APPLICATIONS OF GIS IN SITE SELECTION

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Acknowledgements

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Objectives

- Understand what a GIS is
- Understand how a GIS functions
- Understand how spatial data is represented in a GIS
- Look at some GIS applications

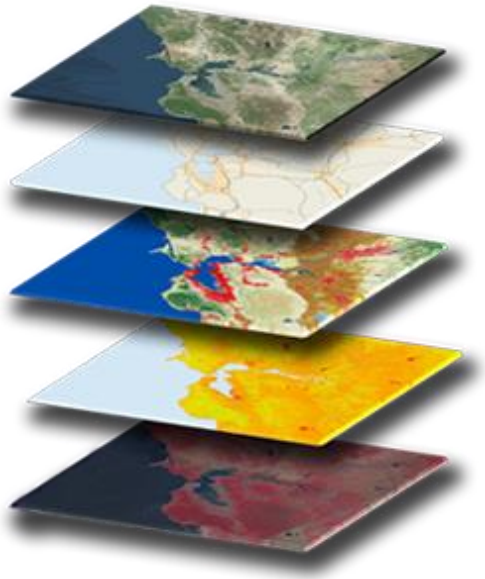
Data vs. Information

- Data, by itself, generally differs from information.
- Data is of little use unless it is transformed into information.
- Information is an answer to a question based on raw data.
- We transform data into information through the use of an Information System.

INFORMATION SYSTEM OVERVIEW

GI Systems vs GI Science

- GI Systems: the software tools
  - –looks at “where”
- GI Science: the technical discipline
  - –Looks at “what”
  - – technical implementation of GI Systems



GISystem vs GIScience: An electric company

GISystem

- The company would store its assets as points, lines and polygons.
- “Where” is their physical geography on a map.

GIScience

- All of these features have attributes tied to them.
- “What” is the information about their feature.

GISystem vs GIScience: An electric company

GISystem

- Points may be towers as XY locations.
- Lines may be wires that are connected to each tower.
- Polygons may be the areas each line services.

GIScience

- Towers can be made of steel, wood and other material.
- Wires can be overhead or underground.
- Service areas can have population and demographics they service.

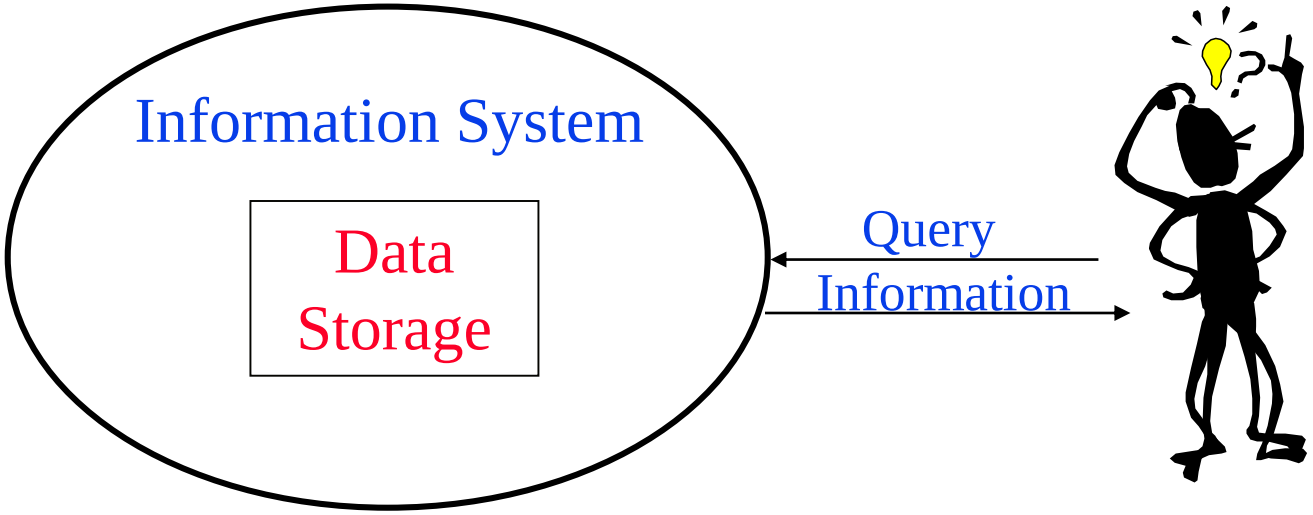
What is an Information System?

SYSTEM USED FOR:

capturing
storing
updating
manipulating
analyzing

DATA

What is an Information System?

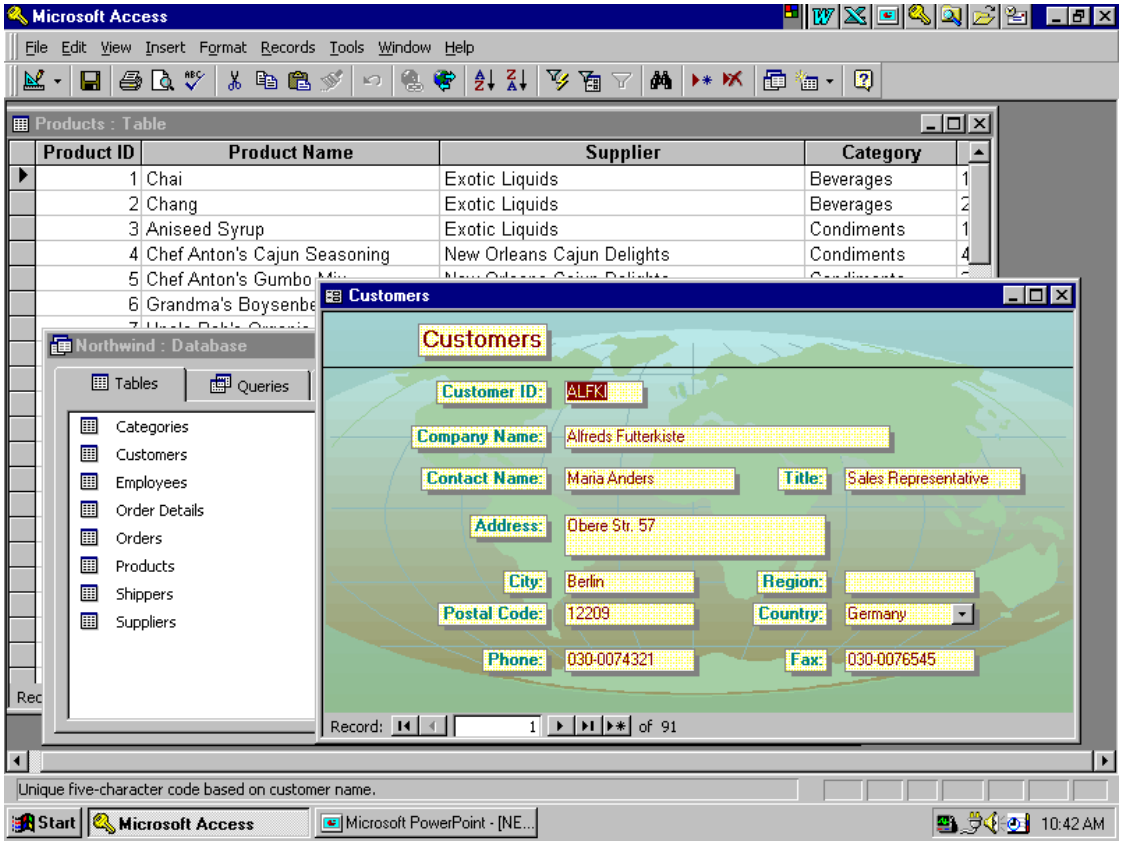


Information systems can be very simple, such as a telephone directory.

What is an Information System?

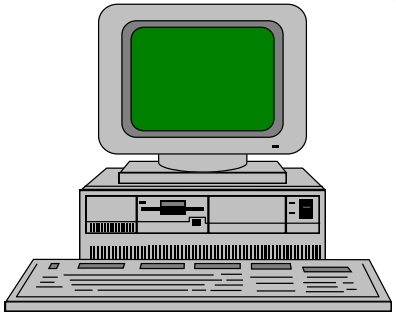
In the digital environment we use software to create complex information systems.

Database Management



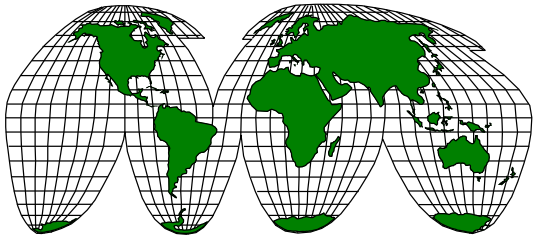
What is a GIS?

Information System



+

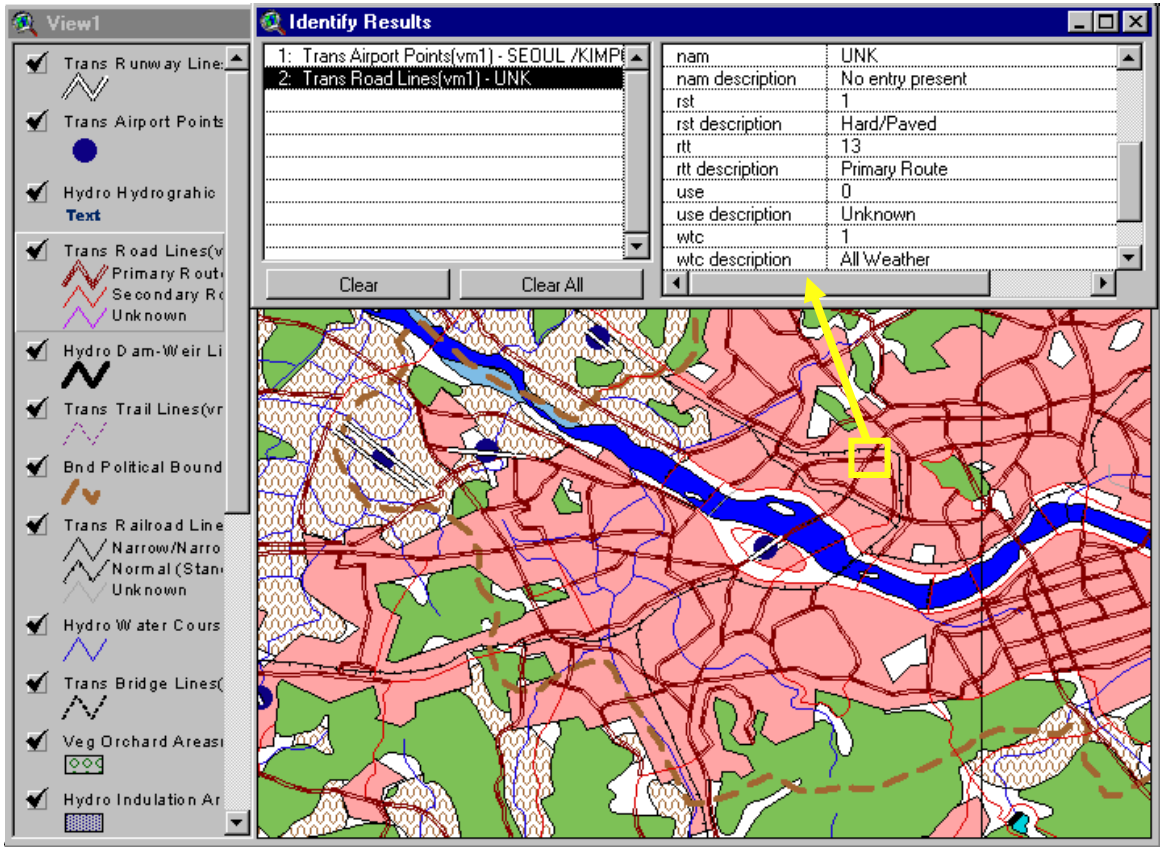
Geographic Position



A means of storing, retrieving, sorting, and comparing *spatial data* to support some analytic process.

What is a GIS?

GEOGRAPHIC Information System



GIS links graphical features (**entities**)
to tabular data (**attributes**)

GIS Definition

- A GIS is a system (hardware + database engine) that is designed to efficiently assemble, store, update, analyze, manipulate, and display **geographically referenced information** (data identified by their locations).

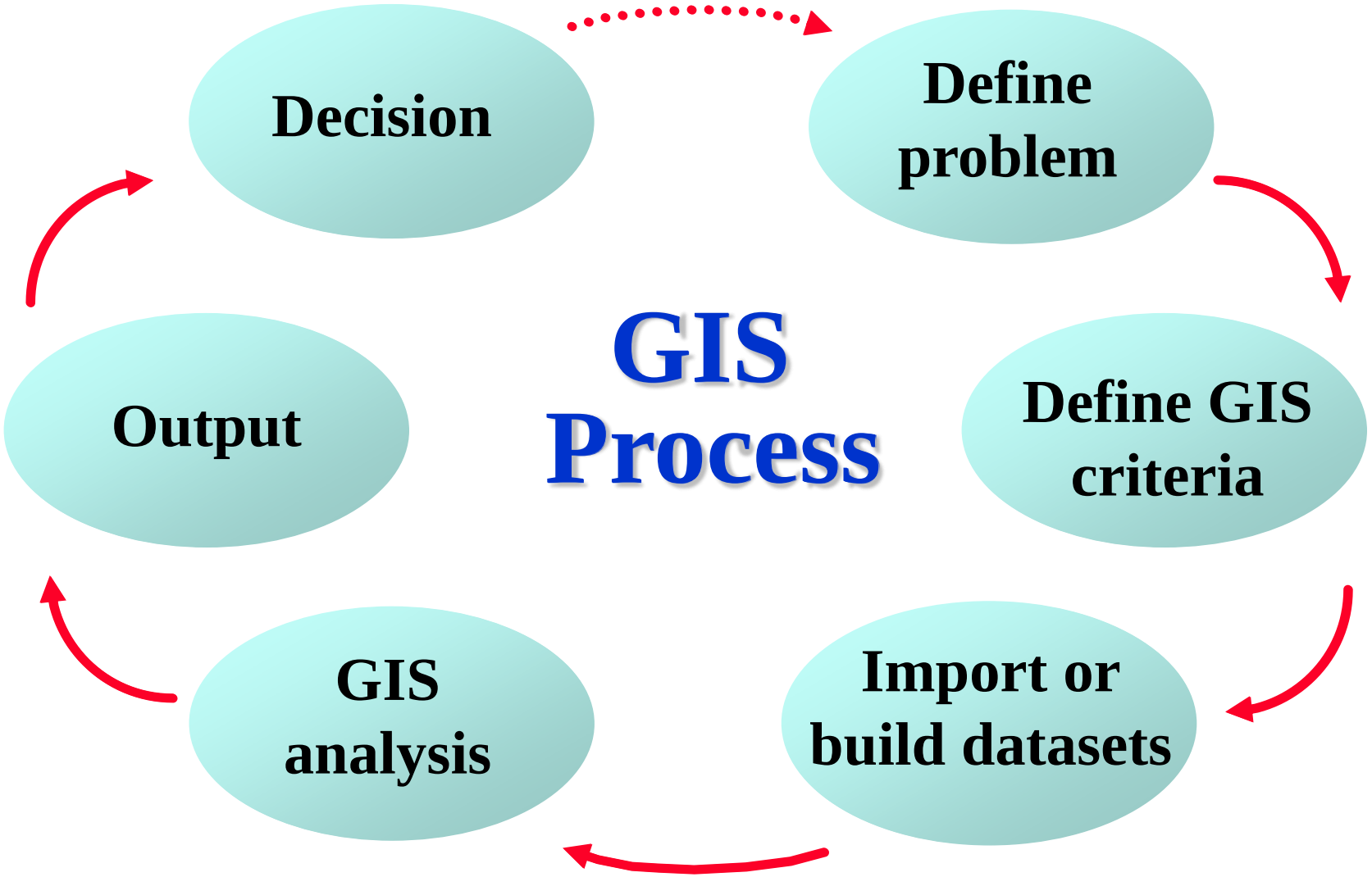
- A GIS also includes the **people** operating the system and the **data** that go into the system.

Key Functions of a GIS

Data can be:

1. Positioned by its known spatial coordinates.
2. Input and organized (generally in **layers**).
3. Stored and retrieved.
4. Analyzed (usually via a Relational DBMS).
5. Modified and displayed

Geographic Information Systems

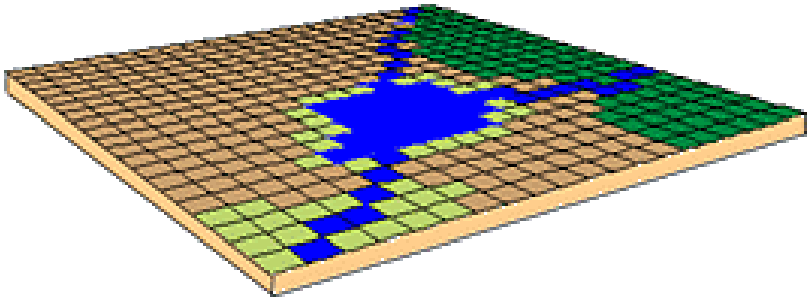


MODELLING AND STRUCTURING DATA

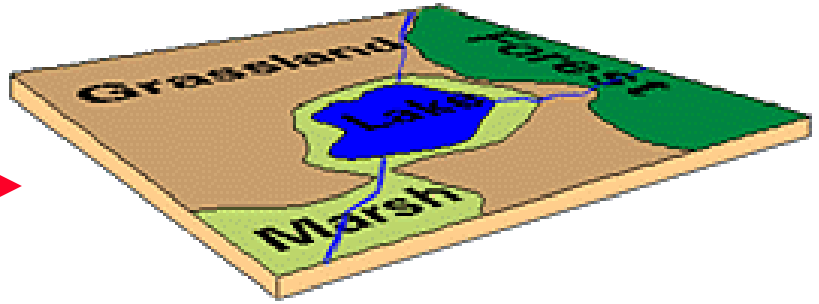
(How we represent features or spatial elements)

Representing Spatial Elements

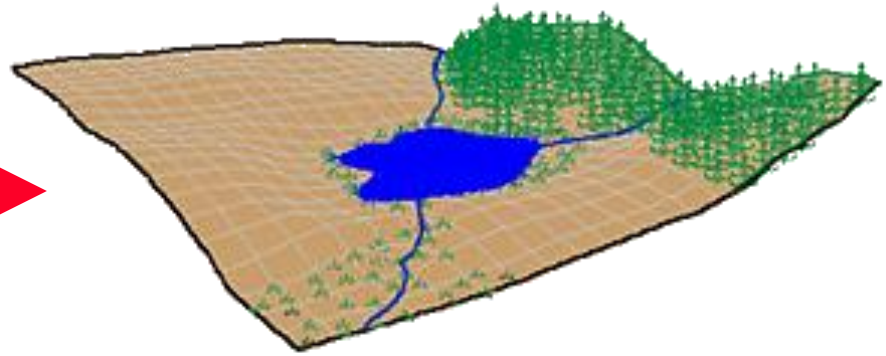
- RASTER



- VECTOR



- Real World



Representing Spatial Elements

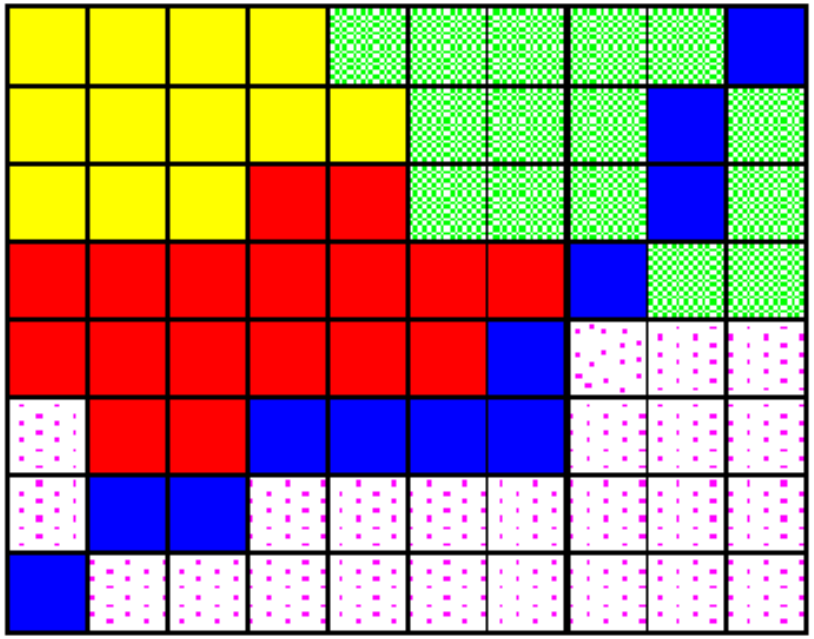
Raster

Stores images as rows and columns of numbers with a Digital Value/Number (DN) for each cell.

Units are usually represented as square grid cells that are uniform in size.

Data is classified as "*continuous*" (such as in an image), or *"thematic"* (where each cell denotes a feature type).

Numerous data formats (TIFF, GIF, ERDAS.img etc)

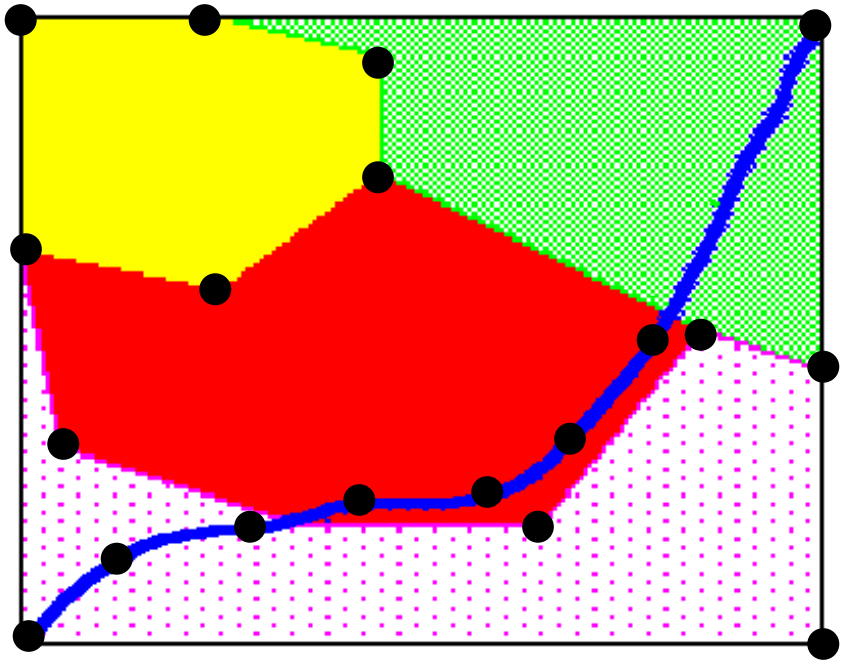


Representing Spatial Elements

Vector

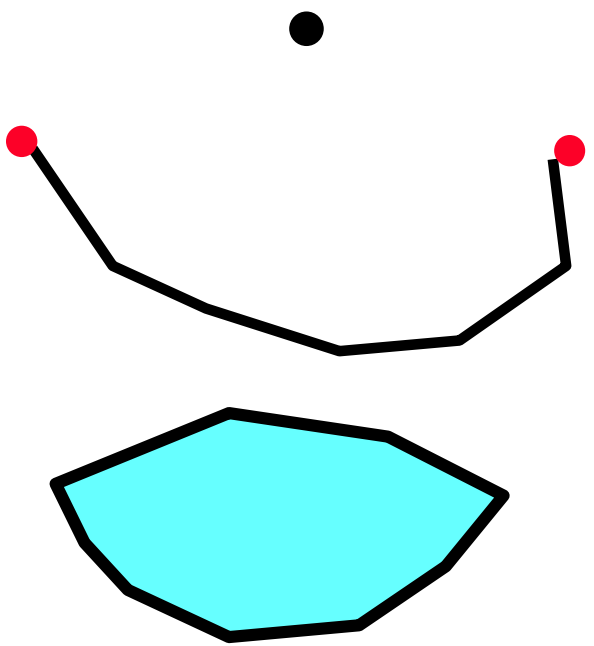
Allows user to specify specific spatial locations and assumes that geographic space is continuous, not broken up into discrete grid squares

We store features as sets of X,Y coordinate pairs.



Entity Representations

We typically represent objects in space as three distinct spatial elements:



Points - simplest element

Lines (arcs) - set of connected points

Polygons - set of connected lines

We use these three spatial elements to represent real world features and attach locational information to them.

Attributes

- In the raster data model, the cell value (Digital Number) is the attribute. Examples: brightness, landcover code, SST, etc.
- For vector data, attribute records are linked to point, line & polygon features. Can store *multiple* attributes per feature. Vector features are linked to attributes by a *unique feature number*.

Raster vs. Vector

Raster Advantages

The most common data format

Easy to perform mathematical and overlay operations

Satellite information is easily incorporated

Better represents “continuous”- type data

Vector Advantages

Accurate positional information that is best for storing discrete thematic features (e.g., roads, shorelines, sea-bed features).

Compact data storage requirements

Can associate unlimited numbers of attributes with specific features

GIS FUNCTIONALITY

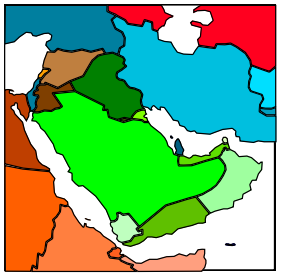
(What do they do?)

GIS Functions

- Data Assembly
- Data Storage
- Spatial Data Analysis and Manipulation
- Spatial Data Output

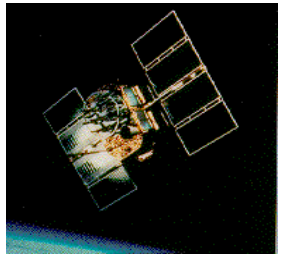
GIS Functions

Data Assembly



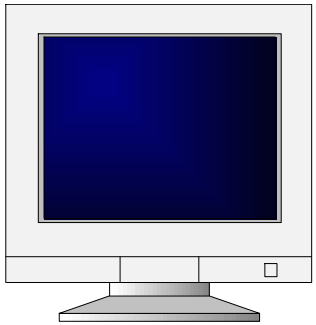
Maps

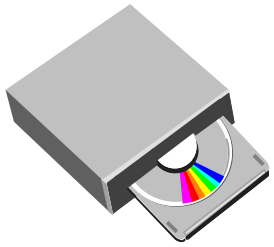
Manual Digitizing
Scanning



RSI

Manual Digitizing
Scanning





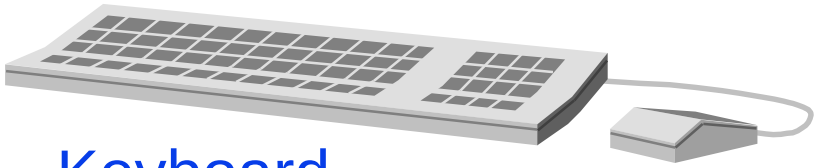
Database

Data Transfer

Data Transfer

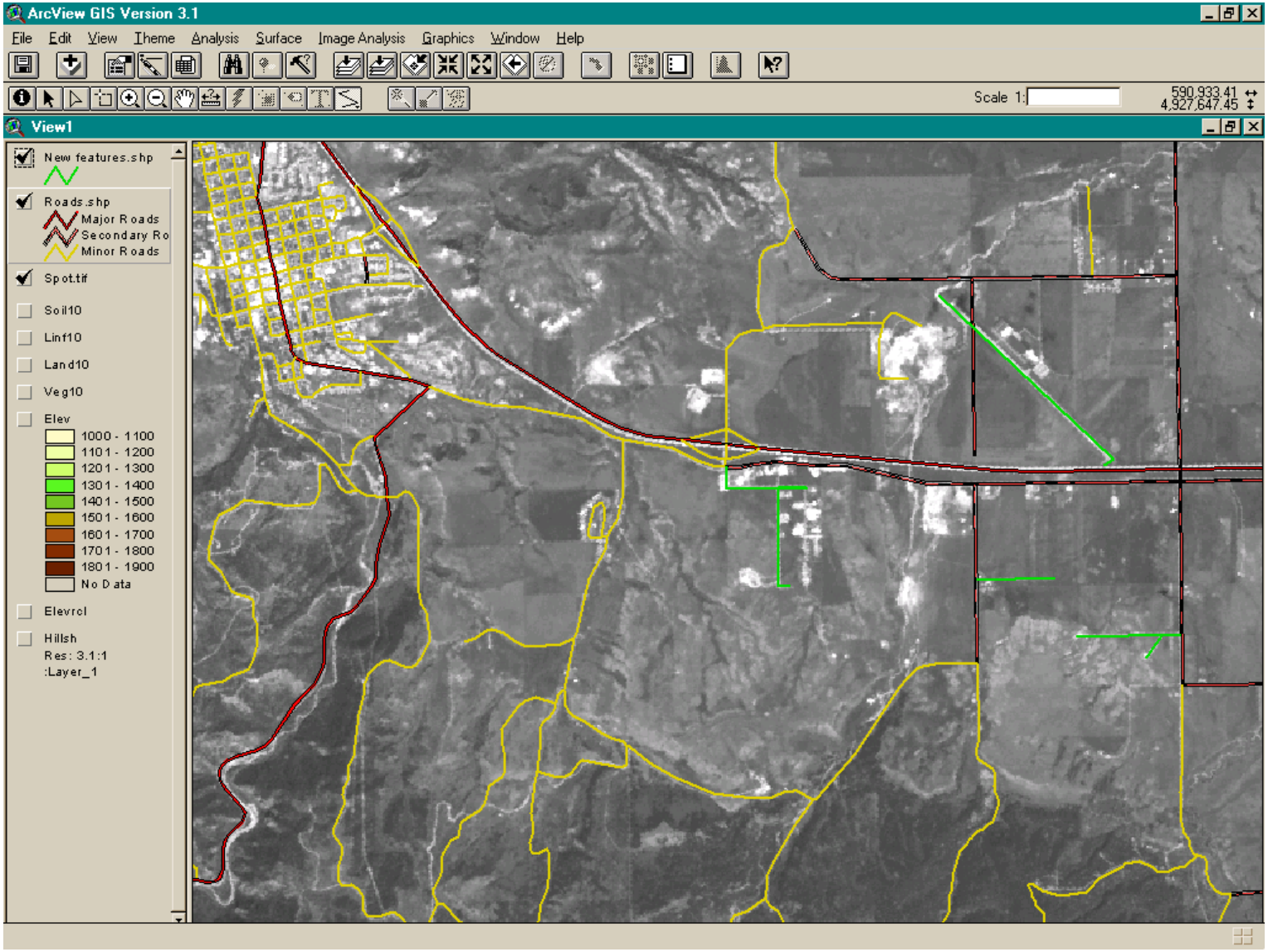
GPS

Direct Entry



Keyboard

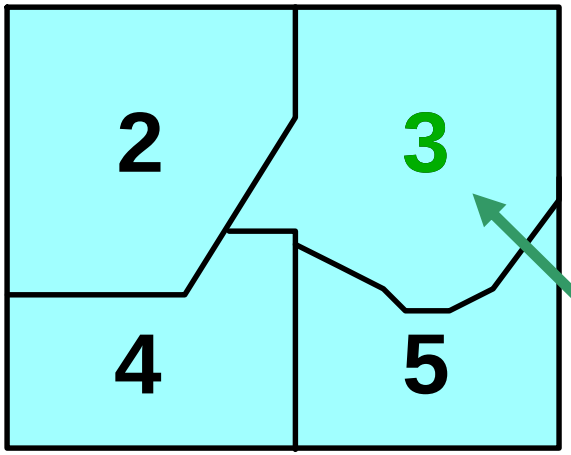
Data Input/Creation



GIS Functions

GIS Storage

1 (Universe polygon)



Spatial data
(ARC functions)

Attribute data
(INFO or TABLES functions)

COV#	ZONE	PIN CODE
1		0
2	C-19	220601
3	A-4	220612
4	C-22	220603
5	A-5	220574

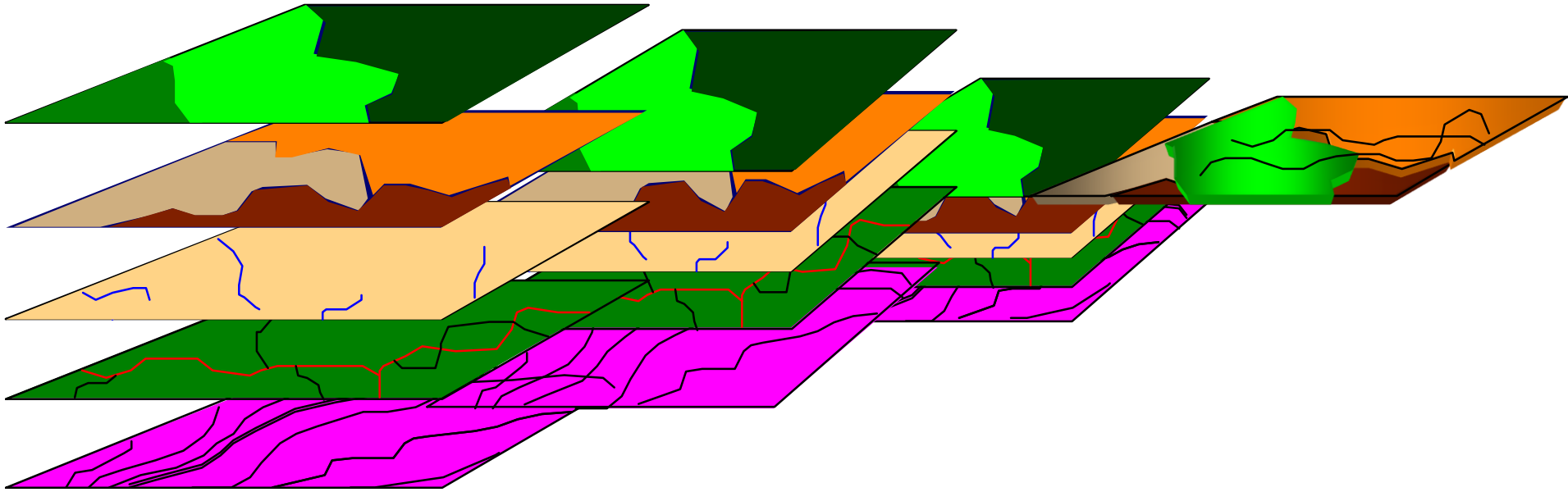
GIS Functions

Spatial Data Manipulation and Analysis

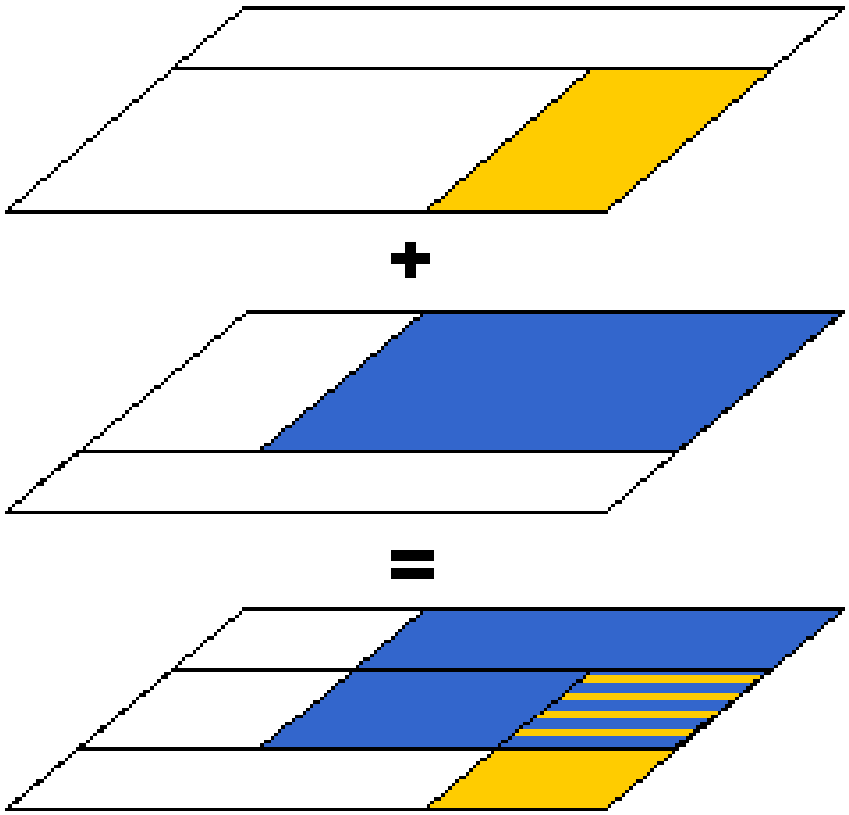
- Common Manipulation
  - Reclassification
  - Map Projection changes
- Common Analysis
  - Buffering
  - Overlay
  - Network

Spatial Analysis

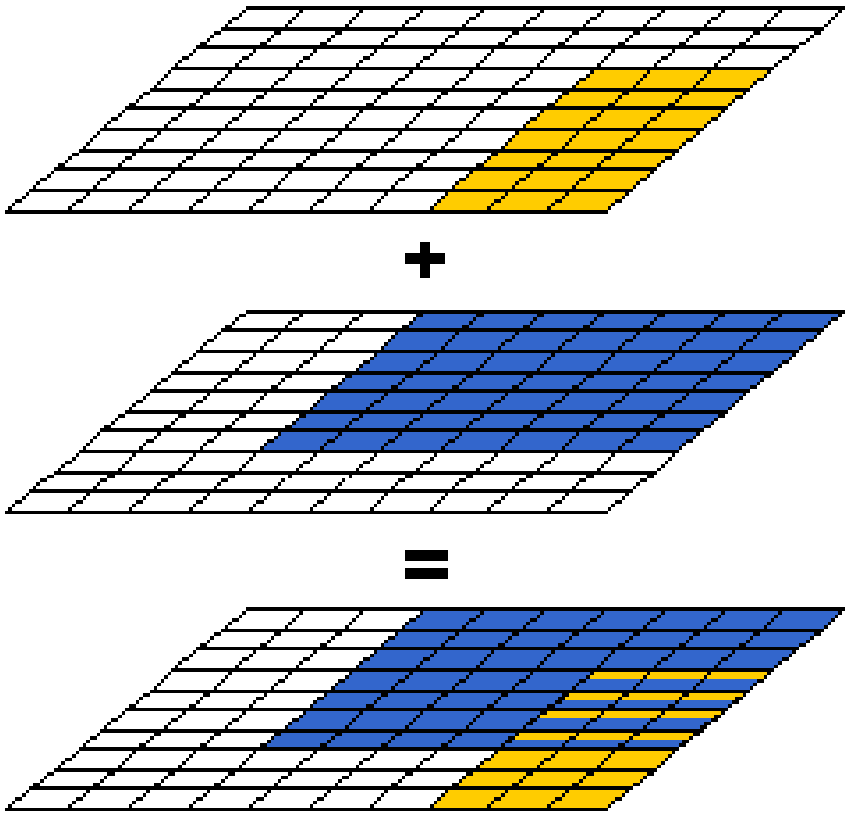
- Overlay function creates new "layers" to solve spatial problems



Map Overlay

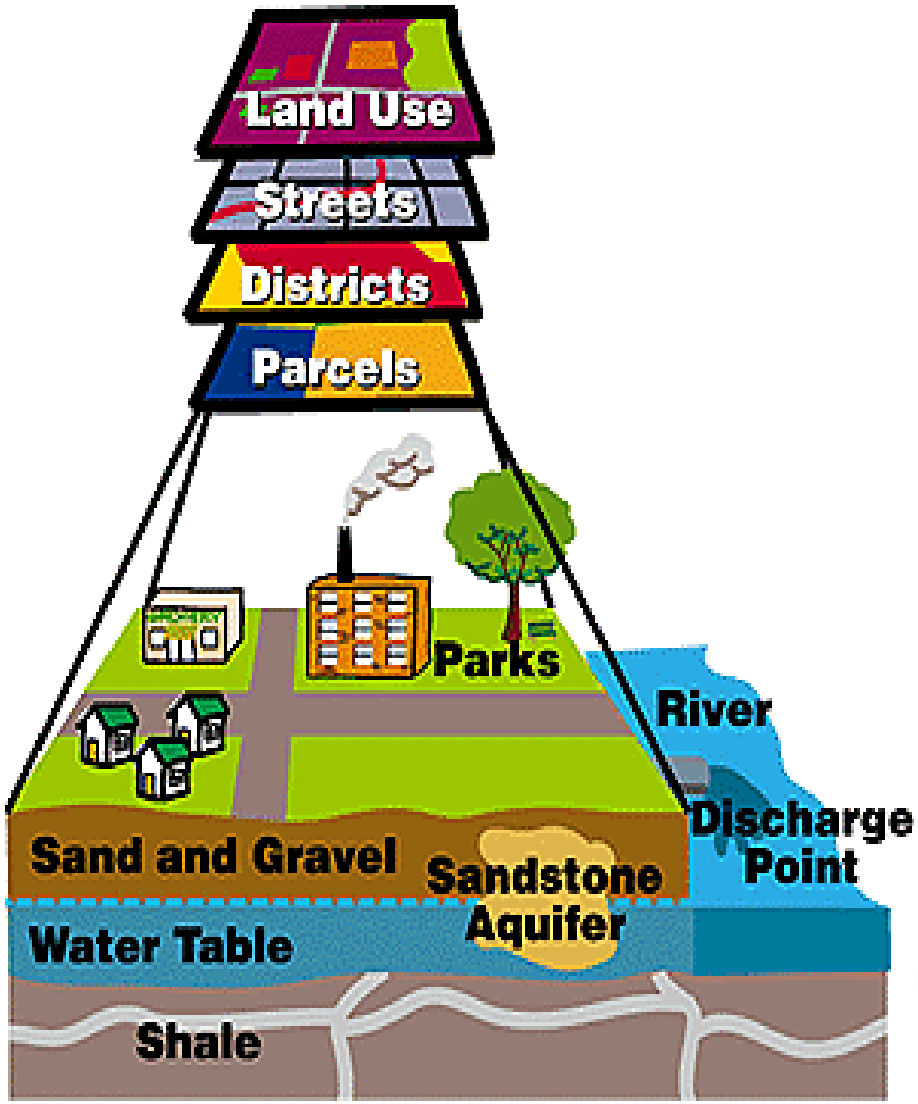


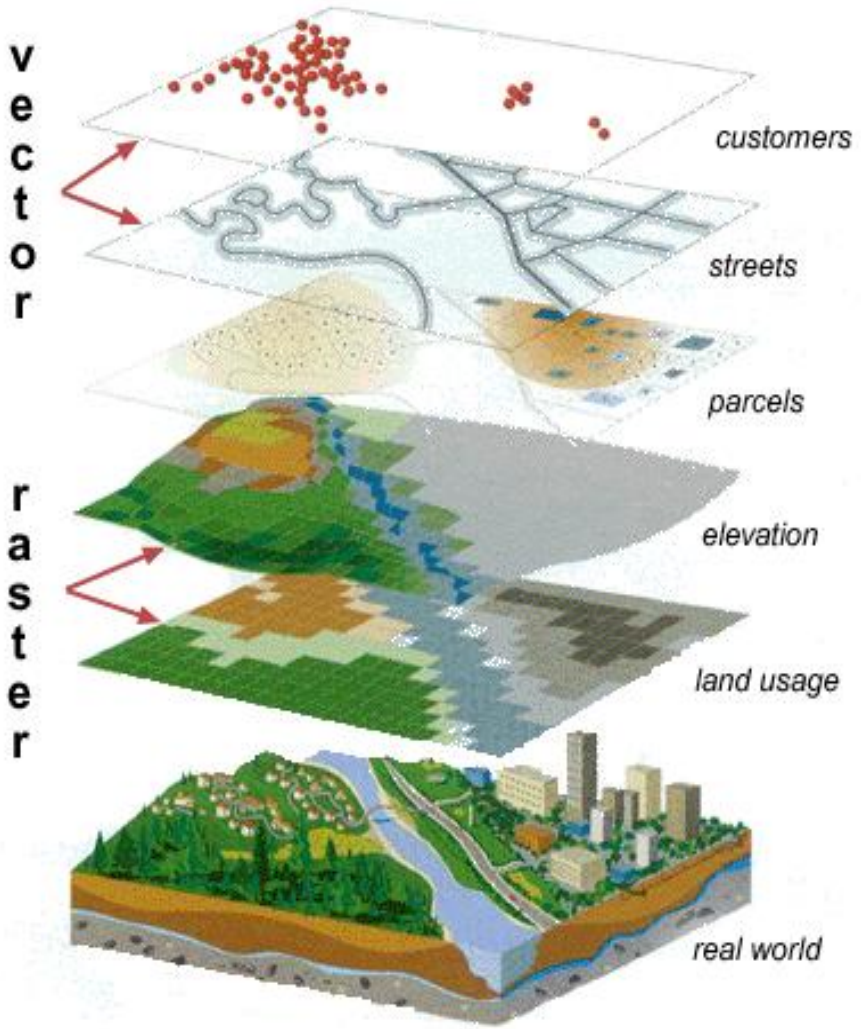
Polygon Overlay



Grid Overlay

Layer Concept in GIS





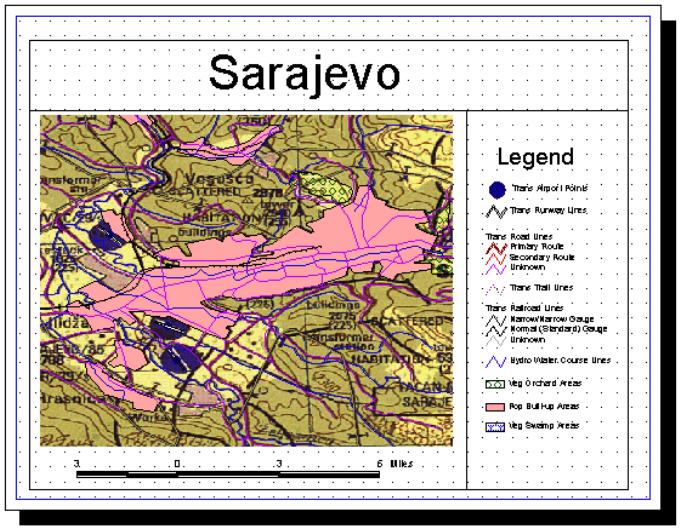
GIS Functions

Spatial Data Output

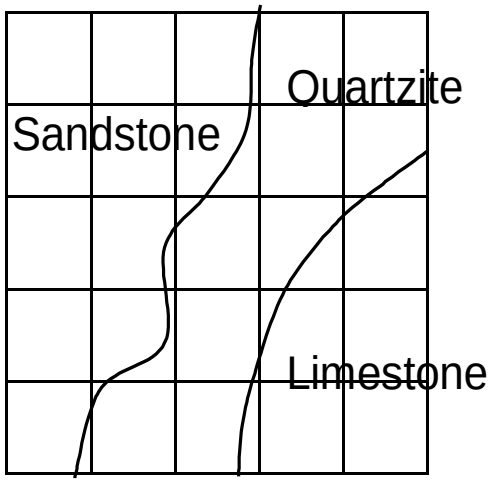
- Tables
- Maps
- Interactive Displays
- 3-D Perspective View

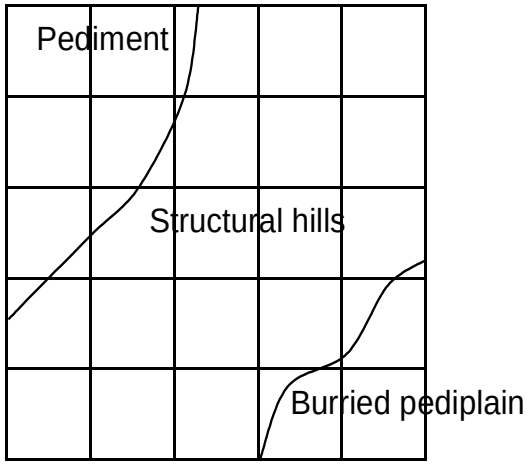
Attributes of Pop Built-up Areas(vm1)

Shape	id	f_code	f_code description	exs	exs description	nam
Polygon	1	AL020	Built-Up Area	999	Other	Vinkovci
Polygon	2	AL020	Built-Up Area	999	Other	Nustar
Polygon	3	AL020	Built-Up Area	999	Other	Bobota
Polygon	4	AL020	Built-Up Area	999	Other	Otok
Polygon	5	AL020	Built-Up Area	999	Other	Bijelo Brdo
Polygon	6	AL020	Built-Up Area	999	Other	Trpinja
Polygon	7	AL020	Built-Up Area	999	Other	Komletinci
Polygon	8	AL020	Built-Up Area	999	Other	UNK
Polygon	9	AL020	Built-Up Area	999	Other	Backi Monostor
Polygon	10	AL020	Built-Up Area	999	Other	Hercegszanto



Index Overlay





Lithology (w-2)

10	10	10	1	1
10	10	10	1	1
10	10	1	1	5
10	10	1	5	5
10	1	1	5	5

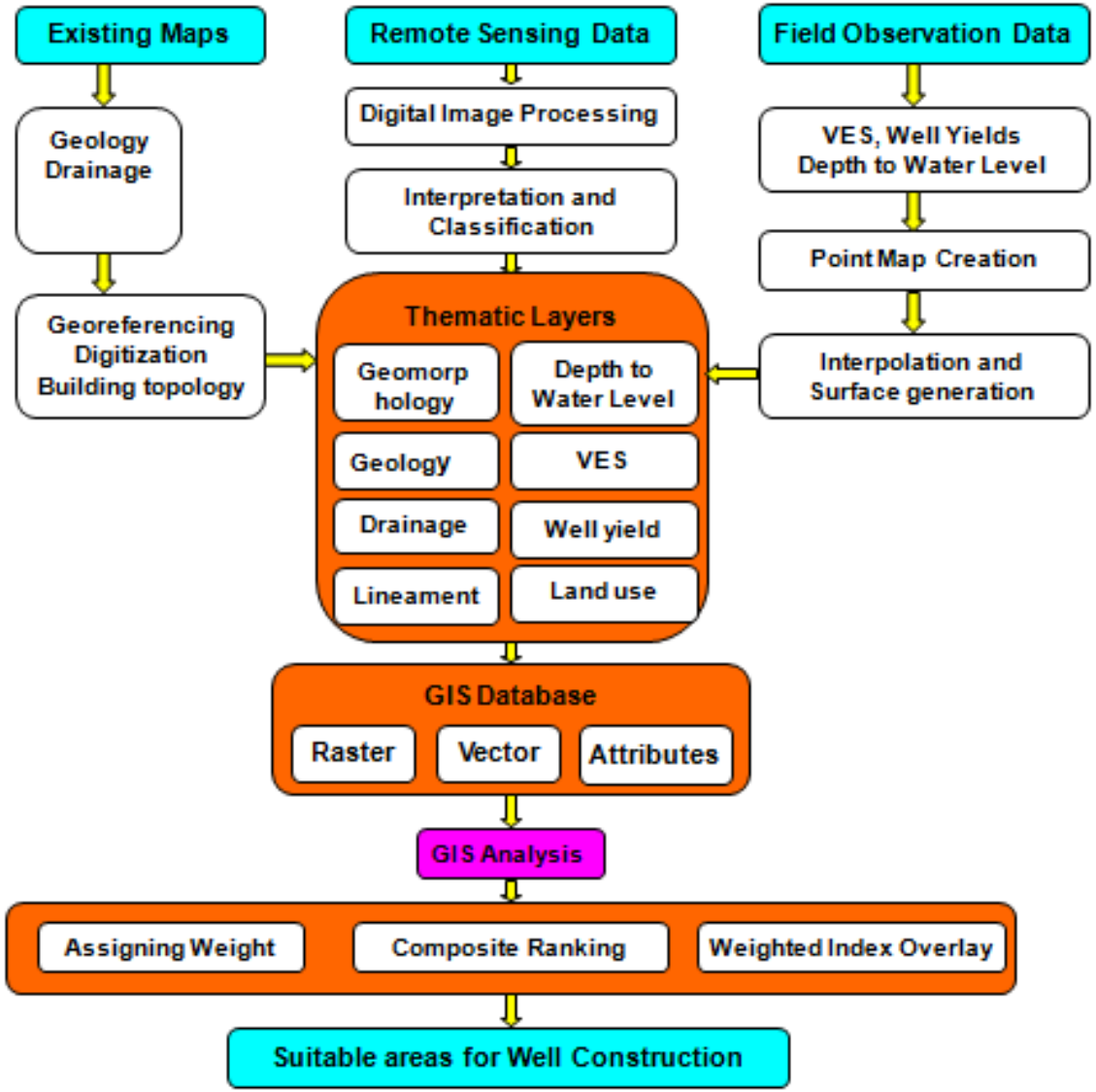
Geomorphology(w-1)

5	5	1	1	1
5	5	1	1	1
5	1	1	1	1
1	1	1	1	10
1	1	1	10	10

Favourability

8.3	8.3	7	1	1
8.3	8.3	7	1	1
8.3	7	1	1	3.7
7	7	1	3.7	6.7
7	7	1	3.7	6.7

Weighted Linear Combination Modelling For Site Selection

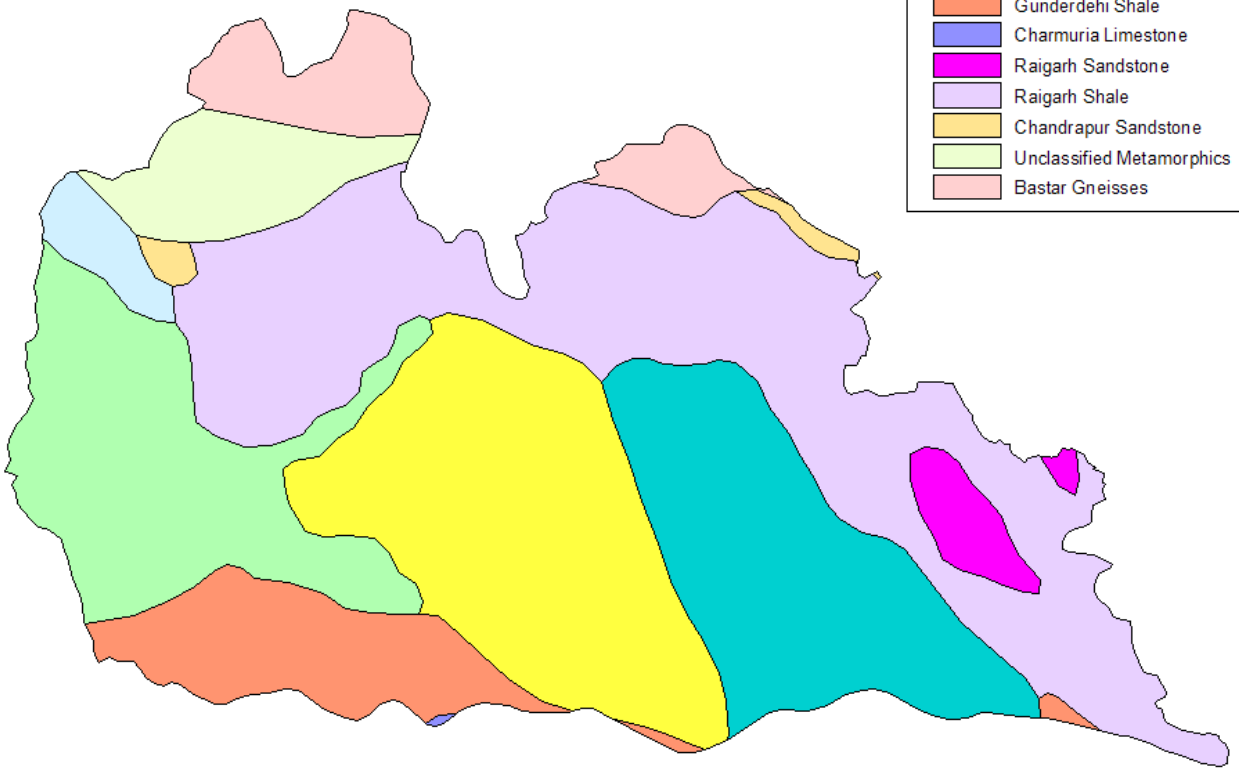


ROLE OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN SITE SELECTION

RS GIS

Weighted Linear Combination Modelling for Site Selection

Lithology



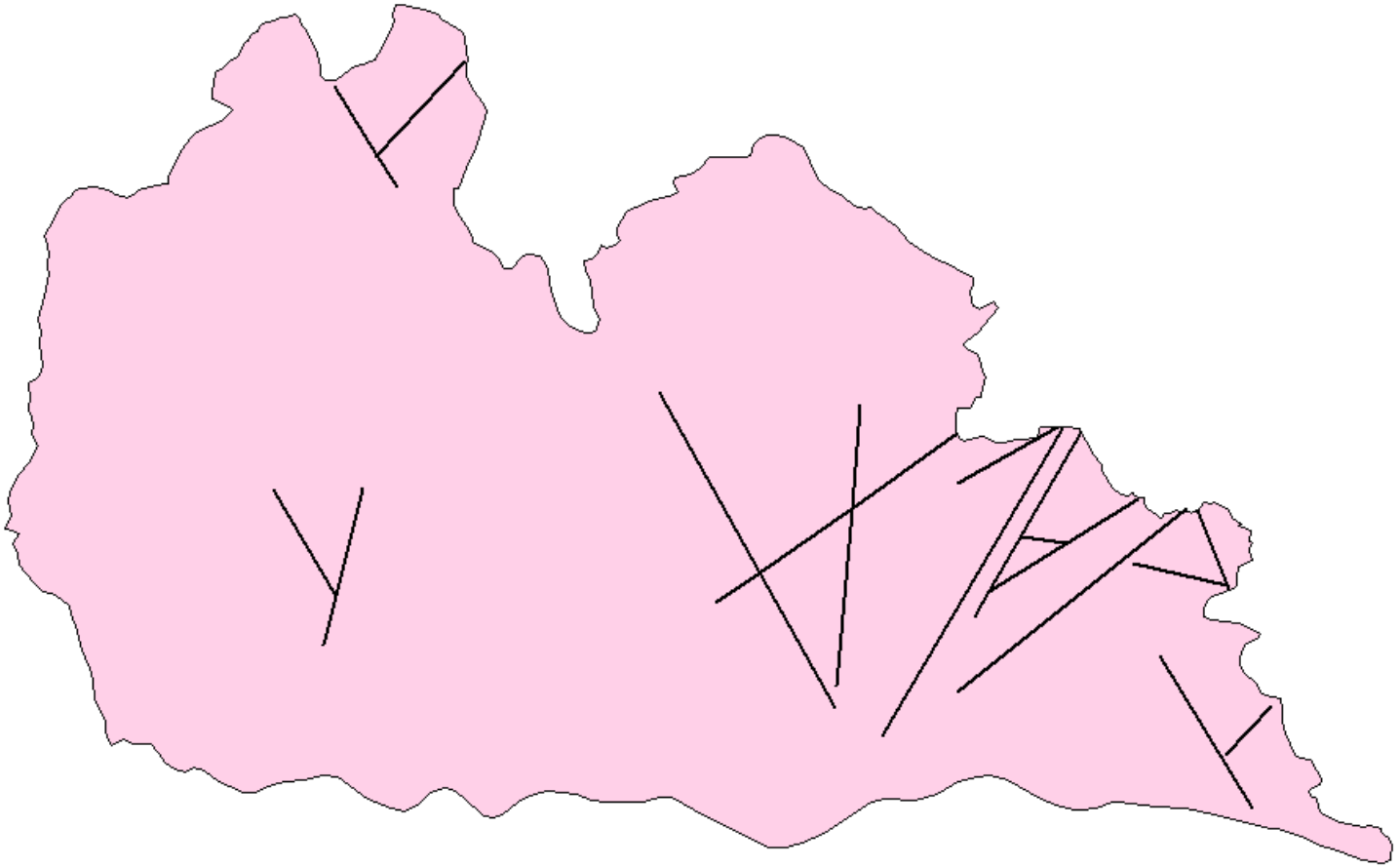
Lithology	Weight	Rank	Score
Saradih Dolomite	25	5	125
Chandi Limestone	25	5	125
Bamnidih Shale	25	3	75
Pandaria Formation	25	7	175
Gunderdehi Shale	25	3	75
Charmuria Limestone	25	3	75
Raigarh Sandstone	25	4	100
Raigarh Shale	25	6	150
Chandrapur Sandstone	25	2	50
Unclassified Metamorphics	25	1	25
Bastar Gneisses	25	2	50

ROLE OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN SITE SELECTION

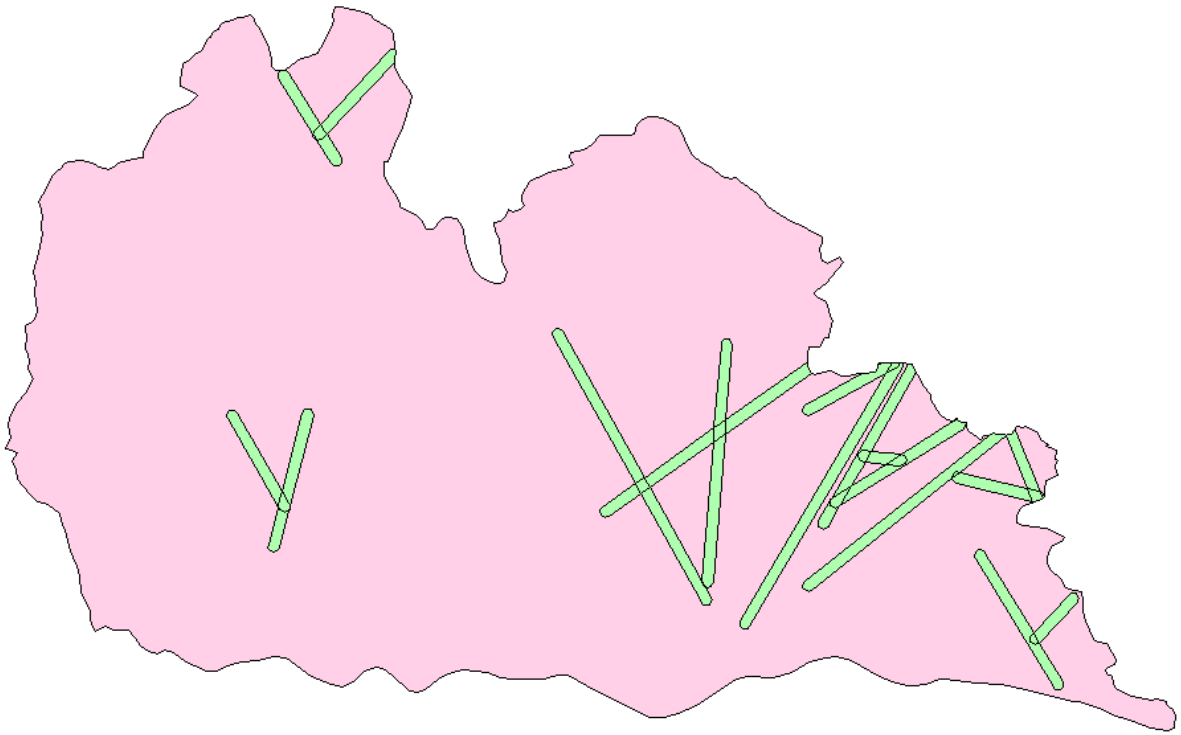
RS GIS

Lineament Map

Weight: 30



Lineament Map: Buffer

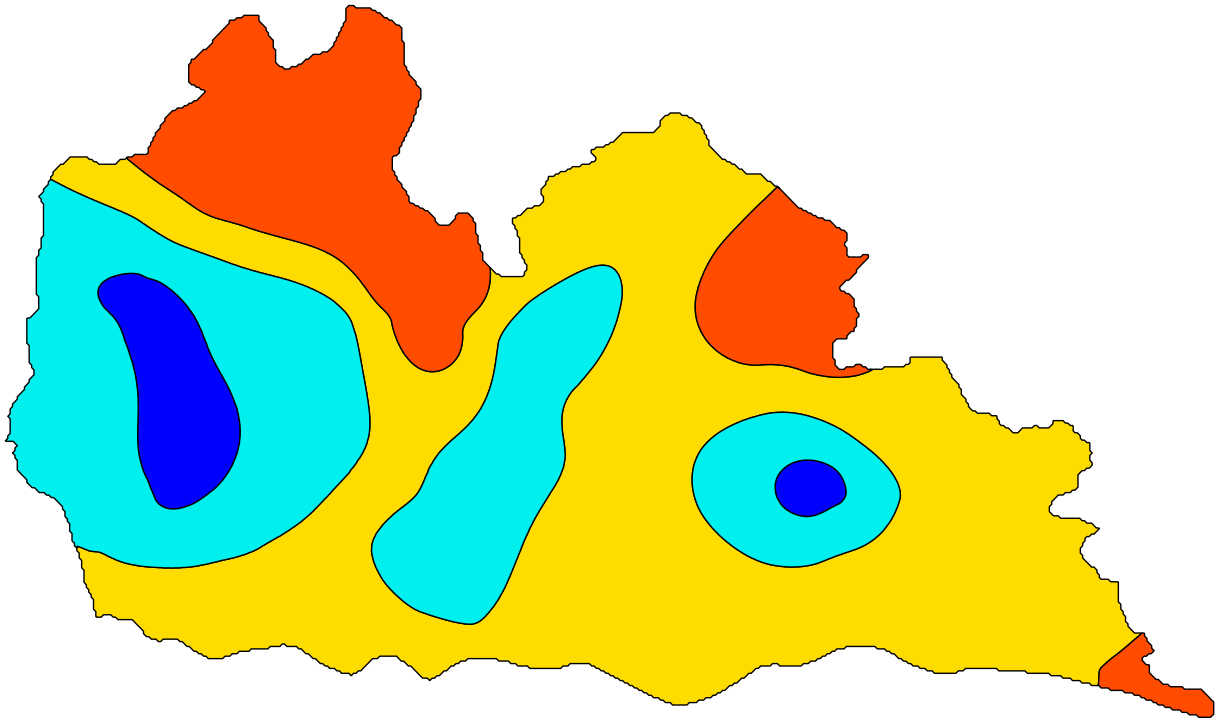


ROLE OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN SITE SELECTION

RS GIS

DTW Map

Class	Weight	Rank	Score
< 3	20	4	80
3 to 6	20	3	60
6 to 10	20	2	40
>10	20	1	20



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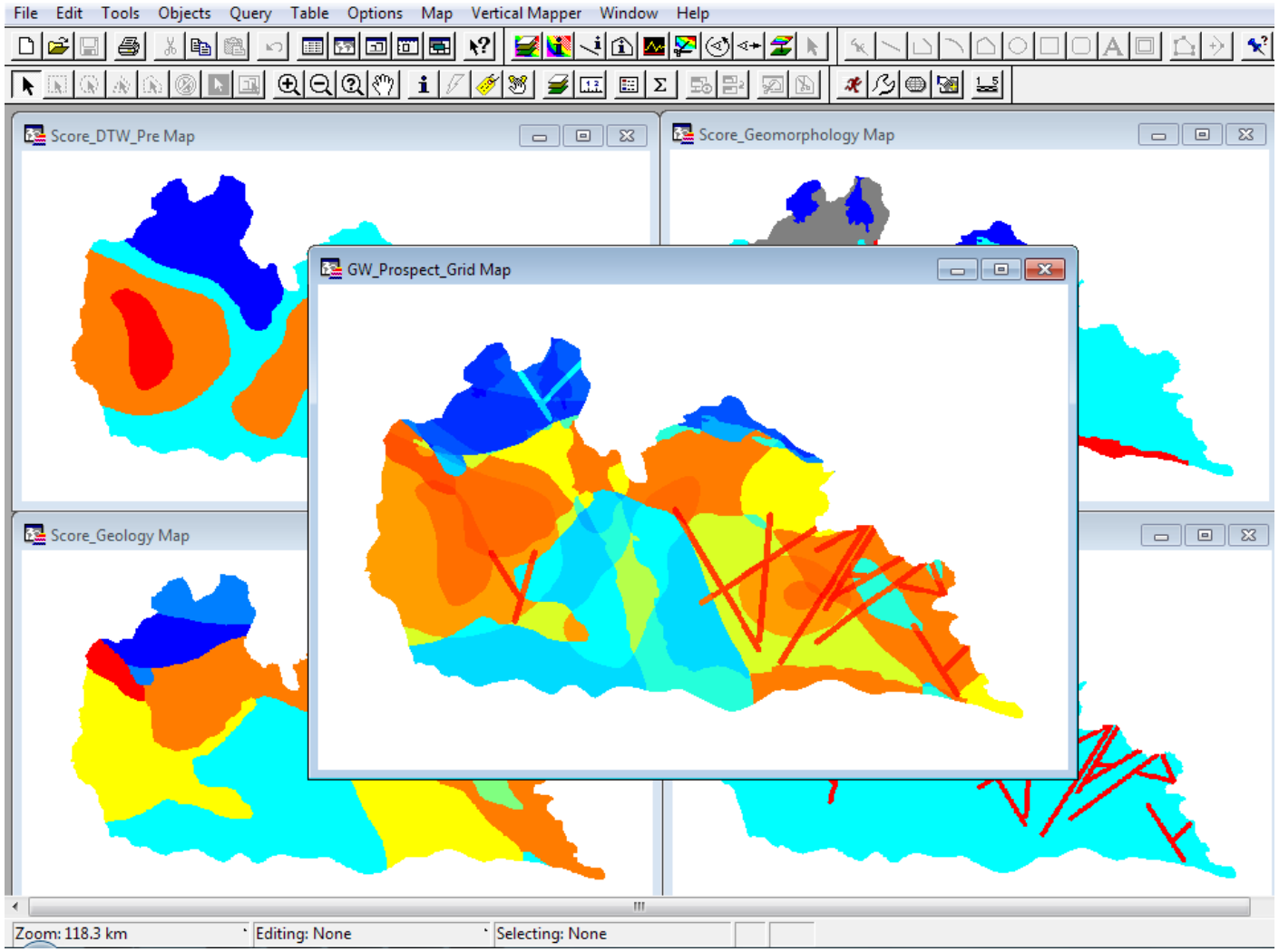
RS GIS



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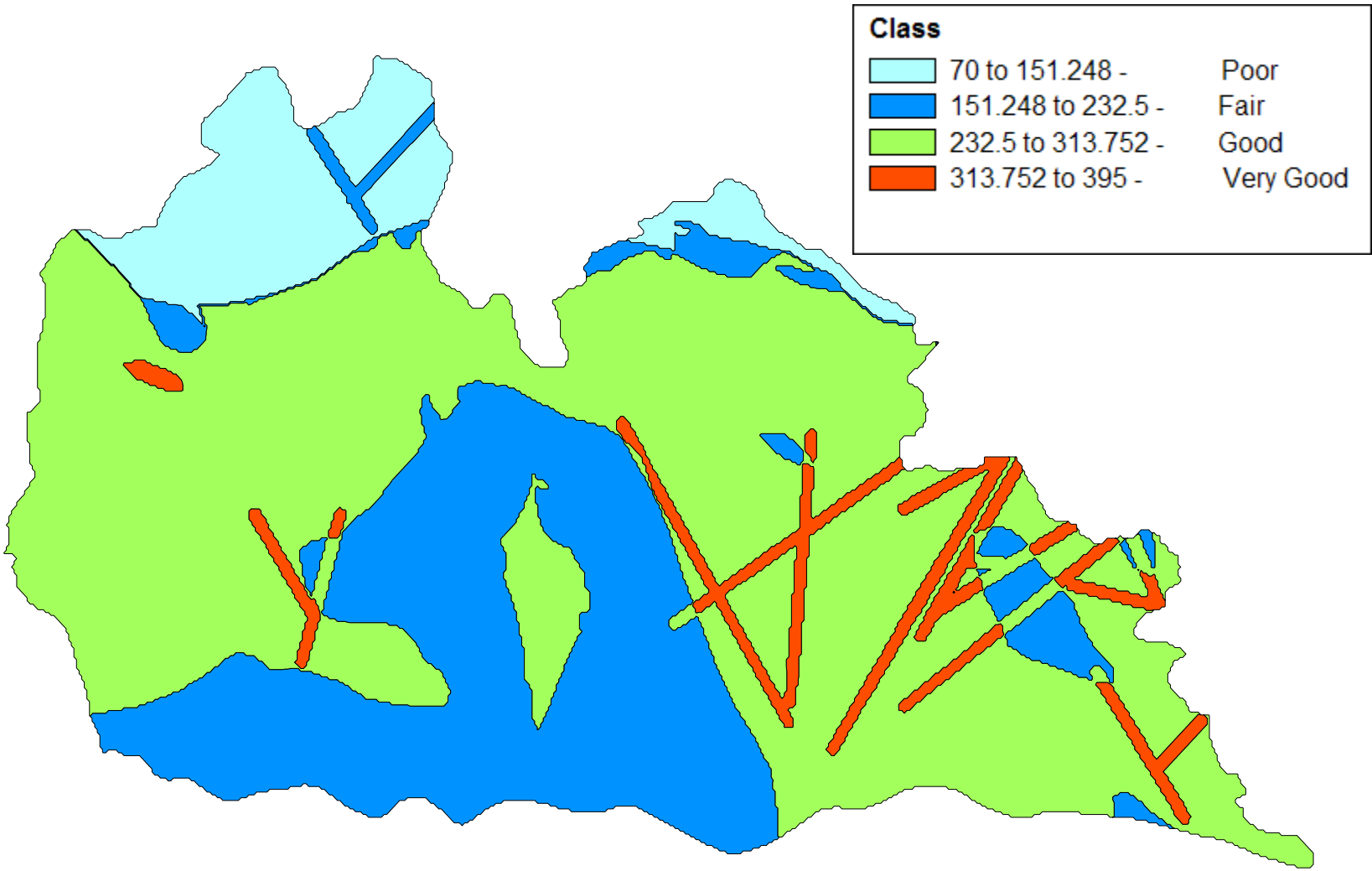


SOME EXAMPLES

AND APPLICATIONS

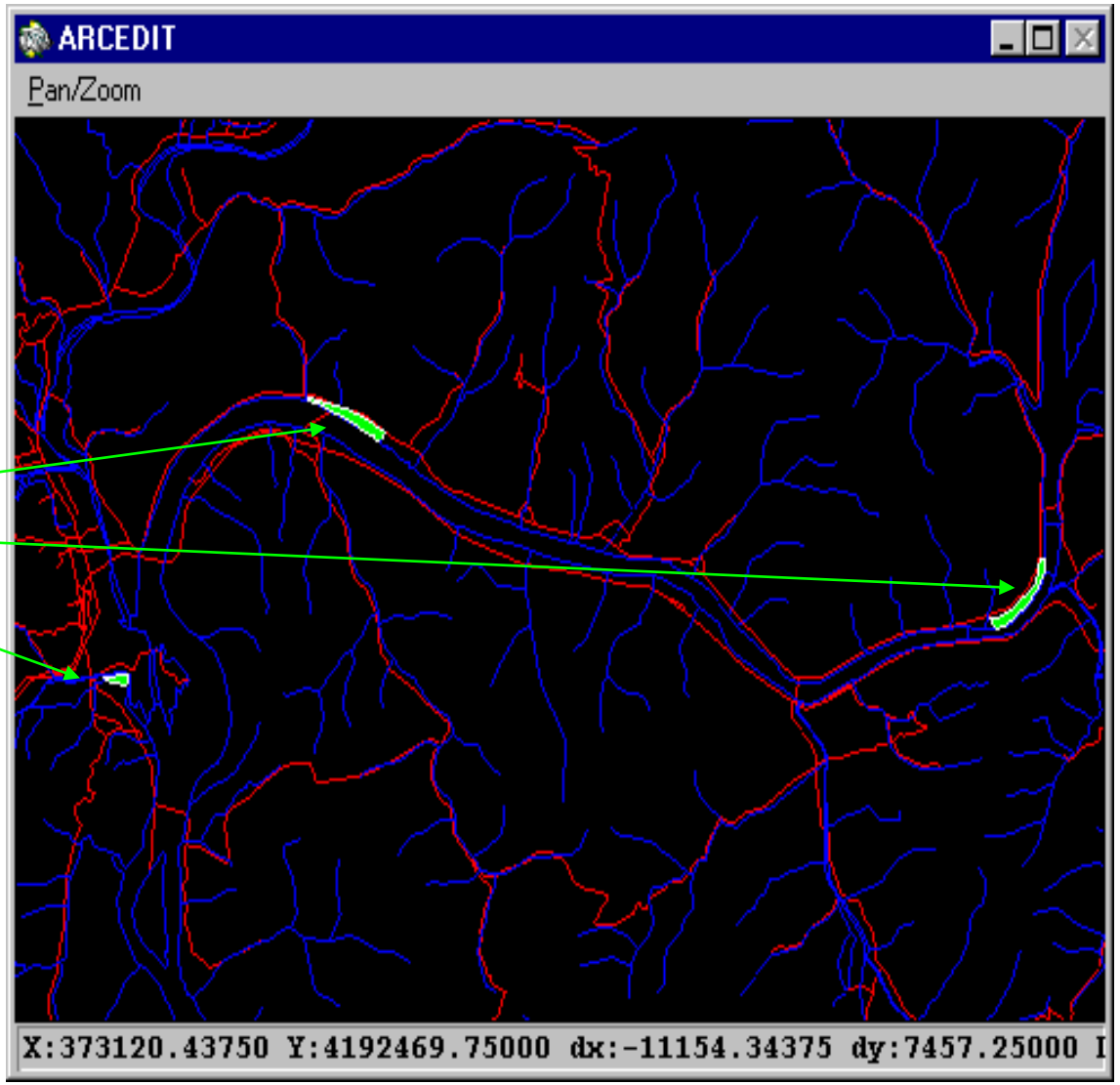
GIS Applications

- Site selection
  - Helicopter Landing Zones
  - Amphibious Assault (Water Depth)
  - Buffer Zones
  - Flight Planning
  - Battlefield Visualisation



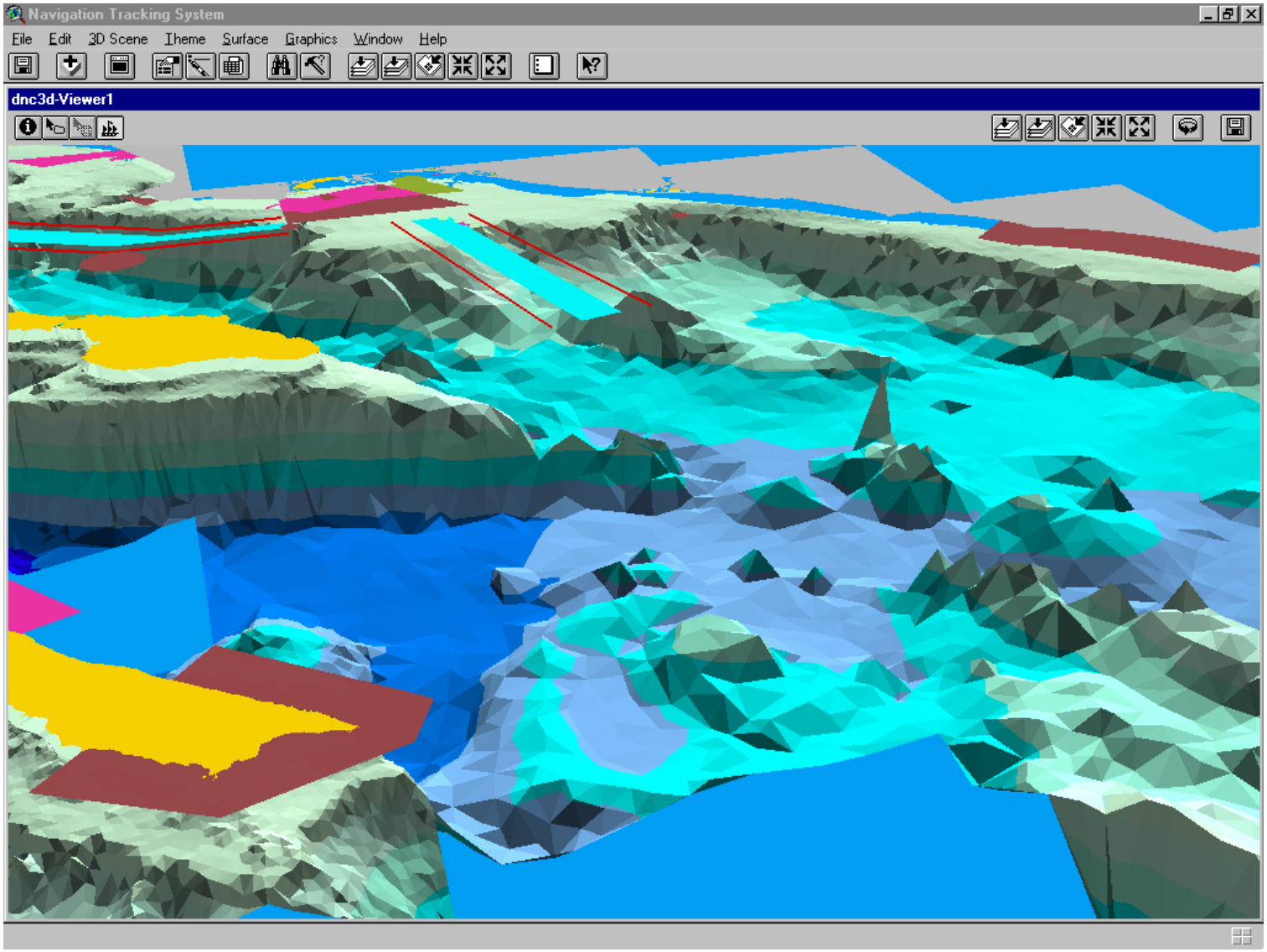


Helicopter Landing Zones



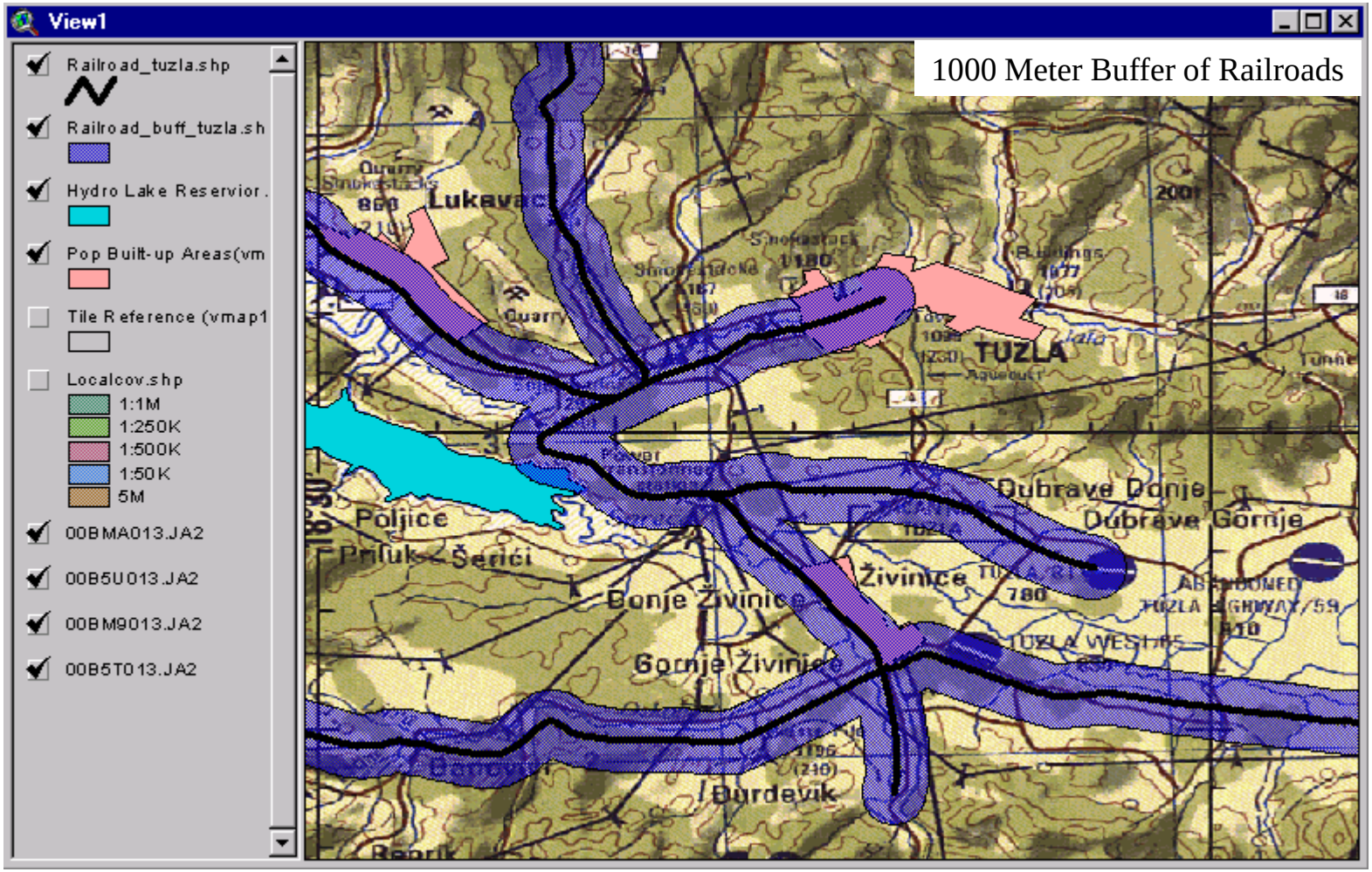
HLZ sites

Amphibious Assault Planning

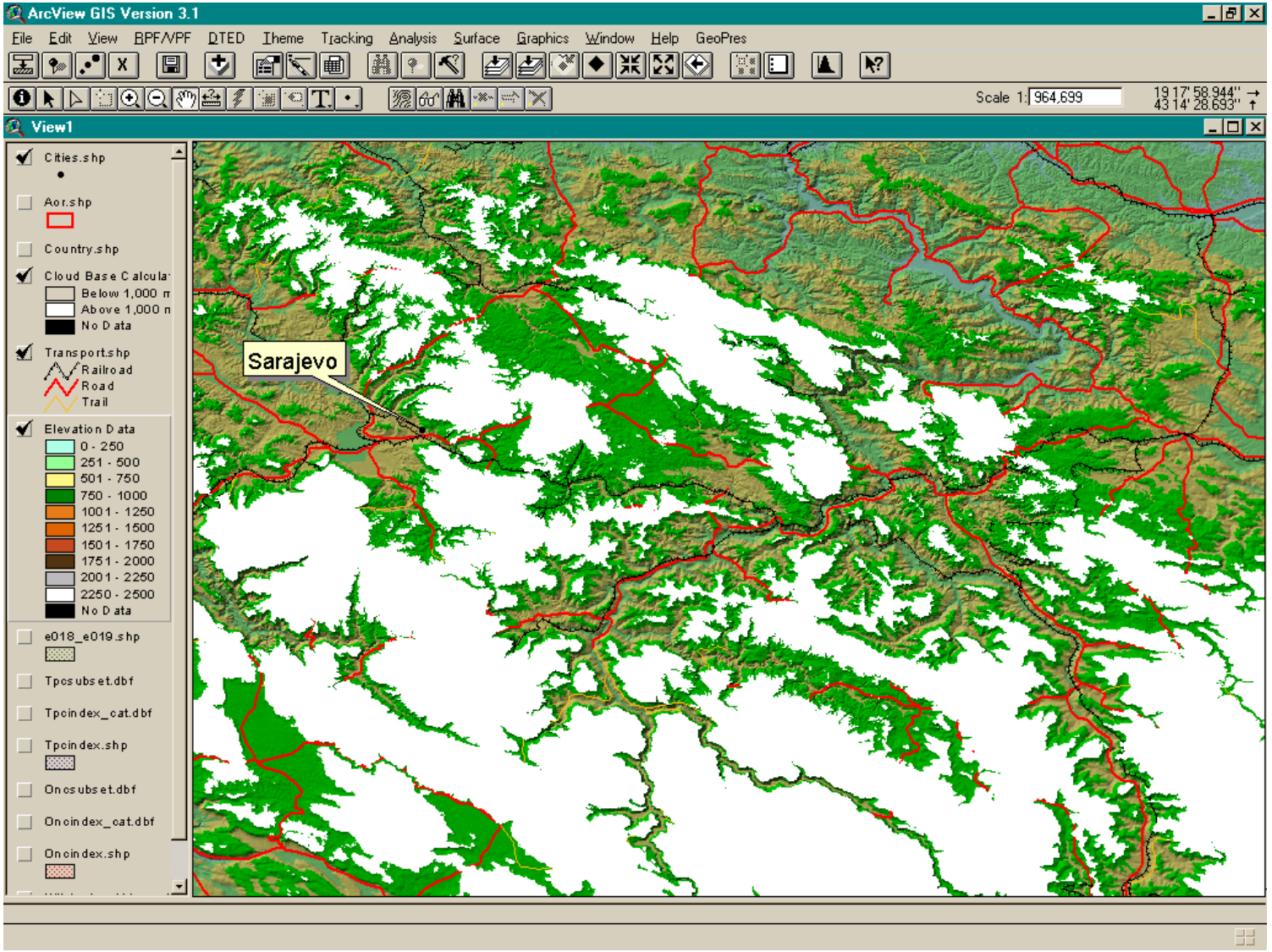


Spatial Analysis

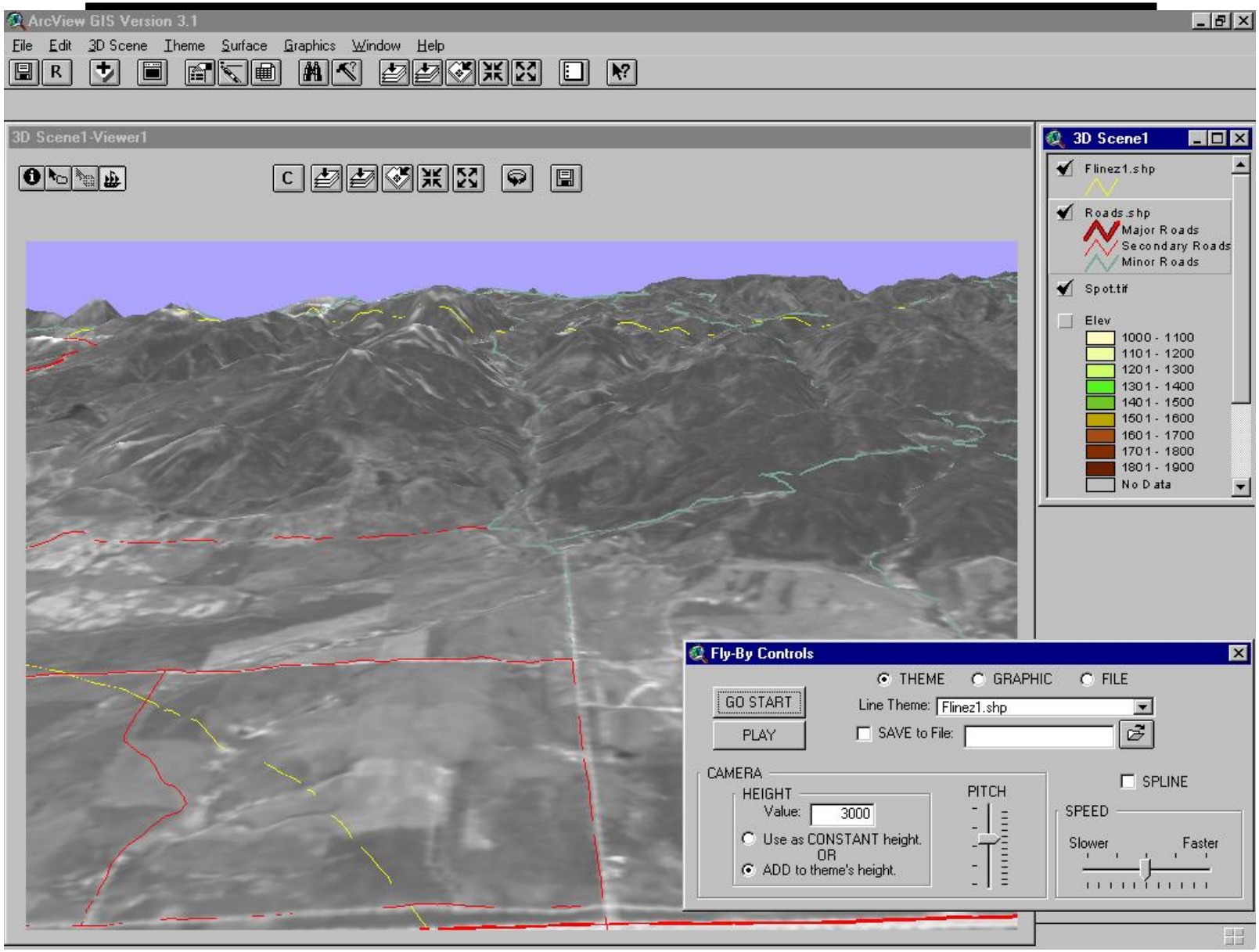
Proximity Analysis (Buffers)



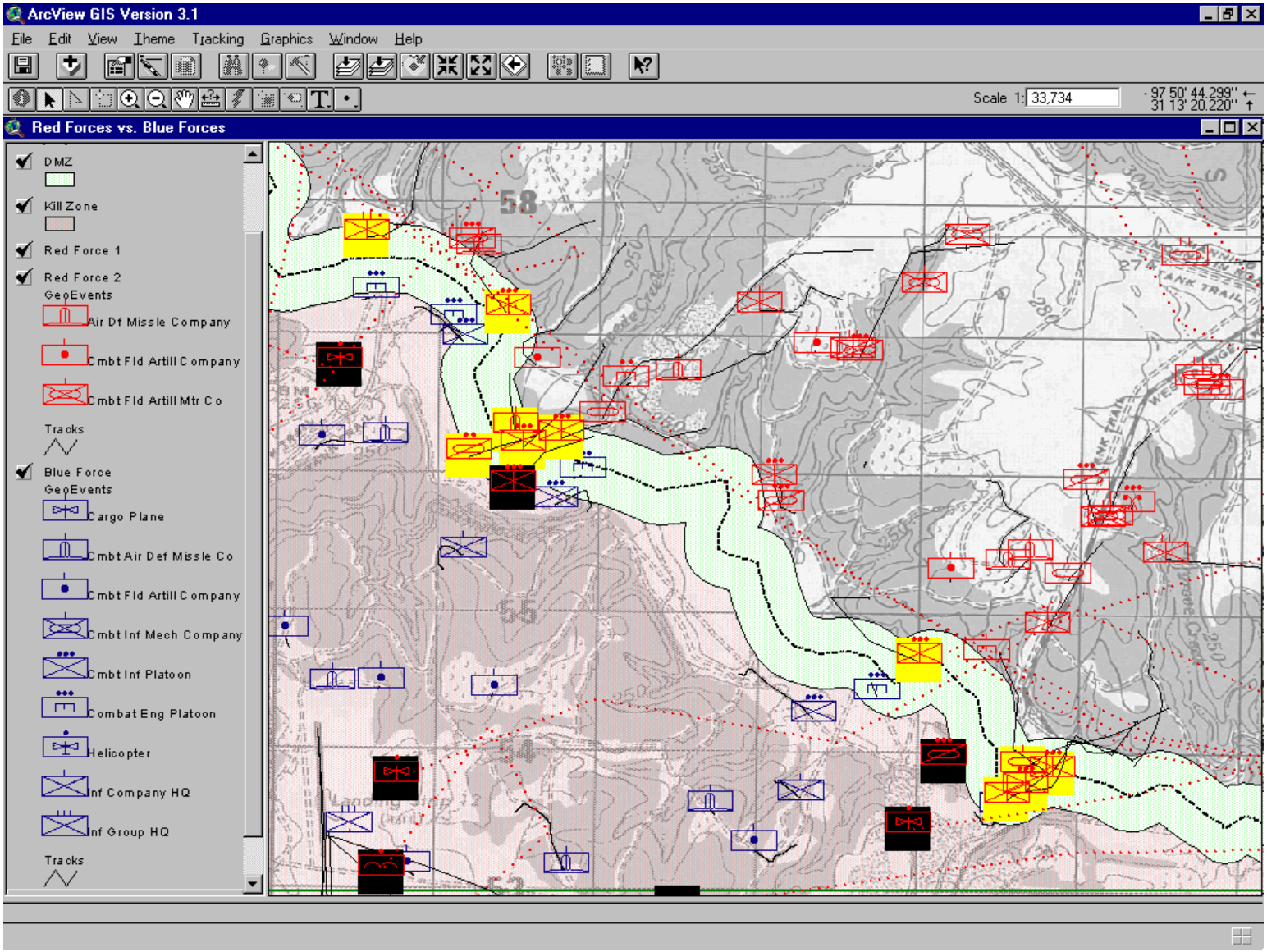
Flight Planning



Flight Planning/Flythroughs



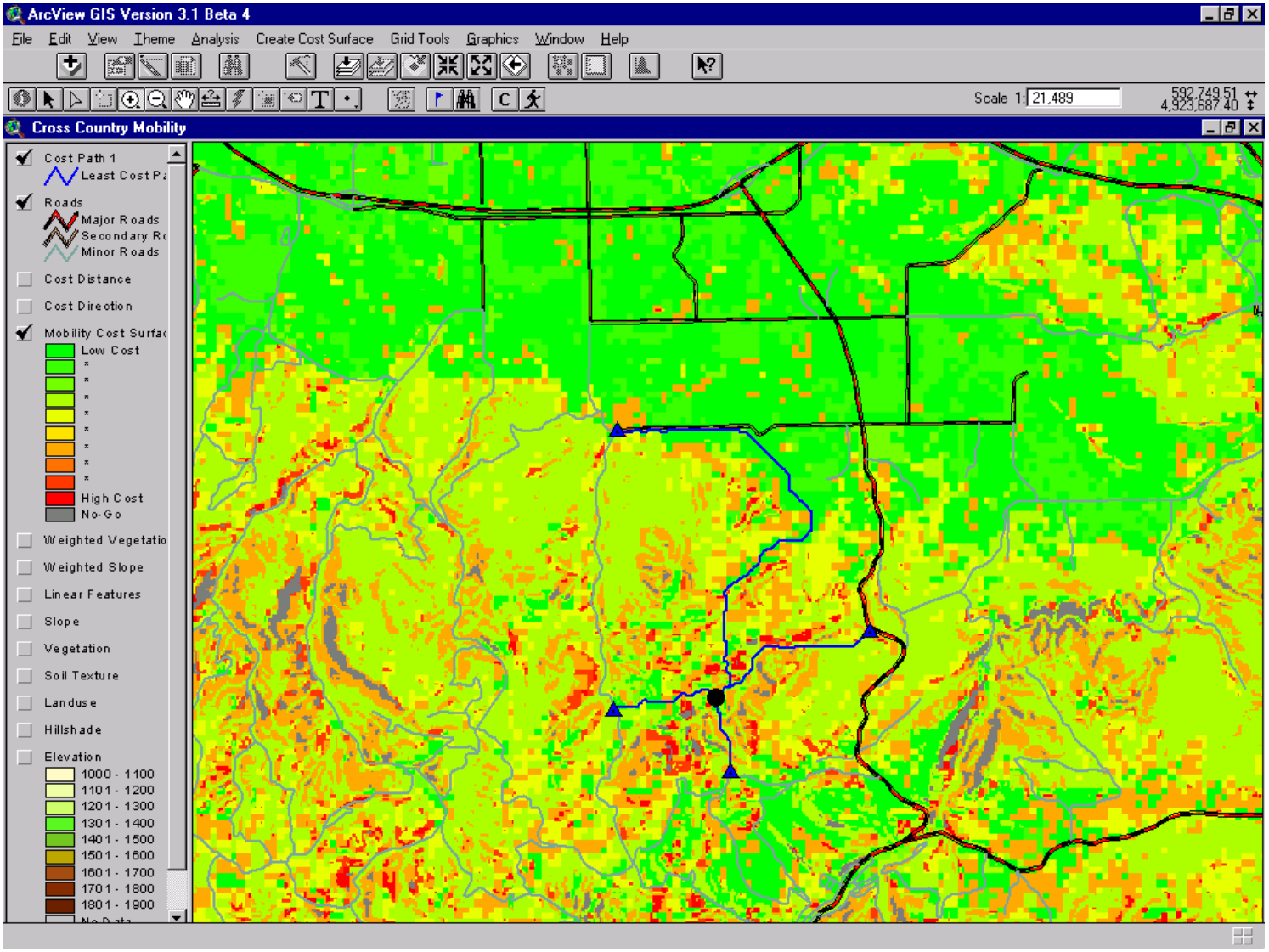
Battlefield Visualization and/or Situation Awareness



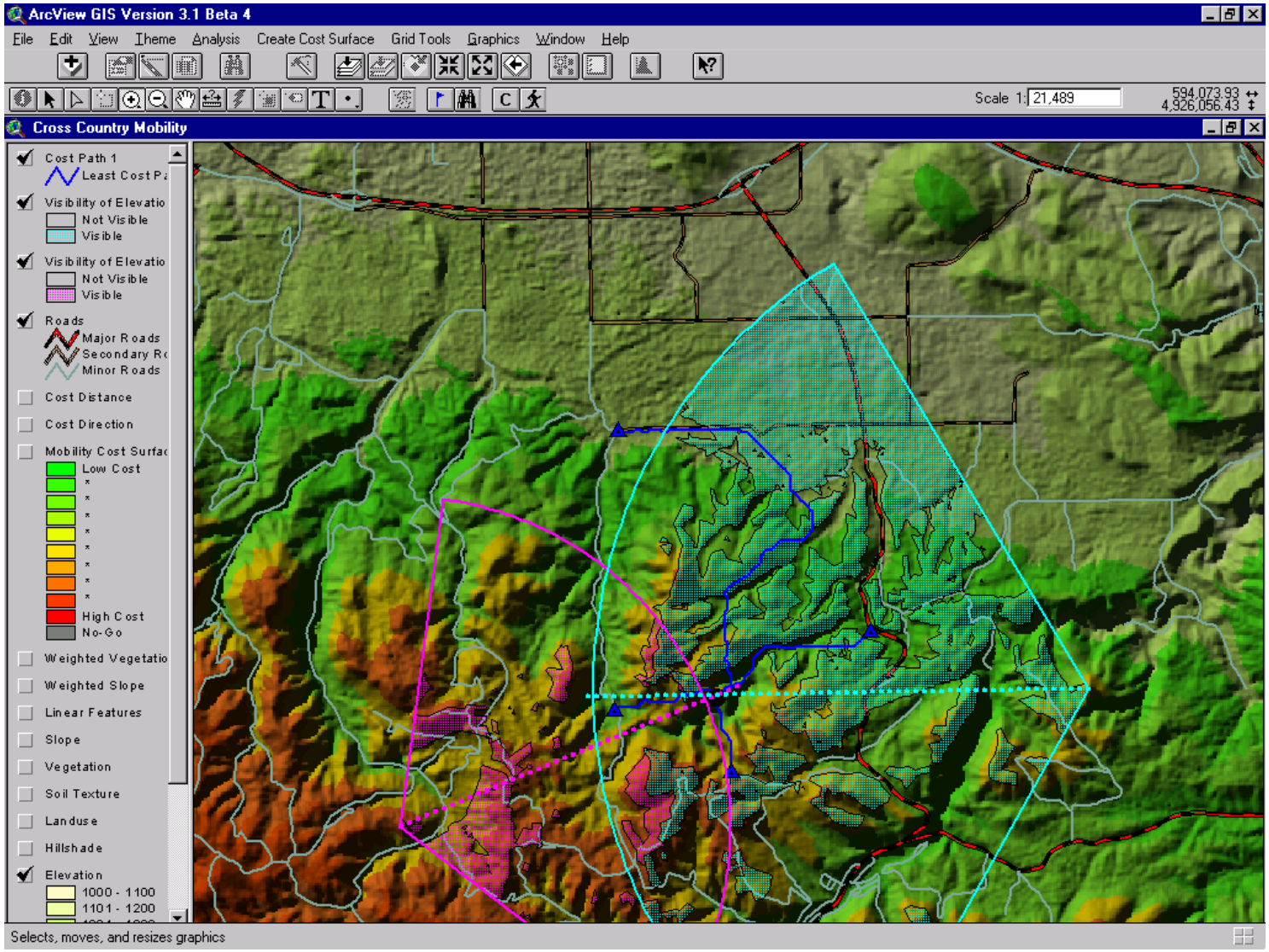
Other GIS Applications

- Cross country movement
  - Route planning
  - Intervisibility study
- Facilities management
- Airfield assessment
- Road network analysis (convoys)
- Propagation coverages
- Observation post siting analysis
- Perspective views

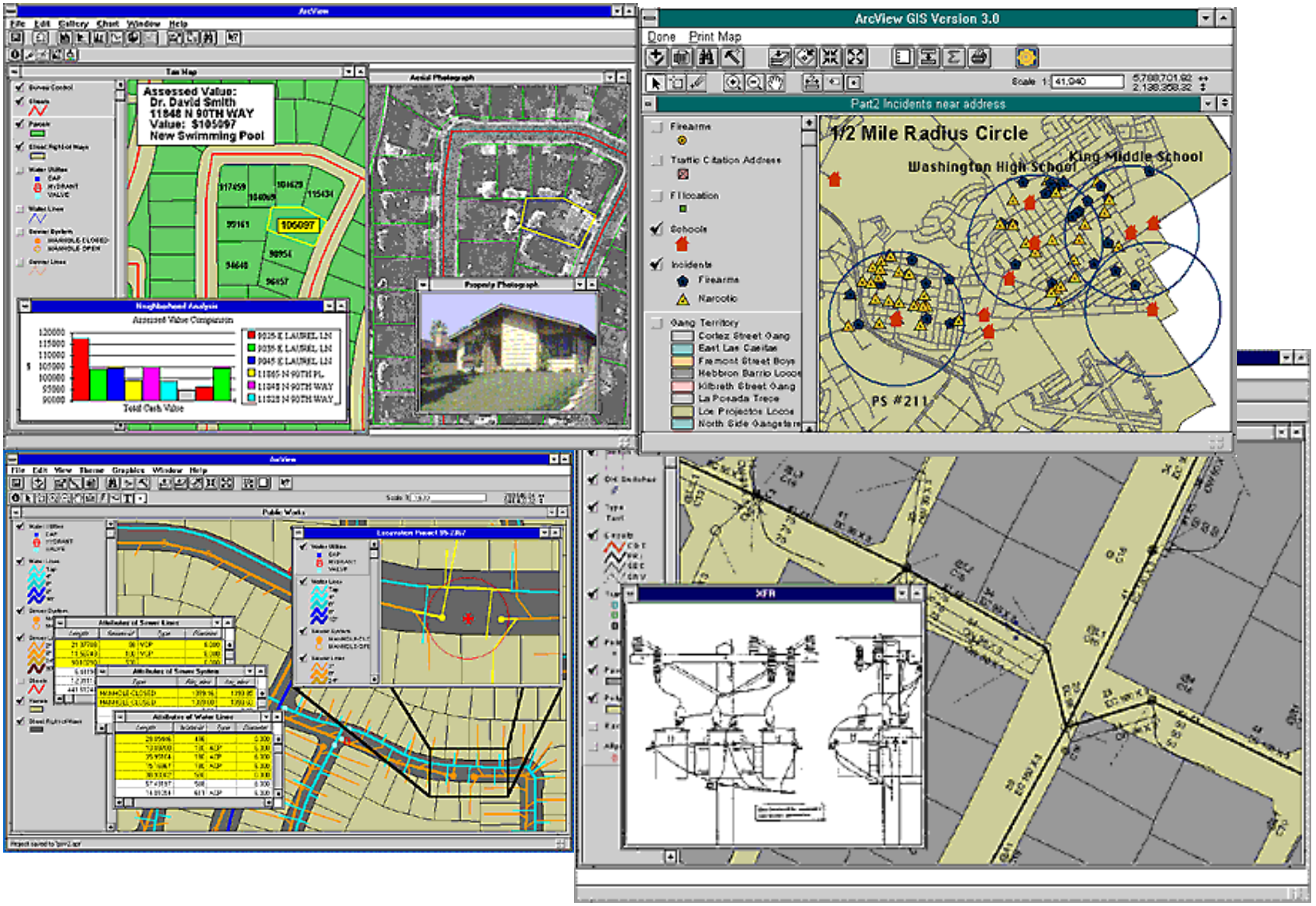
CCM Analysis



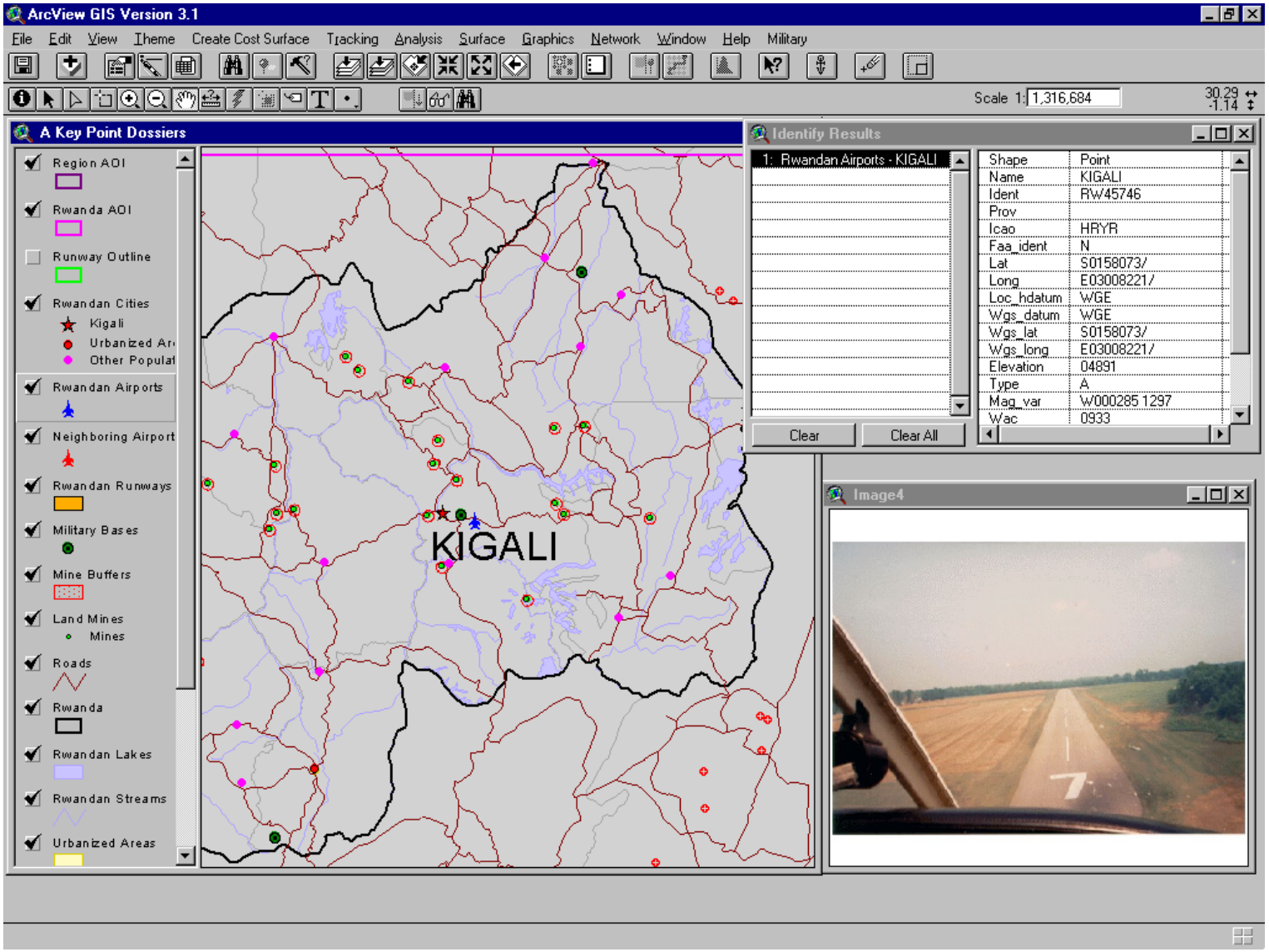
CCM & Viewshed



Facilities Management



Airfields


ArcView GIS Version 3.1
File Edit View Theme Create Cost Surface Tracking Analysis Surface Graphics Network Window Help Military
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A Key Point Dossiers
Region AOI
Rwanda AOI
Runway Outline
Rwandan Cities
Kigali
Urbanized Ar
Other Populat
Rwandan Airports
Neighboring Airport
Rwandan Runways
Military Bases
Mine Buffers
Land Mines
Mines
Roads
Rwanda
Rwandan Lakes
Rwandan Streams
Urbanized Areas
KIGALI
Identify Results
1: Rwandan Airports - KIGALI
Shape Point
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Ident RW45746
Prov
Icao HRYR
Faa_ident N
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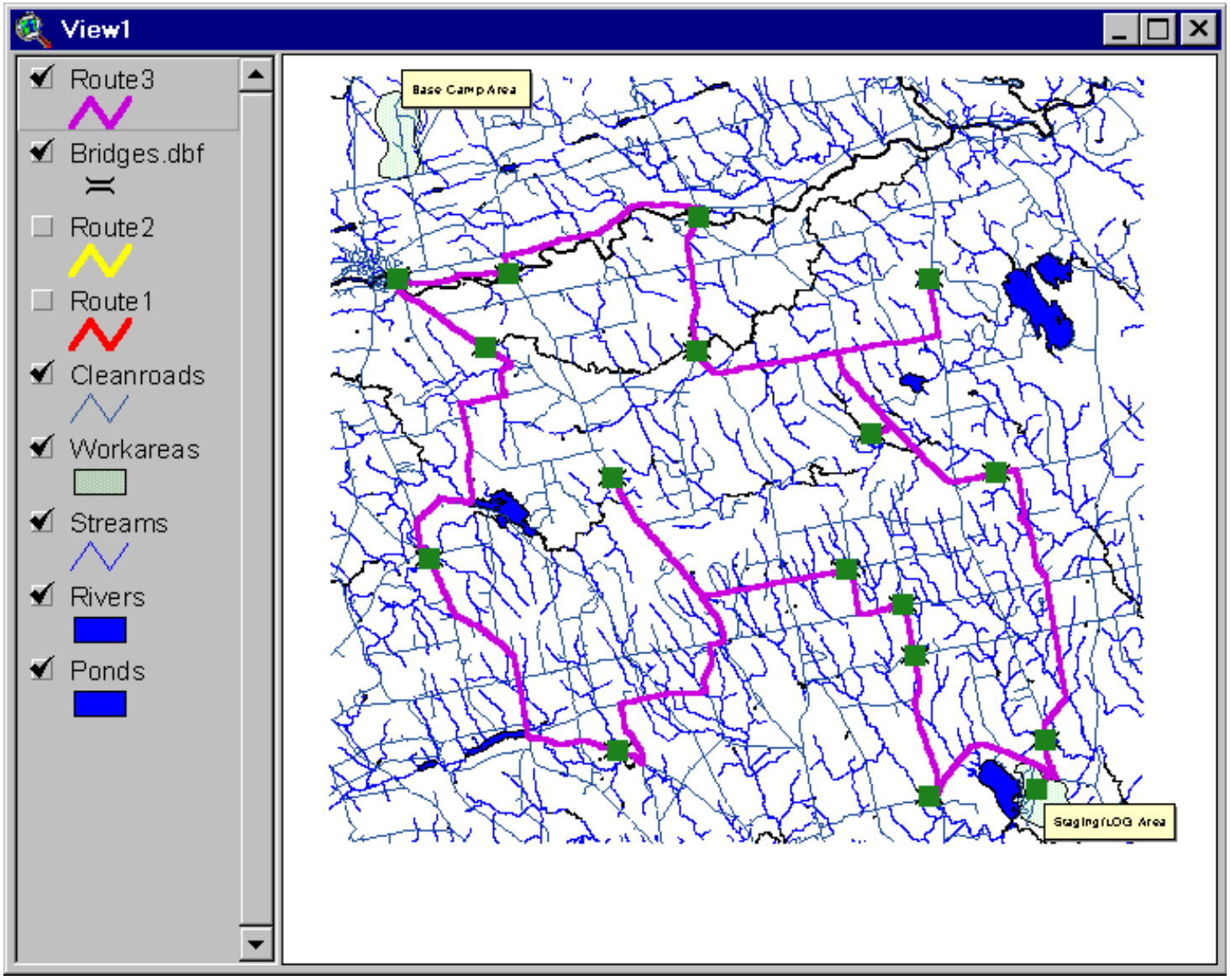
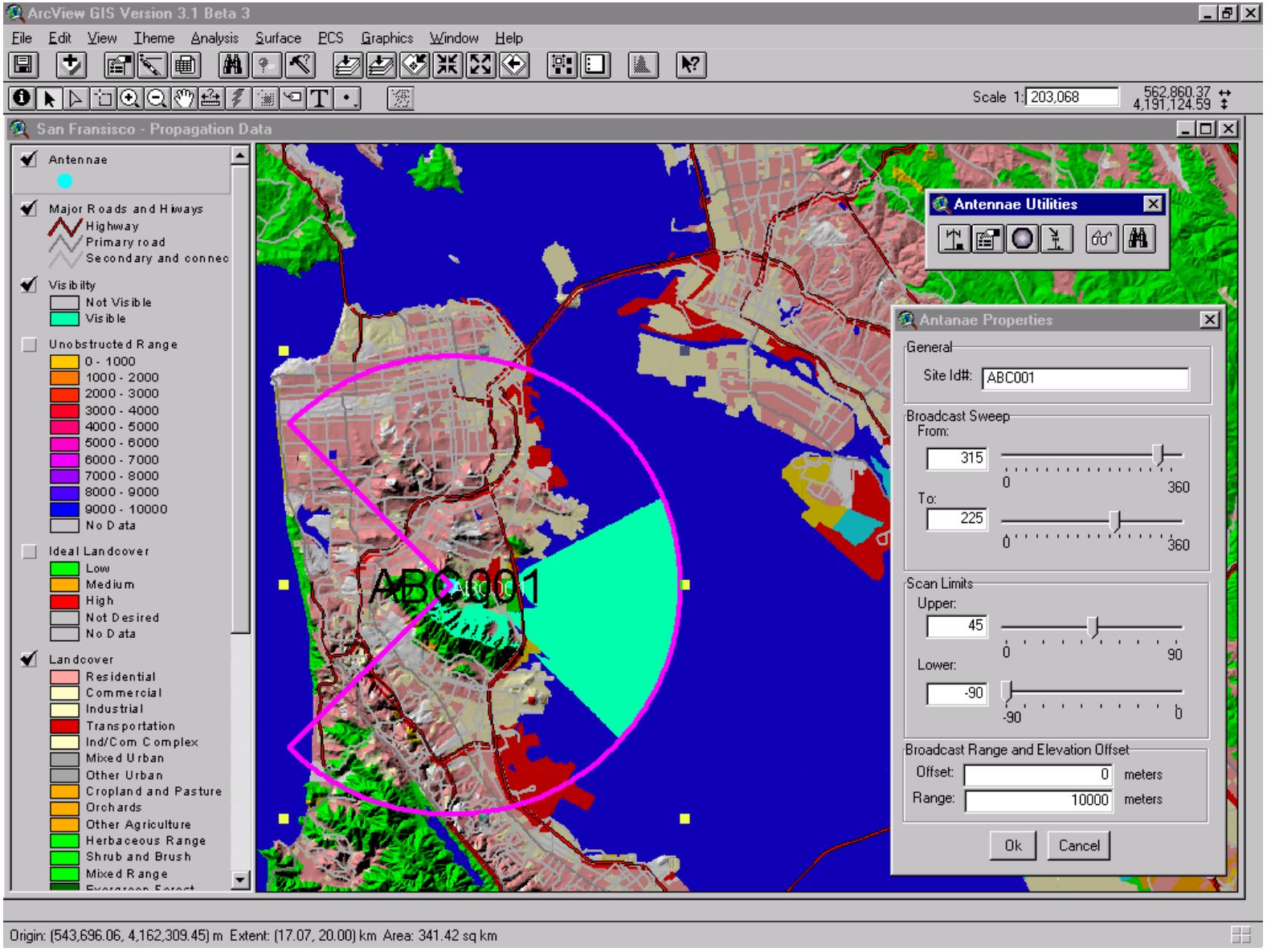
Image4

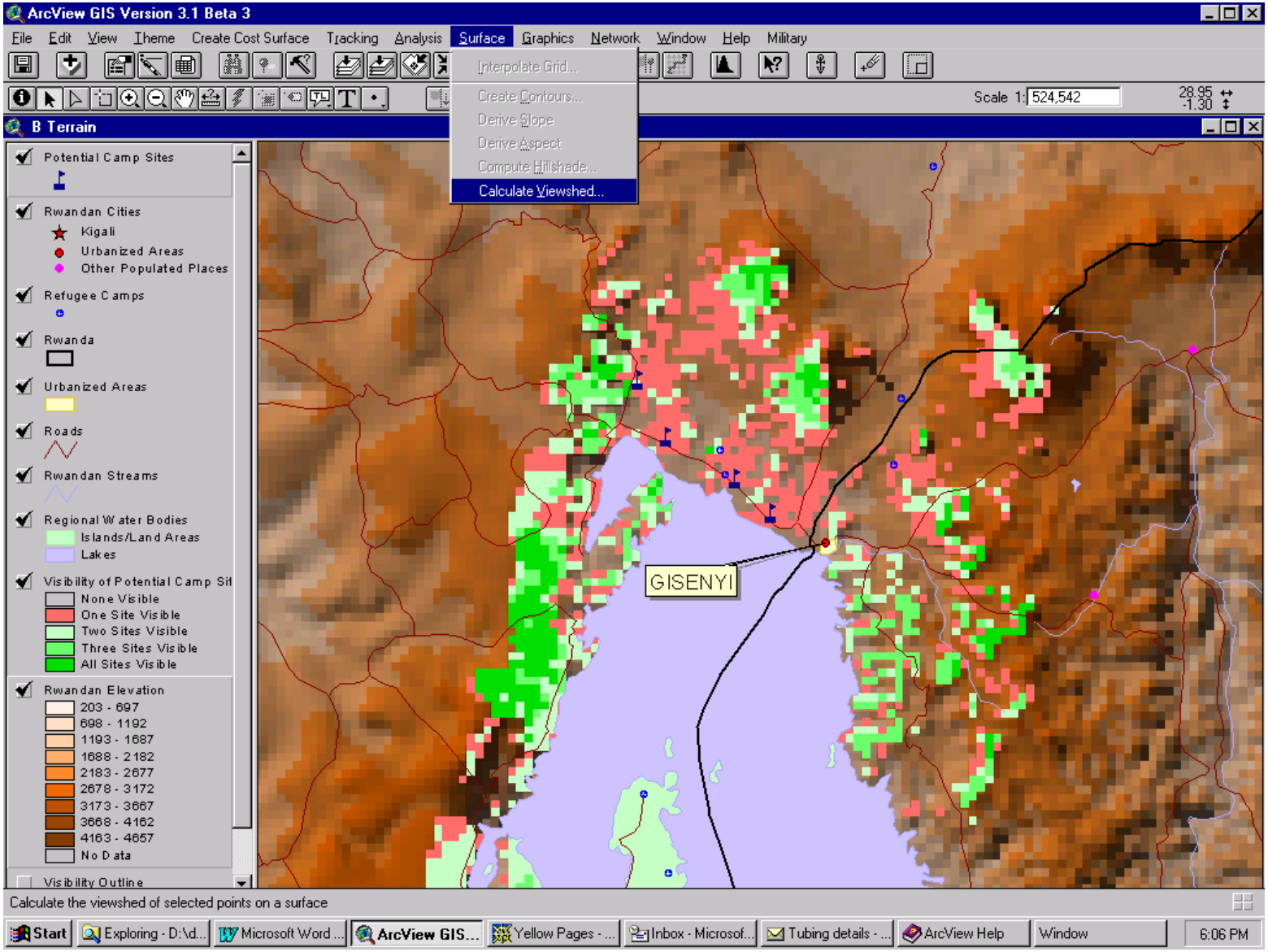
Network Analysis



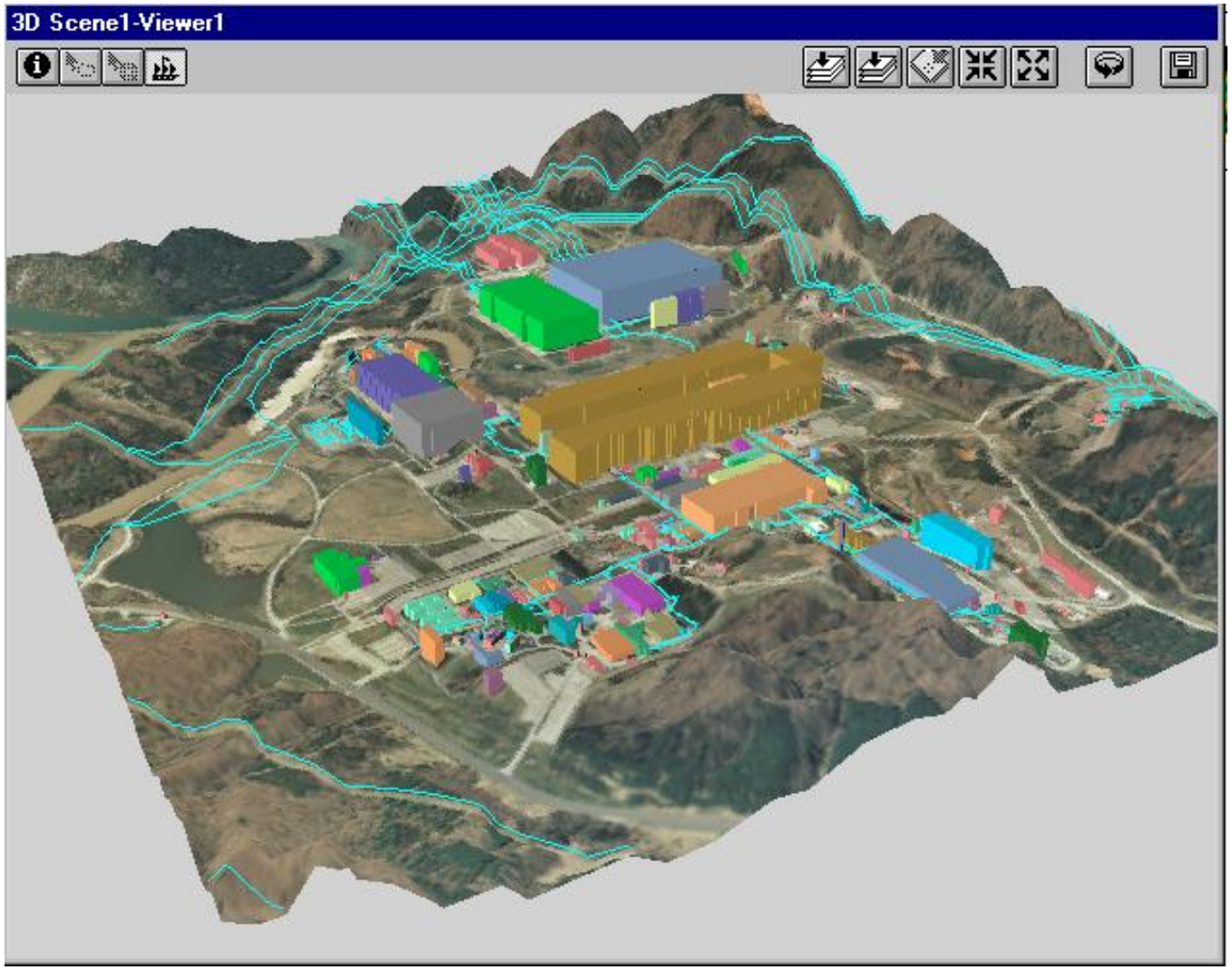
Antenna Propagation Coverages



Observation Post Siting Analysis



Perspective Views



SUMMARY

- ✓ Key Concepts
- ✓ Data representation
- ✓ Applications