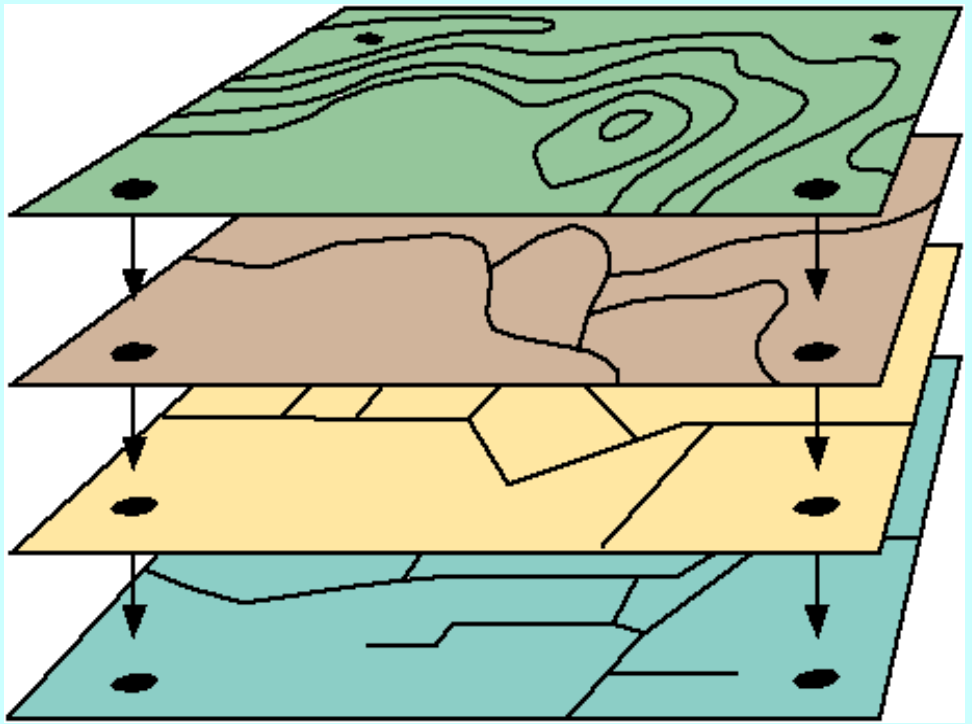


- Geographic Information Systems (GIS) a collection of computer hardware, software, data, personnel and methods that enable you to better understand and evaluate your data by using cartographic tools to display the information stored in your database.

- Spatial analysis of data which shares a common location reveals hidden patterns and relationships that aren't readily apparent in spreadsheets or statistical packages.

GIS Data Structure

STACKED MAP LAYERS: Each layer represents unique phenomena, and the layers can be superimposed.



Average Temperature

Parasite Drug Resistance

Average Age Per Census Tract

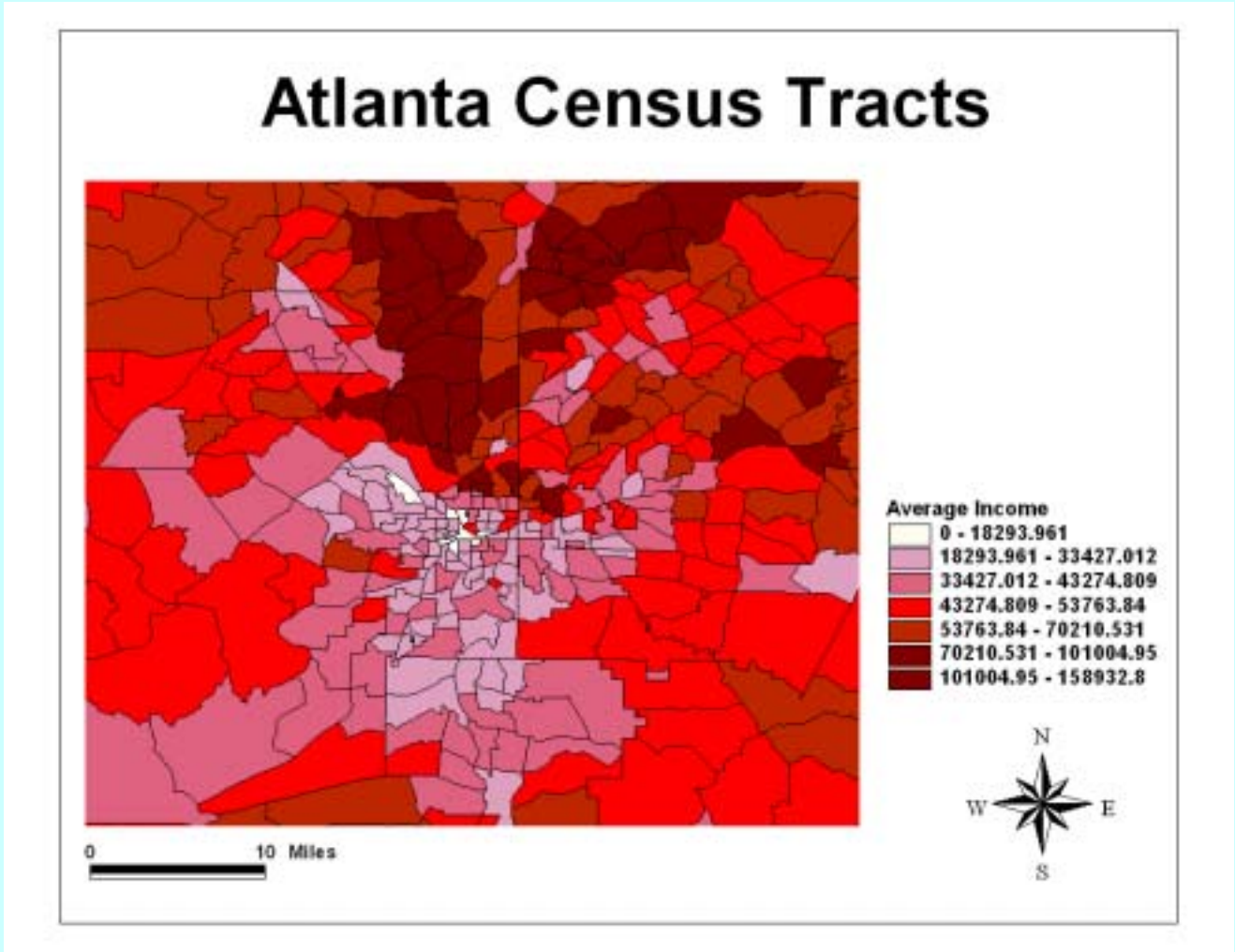
Water Distribution

and Industrial activities

Hospital and Health Stations

others ...

You can change the display of your geographic data by changing the symbols, colors, or legend classifications.

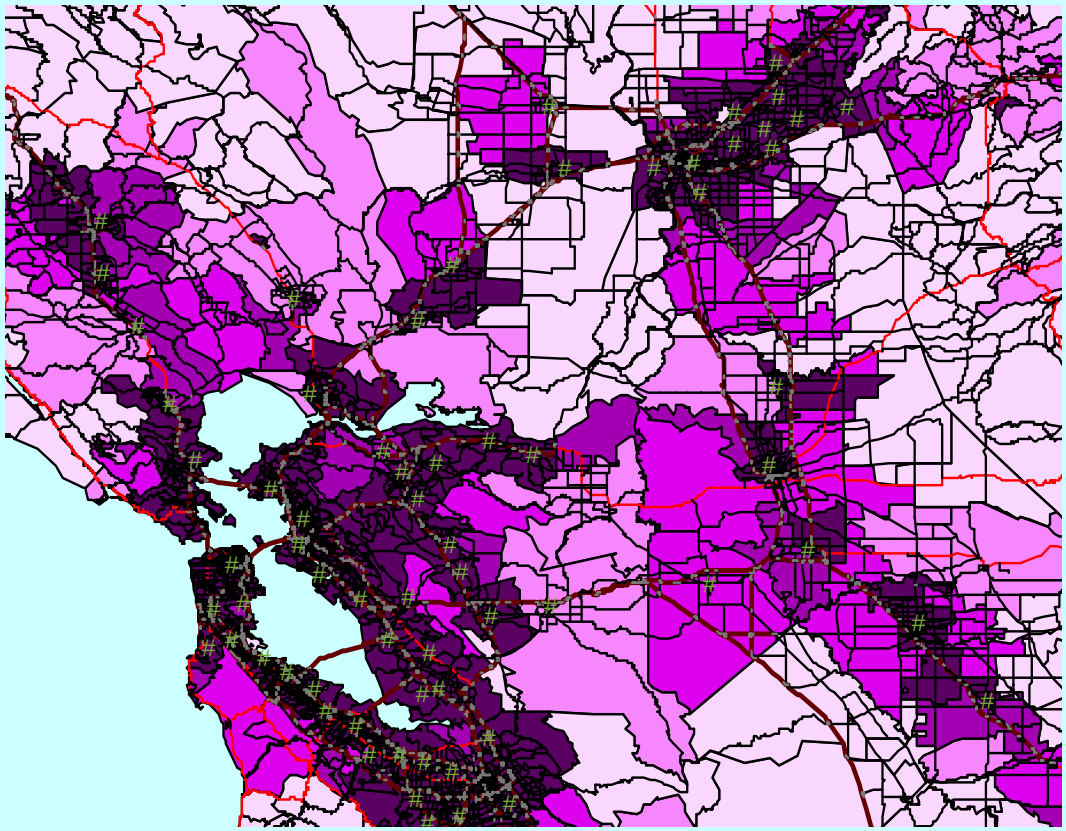


GIS: “I” for Information

- GIS-formatted data; shapefiles, coverages, etc..
- Your own data with explicit or implicit geographic references.
- An explicit geographic reference is absolutely tied to the earth such as latitude and longitude.
  - Data from GPS units.
- An implicit geographic reference such as an address, census tract code, forest stand identifier, or county, can be included by joining tables or using an automated process called "geocoding."

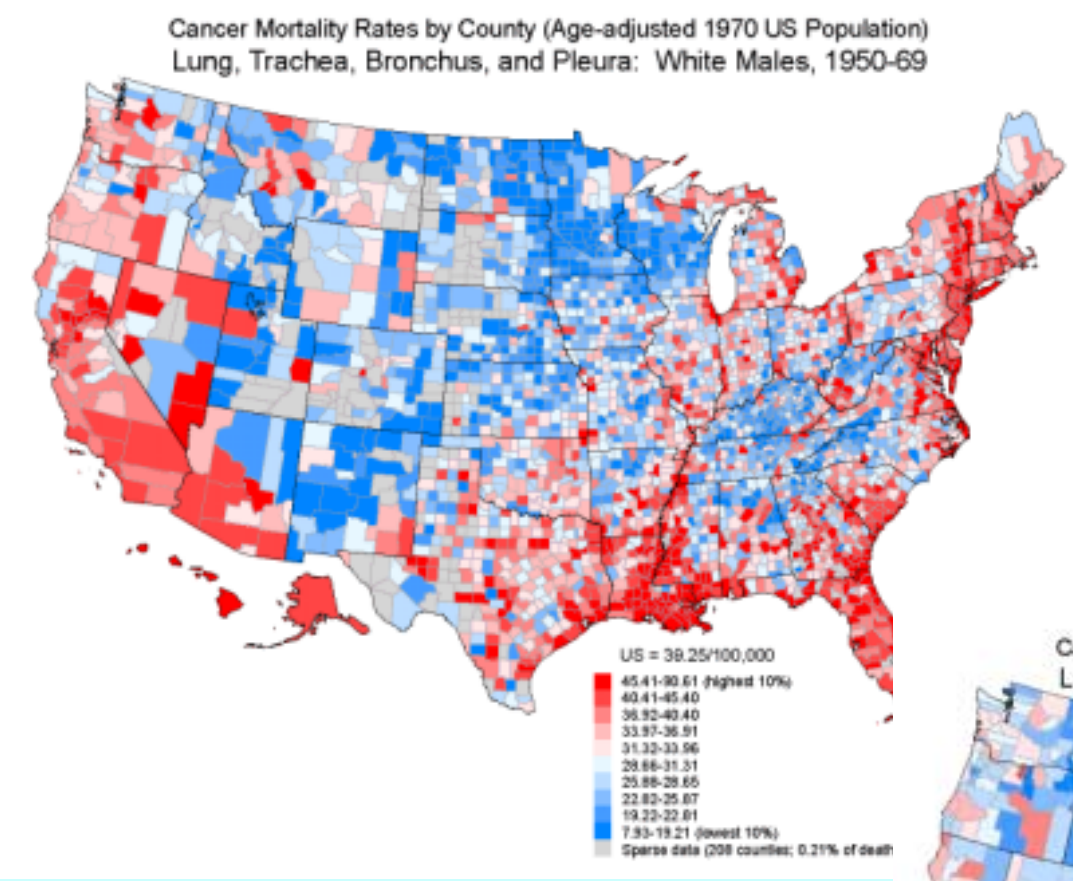
Vector Layers

Points, Lines, Polygons

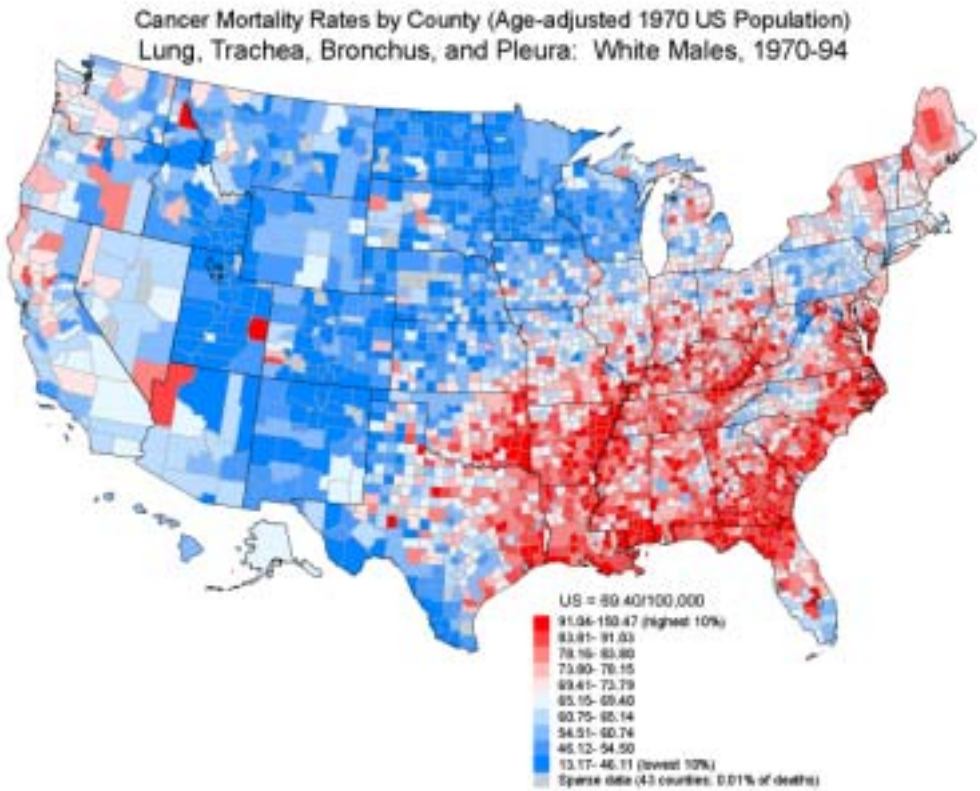


Some possible layers:

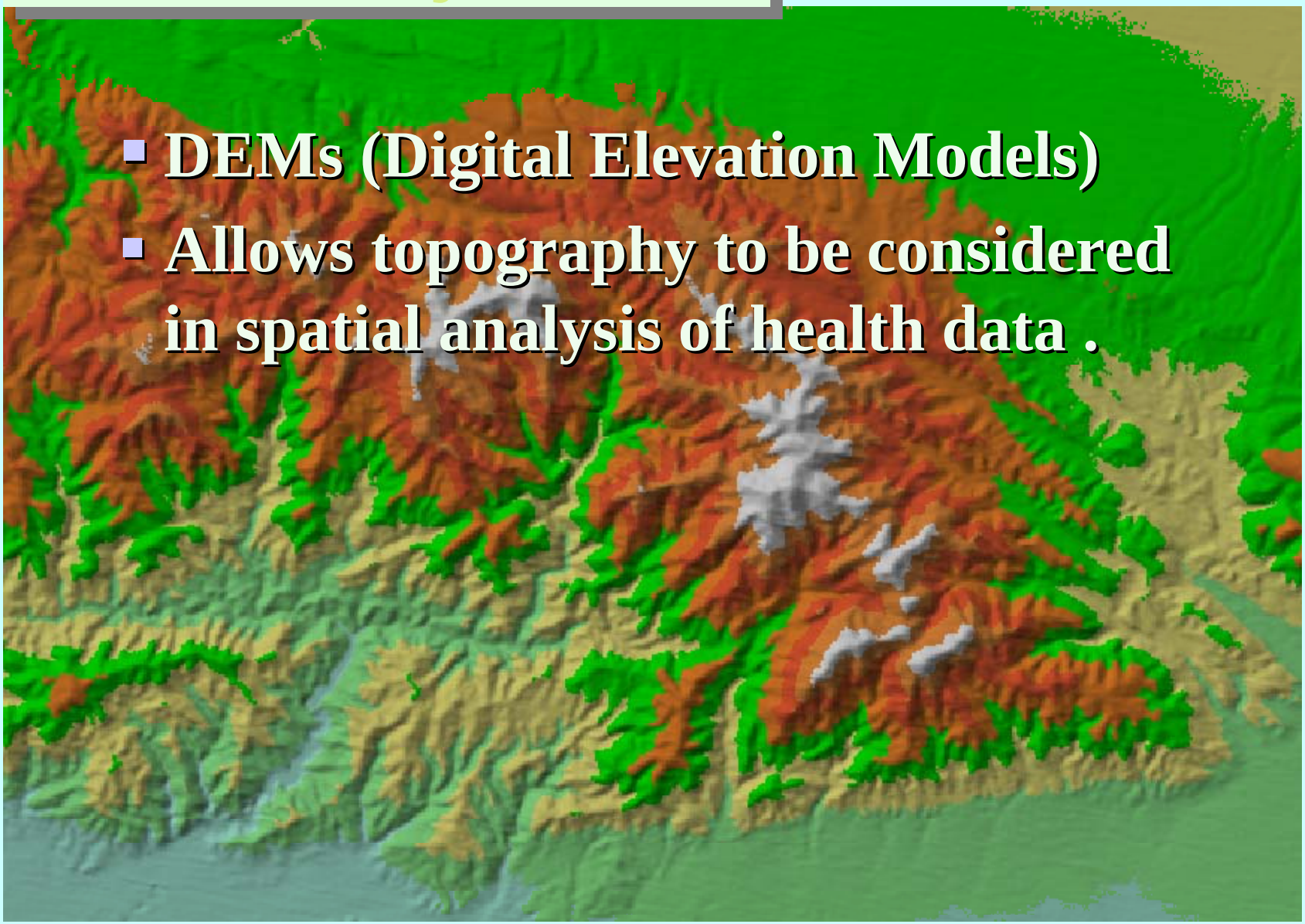
- Political Boundaries
- Census Boundaries
- Zip Code Boundaries
- Streets
- Hydrography
- Medical Facilities
- Patients' home locations



Polygons representing county health statistics can be displayed in both space and time dimensions.

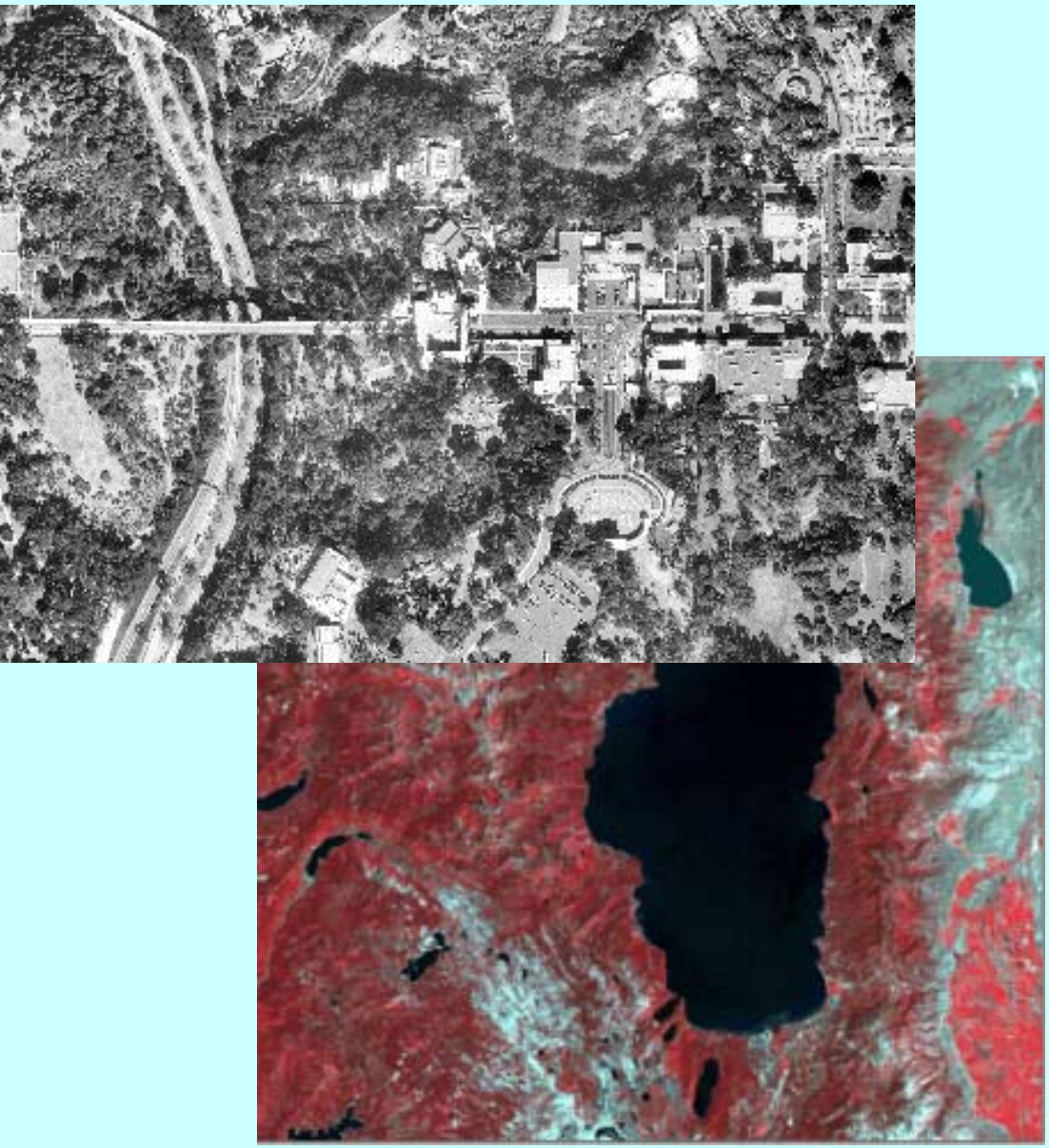


Raster Layers



- DEMs (Digital Elevation Models)
- Allows topography to be considered in spatial analysis of health data .

Imagery in GIS



TYPES

- Aerial Photos
  - B/W, Color
  - From USGS
- Satellite Imagery
  - Landsat, MSS, SPOT

USES

- Assess environmental factors that promote disease transmission
- Perform multispectral categorizations of vegetation cover, landscape structure, and water bodies.
- Perform change detection analysis to find temporal patterns

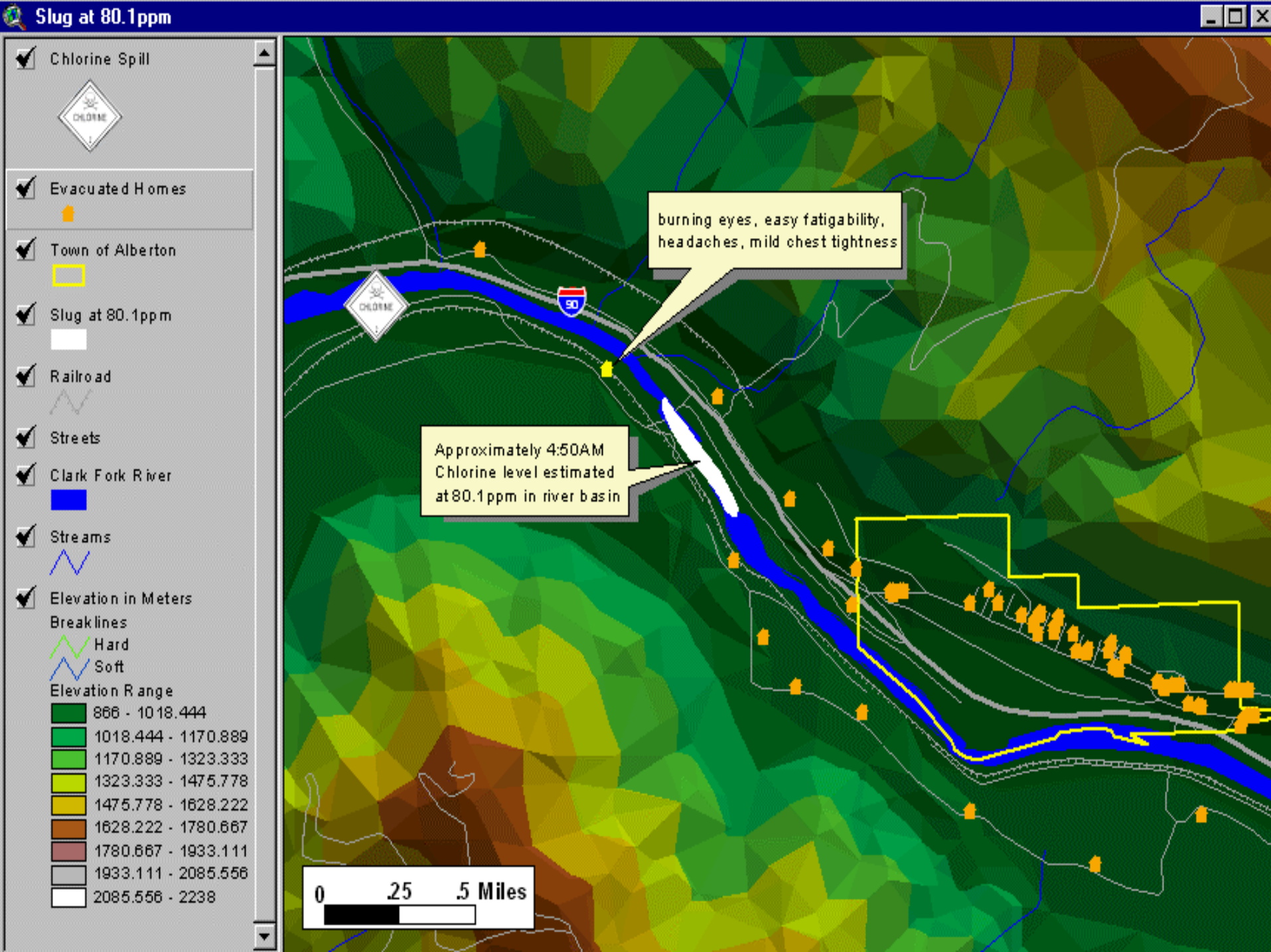
Epidemiologic Applications

ANALYSIS OF DISEASE DISTRIBUTION

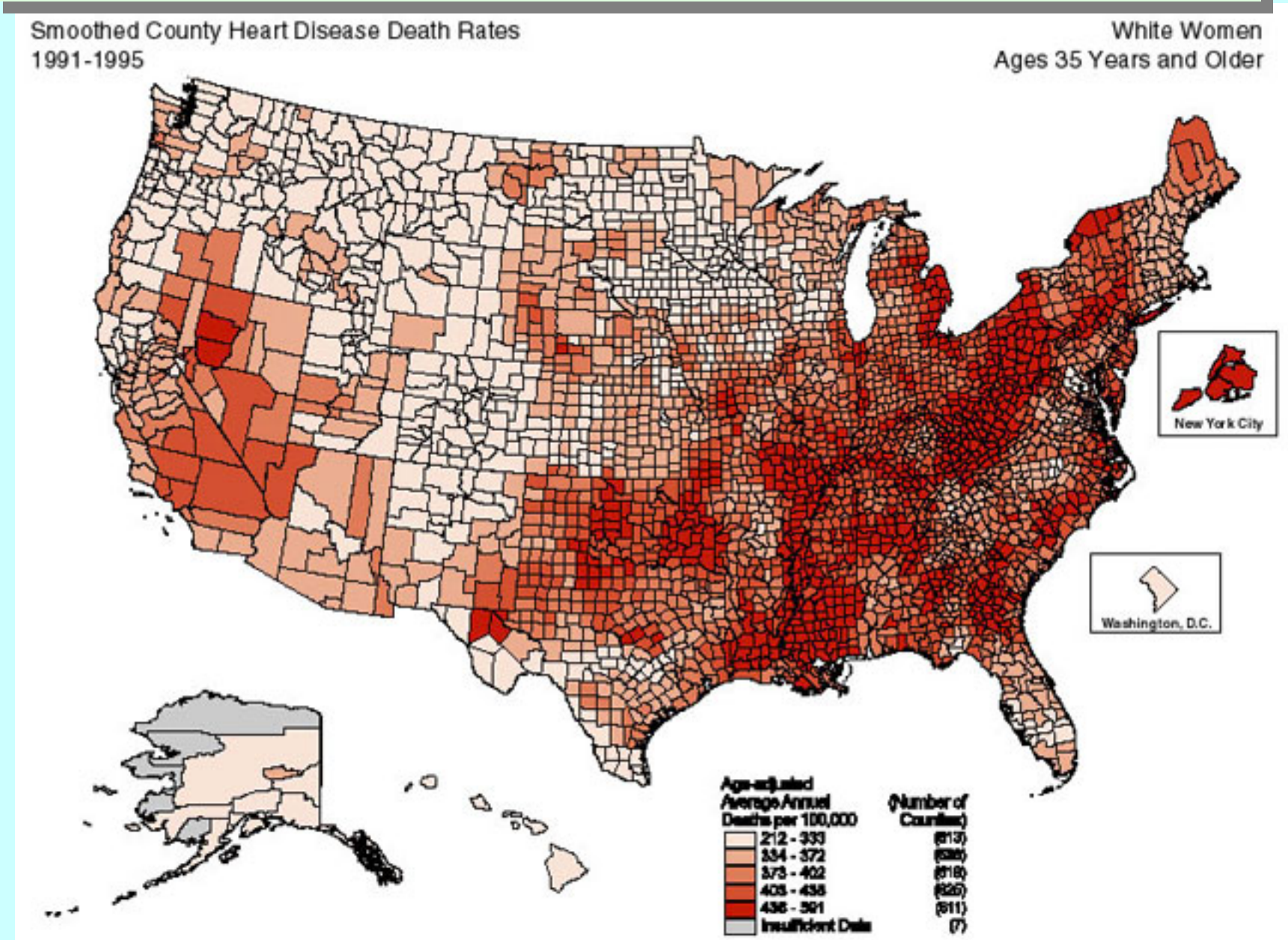
- VECTOR-BORNE DISEASES
- WATER-BORNE DISEASES
- DIFFERENTIAL MORTALITY

ENVIRONMENTAL RISKS

- EXPOSURE TO ELECTROMAGNETIC FIELDS
- LEAD HAZARDS
- PREDICTION OF PEDESTRIAN INJURIES

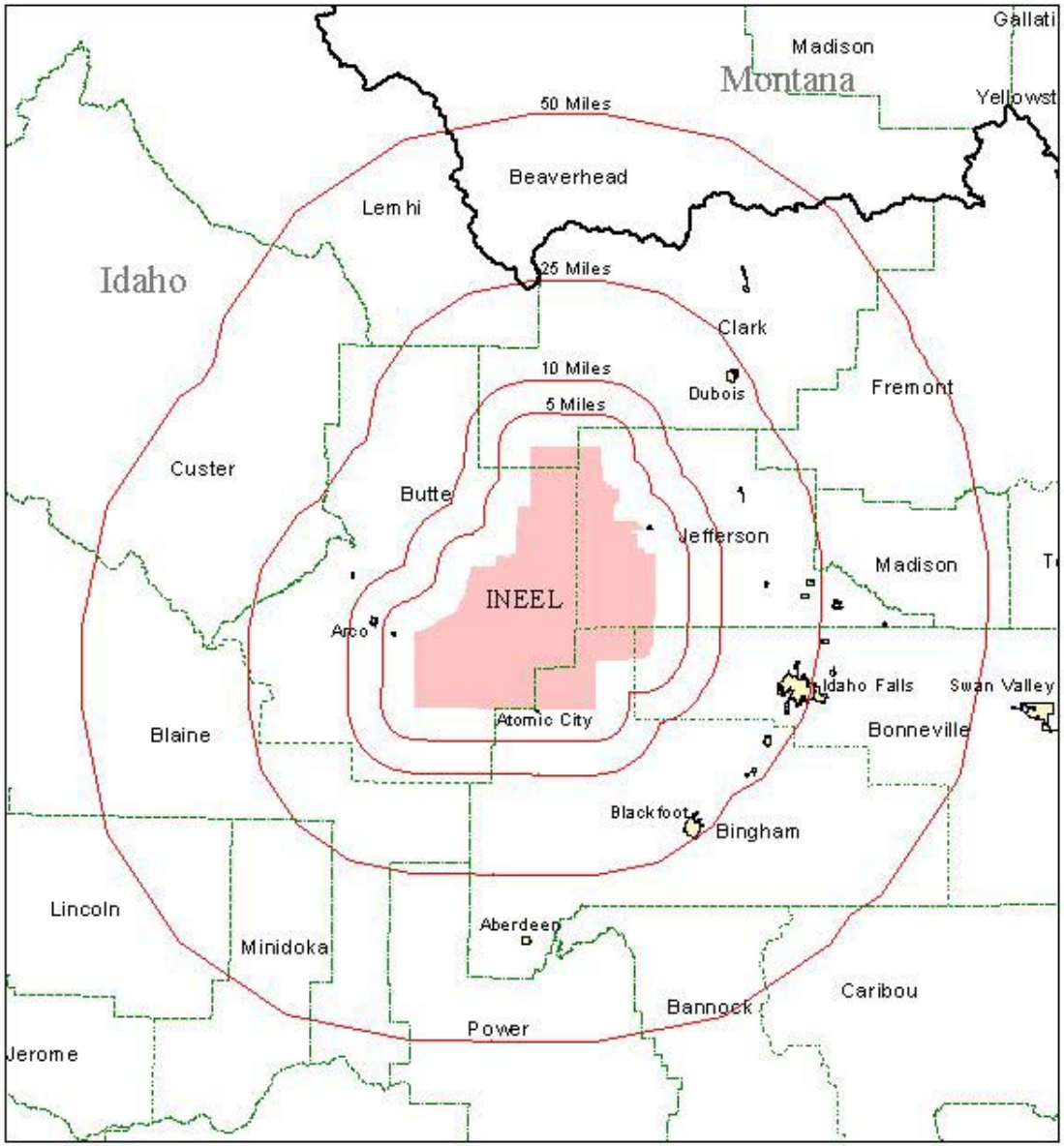

Slug at 80.1ppm
Chlorine Spill
Evacuated Homes
Town of Alberton
Slug at 80.1ppm
Railroad
Streets
Clark Fork River
Streams
Elevation in Meters
Breaklines
Hard
Soft
Elevation Range
866 - 1018.444
1018.444 - 1170.889
1170.889 - 1323.333
1323.333 - 1475.778
1475.778 - 1628.222
1628.222 - 1780.667
1780.667 - 1933.111
1933.111 - 2085.556
2085.556 - 2238
burning eyes, easy fatigability, headaches, mild chest tightness
Approximately 4:50AM Chlorine level estimated at 80.1ppm in river basin
90
0 .25 .5 Miles

Geographic Variation for Heart Disease Death Rate



Demographic Variables in 5, 10, 25, and 50 Mile Increments

Idaho National Engineering and Environmental Laboratory

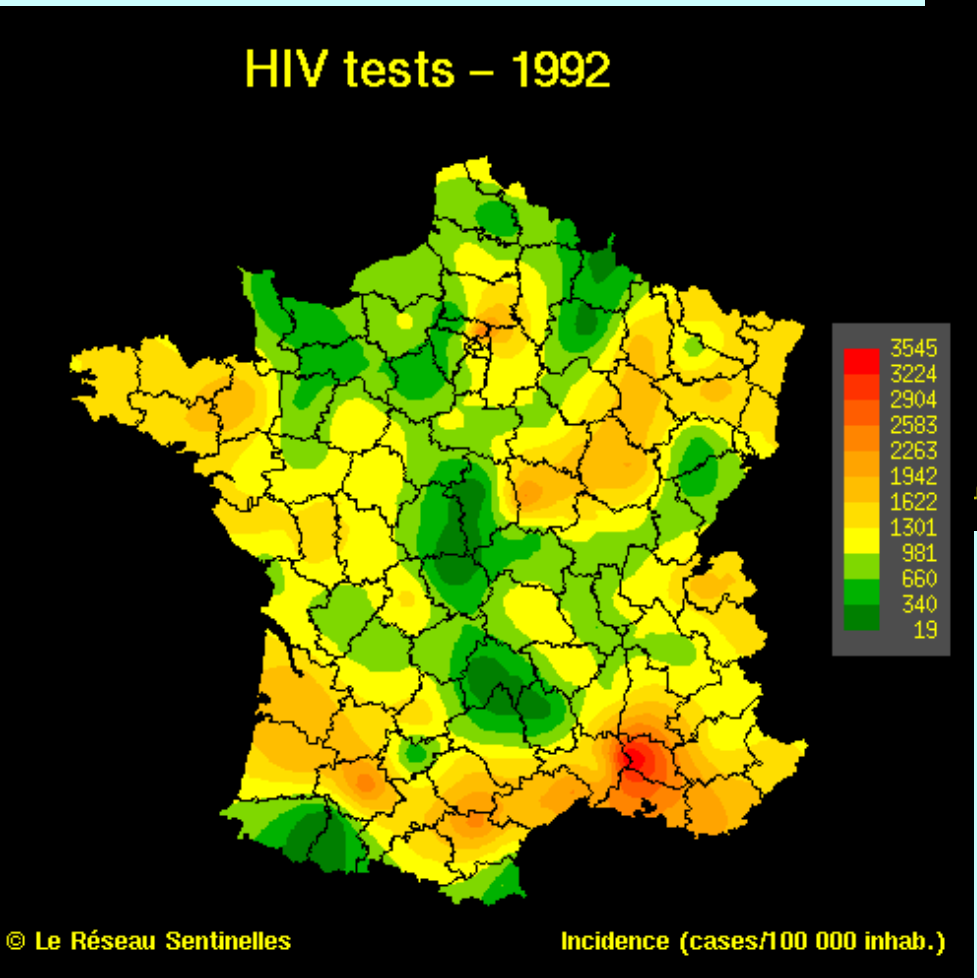


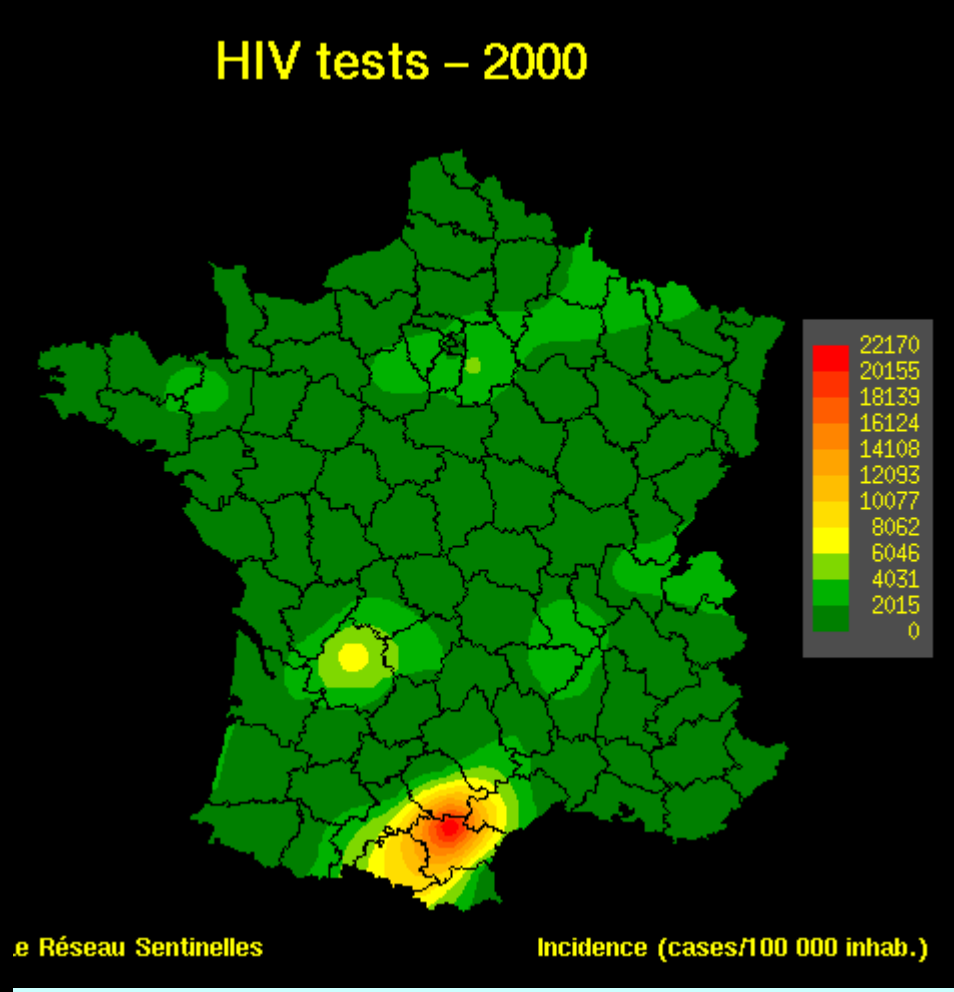
Demographic Variables	Distance in Miles From Site Boundary			
	5	10	25	50
Total Population	1,737	3,892	94,497	231,577
RACIAL CHARACTERISTICS				
White	1,639	3,654	88,372	215,910
Black	1	1	299	823
American Indian, Eskimo, Aleut	17	43	1,250	5,170
Asian or Pacific Islander	2	8	867	2,065
Other Race	77	183	3,076	7,612
Hispanic Origin	141	302	5,911	12,915
SENSITIVE POPULATIONS				
Children Age 6 or Younger	238	485	12,422	29,847
Females Age 15 - 44	327	719	19,700	52,238
Adults Age 65 or Older	132	413	9,257	21,420
OTHER VARIABLES				
Total Housing Units	648	1,600	33,931	81,590
Total Age 18 and Older	1,003	2,425	60,759	150,187
Total Younger than 18	732	1,466	33,742	81,396

Miles
20 0 20 40

Figure 2

Mapping HIV Testing





The Sentinel System is developed under the auspices DGS (National Health Department) and the InVS (Institut de Veille Sanitaire).

Improvements in Vaccination Coverage