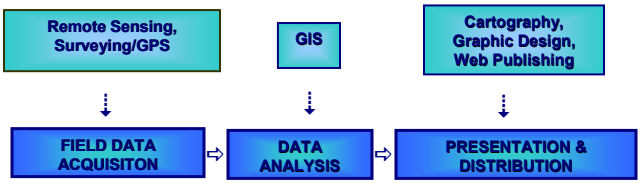
What is GIS?

60-520 Seminar
February 3, 2005

Phil Graniero and Alice Grgicak-Mannion
Earth Sciences

What is Geomatics?

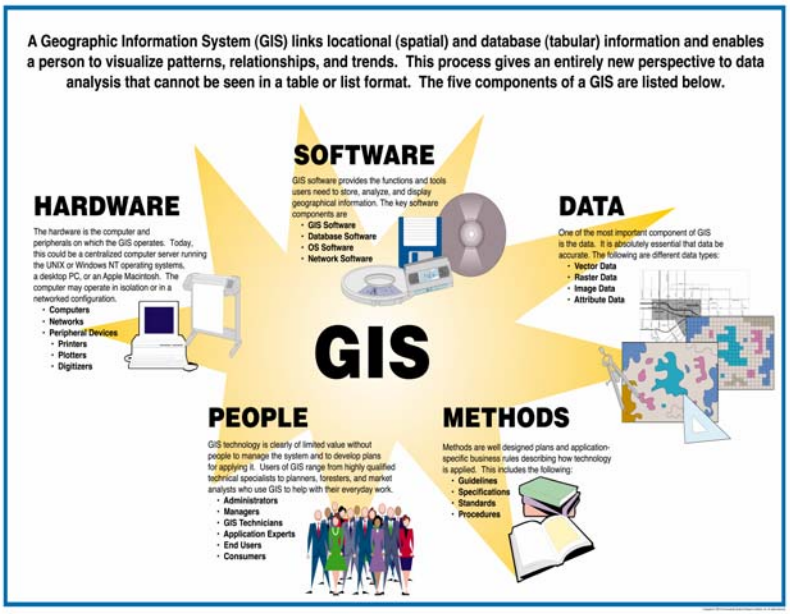
- The science and technology of gathering, analyzing, interpreting, distributing and using geographic information
- Tools include GPS, GIS, Remote Sensing, Surveying and Cartography



What is GIS?

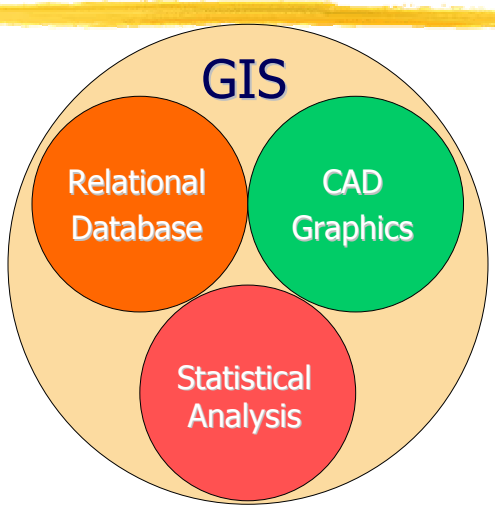
- **G**eographic **I**nformation **S**ystem
- "An integrated software package for the input, management, analysis, and display of spatially referenced data"
- Maps, plus more!
- Transforms *data* into *information*

GIS Components



GIS Technology

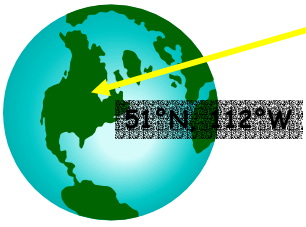
- GIS borrows from other software technology:
  - Relational Database Management Systems
  - Computer Assisted Design and Graphics Software
  - Statistical Analysis and Reporting Packages

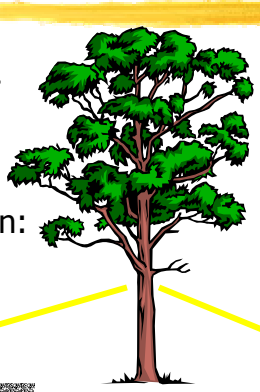


Describing Our World

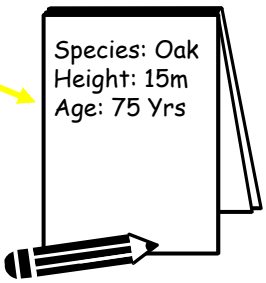
- We can describe any element of our world in two ways:

Location Information: Where is it?



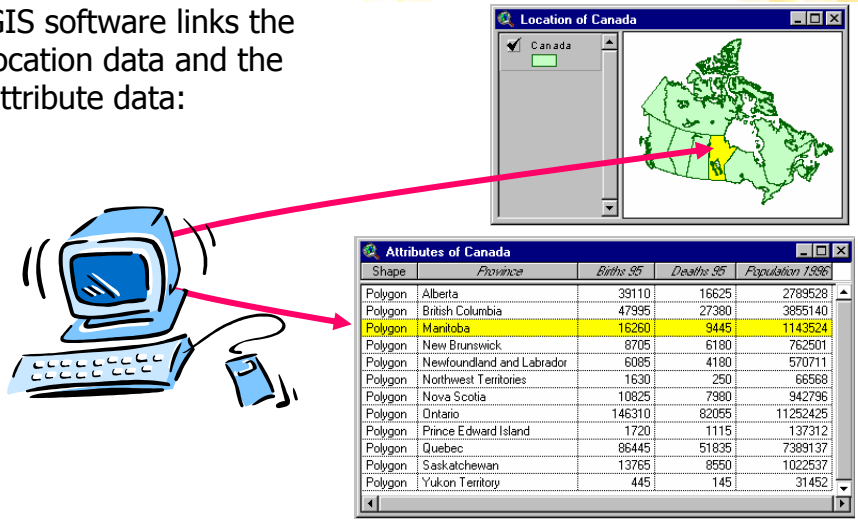


Attribute Information: What is it?



GIS - Links Data Sets

- GIS software links the location data and the attribute data:

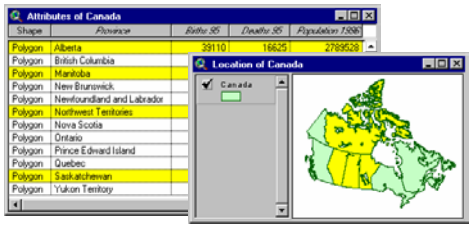


Shape	Province	Births 95	Deaths 95	Population 1996
Polygon	Alberta	39110	16625	2789528
Polygon	British Columbia	47995	27380	3855140
Polygon	Manitoba	16260	9445	1143524
Polygon	New Brunswick	8705	6180	762501
Polygon	Newfoundland and Labrador	6085	4180	570711
Polygon	Northwest Territories	1630	250	66568
Polygon	Nova Scotia	10825	7980	942796
Polygon	Ontario	146310	82055	11252425
Polygon	Prince Edward Island	1720	1115	137312
Polygon	Quebec	86445	51835	7389137
Polygon	Saskatchewan	13765	8550	1022537
Polygon	Yukon Territory	445	145	31452

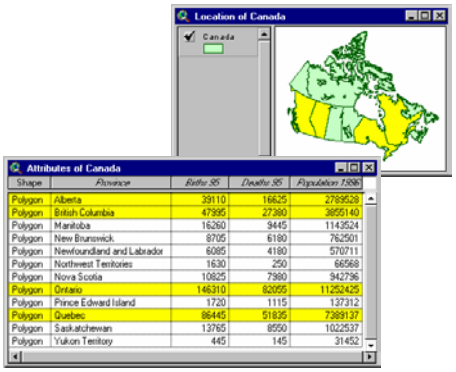
GIS - Analysis

- GIS software can answer questions about our world:

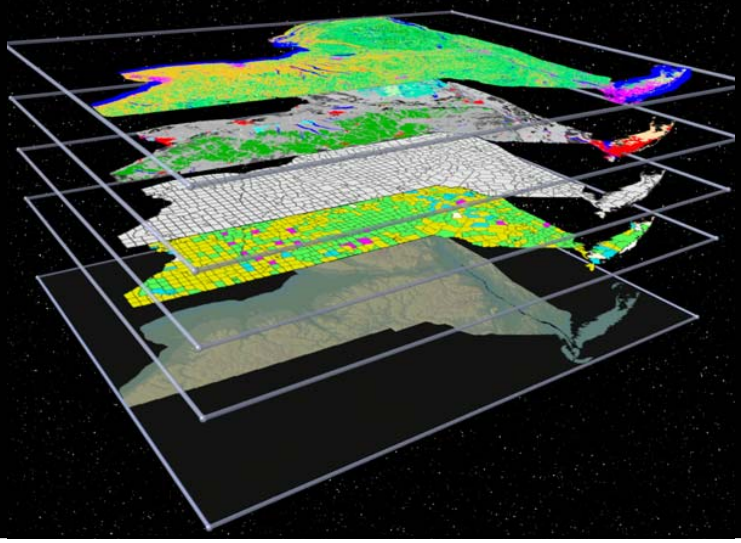
Spatial Questions:



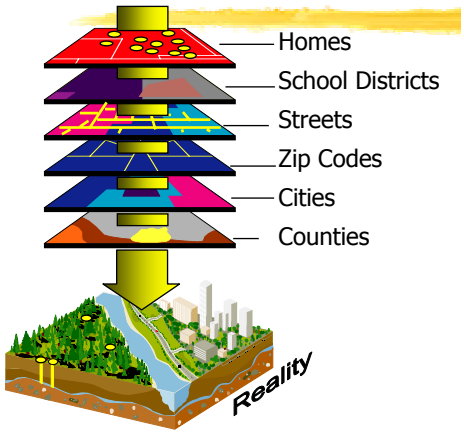
Attribute Questions:

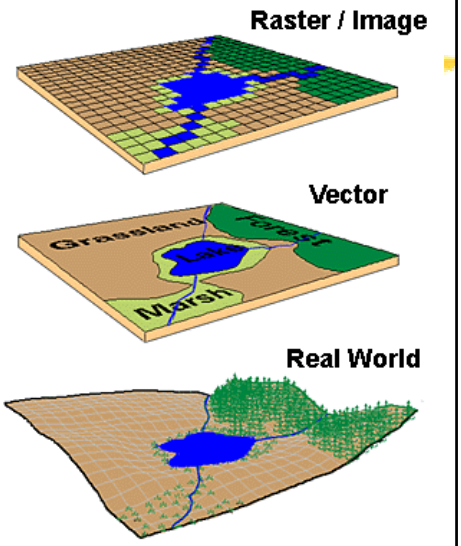


The World: “Layers” of Data



Spatial Data Models





Summary - What is GIS?

- GIS is about using data to describe our world in two ways:
  - Location Data - Where is it?
  - Attribute Data - What is it?
- GIS software maintains a link between layers of location and attribute data
  - With the Link, we can ask questions about our world…

Example: Fire Response

Attributes of fire_stns

FID	Shape*	ADDRESS	FIRE_HALL	MINUTES
0	Point	3200 County Rd 42	Station 8	4
1	Point	254 Lauzon Rd	Station 7	4
2	Point	5650 Tecumseh Rd E	Station 6	4
3	Point	2600 College Ave	Station 4	4
4	Point	2750 Ouellette Ave	Station 3	4
5	Point	1905 Cabana Rd W	Station 5	4
6	Point	2296 Richmond St	Station 2	4
7	Point	815 Goyeau St	Station 1	4
8	Point	2885 Kew St	Station 9	4

Record: 1 Show: All Selected Records (0 out of 9 Selecte

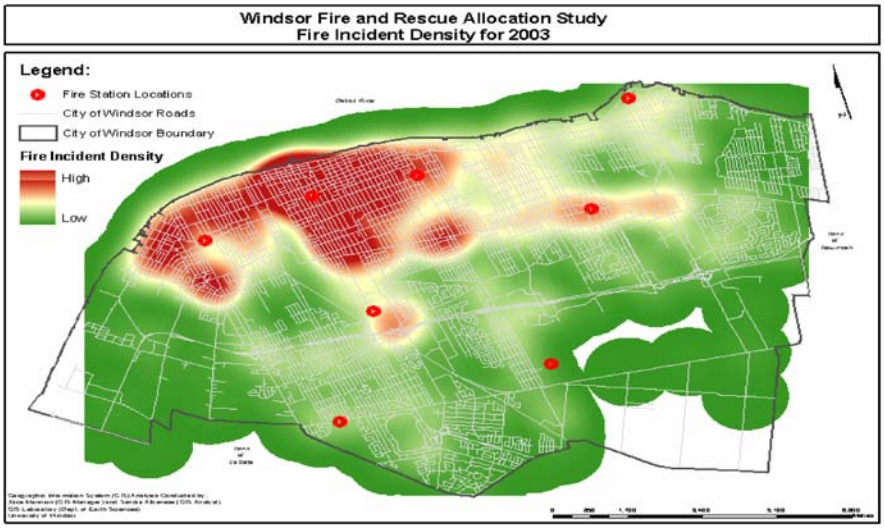
- 9 fire stations handled 6409 incident calls in 2003

Attributes of INCI2003

OID	DATE	INCIDENT	DISTRICT	TYPE	SOURCE	DISPATCH	RESPONSE
748	Sat 22 Feb 2003	1293	6203	Alarm Company:Normal:Commercial:Single	Phone	1.16667	3.96667
749	Sat 22 Feb 2003	1294	6201	Smoke:Indoor:Residential:Multiplex	E-911	1.41667	2.93333
750	Sat 22 Feb 2003	1299	6102	Medical:VSA	Ambulance	0.26666	2.33333
751	Sat 22 Feb 2003	1305	6205	Rescue:Vehicle:MVA:Injuries	Police	1.51667	6.3
752	Sat 22 Feb 2003	1307	4101	Medical:VSA	E-911	0.4	2.13333
753	Sat 22 Feb 2003	1308	3102	Alarm Company:Normal:Commercial:Single	Alarm Monit	0.45	5.96667
754	Sat 22 Feb 2003	1309	3103	Rescue:Vehicle:MVA:Injuries	Police	0.93333	8.41667
755	Sat 22 Feb 2003	1310	5103	Smoke:Indoor:Residential:Dwelling	E-911	0.7	9.33333
756	Sat 22 Feb 2003	1311	1103	Electrical:Outdoor:Lines	E-911	0.28333	7.05
757	Sat 22 Feb 2003	1312	7202	Rescue:Vehicle:MVA:Injuries	Ambulance	0.4	6.81667
758	Sat 22 Feb 2003	1314	1101	Fire:Vehicle:Car/Van/Pick-up	E-911	0.51666	4.26667
759	Sat 22 Feb 2003	1315	1202	Alarm Company:Normal:Residential:Dwelling	258-4444	1.15	5.6
760	Sun 23 Feb 2003	1316	1101	Medical:VSA	Ambulance	0.3	2.01667
761	Sun 23 Feb 2003	1317	4102	Alarm Company:Normal:Educational:Universit	Alarm Monit	0.6	6.61667
762	Sun 23 Feb 2003	1319	8303	Rescue:Vehicle:MVA:Injuries	Ambulance	0.61666	7.78333
763	Sun 23 Feb 2003	1320	7102	Alarm Company:Normal:Residential:Apartme	Alarm Monit	0.33333	6.85
764	Sun 23 Feb 2003	1321	4103	Medical:VSA	Ambulance	0.38333	5.36667
765	Sun 23 Feb 2003	1323	4302	Rescue:Vehicle:MVA:Injuries	E-911	1	7.05
766	Sun 23 Feb 2003	1324	3102	Medical:VSA	Ambulance	0.36666	4.93333

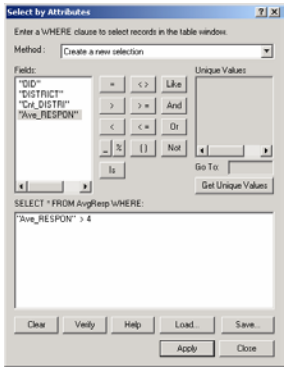
Record: 1 Show: All Selected Records (0 out of 6409 Selected.) Options

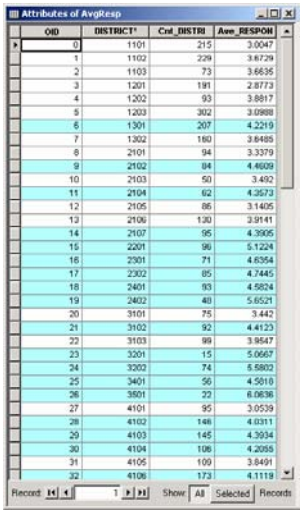
Where were the calls?



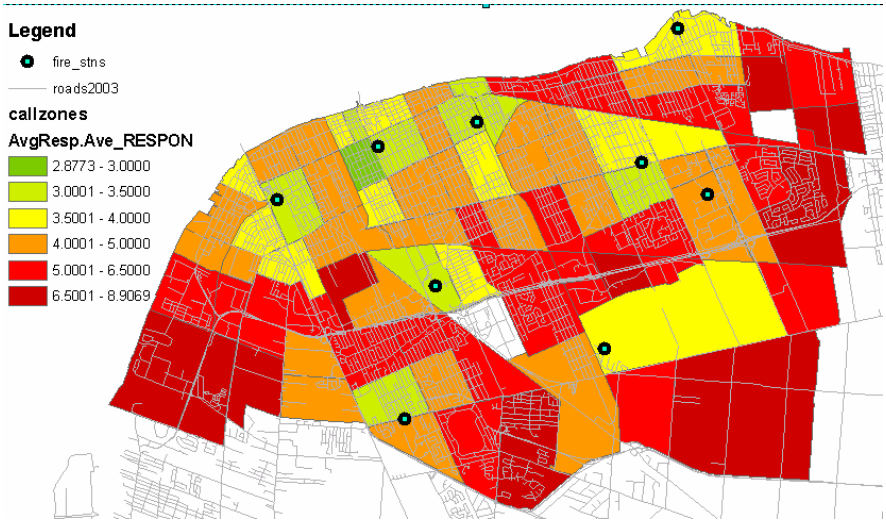
Your Typical Tabular Analysis

- Target reponse time is less than 4 minutes per call
- How well did we do in 2003?
- 67 of 91 call zones had an average > 4 minutes
- **WHY?**
- **WHERE?**



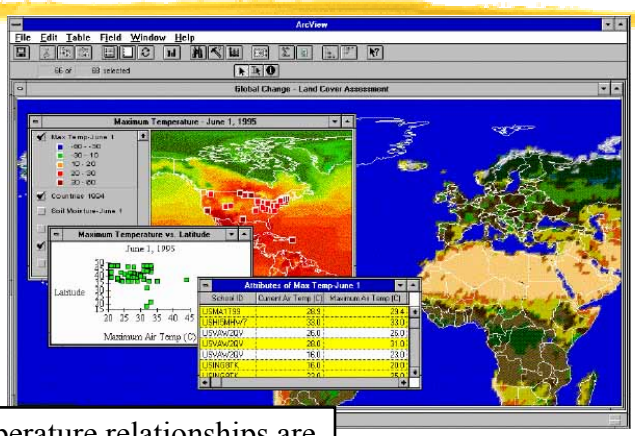


The GIS View



Environmental

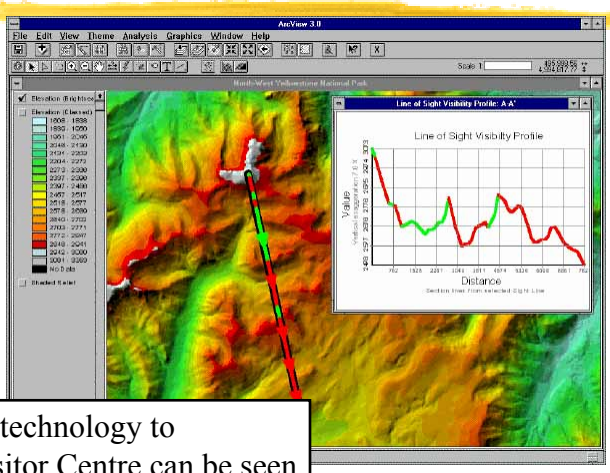
- What are the effects of Global Warming?



Land cover and temperature relationships are made clear when the data are seen at once using Geotechnology.

Park Management

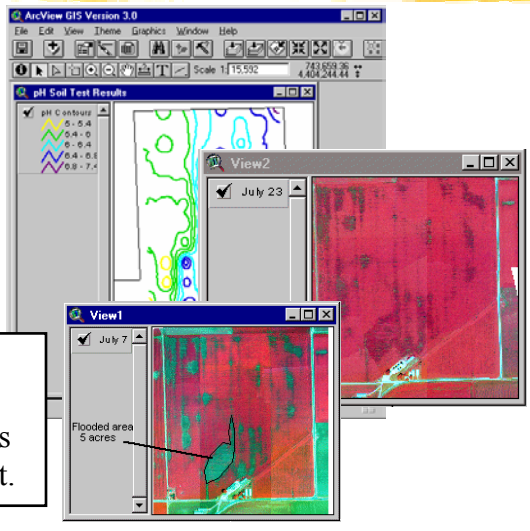
- Will the new building spoil the Park Scenery?



Park planners use Geotechnology to determine if a new Visitor Centre can be seen from the peak.

Agriculture

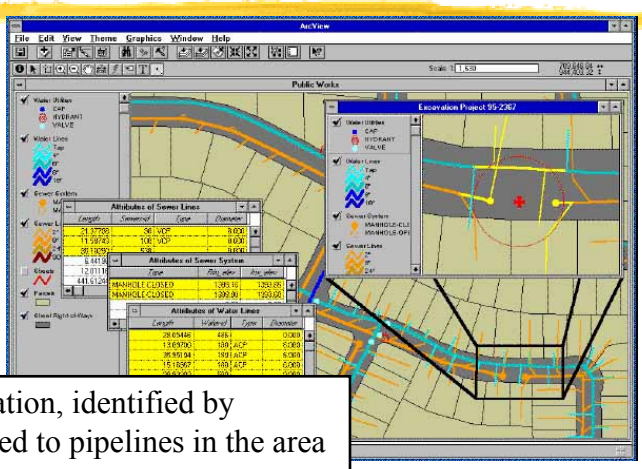
- How can I improve food production?



Geotechnology is used in making crop management decisions to maximize yields and minimize fertilizer input.

Public Utilities

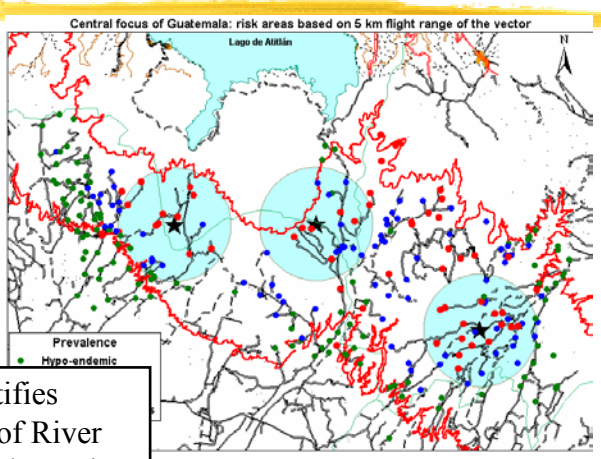
- Is it safe to dig here?



A proposed excavation, identified by address, is compared to pipelines in the area using Geotechnology.

Health Care

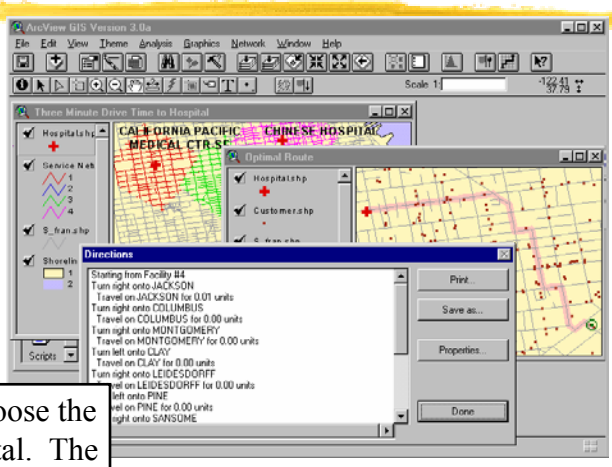
- What Communities are at risk from Disease?



Geotechnology identifies communities at risk of River Blindness and helps determine the impact of treatment.

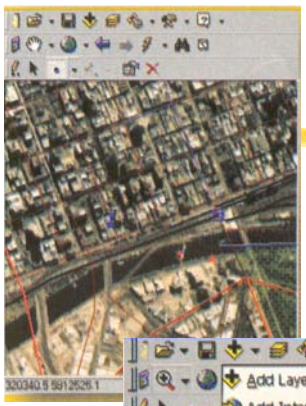
Emergency 911

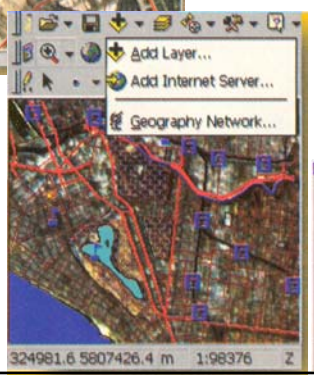
- What is the fastest route to the Hospital?

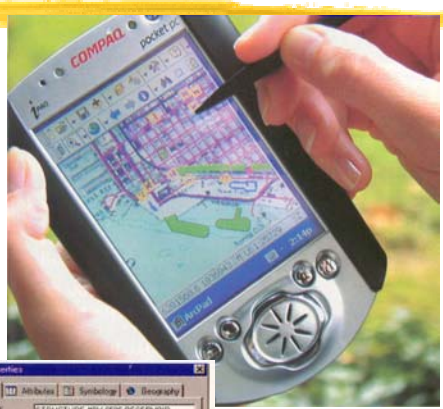


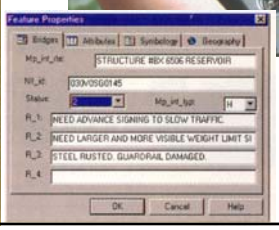
Geotechnology can choose the fastest route to a hospital. The GIS can take into account traffic and other impediments.

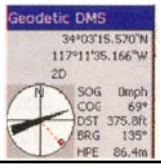
Mobile Access



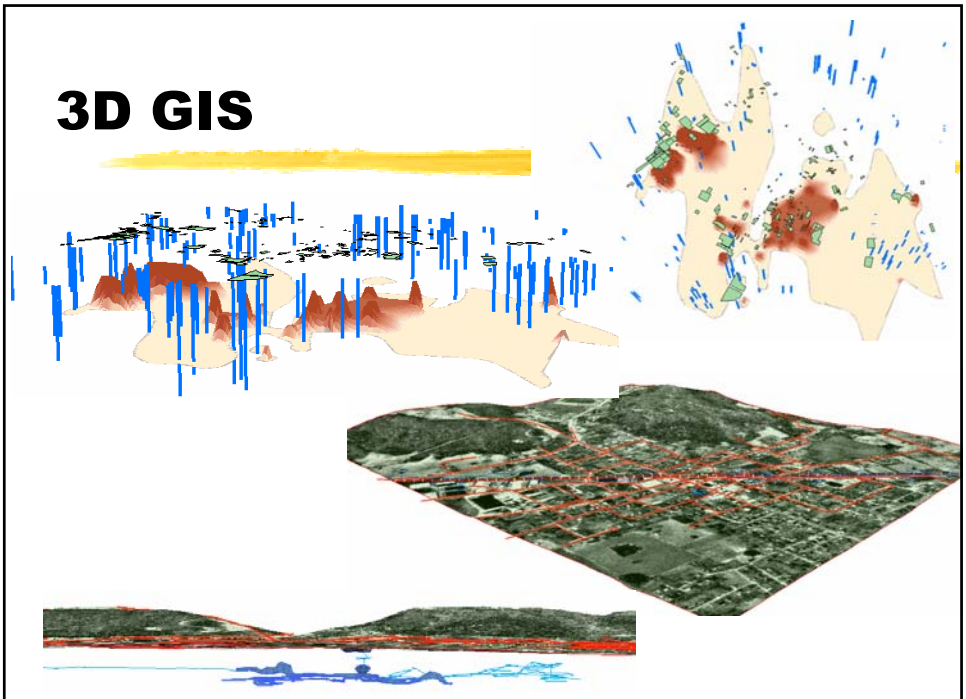




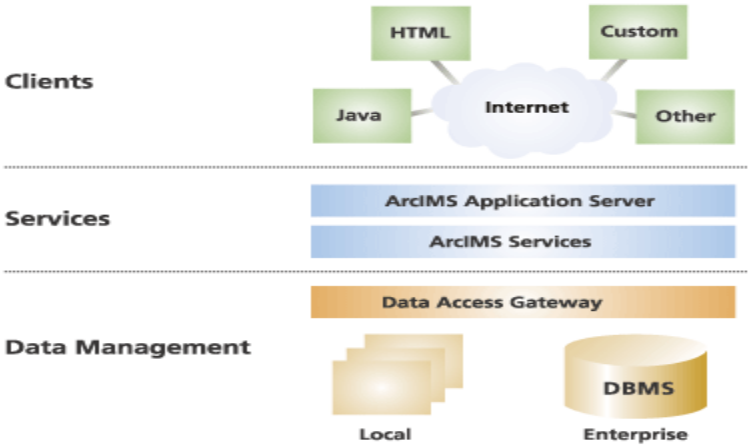




3D GIS



Web Based GIS



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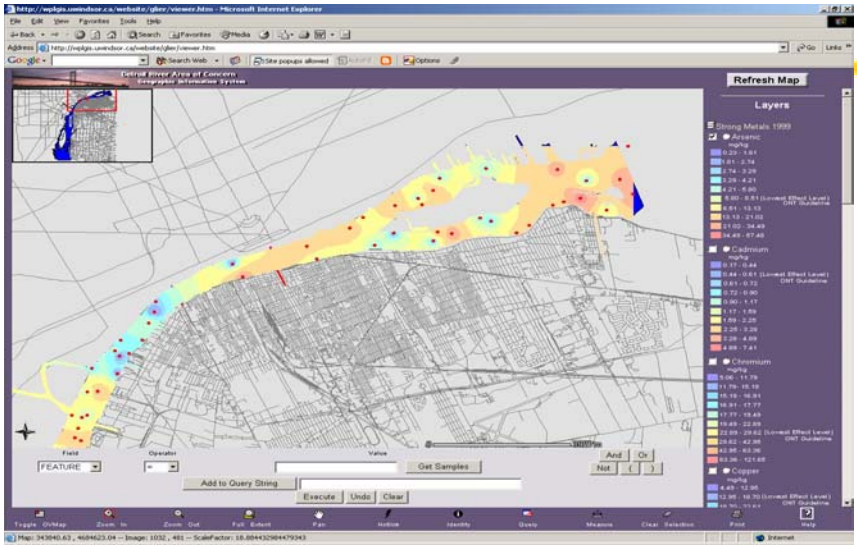


Our Community Projects

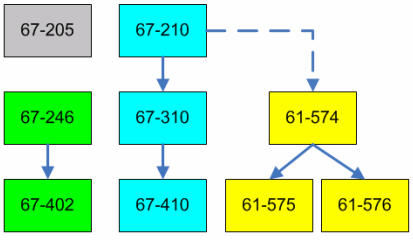
- iCity Historic Sites of Walkerville
- Pelee Island – How we got to the Present Millenium
- City of Windsor Tourism Mapping Project
- Great Lakes Institute – Detroit River Study
- Windsor-Essex Health Gateway
- Health Canada Air Quality Study – Landuse Regression Modeling
- Windsor Fire and Rescue – Fire Station Allocation Study
- Windsor – Essex Geospatial/Environmental Metadata Locator Tool

Our Geomatics Projects

- **GIST** – Integrating AI/ES and GIS methods for real-time geotechnical hazard monitoring – ***recruiting PhDs***
- **GPR Construction Kit** – Ground-penetrating radar, GPS, and GIS for 3D subsurface model construction
- **DrillView** - 3D query, analysis and visualization of subsurface structure using borehole and lithology data
- **ProbeFusion** – Mobile environmental data acquisition system for real-time GIS updating
- **ECO-COSM** – Spatial simulation modelling framework
- **OCIPEP** – GPS and radio modem transmission reliability in urban areas

Our Geomatics Courses

- Undergrad GIS (Service)
  - 67-205: Intro to GIS
- Undergrad GIS (Core)
  - 67-210: Principles and Applications of GIS
  - 67-310: GIS Problem Solving and Spatial Modeling
  - 67-410: Advanced Methods in GIS Analysis



- Undergrad Geomatics
  - 67-246: Intro to Aerial Photography and Cartography
  - 67-402: Remote Sensing
  - 61-470: GIS: A Computing Perspective (special topics)
- Graduate Geomatics
  - 61-574: Adv.Topics in Geoinformatics
  - 61-575: Adv. Integration of Remote Sensing and GIS Techniques
  - 61-576: Environmental Modelling and Spatial Simulation
- B.Sc. Geoinformatics
  - Joint Earth Sciences - Computer Science Honours program