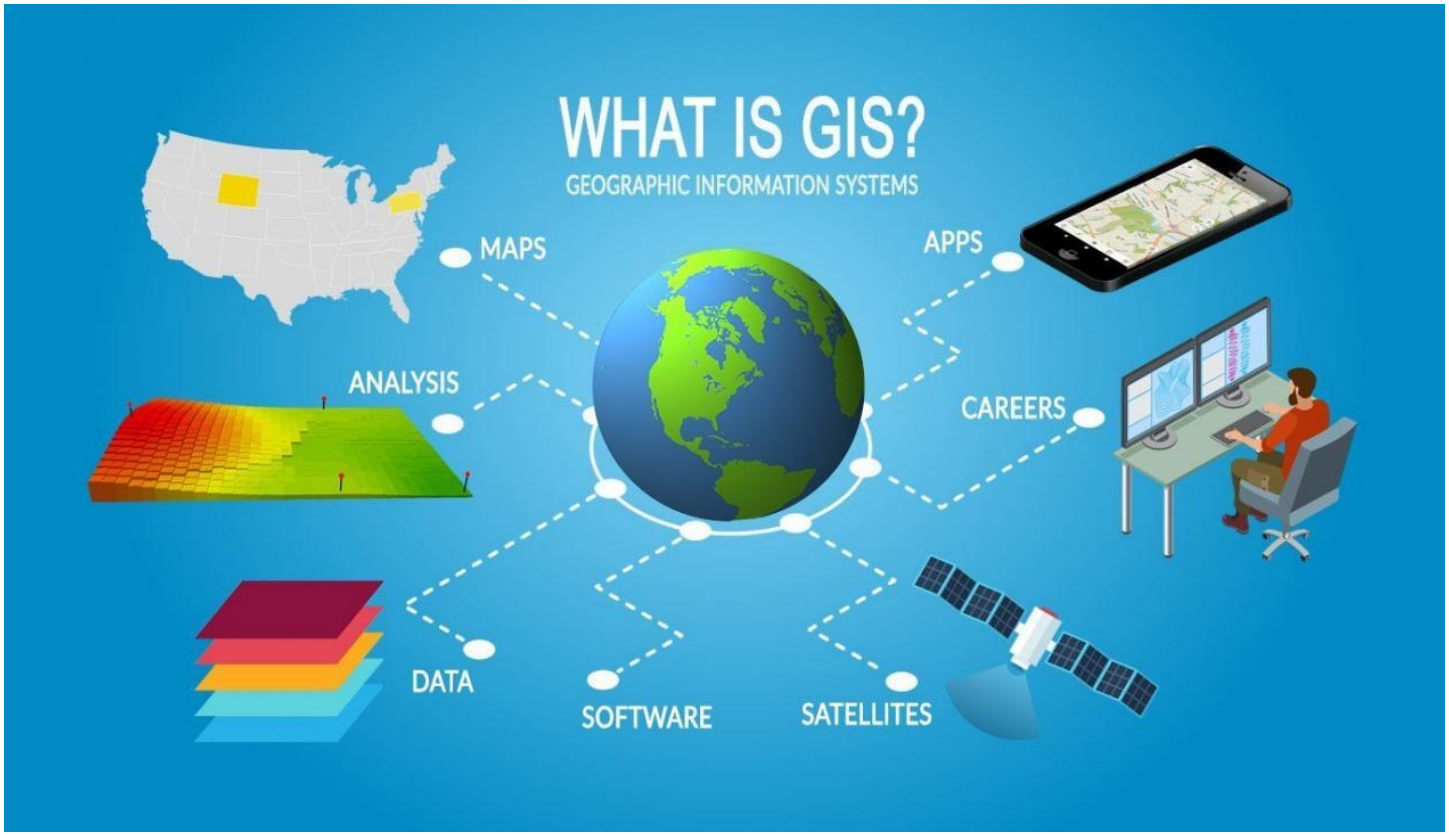
- GEOGRAPHICAL INFORMATION SYSTEM



GEOGRAPHICAL INFORMATION SYSTEM

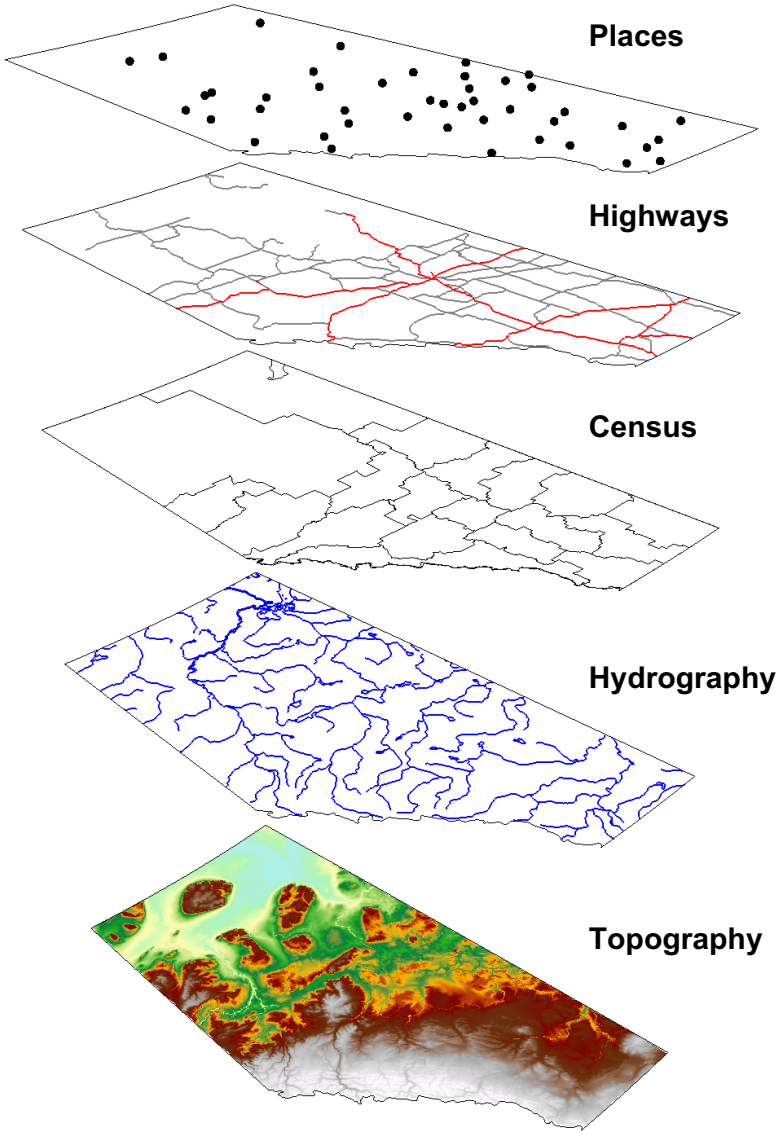
- "GIS is a computerized system for capturing, storing, checking, integrating, manipulating, analyzing, and displaying data related to positions on the Earth's surface."

GEOGRAPHICAL INFORMATION SYSTEM

- Geographic Information System (GIS) is defined as an information system that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data, in order to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records.
- The term *Geographic Information System (GIS) first appeared in published literature* in the mid-1960s. But although the term is relatively new, many of its concepts have long been in existence. For example, the *map overlay concept, which is* one of the important tools used in GIS spatial analysis, was used by French cartographer Louis-Alexandre Berthier more than 200 years ago. He prepared and overlaid a series of maps to analyze troop movements during the American Revolution.
- GIS data can be assembled from existing databases; digitized or scanned from existing maps and plans; or collected using conventional surveying techniques, including GPS surveying techniques.

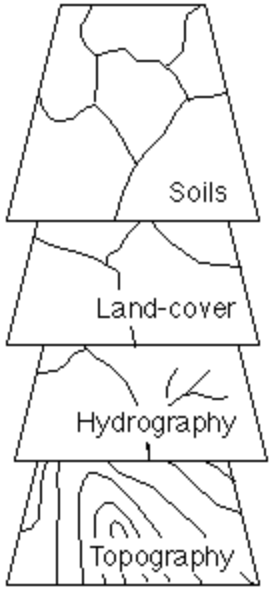
GEOGRAPHICAL INFORMATION SYSTEM

- The ability to 'stack' layers in a GIS allows us to ask questions about the **relationship between** different objects of study

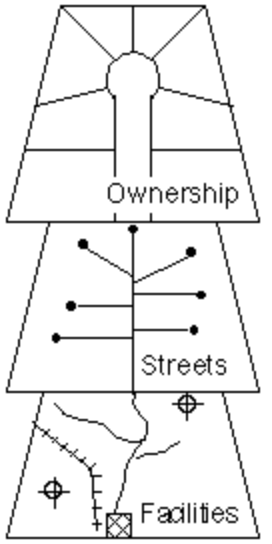


- **Attribute** data
  - Information about **what can be found** at a particular location

Maps → Attribute Database



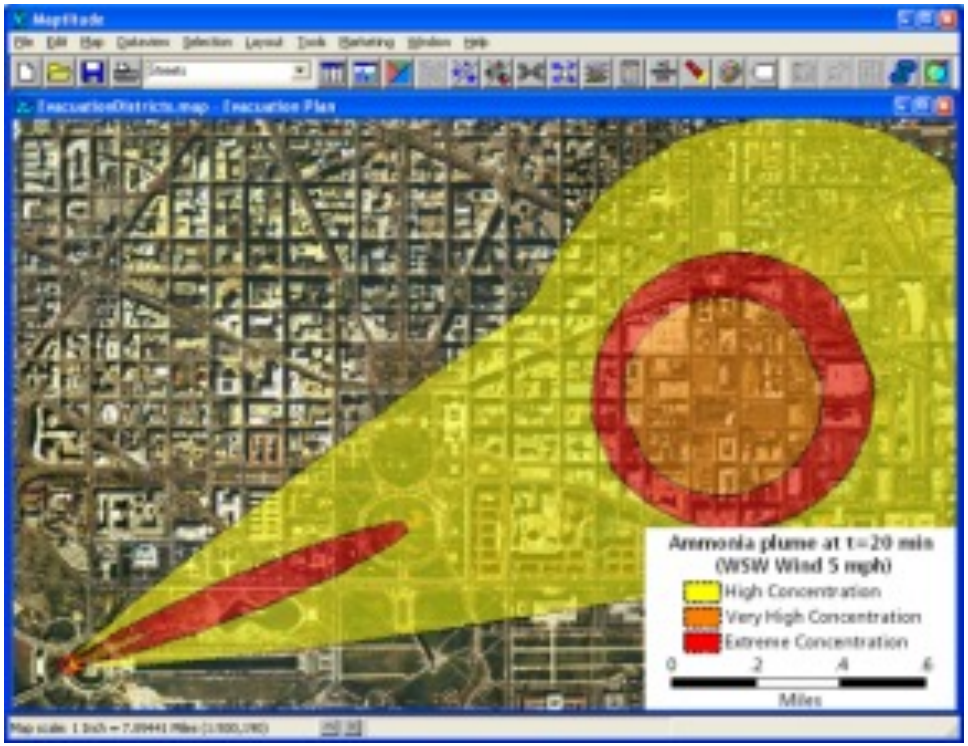
Map Data	Attribute Data
Soils	• type • texture • pH • erosion potential
Land-cover	• dominant species • size • density
Hydrography	• lakes • streams • watersheds • gauging stations
Topography	• elevation • slope • aspect



Map Data	Attribute Data
Ownership	• address • size • zoning • legal description
Streets	• type • width / length • paving
Facilities	• powerlines • water • sewer • buried cables

Overlay - GIS

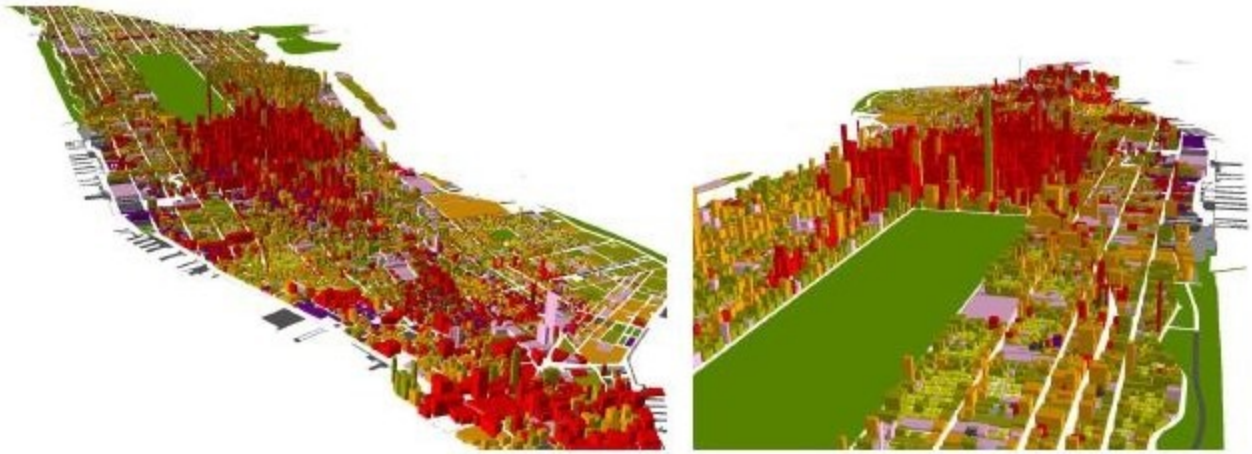
- What residences lie beneath this toxic plume of ammonia?



What can I do with GIS?

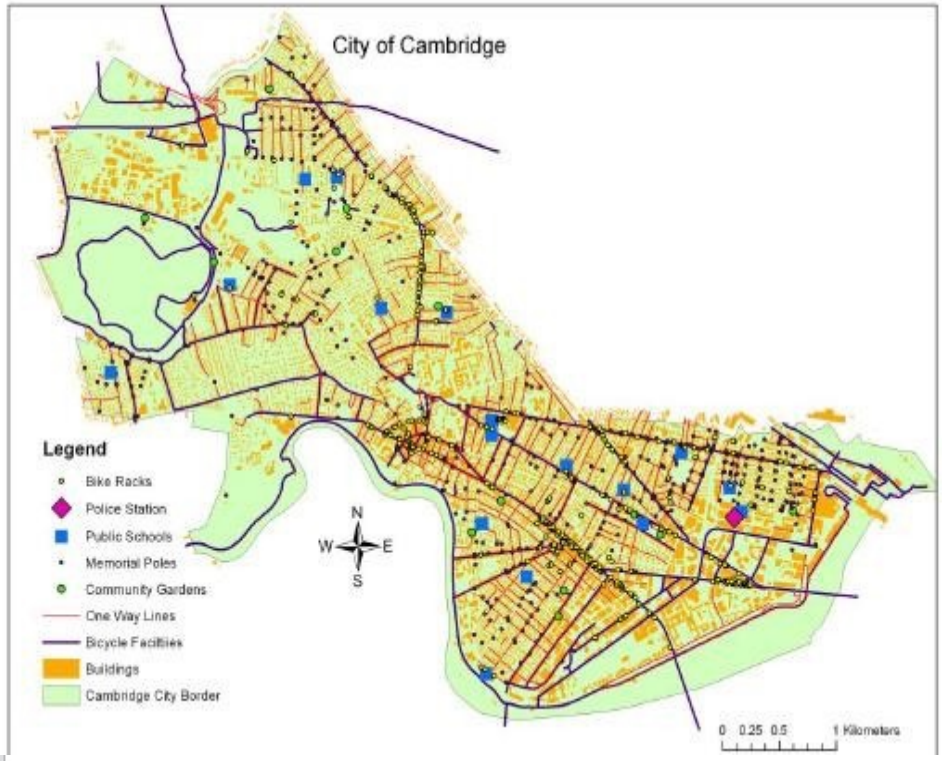
View Imagery

Create 3D models



Create Maps


Pin it
Irish Roots
U.S. population with Irish ancestry: 11.1%
Irish Ancestry as a Share of County Population: 2009-2013
20.0% or more
15.0% to 19.9%
10.0% to 14.9%
5.0% to 9.9%
Less than 5.0%


City of Cambridge
Legend
Bike Racks
Police Station
Public Schools
Memorial Poles
Community Gardens
One Way Lines
Bicycle Facilities
Buildings
Cambridge City Border
N
W
E
S
0 0.25 0.5 1 Kilometers

…and More!

- Calculate area and volume
- Join data based on a common attribute (ID, name, etc.) or its spatial location
- Find where data layers intersect
- Find the nearest features
- Perform surface analysis
  - Contour
  - Slope
  - Hillshade
  - Viewshed
  - Hydrology

GEOGRAPHICAL INFORMATION SYSTEM

Why a GIS

- Old Records/maps are poorly maintained
- Poorly Updated
- Inaccurate
- No Sharing
- No data retrieval service for maps

GEOGRAPHICAL INFORMATION SYSTEM

Benefits of GIS

Once a GIS is implemented, following benefits are expected:

- Better Maintained data
- Standard format
- Easy revision,
- Easy updation
- Easy Units conversion
- Easy to share
- Easier to search, analyze and represent
- Many value added products
- Enhance productivity of staff
- Time and Money saved
- Better Decision making

GEOGRAPHICAL INFORMATION SYSTEM

GIS Software

- ESRI: ARC/INFO, ARC VIEW, ARC GIS
- Intergraph: MGE
- Grass Information Centre: GRASS*
- Clark University: IDRISI
- AUTODESK: ARC MAP
- ILWIS: Integrated Land and Water Information System.

GEOGRAPHICAL INFORMATION SYSTEM

GIS as a Multi-Disciplinary Science

Combination of following traditional sciences

- Geography
- Statistics
- Cartography
- Remote Sensing
- Photogrammetry
- Computer Science
- Operation Research
- Mathematics
- Surveying
- Civil Engineering
- Geodesy
- Urban Planning
- Environmental Engineering, etc.

GEOGRAPHICAL INFORMATION SYSTEM

GEOGRAPHICAL INFORMATION SYSTEM

WHO USES GIS?

Business
- Banking and Financial Services
- Facilities Management
- Insurance
- Media and Press
- Real Estate
- Retail

Defense and Intelligence
- Defense and Force Health Protection
- Enterprise GIS
- Geospatial Intelligence
- Installations and Environment
- Military Operations (C4ISR)

Education
- Libraries and Museums
- Schools (K–12)
- Universities and Community Colleges

Government
- Federal, State, Local, Gov 2.0
- Architecture, Engineering and Construction (AEC)
- Economic Development
- Elections and Redistricting
- Land Administration
- Public Works
- Surveying
- Urban and Regional Planning

Health and Human Services
- Public Health
- Human Services
- Hospital and Health Systems
- Managed Care
- Academic Programs and Research

Mapping and Charting
- Aeronautical
- Cartographic
- Nautical
- Topographic

Natural Resources
- Agriculture
- Climate Change
- Conservation
- Environmental Management
- Forestry
- Marine and Coast
- Mining
- Oceans
- Petroleum
- Water Resources

Public Safety
- Computer-Aided Dispatch
- Emergency/Disaster Management
- Fire, Rescue, and EMS
- Homeland Security
- Law Enforcement
- Wildland Fire Management

Transportation
- Aviation
- Highways
- Logistics
- Railways
- Ports and Maritime
- Public Transit

Utilities and Communications
- Electric
- Gas
- Location-Based Services
- Pipeline
- Telecommunications
- Water/Wastewater

UNDERSTANDING SPATIAL DATA

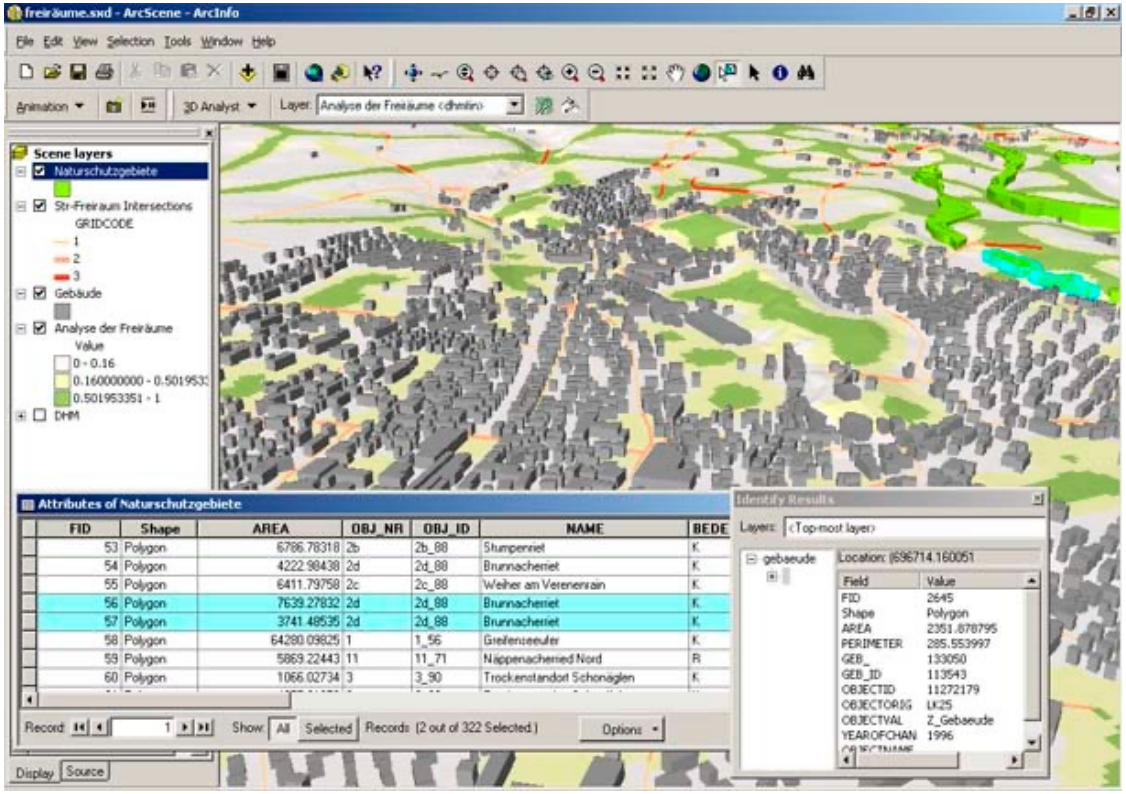
What is spatial data?

- Information about the locations and shapes of geographic features and the relationships between them, usually stored as coordinates and topology.

- Any data that can be mapped.

GIS Components

- Software
  - A technology for storing and analyzing location and attribute data



GIS Components

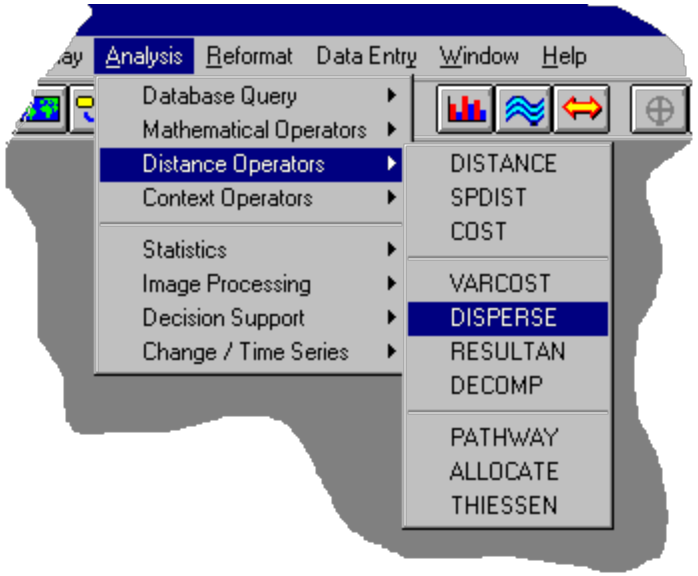
- Hardware
  - Systems to support rapid graphic analysis and processing

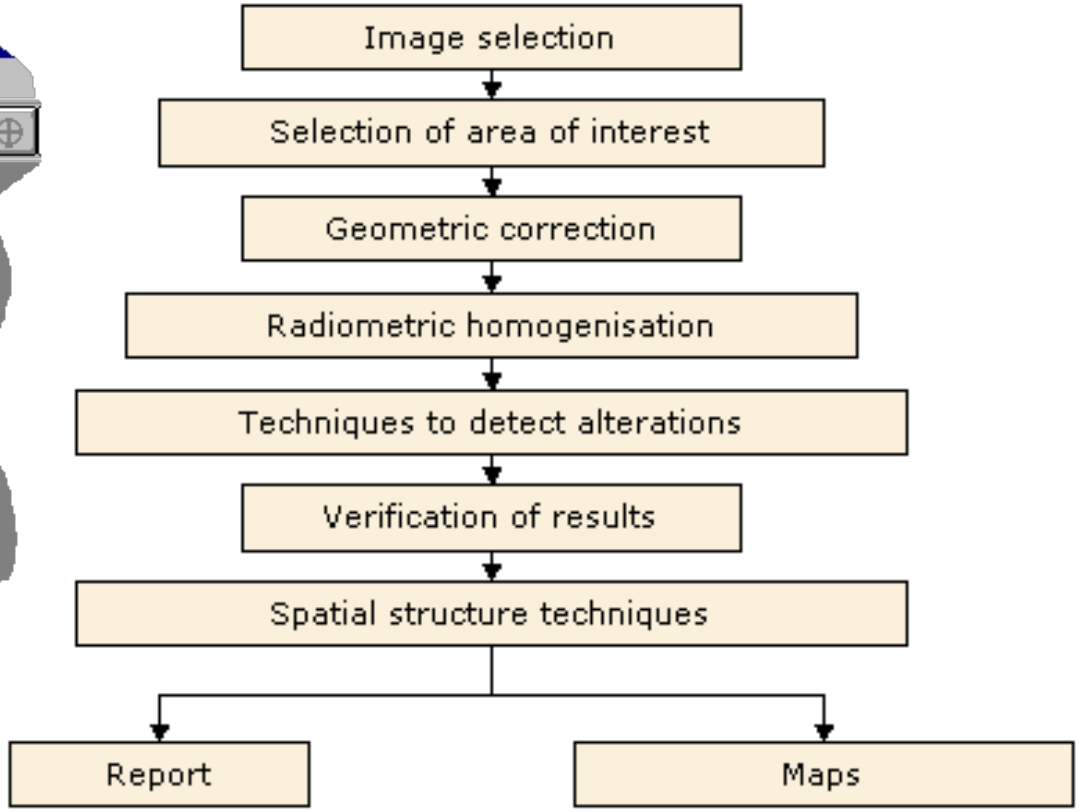
GIS Personnel

- Data
- People
  - Project coordinators
  - Data analysts
  - Programmers
  - Data and knowledge managers
    - Librarians

GIS Components

- Methods
  - The analysis to be performed on the data





GIS Methods and Analysis

- GIS is used to **answer questions and support decisions**

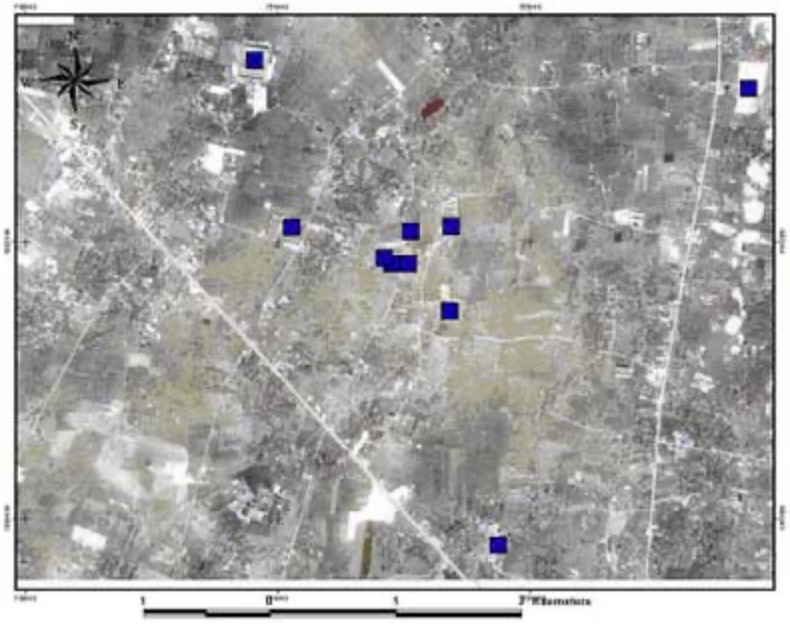
- The quality of the answer depends on:
  - The **METHODS** chosen
  - The **DATA** (more on that later)

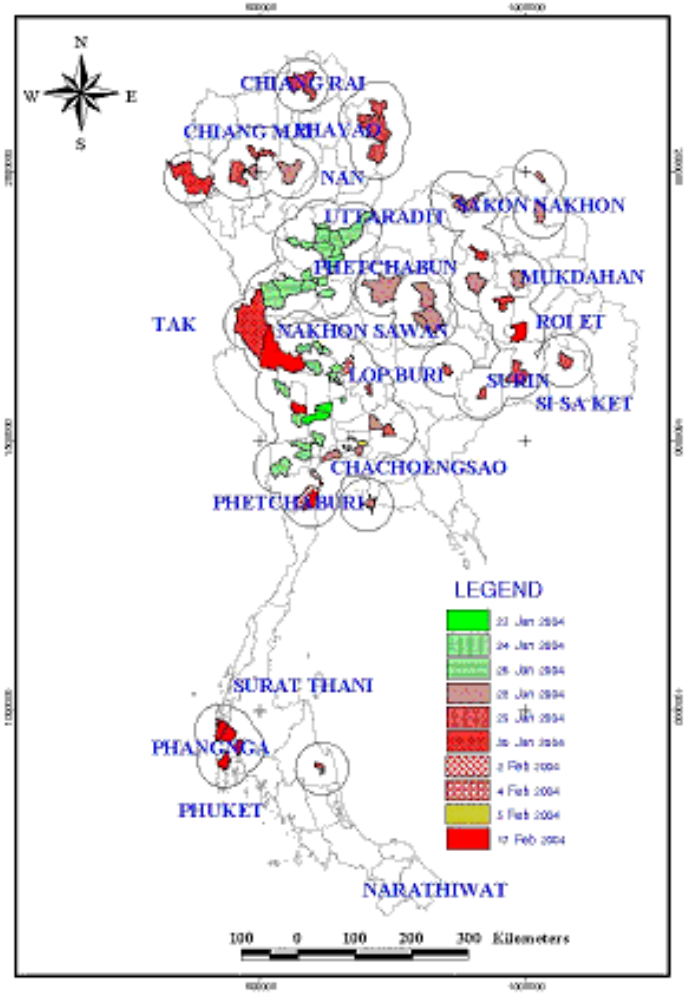
Modeling - Site Selection

- Combining best conditions from multiple layers to come up with the best location for a proposed facility

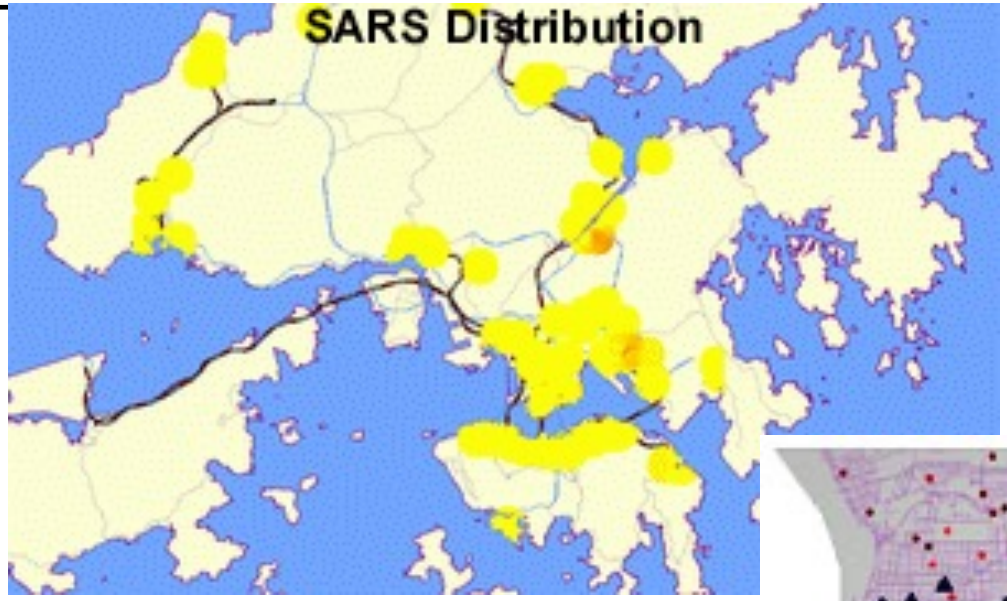
- Eg. Good slope drainage + enough distance from streams + access to roads = Best site

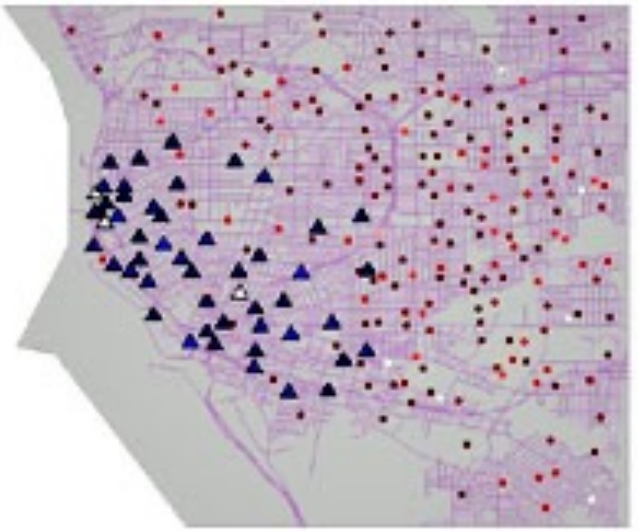
Health Care: Disease outbreak monitoring and modeling





SARS Mapping





GIS and Libraries

- Community demographic analysis