Programs in Geographic Information Systems and Science at AUM

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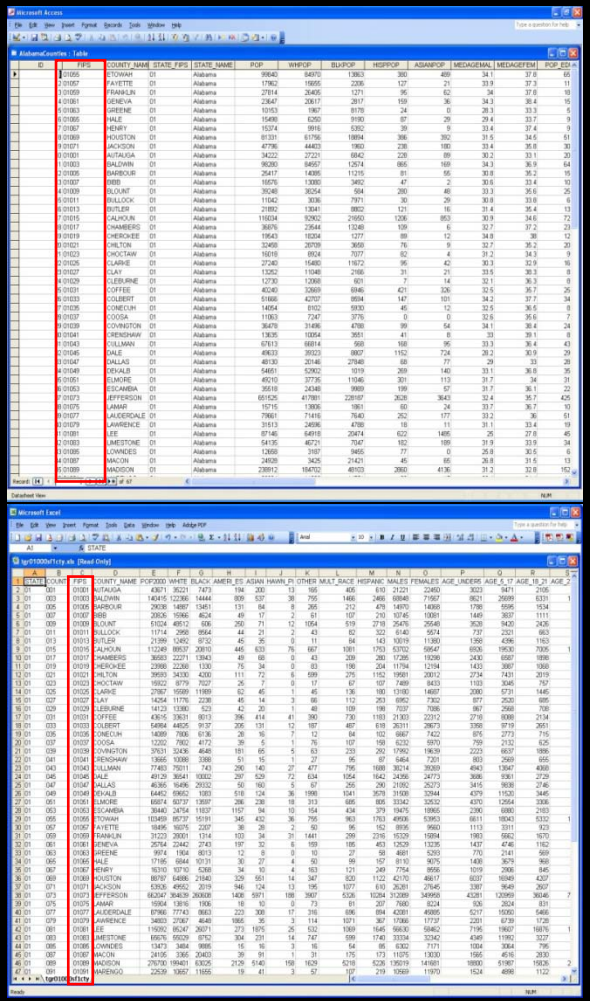
What Is GIS?

- Intergraph
  - A data management system that allows you to capture, store, analyze, and display geographic information.
- ESRI
  - A collection of computer hardware, software, geographic data, personnel and processes designed to efficiently capture, store, update, manipulate, analyze, and display different forms of geographically referenced information.

What Does A GIS Do?

- Maps represent where features or entities exist in the real world. (SPATIAL)
- All maps provide *relative* locations. (SPATIAL)
- Some maps provide both relative and *absolute* locations of entities. (SPATIAL)
- A GIS organizes information about locations (attributes) according to location. (ASPATIAL)
  - Links geographic locations with information about locations so you can create maps, make decisions, identify spatial relationships, and analyze information.
  - For example, where do we find the highest frequencies of water jars at a particular site?

A GIS Has Relational Databases



Quadrat no.	Collector	Collection date	Site no.
1	Smith	6/10/96	2
2	Jones	7/01/96	3
3	.	.	.
.	.	.	.

Quadrats table

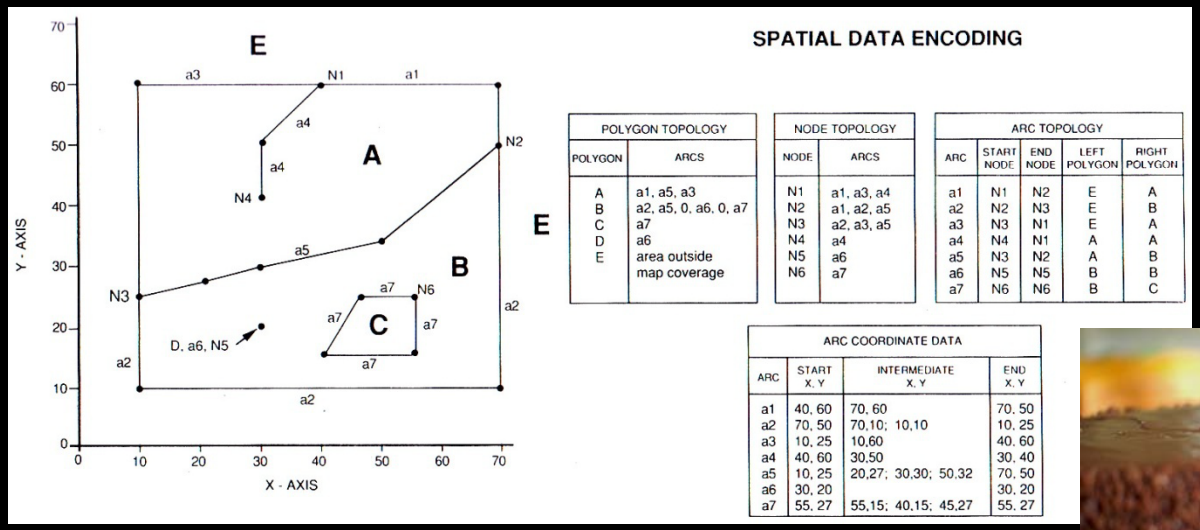
Quadrat no.	Species no.	Latitude	Longitude
1	3	35.19°N	106.10°W
1	4	35.19°N	106.10°W
2	2	35.20°N	.
.	.	.	.

Species code no. table

Species no.	Species name	Type
1	Conomyrma insana	Generalist
2	Pogonomyrmex rugosus	Specialist
.	.	.
.	.	.

Species table

How Does A GIS Really Work?



SPATIAL DATA ENCODING

POLYGON TOPOLOGY	
POLYGON	ARCS
A	a1, a5, a3
B	a2, a5, 0, a6, 0, a7
C	a7
D	a6
E	area outside map coverage

NODE TOPOLOGY	
NODE	ARCS
N1	a1, a3, a4
N2	a1, a2, a5
N3	a2, a3, a5
N4	a4
N5	a6
N6	a7

ARC TOPOLOGY				
ARC	START NODE	END NODE	LEFT POLYGON	RIGHT POLYGON
a1	N1	N2	E	A
a2	N2	N3	E	B
a3	N3	N1	E	A
a4	N4	N1	A	A
a5	N3	N2	A	B
a6	N5	N5	B	B
a7	N6	N6	B	C

ARC COORDINATE DATA			
ARC	START X, Y	INTERMEDIATE X, Y	END X, Y
a1	40, 60	70, 60	70, 50
a2	70, 50	70,10; 10,10	10, 25
a3	10, 25	10,60	40, 60
a4	40, 60	30,50	30, 40
a5	10, 25	20,27; 30,30; 50,32	70, 50
a6	30, 20		30, 20
a7	55, 27	55,15; 40,15; 45,27	55, 27

A Chocolate Cake

Topology: a mathematical model used to define spatial relationships.

Topology is like the icing between layers of a cake. It binds them together as one.

Arc: a series of points that start and end at a node.

Node: an intersection point where two or more arcs meet or they can occur at the end of dangling arcs.

Polygons: a closed chain of arcs representing the boundaries of an area.

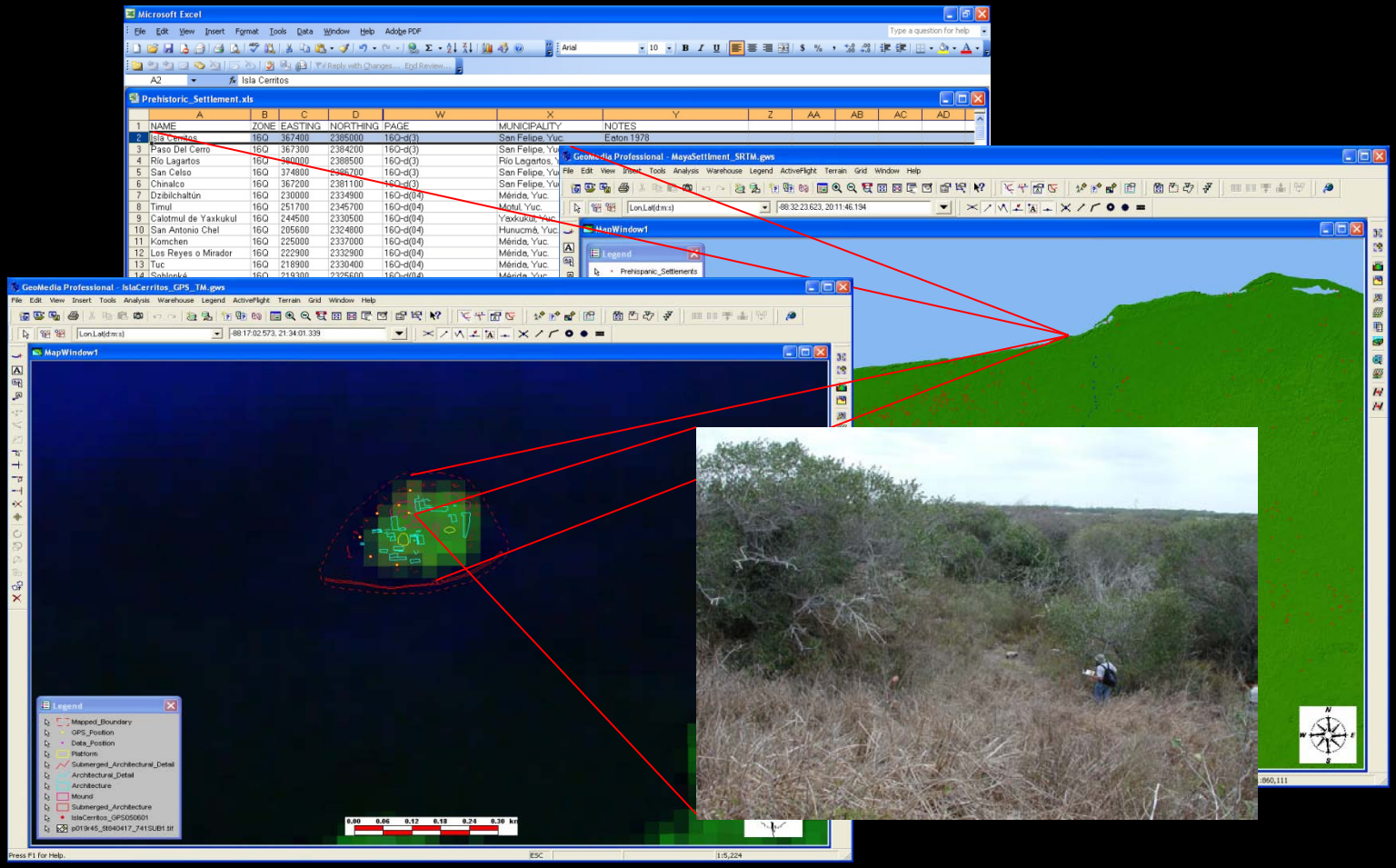
Topology is stored in three data tables, one for each type of element. Coordinate data are stored in a fourth table.

Advantage: contiguity (adjacency) and connectivity (networks, optimum routes) analyses can be accomplished without using coordinate data.

What Could You Do With A GIS?

- Visualize geospatial data... assess information by seeing it in virtual space.
- Organize data... structure data according to geographic coordinates and logical spatial relationships.
- Integrate data... combine geographic data from a variety of sources such as maps, air photos and tabular information in a coherent and compatible (geo-referenced) manner.
- Merge data ... join a-spatial data (attributes) to spatial data (objects).
- Analyze... infer meaning from data.
- Predict... model the future from patterns in the spatial distribution of data.
- Question... ask questions about features in the database or the distribution of attributes.
- Discover... find relationships that are unperceivable in other expressions.

An Application in GIS: Archaeological Research



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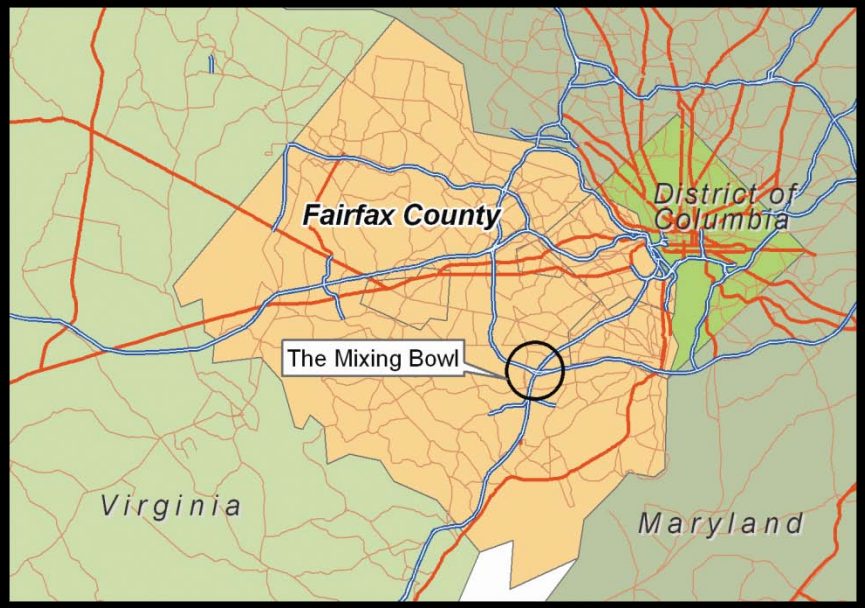
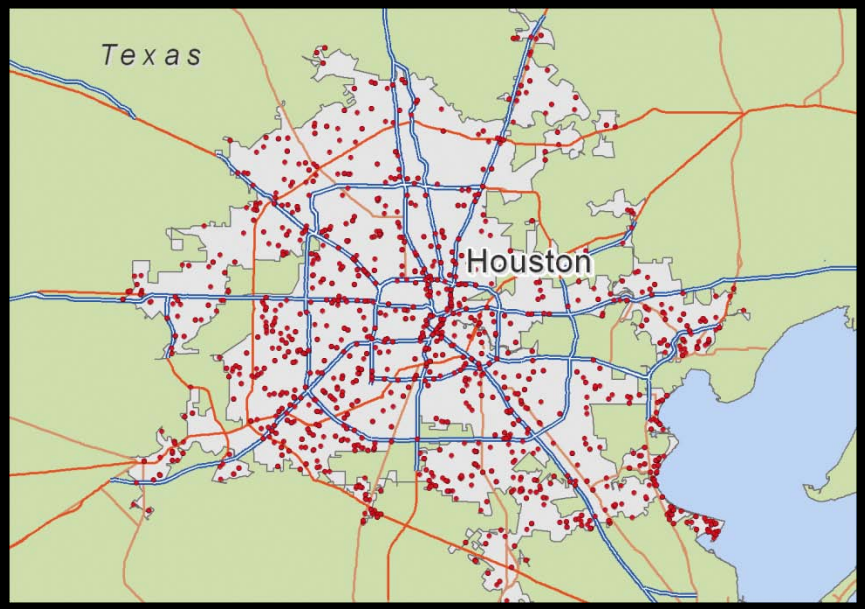
An Application in GIS: Hazards Emergencies

- What happens after a hazardous materials spill?
- How do public safety officials choose to reroute traffic?
- Where do evacuees in a hazardous materials spill actually go?
- In a hazardous materials spill, what's the proper evacuation distance?
- What are the possible evacuation shelters and how will evacuees get to them?
- What roads will need to be closed near the spill?
- How will traffic get around the spill area?
- How many evacuees will there be?

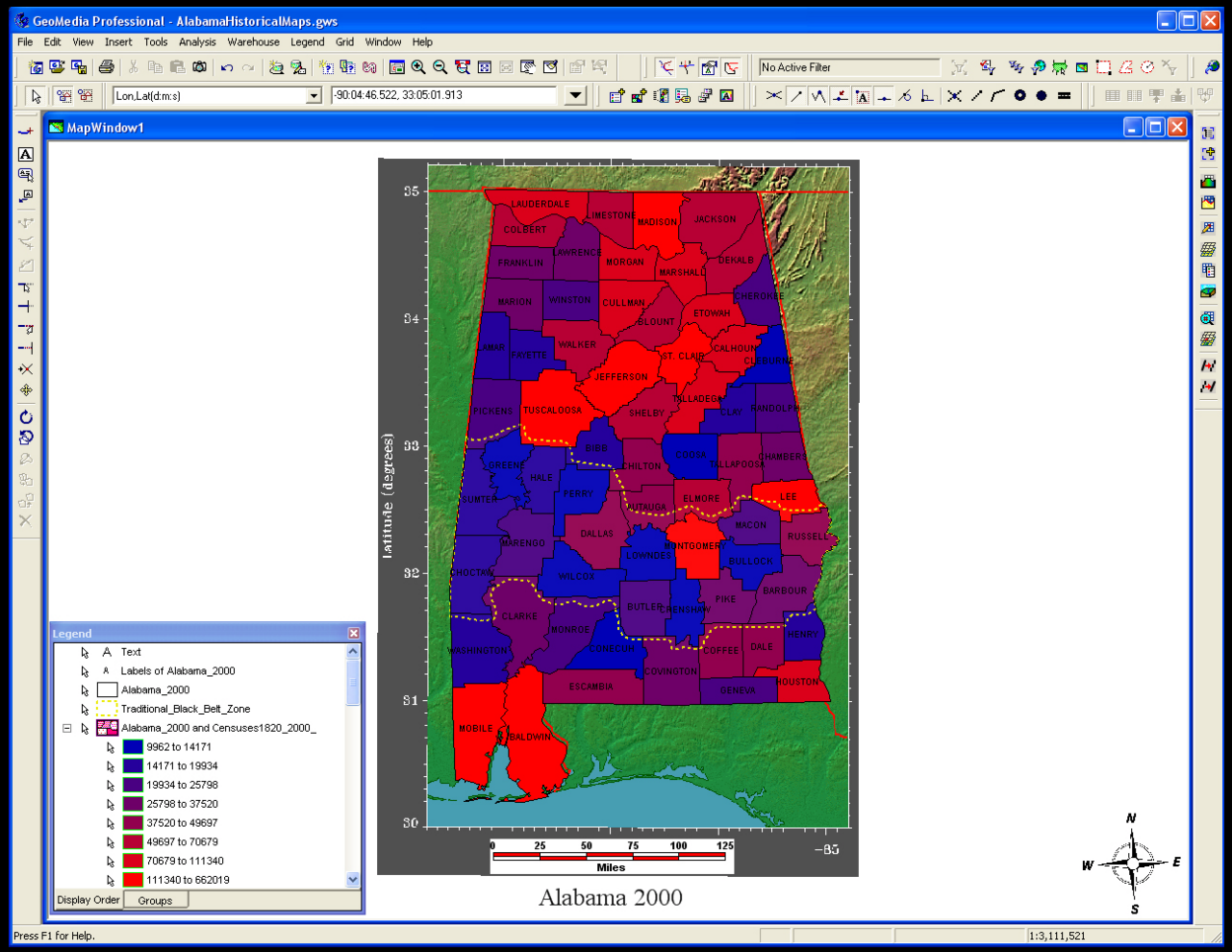


An Application in GIS: Law Enforcement

- Focus on the distribution of crime in Houston.
- Look at the different factors that affect crime in a large city.
- Analyze which parts of the city need additional police presence.
- Where are the crime "hot spots" in Houston?
- Are different types of crimes concentrated in different neighborhoods?
- How are the police distributed in Houston?
- Are there better ways to distribute the police presence in Houston to combat crime?

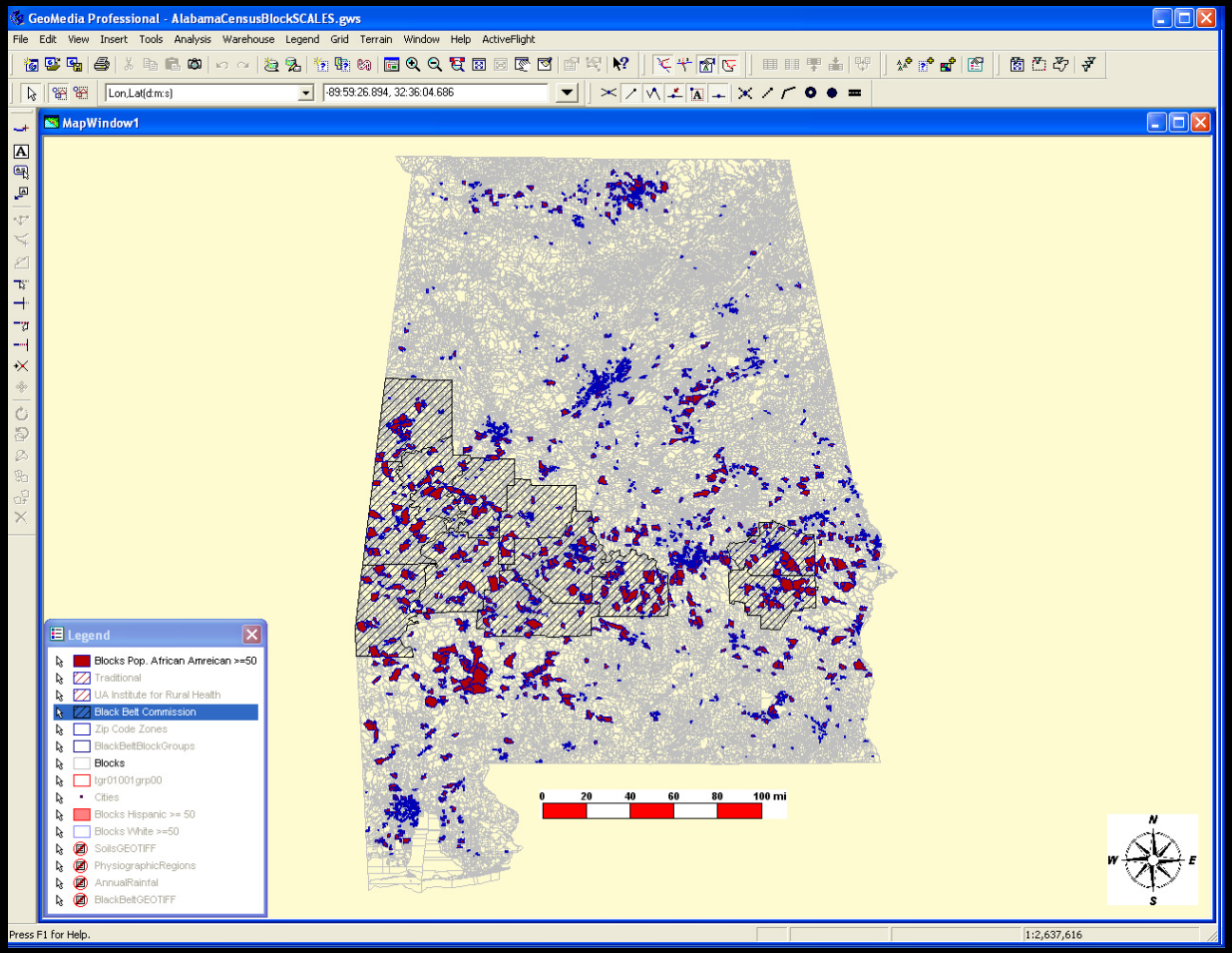


An Application in GIS: Population Distribution



Total Population by County, Alabama

An Application in GIS: Population Ethnicity



Blocks >=50% African American

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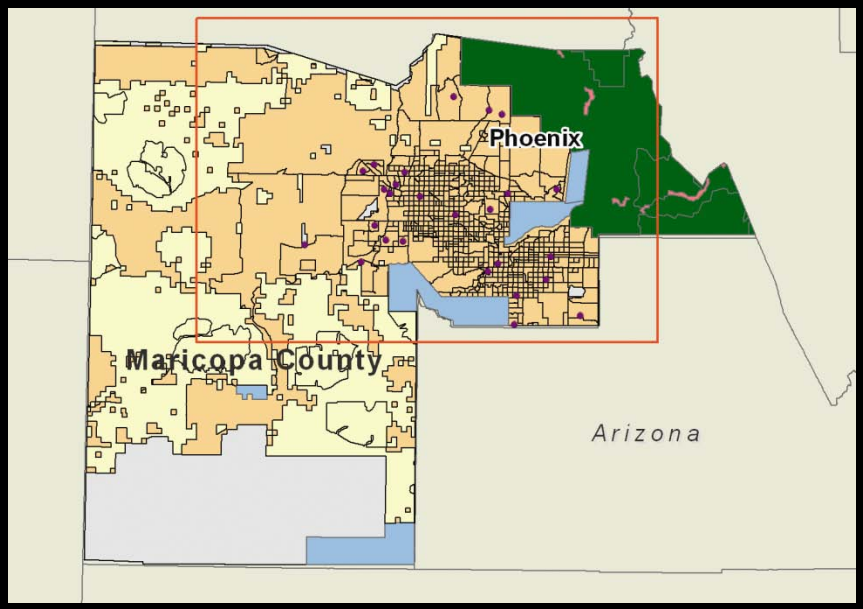
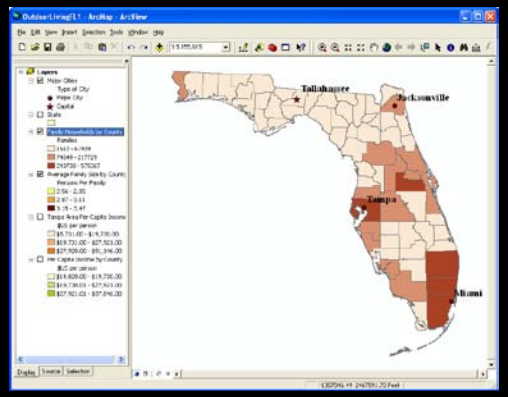
An Application in GIS: Location Decisions

- Identify the best locations given different criteria.
- Explore what happens when different decision criteria have greater or lesser importance.
- Use GIS to aid in spatial decision making.
- How do you choose appropriate criteria to make a spatial decision?
- What is the best scale to use to compare disparate measures (distance to a location versus median home value)?
- What is the appropriate weight to give each decision factor?
- Where can you obtain data to support spatial decision making?

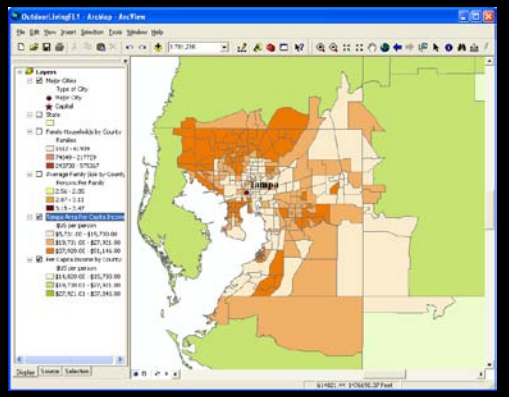


An Application in GIS: Marketing Strategies

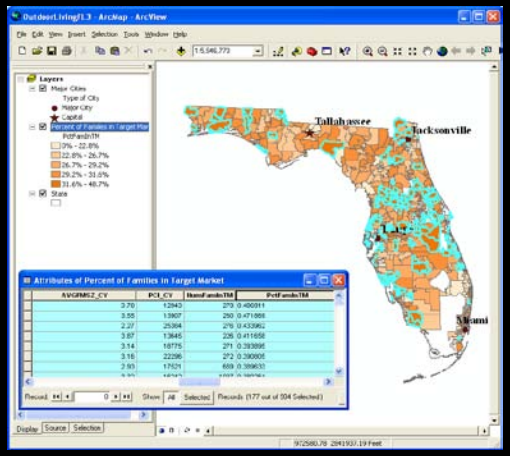
- Create map symbology to display population demographics
- Select target families for advertising and direct mail components of a promotional campaign using appropriate geographic units and demographic attributes
- Select area recreational stores with outdoor shows based on their location relative to target market households
- Design maps to communicate and support your recommendations.



Households by County

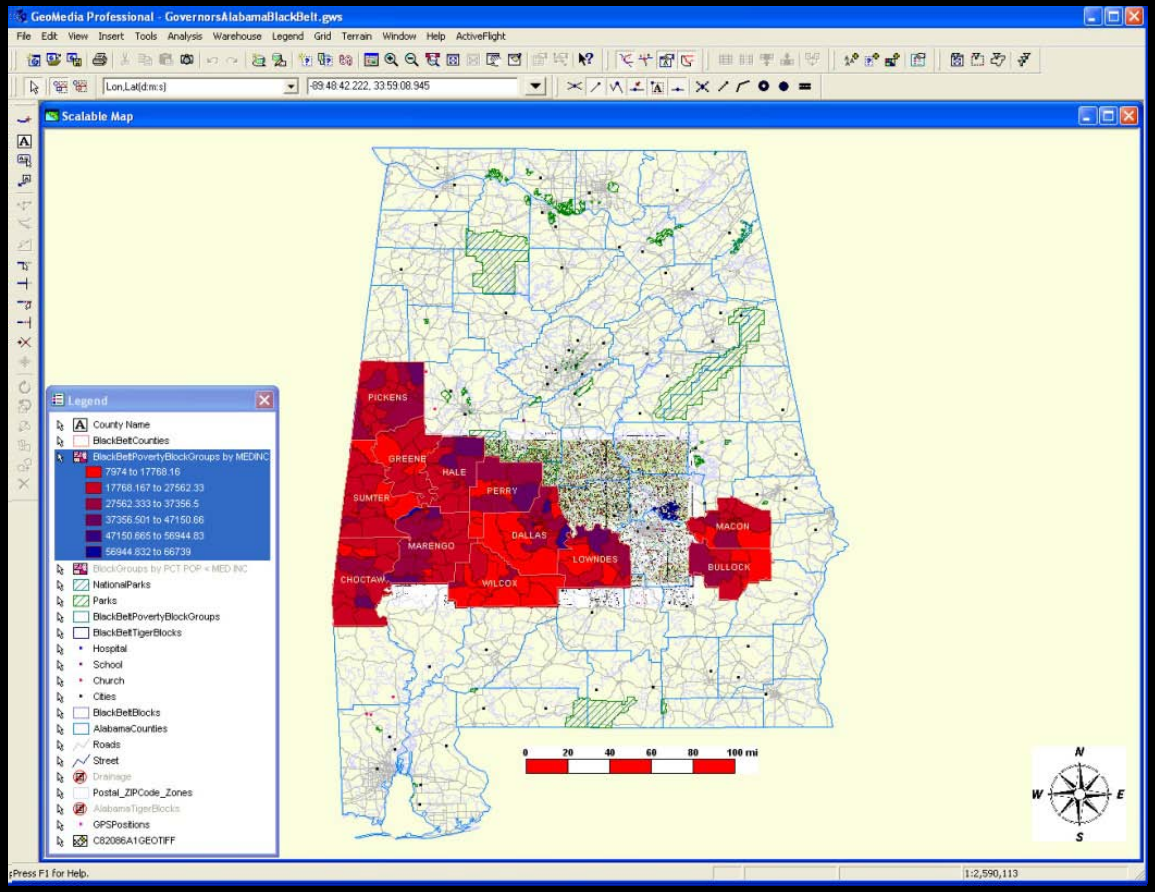


Per-capita Income by Census Tract



Target Areas by Zip Code

An Application in GIS: Population Economics



1. Block Group Percent of Population Below Poverty (Highest Percentage Below = RED)
2. Block Group Median Income (Lowest Median Income = RED)

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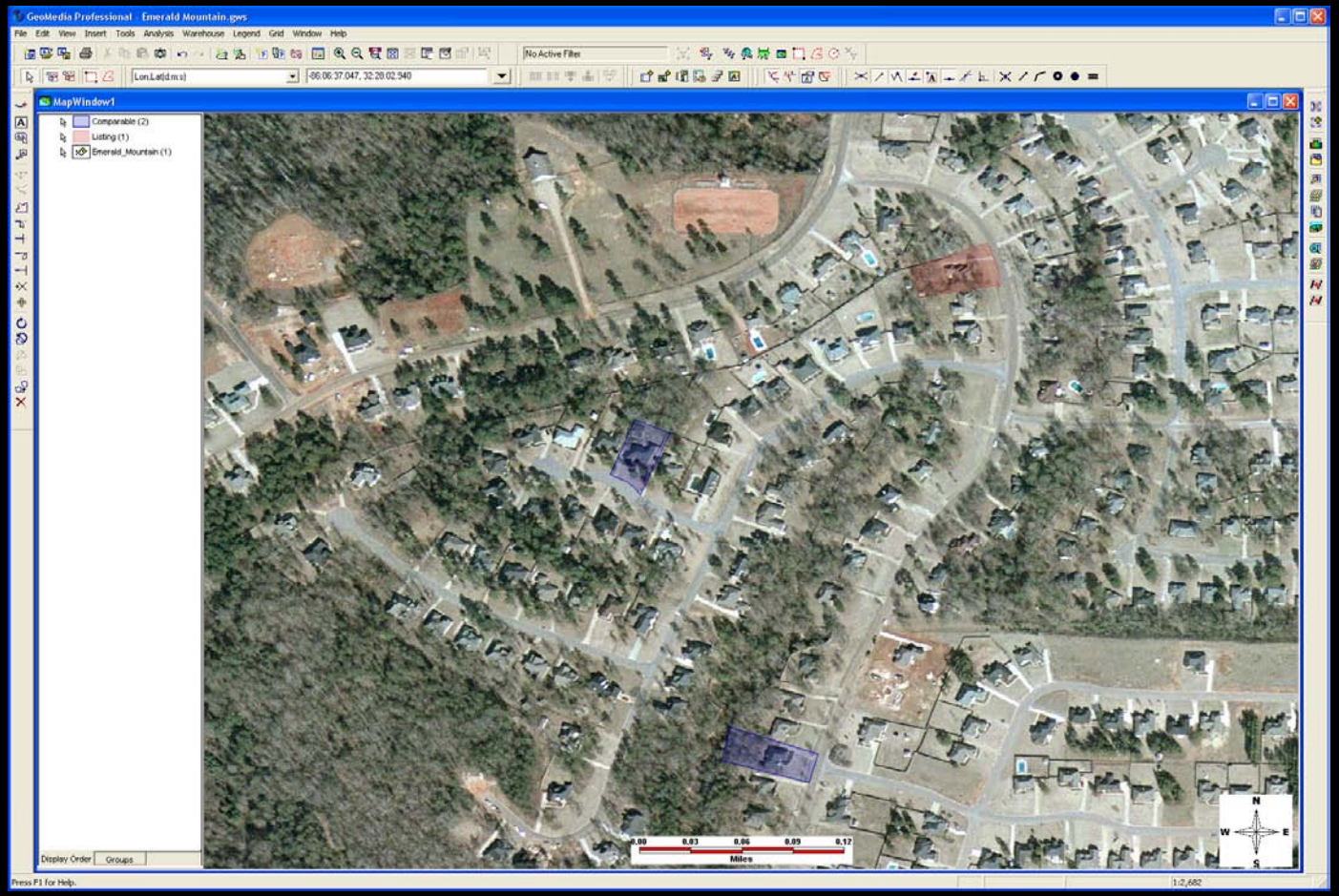
An Application in GIS: Real Estate



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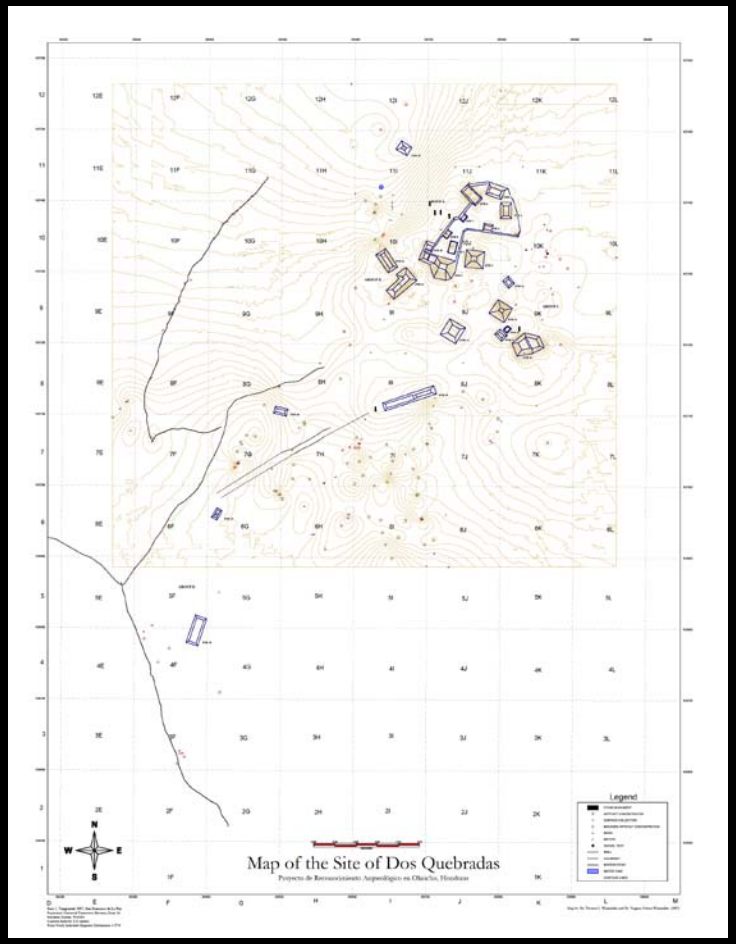
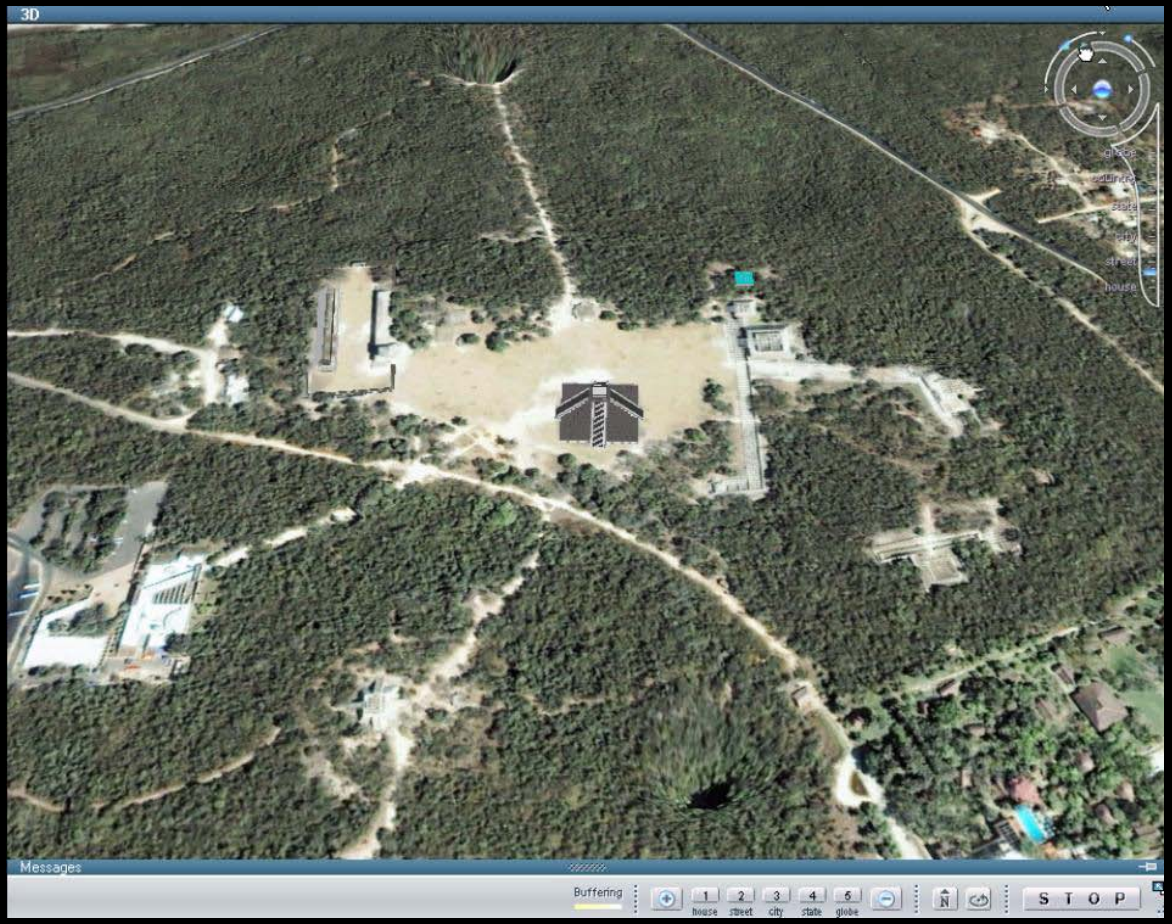
An Application in GIS: Mapping Operations



Laser Total Station

Trimble GPS

An Application in GIS: 3D Visualizations



Chichén Itza, Yucatan, Mexico

Options

- Certificate in Geographic Information Systems (Five Courses – non-matriculating)
- Bachelor of Liberal Arts - Geographic Information Systems (120 hours)
- Master of Liberal Arts - Geographic Information Systems (30 hours Thesis)
- The Course of Study
- Catalog Listings
  - GEOG 3940 / 6340 Cartography with Lab (4CR)
  - GEOG 3950 / 6350 Introduction to Geographic Information Systems with Lab (4CR)
  - GEOG 4950 / 6450 Advanced Geographic Information Systems with Lab (4CR). Prerequisites - GEOG 3940, GEOG 3950
  - GEOG 4960 / 6460 Remote Sensing and GPS Applications in Geographic Information Systems with Lab (4CR). Prerequisites - GEOG 3950 and GEOG 4950
  - GEOG 4990 / 6990 Applied Research in Geographic Information Science and Systems with Lab (4CR). Prerequisites - GEOG 3940, GEOG 3950, GEOG 4950, and GEOG 4960
- Software
  - Intergraph GeoMedia Professional 6.1, GeoMedia Grid 6.1
  - ESRI ArcGIS 9.3, ArcPad 7.2
  - Auto Desk Map 3D
  - Surfer 9.0
  - Trimble Pathfinder Office
  - ENVI 4.6.1