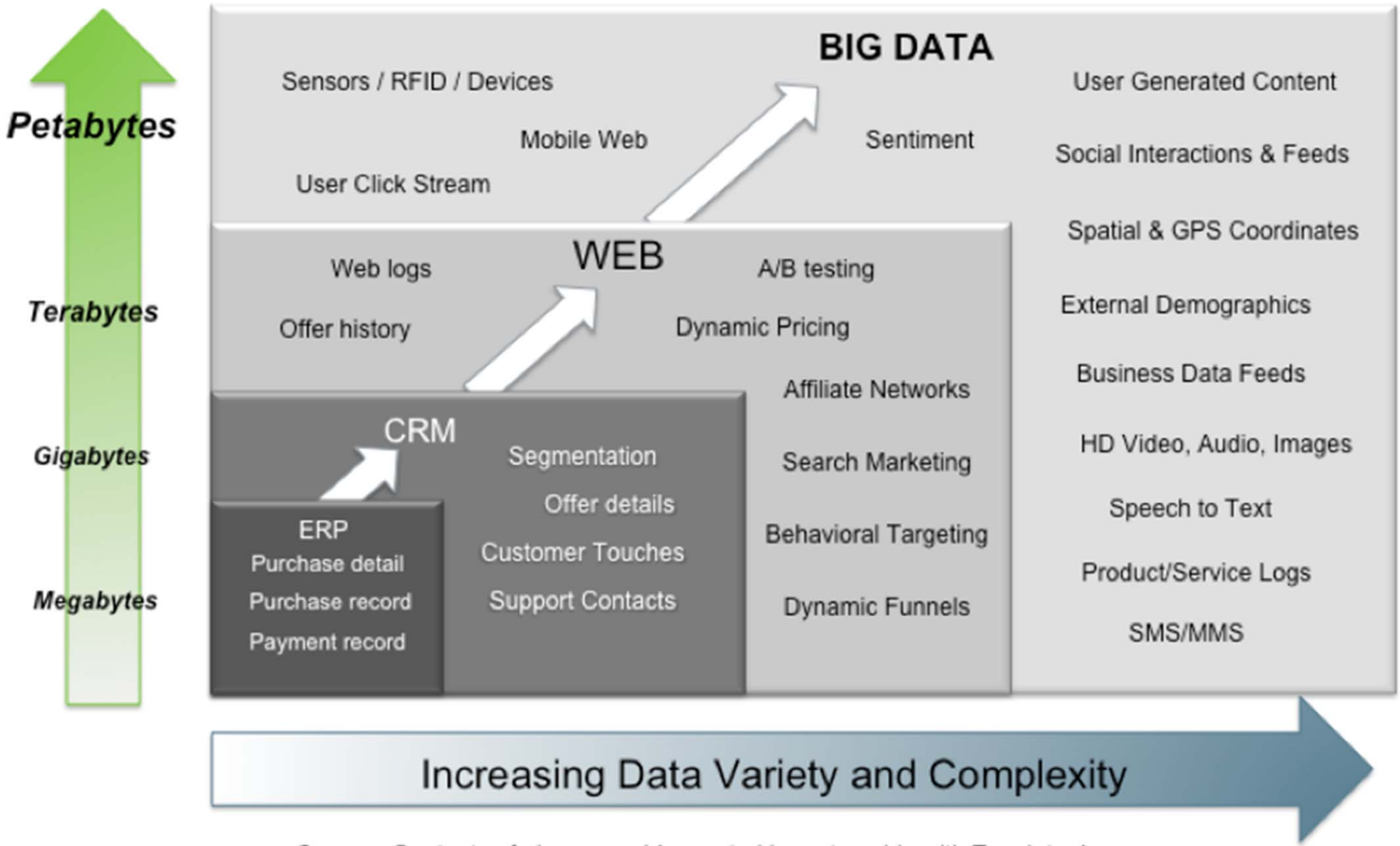
Geographical Information System (GIS)

Dr. Tarendra Lakhankar

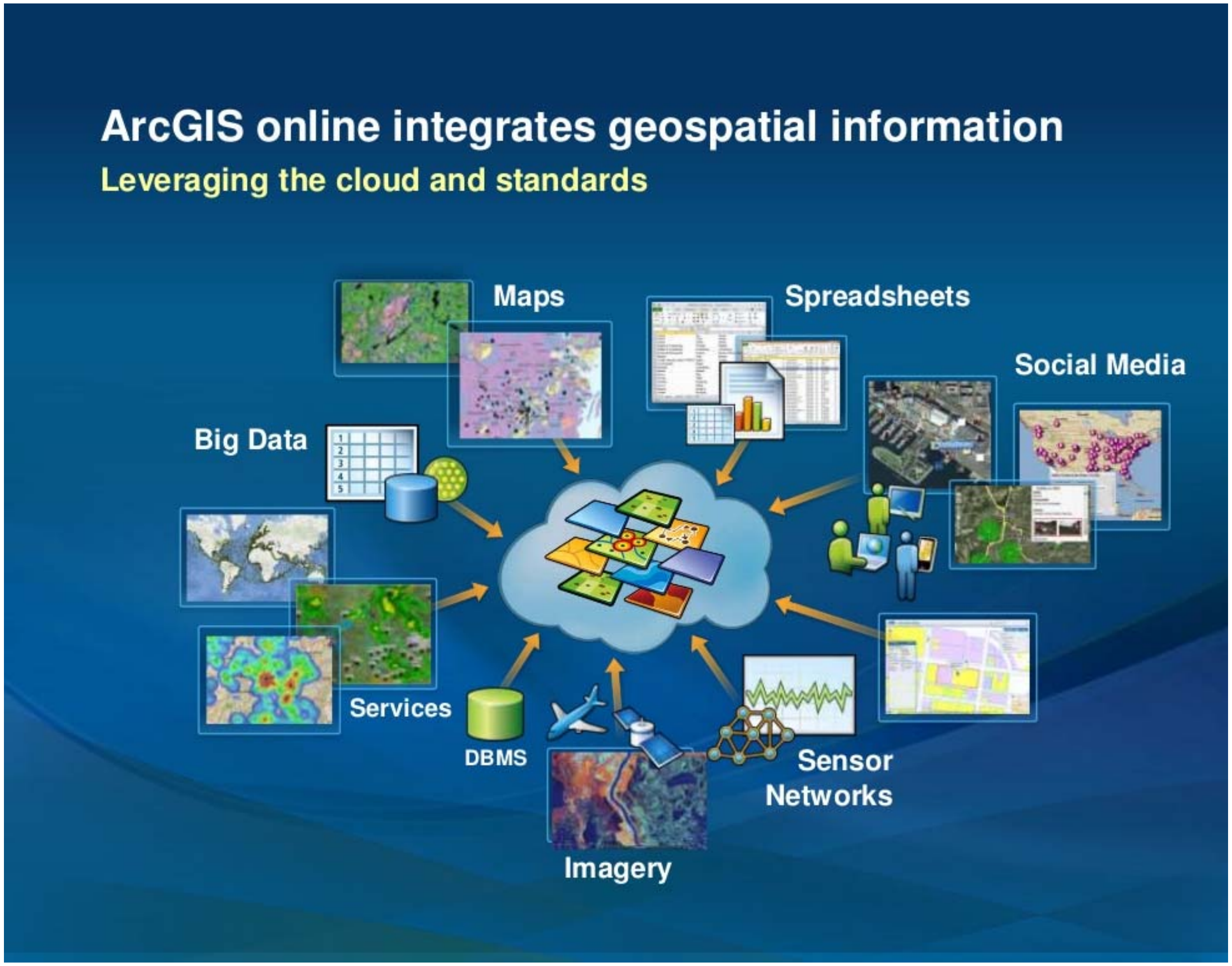
Data…. Big Data?

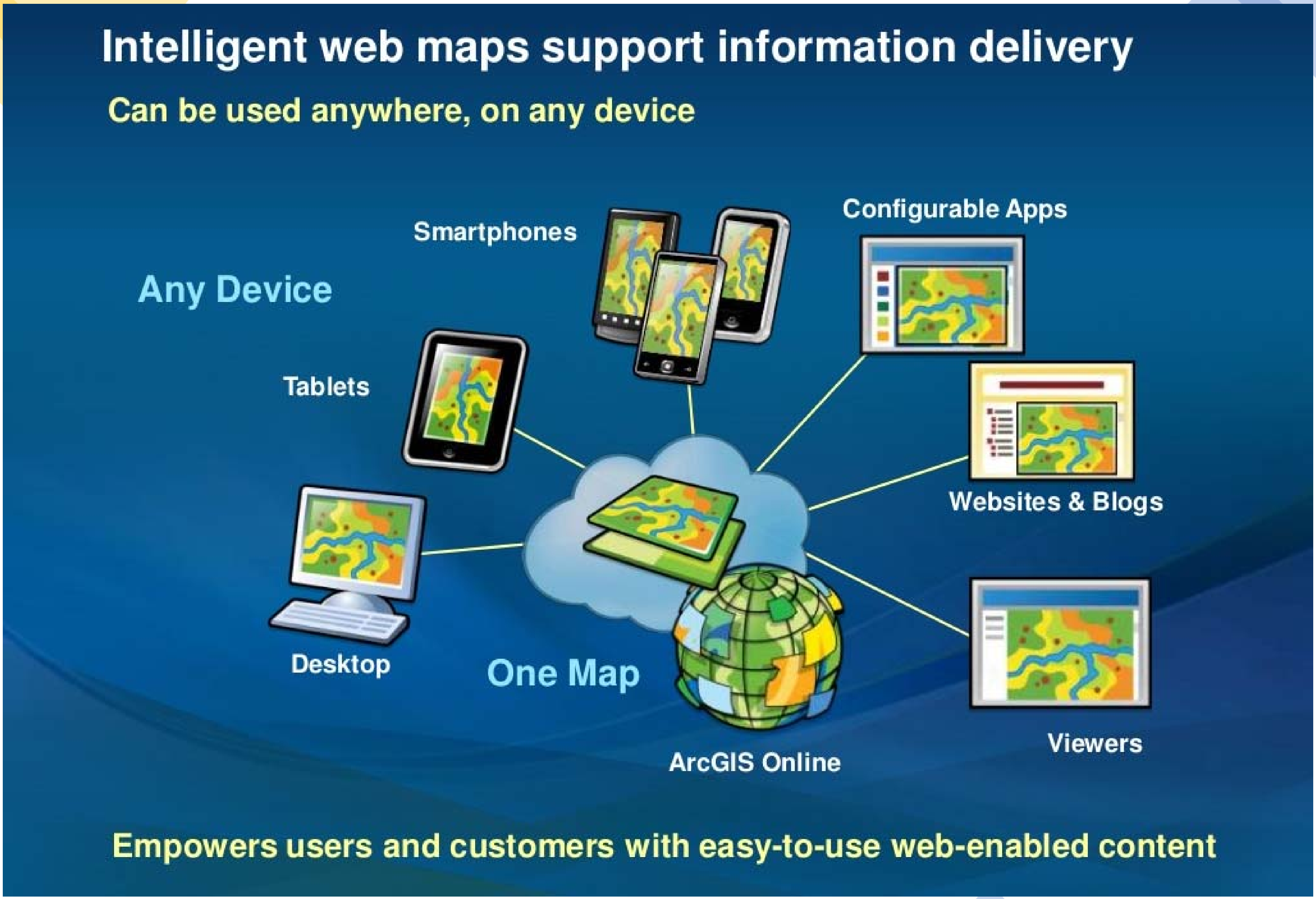
Big Data = Transactions + Interactions + Observations



Source: *Contents of above graphic created in partnership with Teradata, Inc.*

Source: ESRI


ArcGIS online integrates geospatial information
Leveraging the cloud and standards
Maps
Spreadsheets
Social Media
Big Data
Services
DBMS
Imagery
Sensor Networks


Intelligent web maps support information delivery
Can be used anywhere, on any device
Any Device
Smartphones
Configurable Apps
Tablets
Websites & Blogs
Desktop
One Map
ArcGIS Online
Viewers
Empowers users and customers with easy-to-use web-enabled content

Source: ESRI

Authoritative content

- **Basemaps**
- **Reference layers**
- **Demographic**
- **Templates**

The foundation and building blocks for making maps and apps

Source: ESRI

What is GIS?

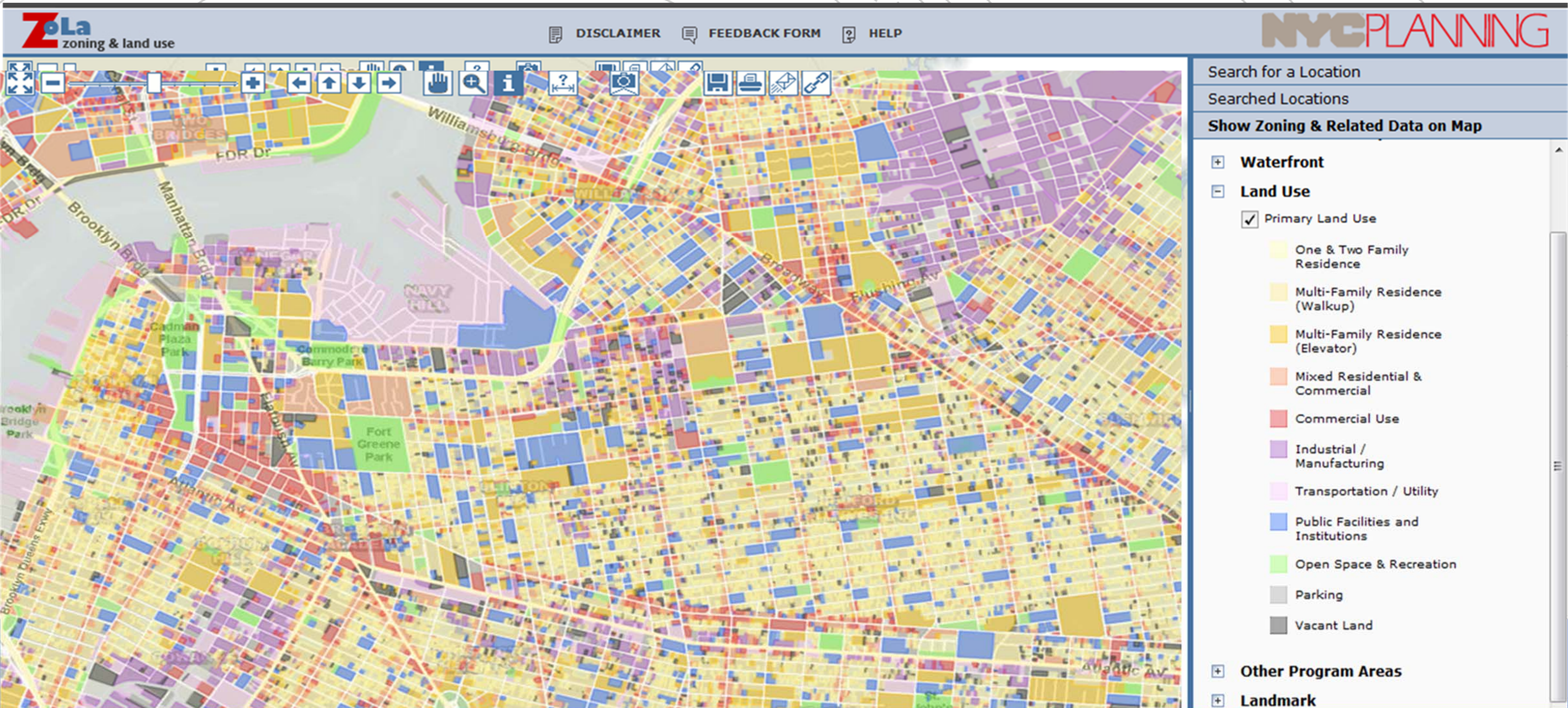
It's **Geographic Information System**

So, GIS deals with any data with geographical coordinates?

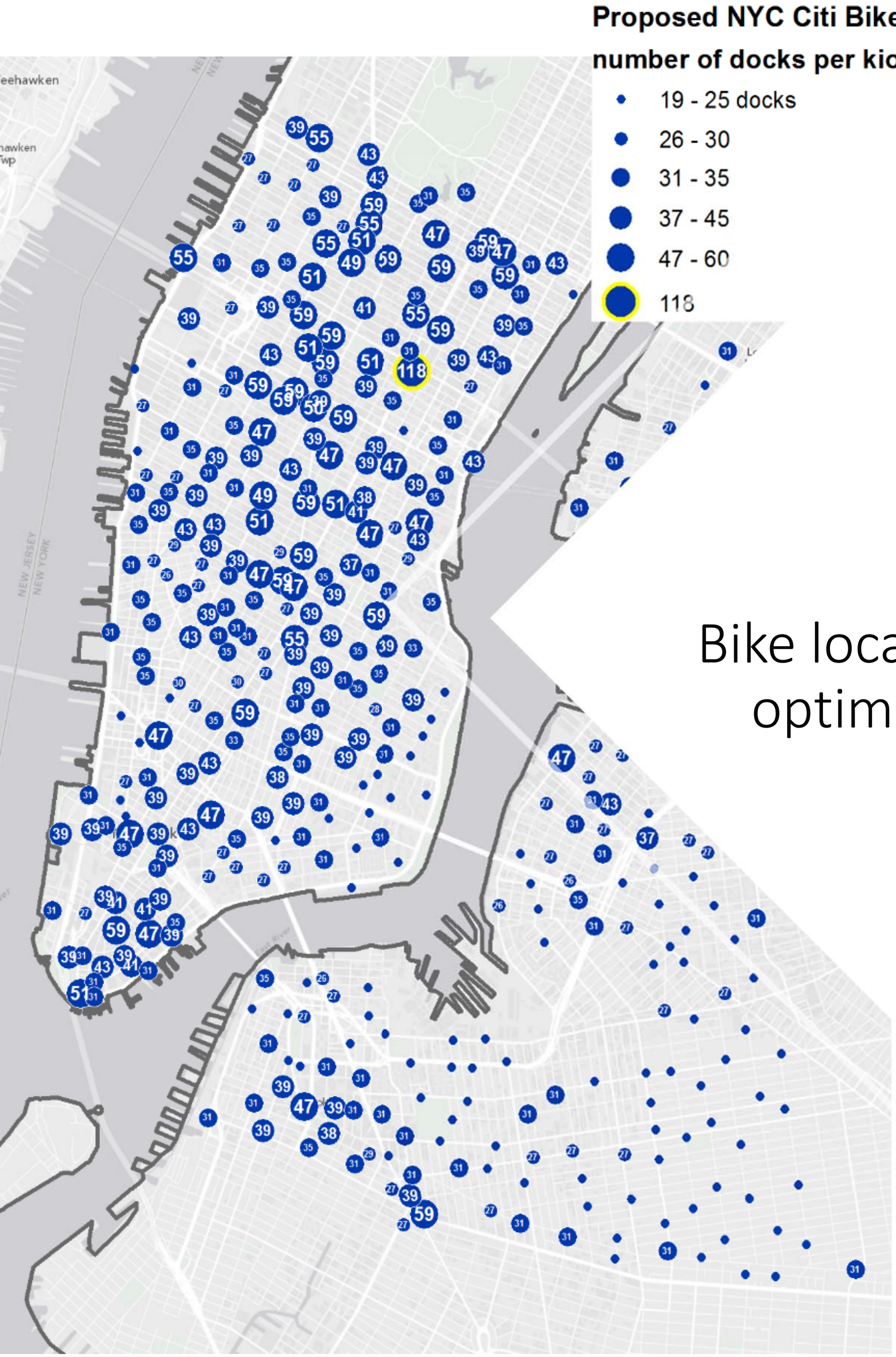
Examples of Applied GIS

- **Urban Planning, Management & Policy**
  - Zoning, subdivision planning
  - Land acquisition
  - Economic development
  - Code enforcement
  - Housing renovation programs
  - Emergency response
  - Crime analysis
  - Tax assessment
- **Environmental Sciences**
  - Monitoring environmental risk
  - Modeling stormwater runoff
  - Management of watersheds, floodplains, wetlands, forests, aquifers
  - Environmental Impact Analysis
  - Hazardous or toxic facility siting
  - Groundwater modeling and contamination tracking
- **Political Science**
  - Redistricting
  - Analysis of election results
  - Predictive modeling
- **Civil Engineering/Utility**
  - Locating underground facilities
  - Designing alignment for freeways, transit
  - Coordination of infrastructure maintenance
- **Business**
  - Demographic Analysis
  - Market Penetration/ Share Analysis
  - Site Selection
- **Education Administration**
  - Attendance Area Maintenance
  - Enrollment Projections
  - School Bus Routing
- **Real Estate**
  - Neighborhood land prices
  - Traffic Impact Analysis
  - Determination of Highest and Best Use
- **Health Care**
  - Epidemiology
  - Needs Analysis
  - Service Inventory

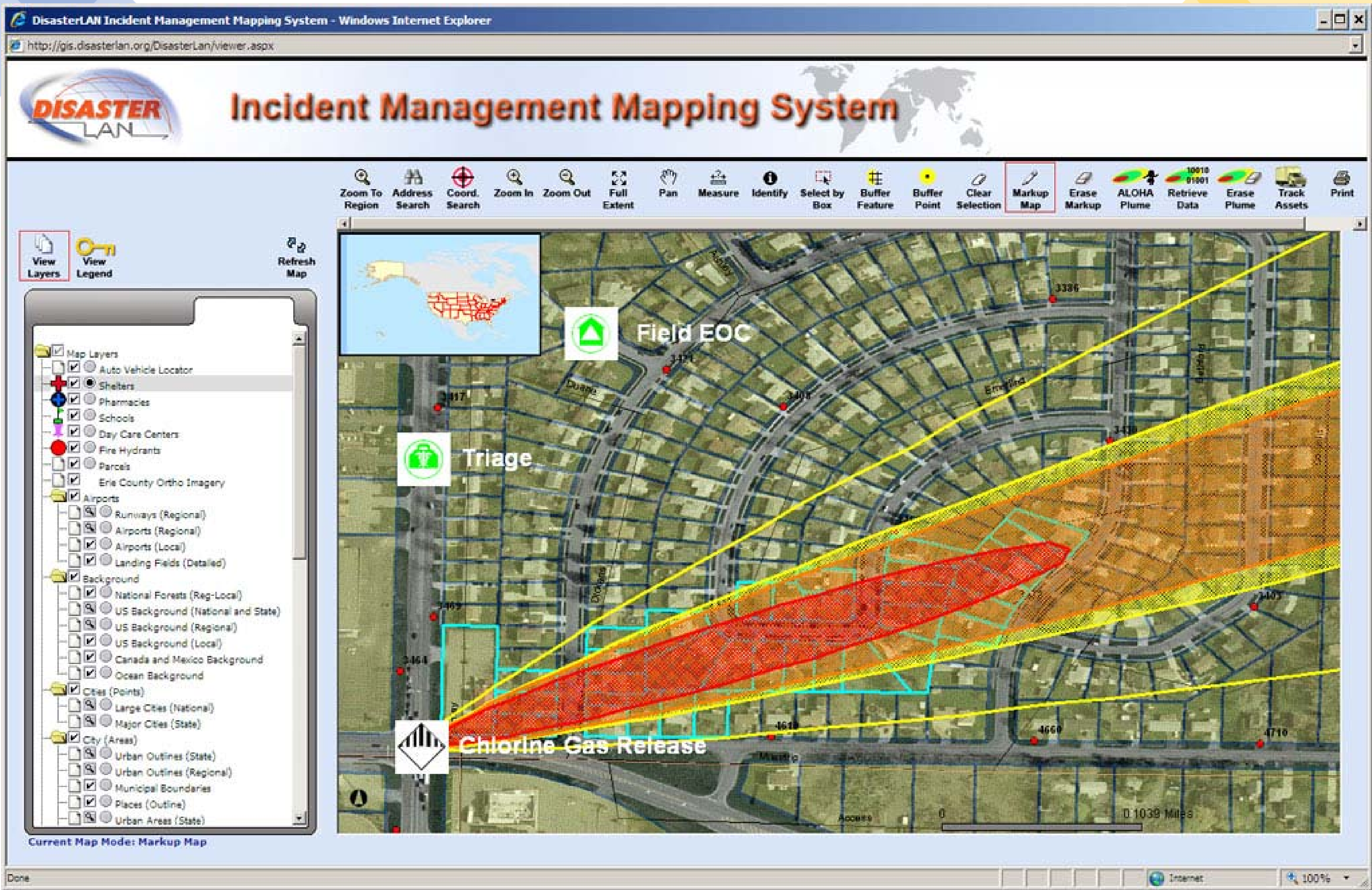
Urban planning and management



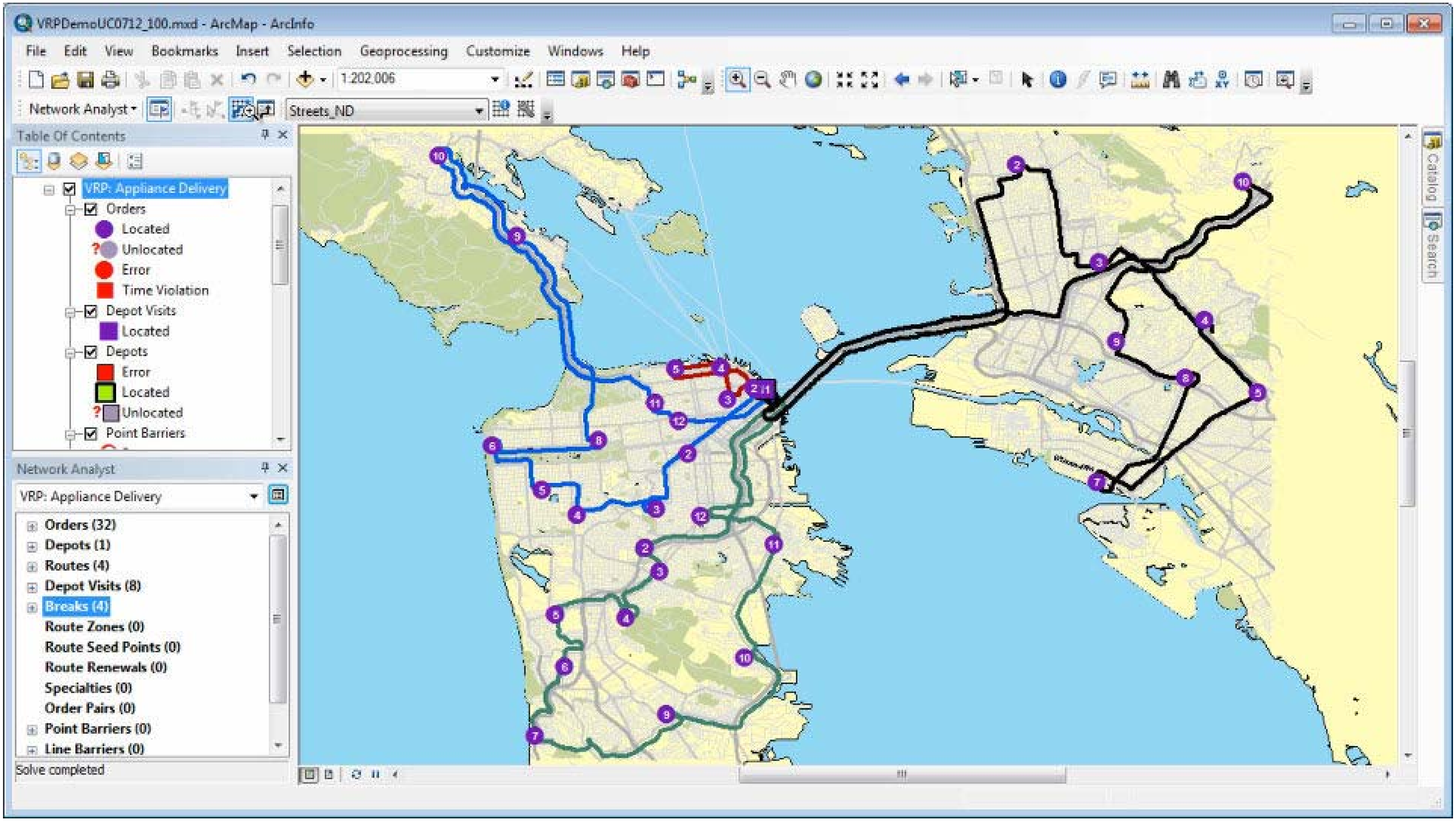
Landuse data



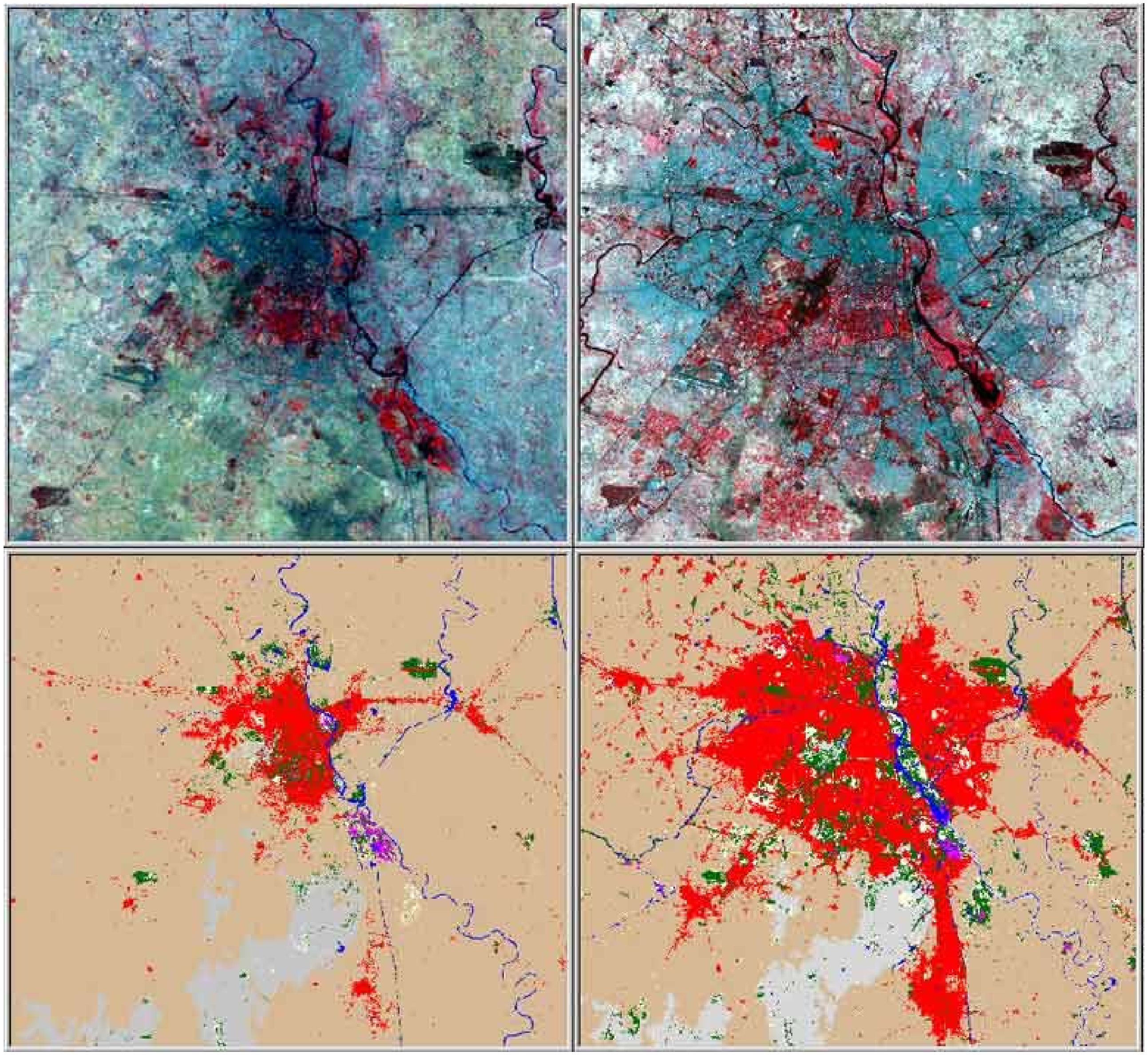
Bike location and optimization


DisasterLAN Incident Management Mapping System - Windows Internet Explorer
http://gis.disasterlan.org/DisasterLan/viewer.aspx
DISASTER LAN
Incident Management Mapping System
Zoom To Region
Address Search
Coord. Search
Zoom In
Zoom Out
Full Extent
Pan
Measure
Identify
Select by Box
Buffer Feature
Buffer Point
Clear Selection
Markup Map
Erase Markup
ALOHA Plume
Retrieve Data
Erase Plume
Track Assets
Print
View Layers
View Legend
Refresh Map
Map Layers
Auto Vehicle Locator
Shelters
Pharmacies
Schools
Day Care Centers
Fire Hydrants
Parcels
Erie County Ortho Imagery
Airports
Runways (Regional)
Airports (Regional)
Airports (Local)
Landing Fields (Detailed)
Background
National Forests (Reg-Local)
US Background (National and State)
US Background (Regional)
US Background (Local)
Canada and Mexico Background
Ocean Background
Cities (Points)
Large Cities (National)
Major Cities (State)
City (Areas)
Urban Outlines (State)
Urban Outlines (Regional)
Municipal Boundaries
Places (Outline)
Urban Areas (State)
Current Map Mode: Markup Map
Field EOC
Triage
Chlorine Gas Release
0.1039 Miles
Done
Internet
100%

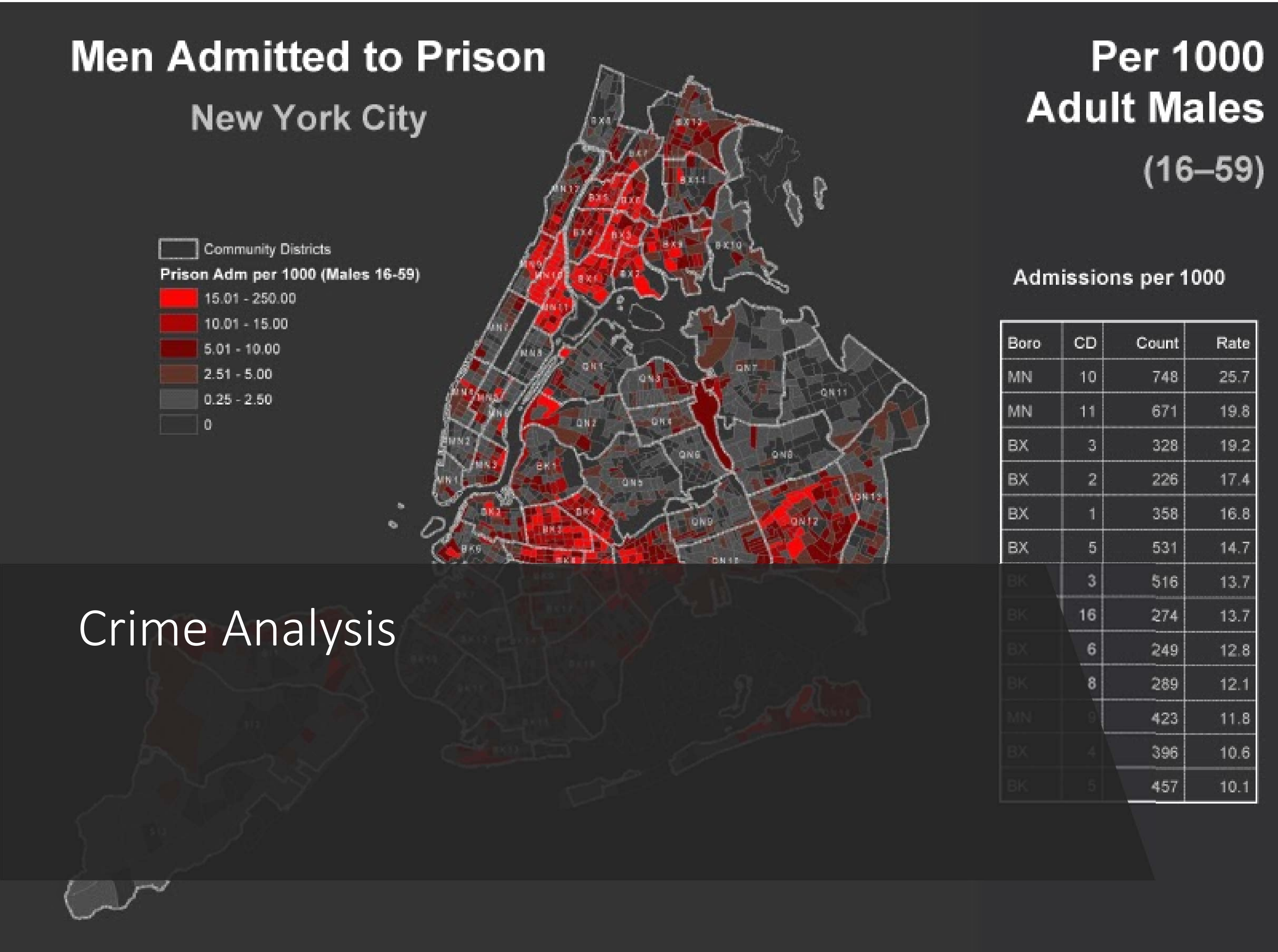
Road Network Analysis



Mapping and Compare Urban Growth



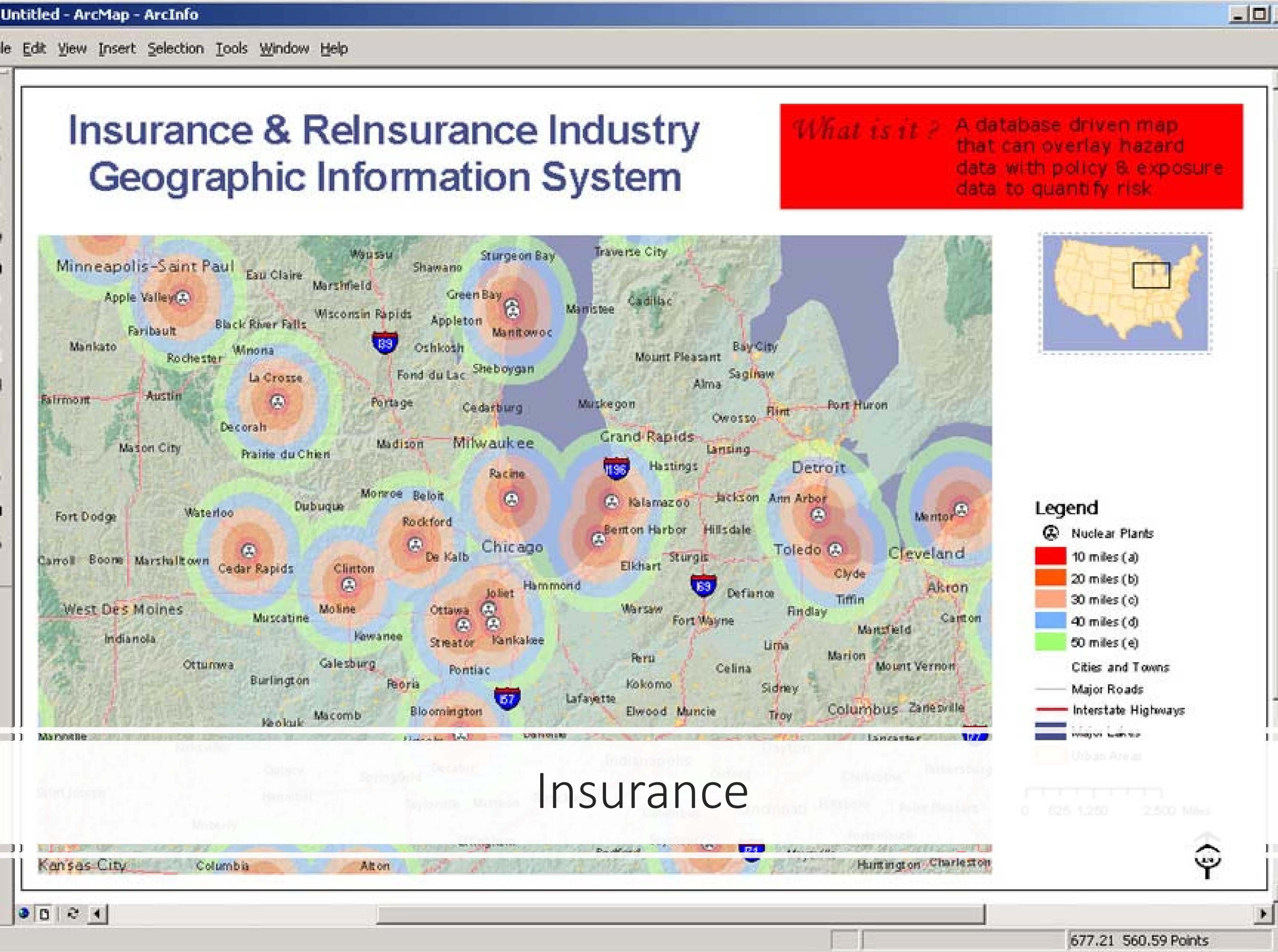
911 - GIS Integration



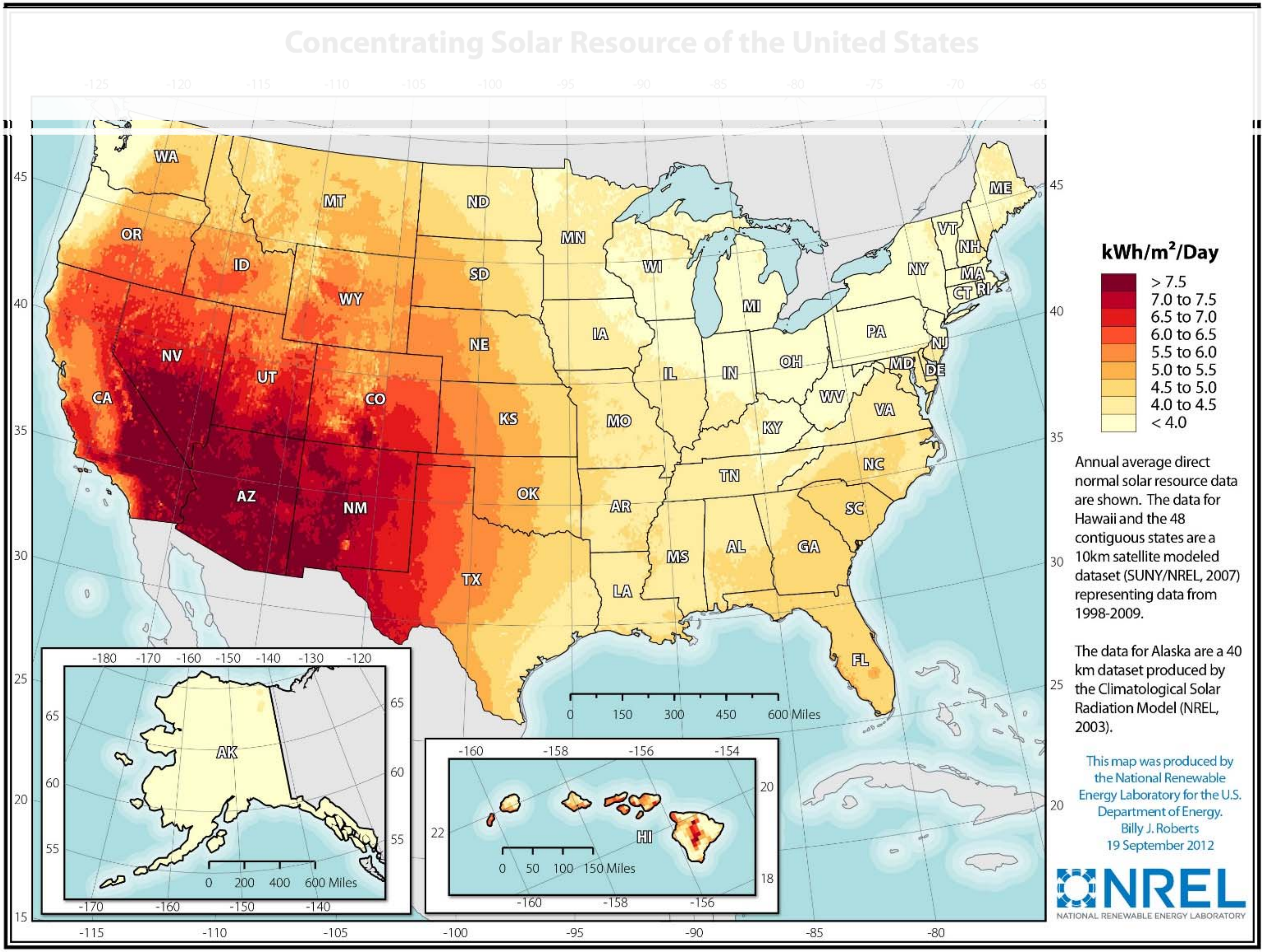
Boro	CD	Count	Rate
MN	10	748	25.7
MN	11	671	19.8
BX	3	328	19.2
BX	2	226	17.4
BX	1	358	16.8
BX	5	531	14.7
BK	3	516	13.7
BK	16	274	13.7
BX	6	249	12.8
BK	8	289	12.1
MN	9	423	11.8
BX	4	396	10.6
BK	5	457	10.1

Crime Analysis

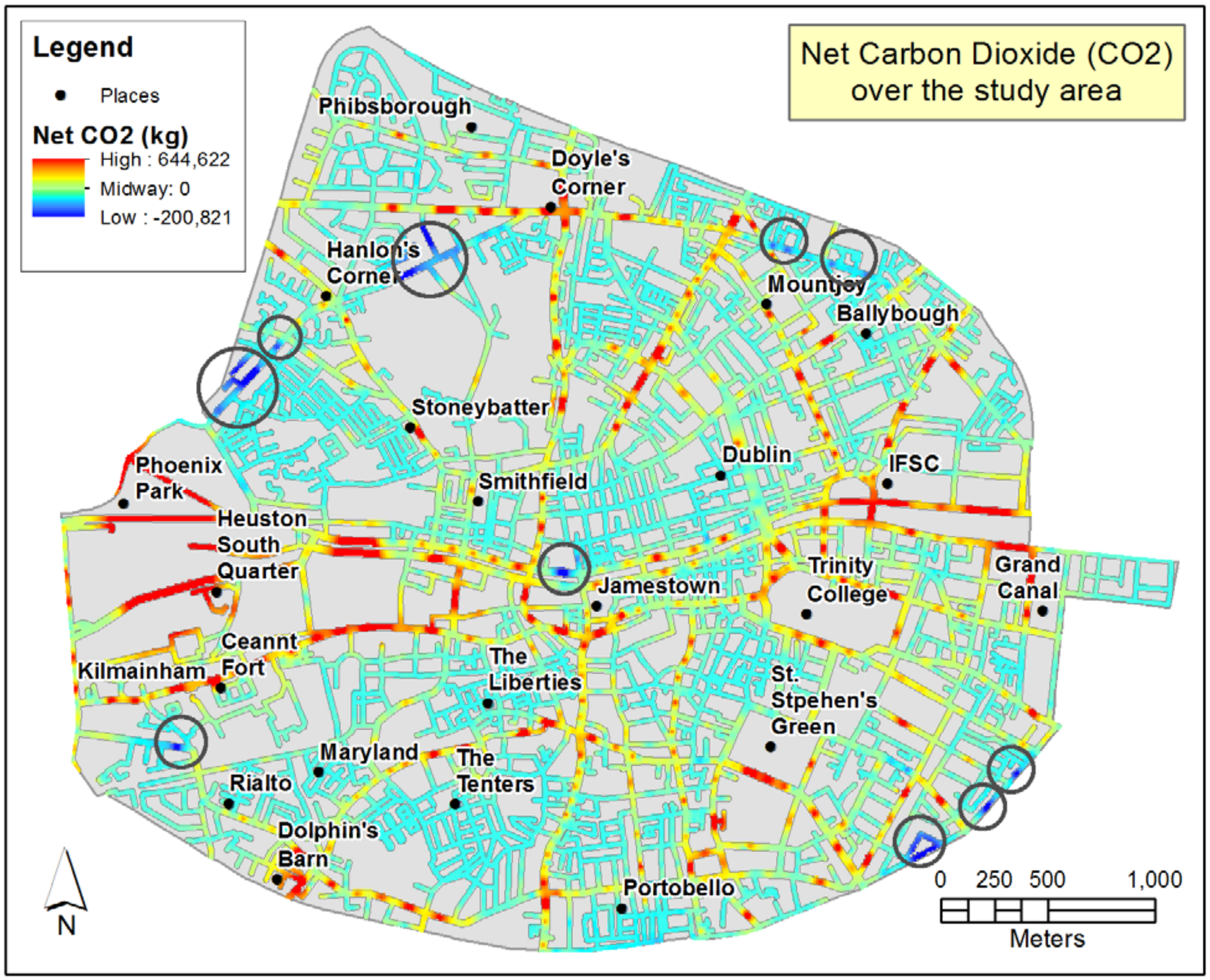
Environmental applications


Untitled - ArcMap - ArcInfo
le Edit View Insert Selection Tools Window Help
Insurance & ReInsurance Industry
Geographic Information System
What is it ? A database driven map that can overlay hazard data with policy & exposure data to quantify risk
Minneapolis-Saint Paul
Milwaukee
Chicago
Grand Rapids
Detroit
Toledo
Cleveland
Akron
West Des Moines
Columbus
Kansas City
Legend
Nuclear Plants
10 miles (a)
20 miles (b)
30 miles (c)
40 miles (d)
50 miles (e)
Cities and Towns
Major Roads
Interstate Highways
677.21 560.59 Points

Insurance

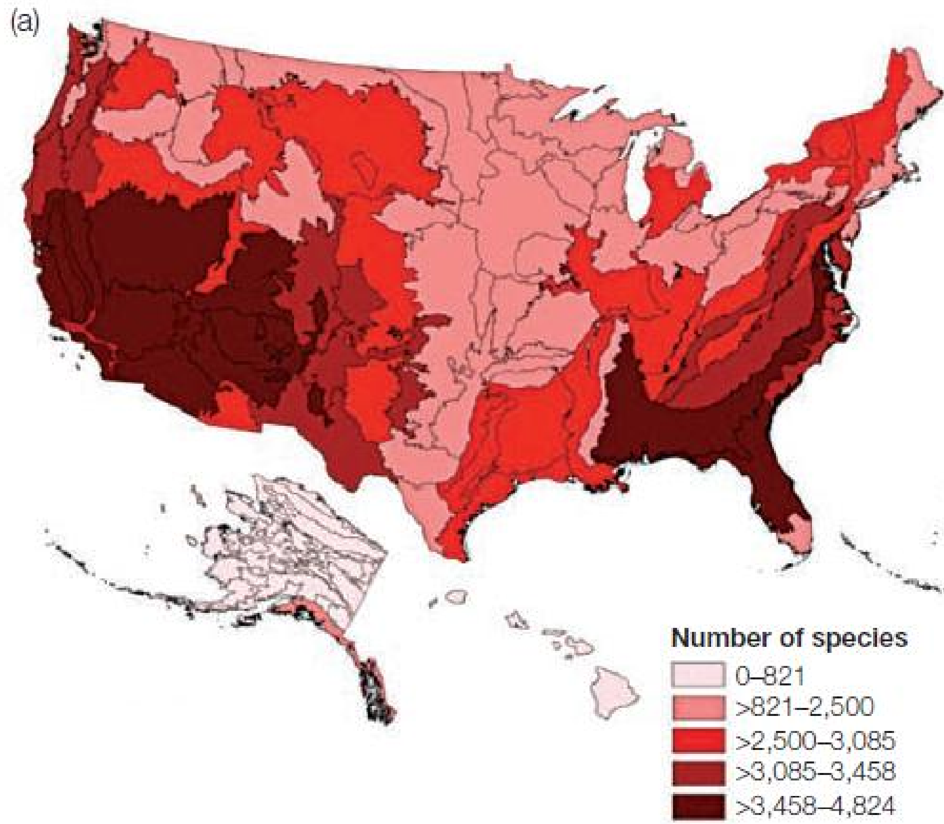

Concentrating Solar Resource of the United States
WA
OR
CA
NV
ID
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MI
IN
OH
KY
TN
MS
AL
GA
FL
SC
NC
VA
WV
PA
NY
MD
DE
NJ
CT
RI
MA
VT
NH
ME
AK
HI
0 150 300 450 600 Miles
0 200 400 600 Miles
0 50 100 150 Miles
kWh/m²/Day
> 7.5
7.0 to 7.5
6.5 to 7.0
6.0 to 6.5
5.5 to 6.0
5.0 to 5.5
4.5 to 5.0
4.0 to 4.5
< 4.0
Annual average direct normal solar resource data are shown. The data for Hawaii and the 48 contiguous states are a 10km satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2009.
The data for Alaska are a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
Billy J. Roberts
19 September 2012
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

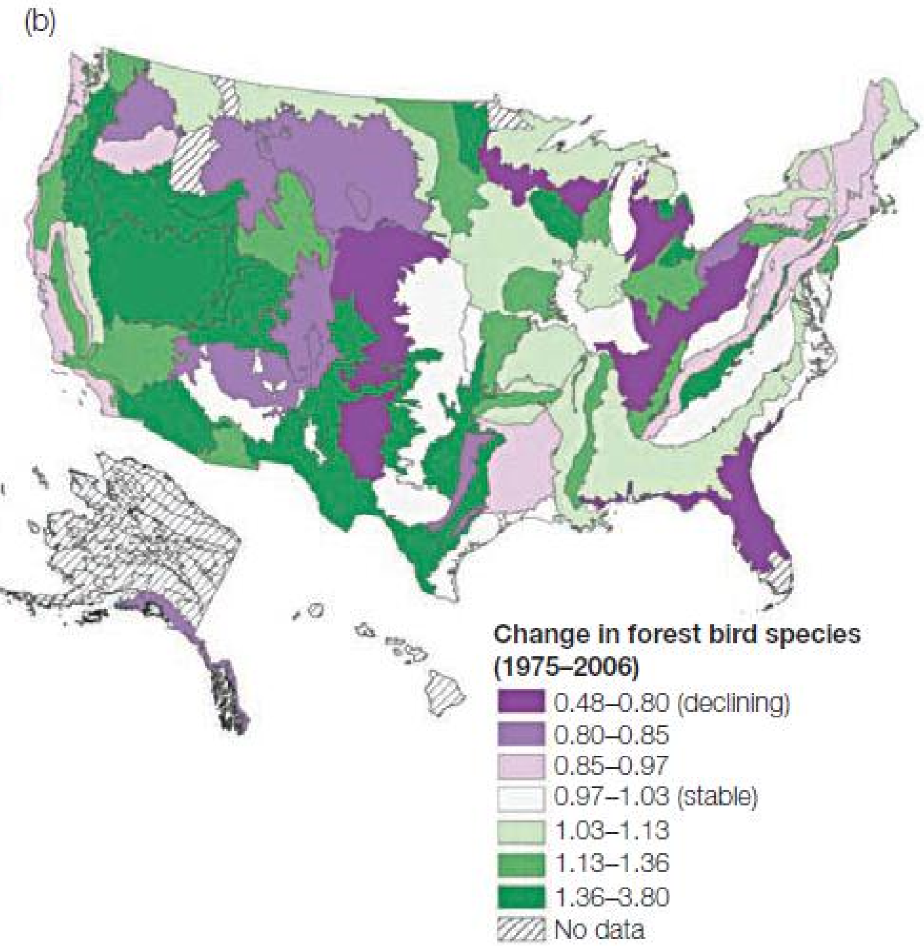
Environmental Analysis: CO2 and Traffic Congestion



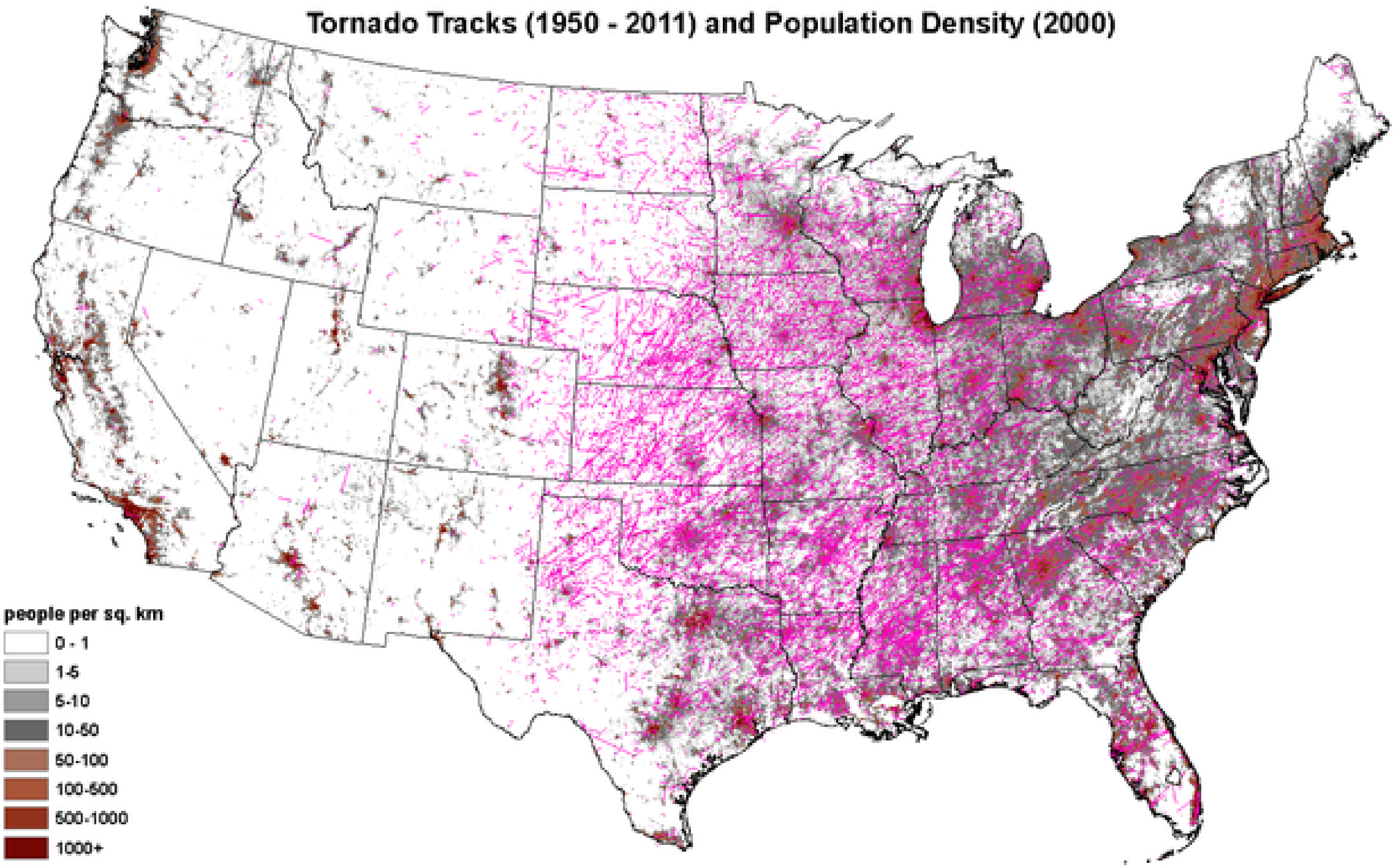
Biodiversity

Figure 4-1. (a) The number of vascular plants and vertebrate species associated with forest habitats (2009, data provided by NatureServe). (b) The estimated change in the number of forest-associated bird species from 1975 to 2006 (data provided by U.S. Geological Survey). Change is measured by the ratio of the 2006 species count estimate to the 1975 species count estimate. Values greater than 1 indicate increasing species counts (green shades); values less than 1 indicate declining species counts (purple shades).

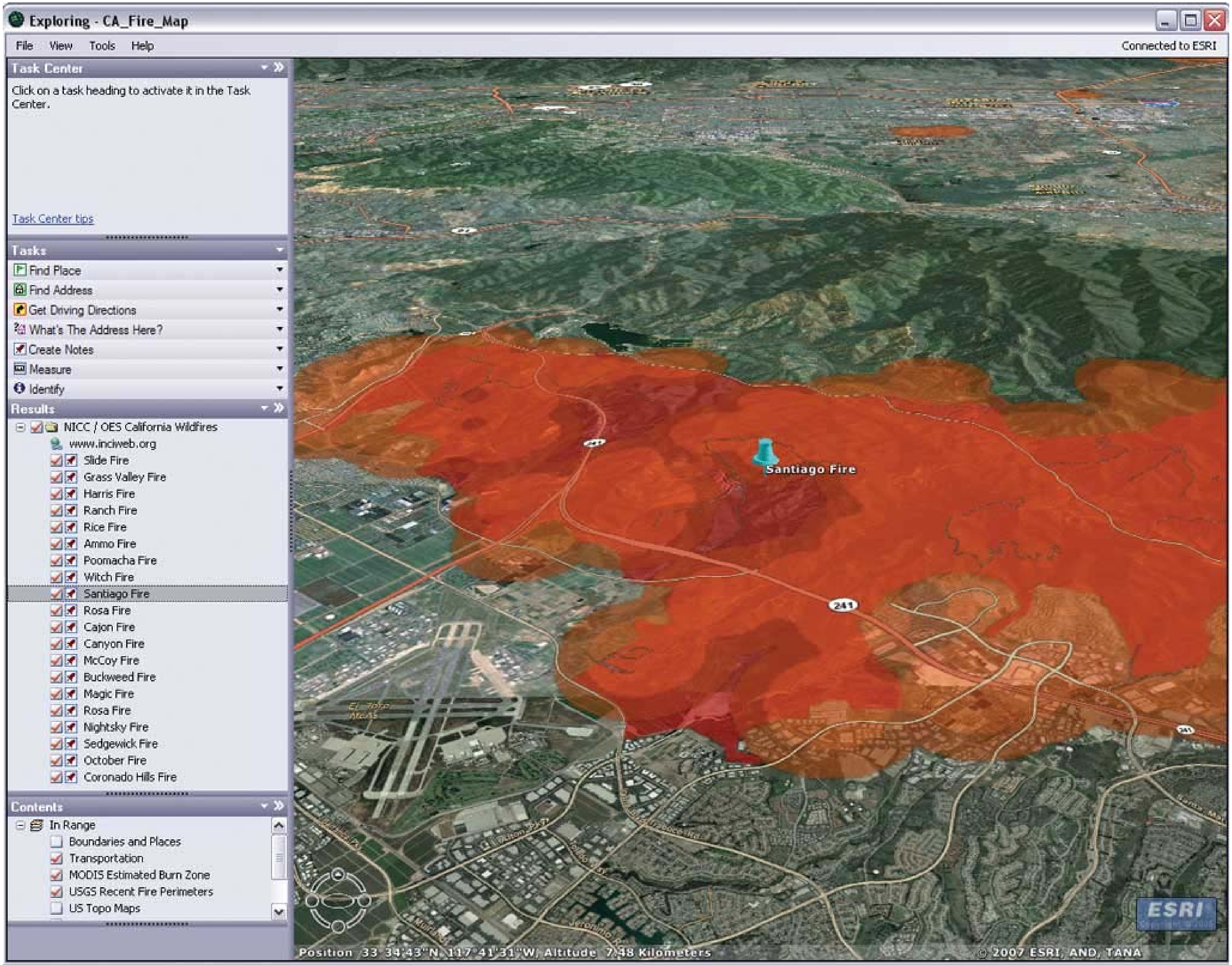




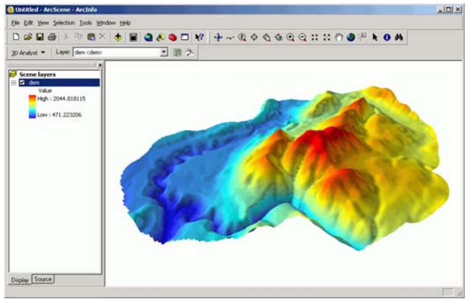
Tornado Tracking

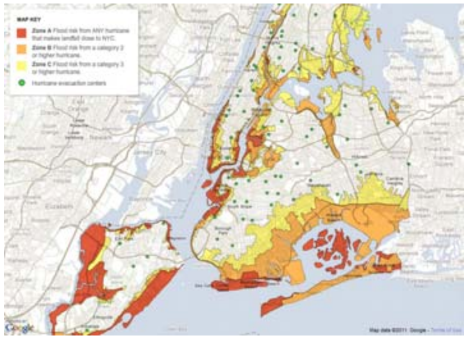


Forest Fire

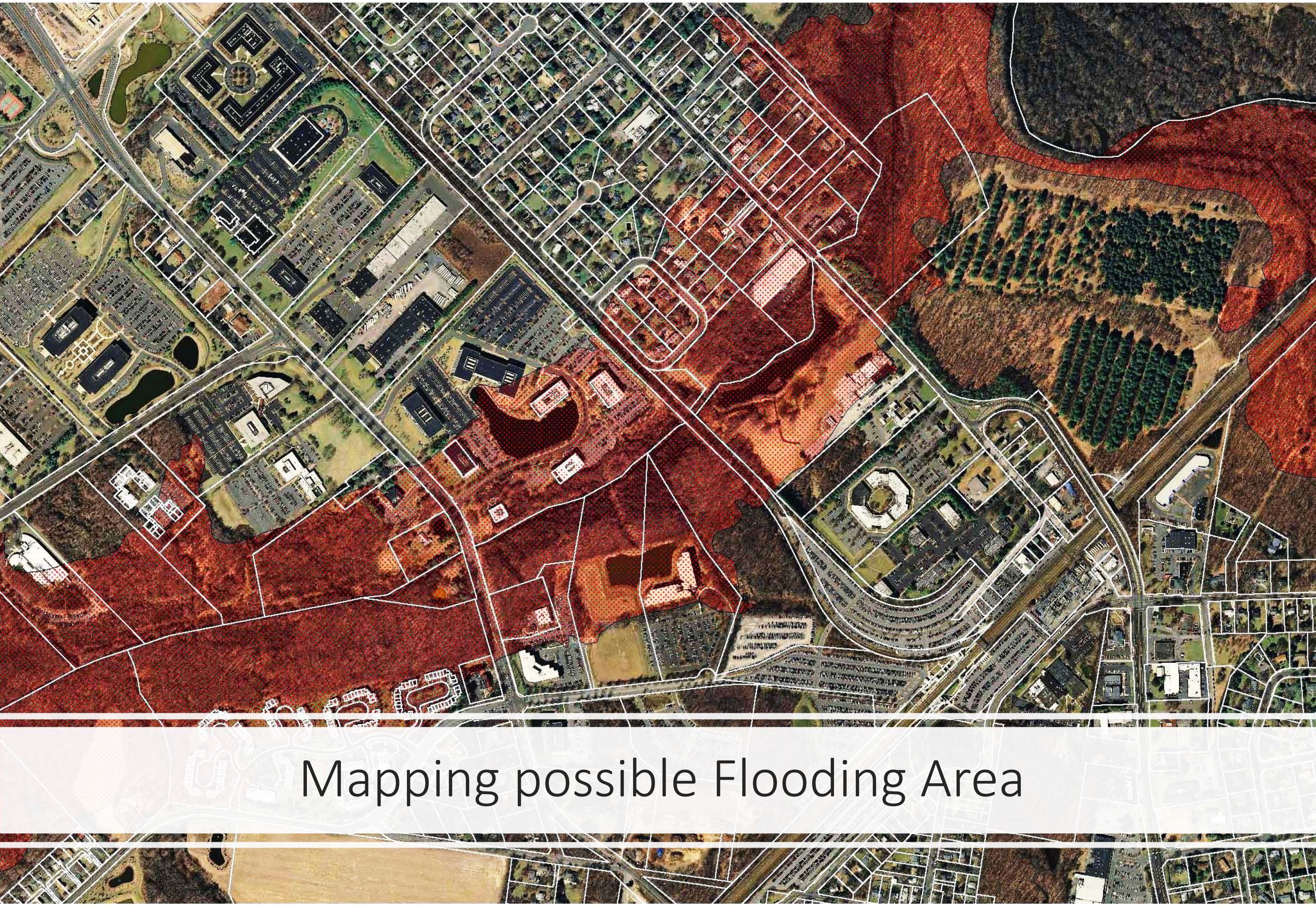


Exploring - CA_Fire_Map
File View Tools Help
Connected to ESRI
Task Center
Click on a task heading to activate it in the Task Center.
Task Center tips
Tasks
Find Place
Find Address
Get Driving Directions
What's The Address Here?
Create Notes
Measure
Identify
Results
NICC / OES California Wildfires
www.inciweb.org
Slide Fire
Grass Valley Fire
Harris Fire
Ranch Fire
Rice Fire
Ammo Fire
Poomacha Fire
Witch Fire
Santiago Fire
Rosa Fire
Cajon Fire
Canyon Fire
McCoy Fire
Buckweed Fire
Magic Fire
Rosa Fire
Nightsky Fire
Sedgewick Fire
October Fire
Coronado Hills Fire
Contents
In Range
Boundaries and Places
Transportation
MODIS Estimated Burn Zone
USGS Recent Fire Perimeters
US Topo Maps
Santiago Fire
241
ESRI
Position 33°34'43"N, 117°41'31"W, Altitude 7.48 Kilometers
© 2007 ESRI, AND, TANA

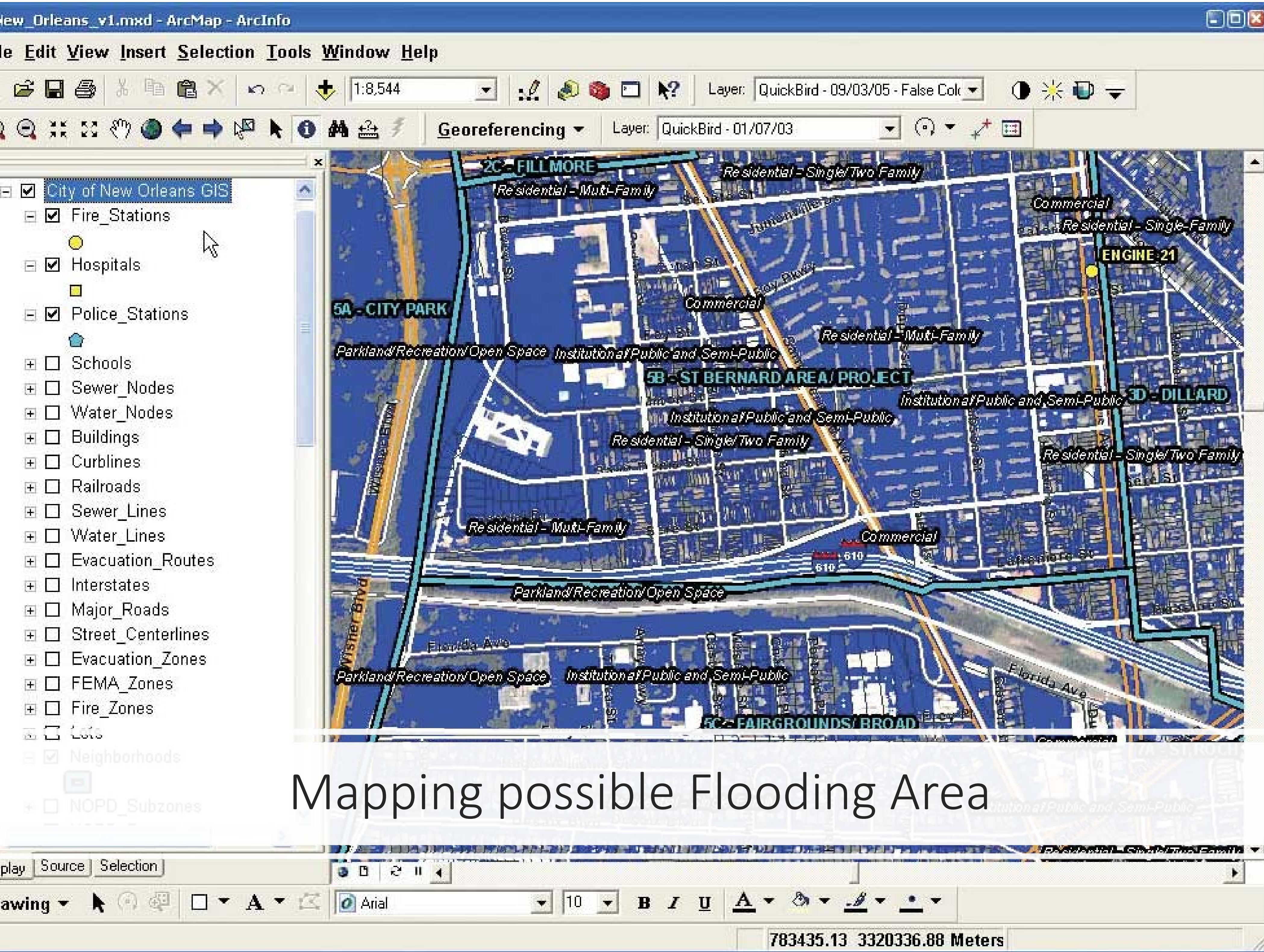




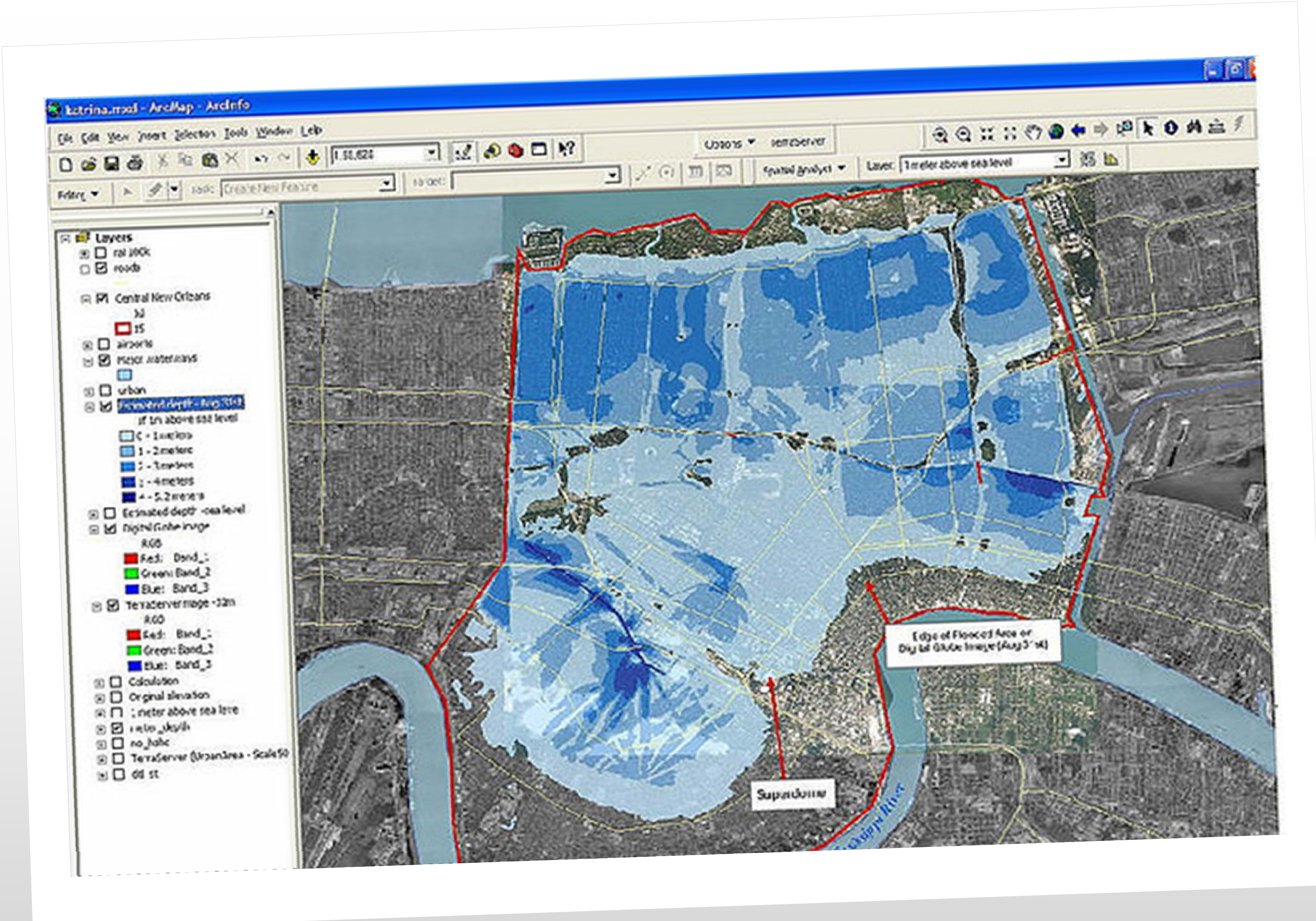
Mapping possible Flooding Area 3D



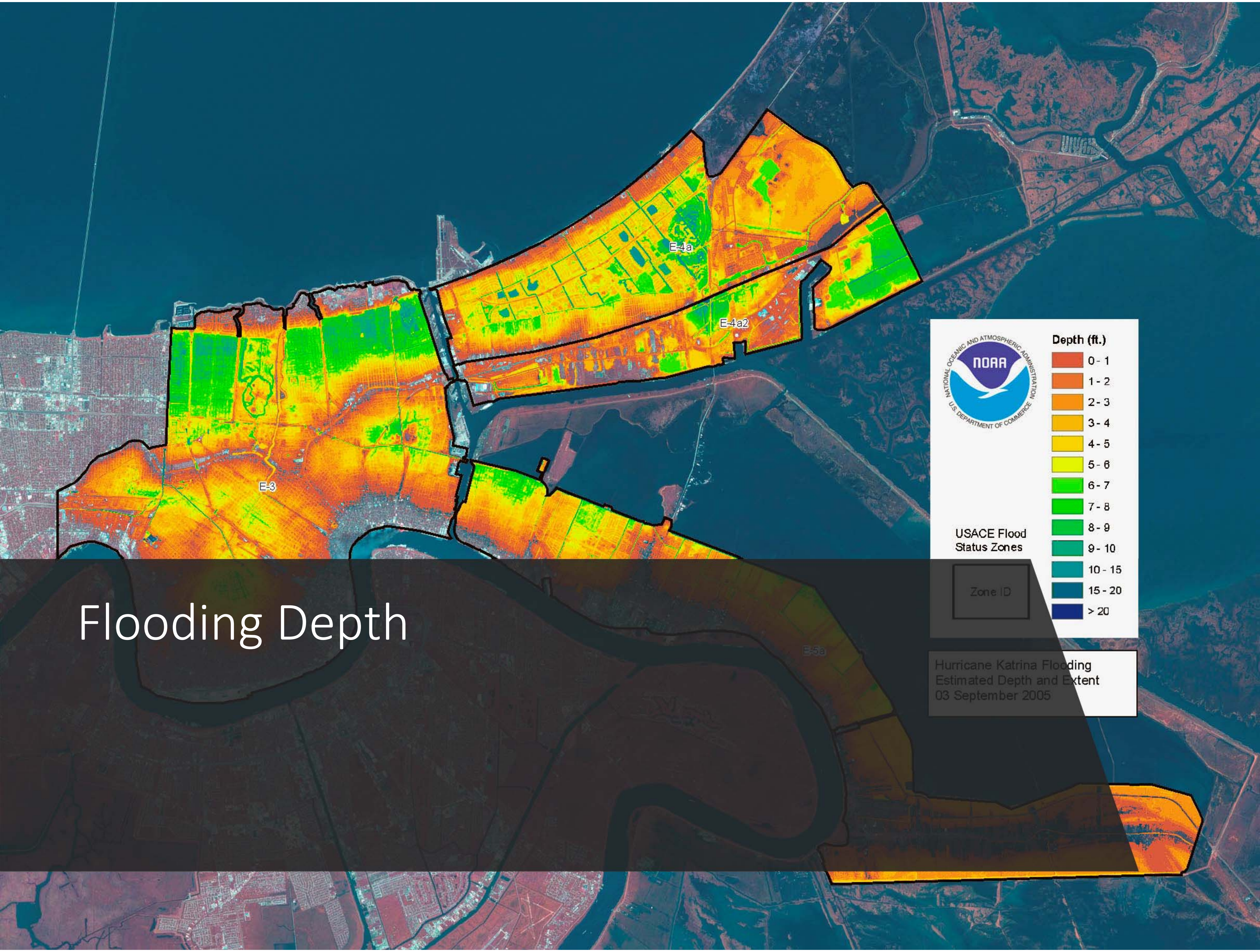
Mapping possible Flooding Area

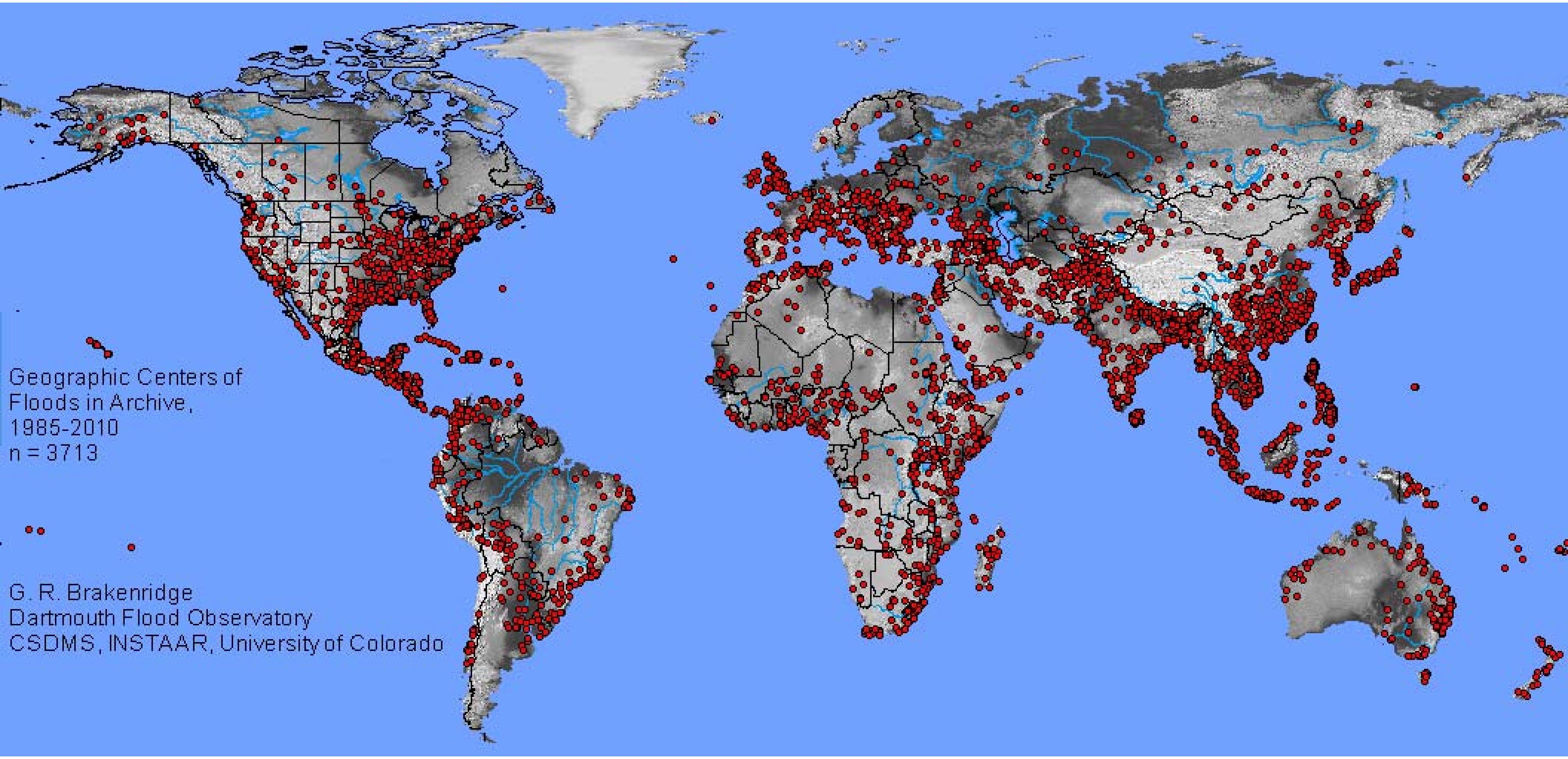


Mapping possible Flooding Area


Layers
Central New Orleans
airports
urban
RGB
Superdome

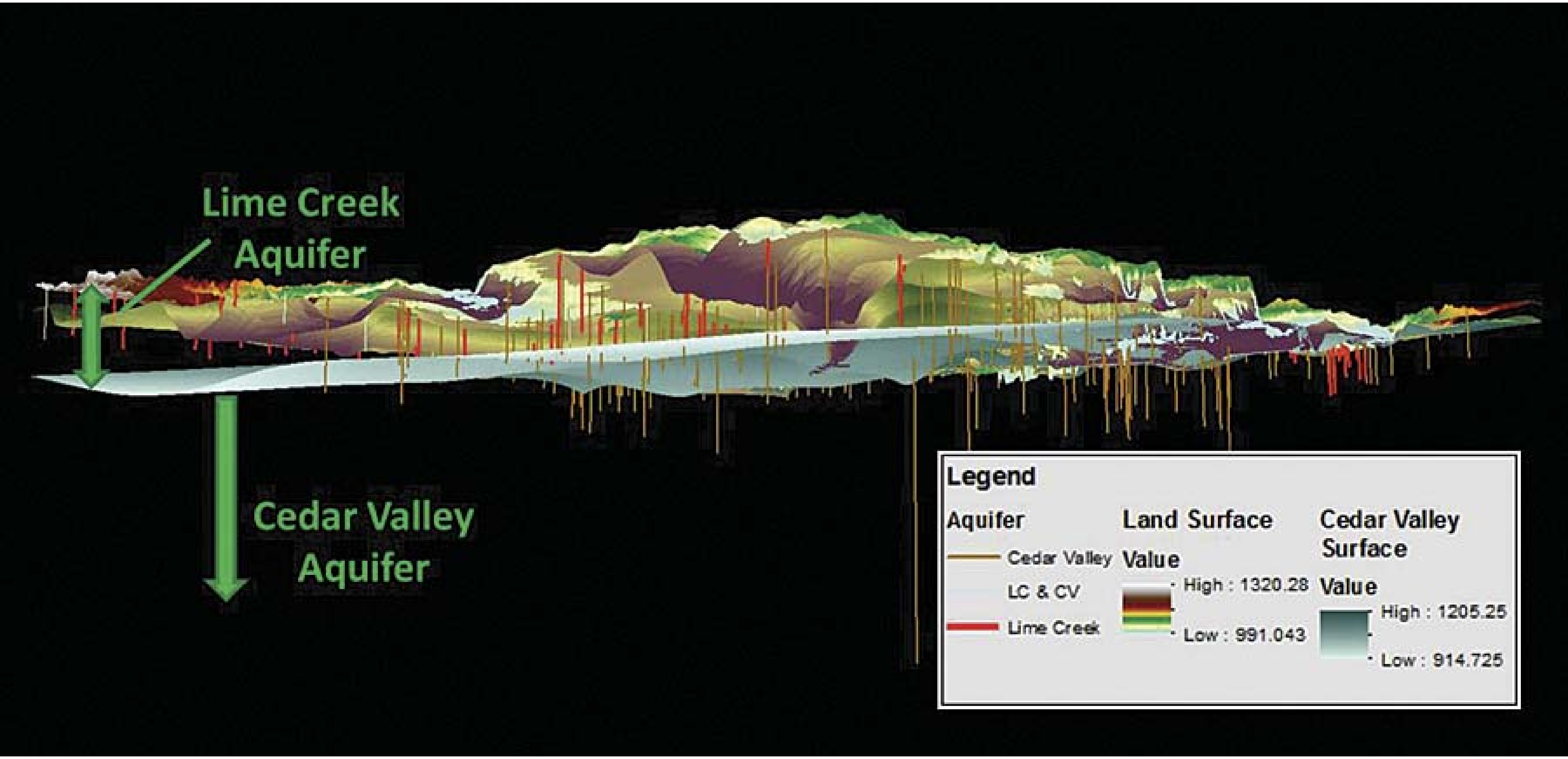
Flooding Depth



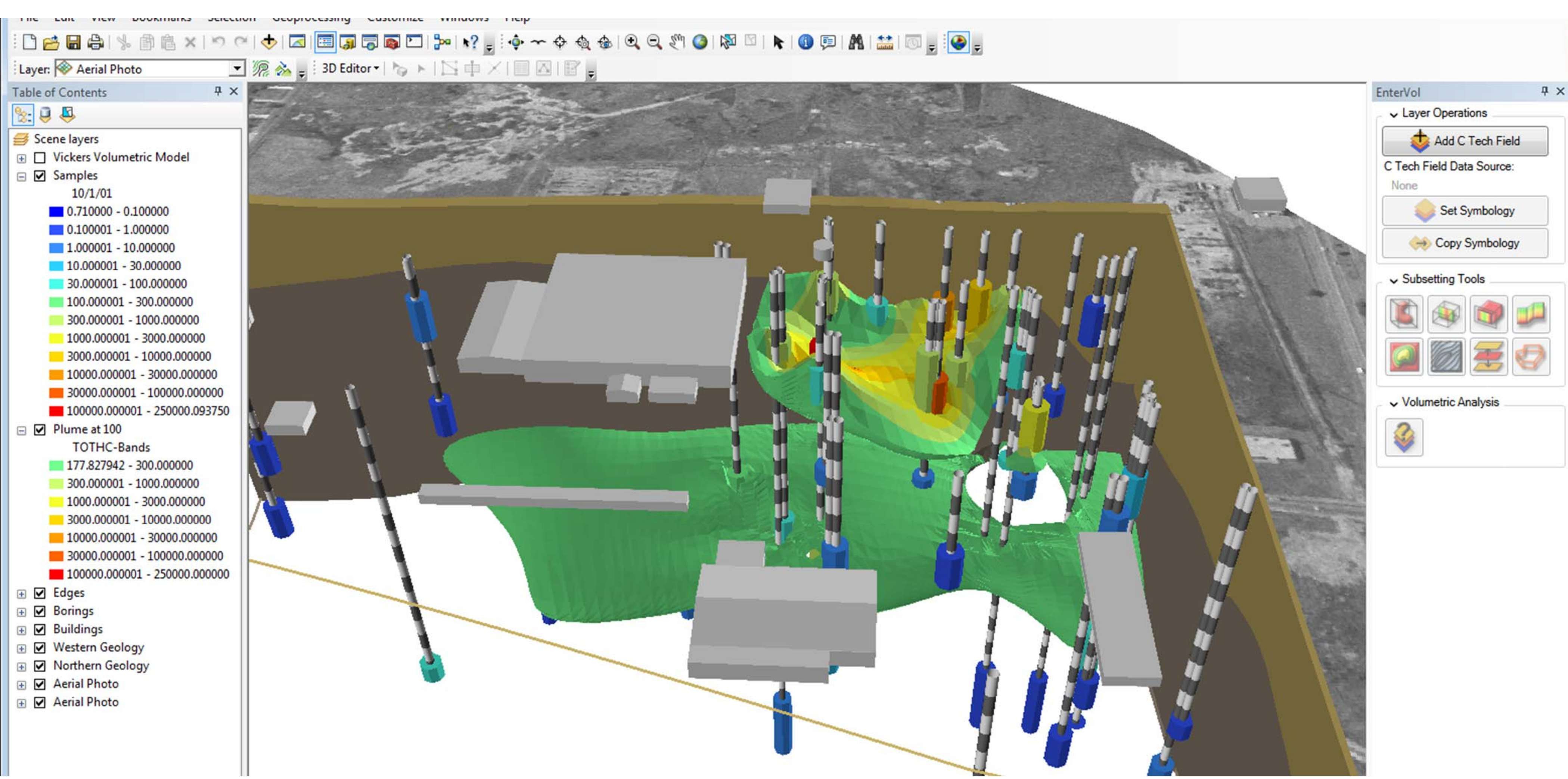

Geographic Centers of
Floods in Archive,
1985-2010
n = 3713
G. R. Brakenridge
Dartmouth Flood Observatory
CSDMS, INSTAAR, University of Colorado

Floods

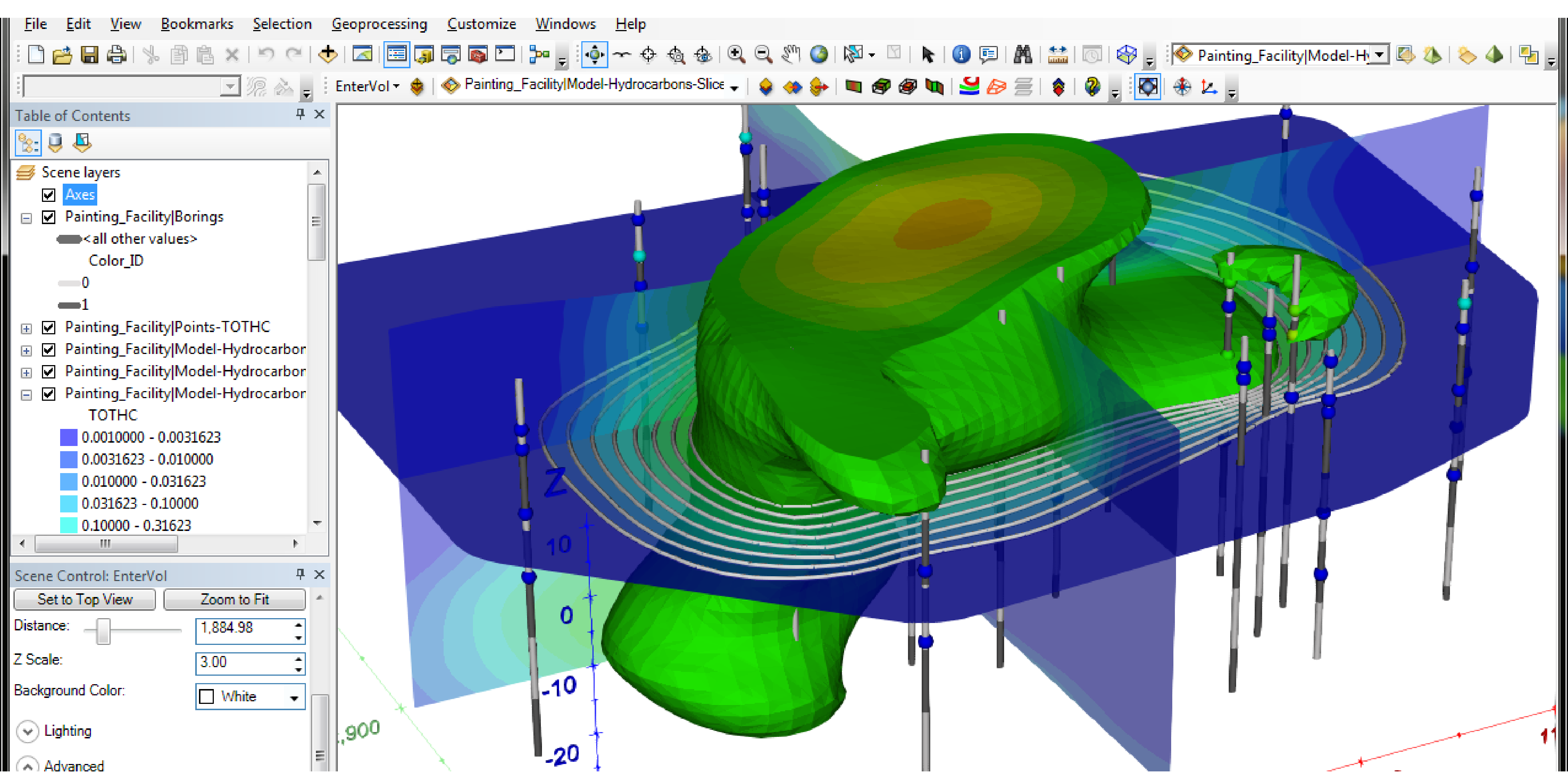
National Flood Insurance Program



Groundwater Contamination

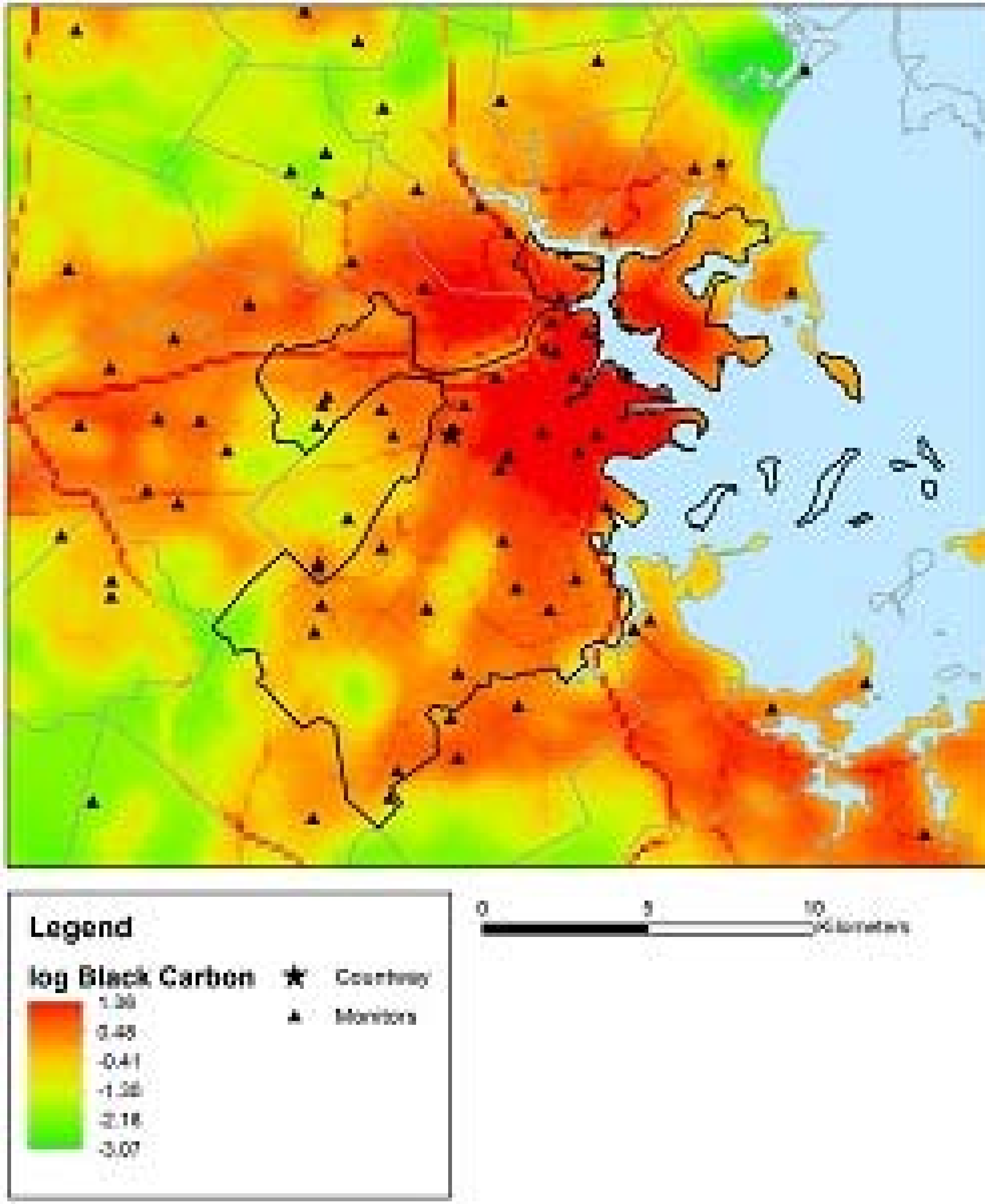


Groundwater Contamination

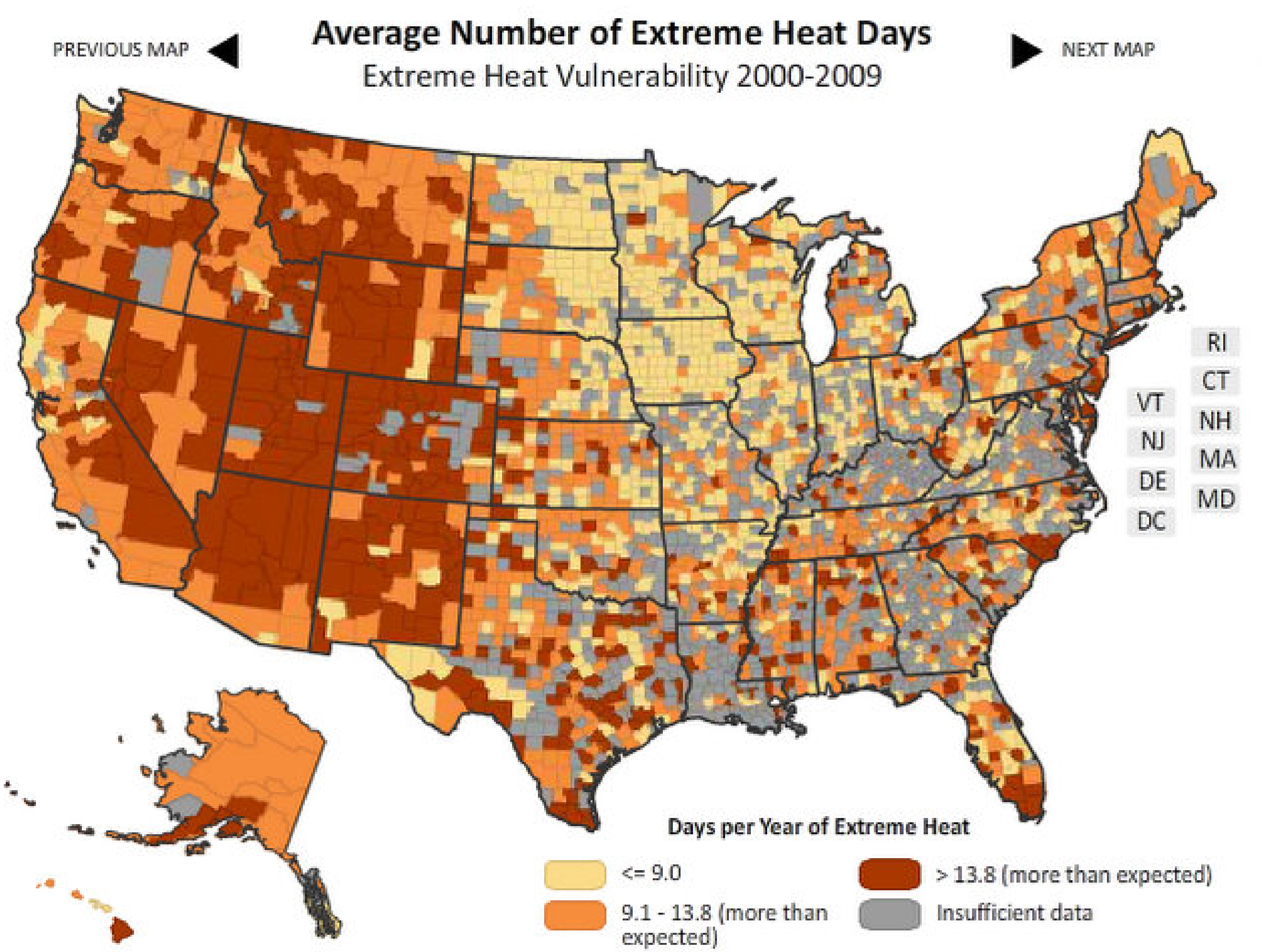


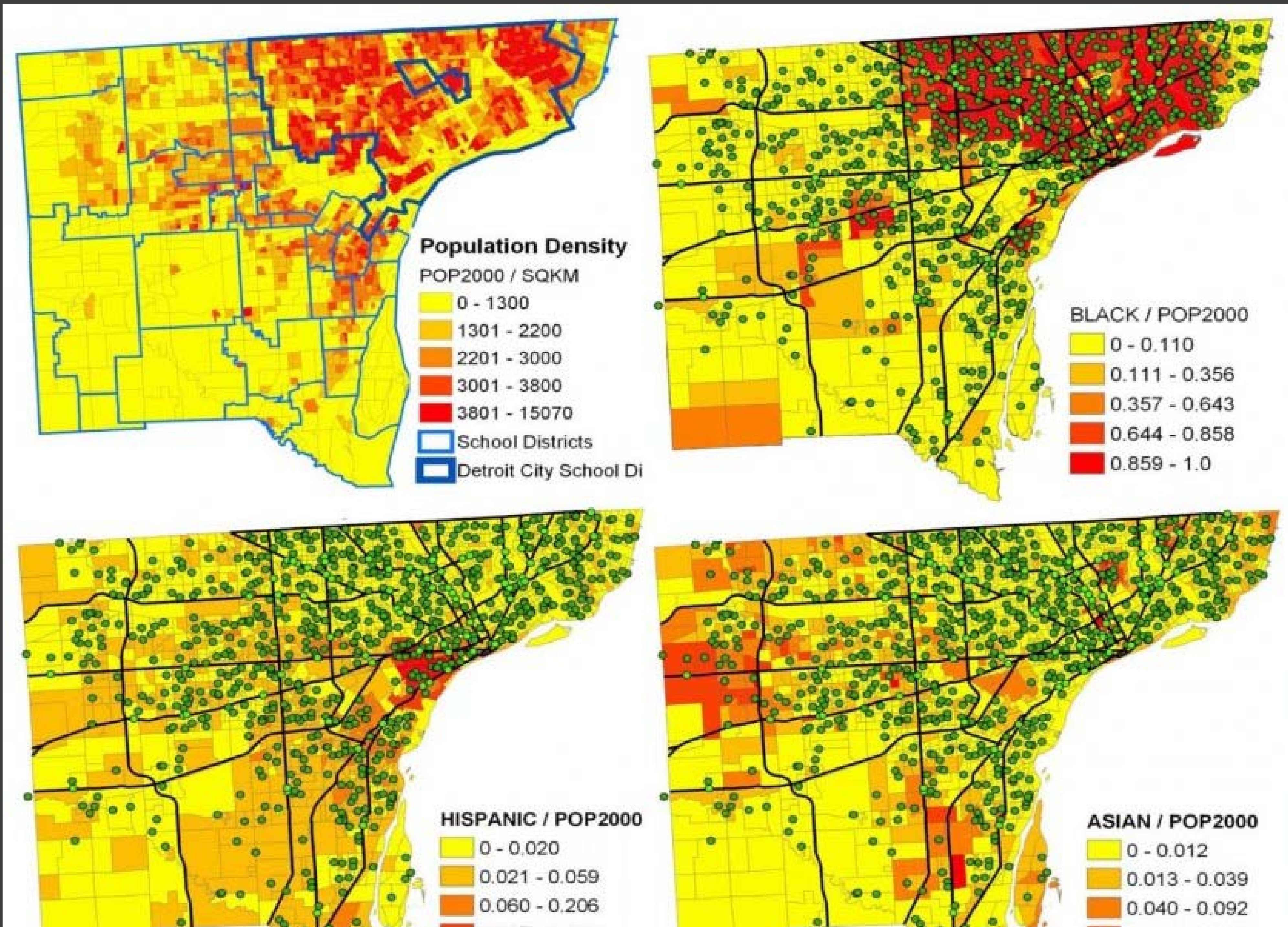
Groundwater Contamination

Air Quality

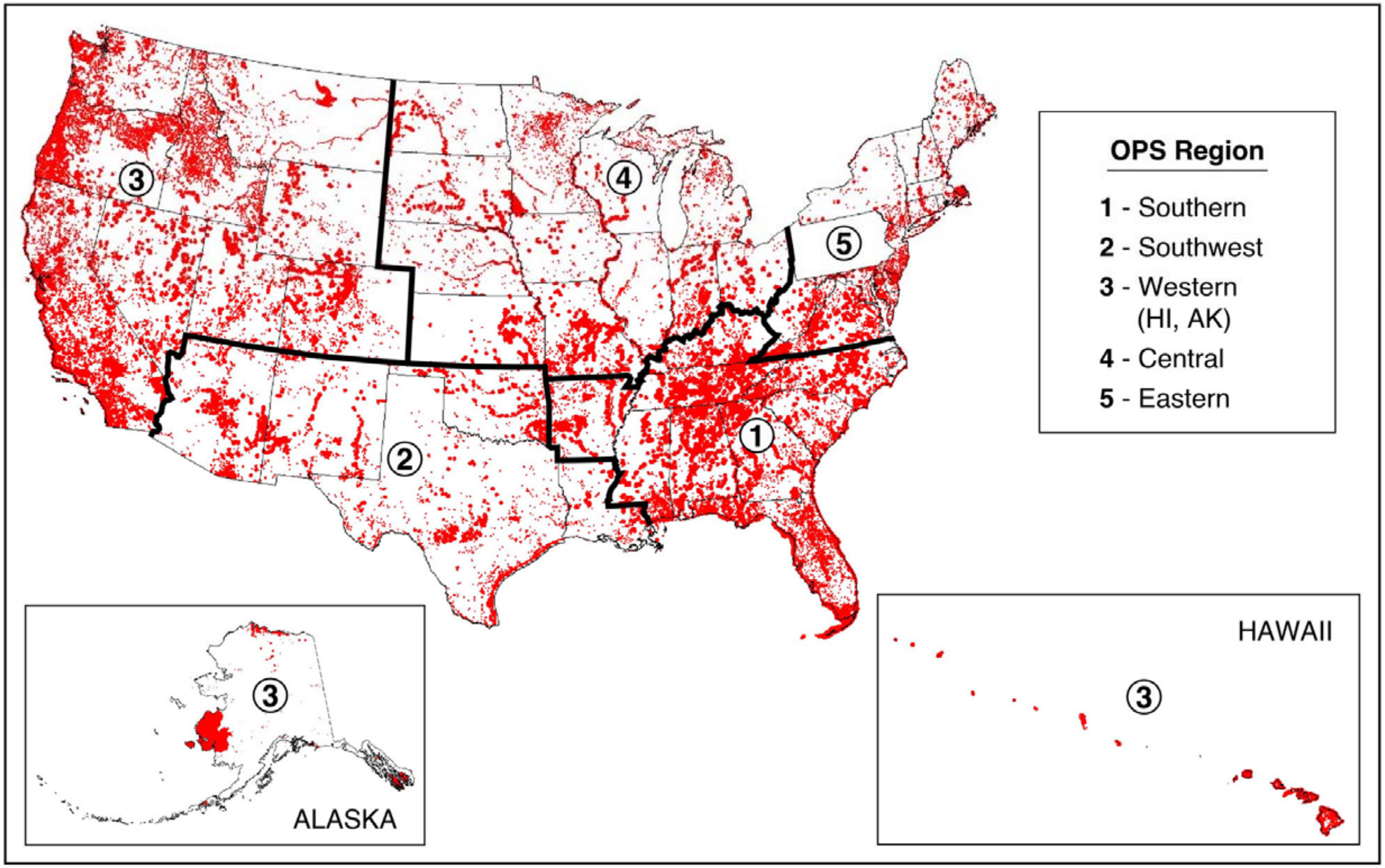


Extreme Heat Days




Population Density
POP2000 / SQKM
0 - 1300
1301 - 2200
2201 - 3000
3001 - 3800
3801 - 15070
School Districts
Detroit City School Di
BLACK / POP2000
0 - 0.110
0.111 - 0.356
0.357 - 0.643
0.644 - 0.858
0.859 - 1.0
HISPANIC / POP2000
0 - 0.020
0.021 - 0.059
0.060 - 0.206
ASIAN / POP2000
0 - 0.012
0.013 - 0.039
0.040 - 0.092

Hazardous Liquid Pipeline Accident

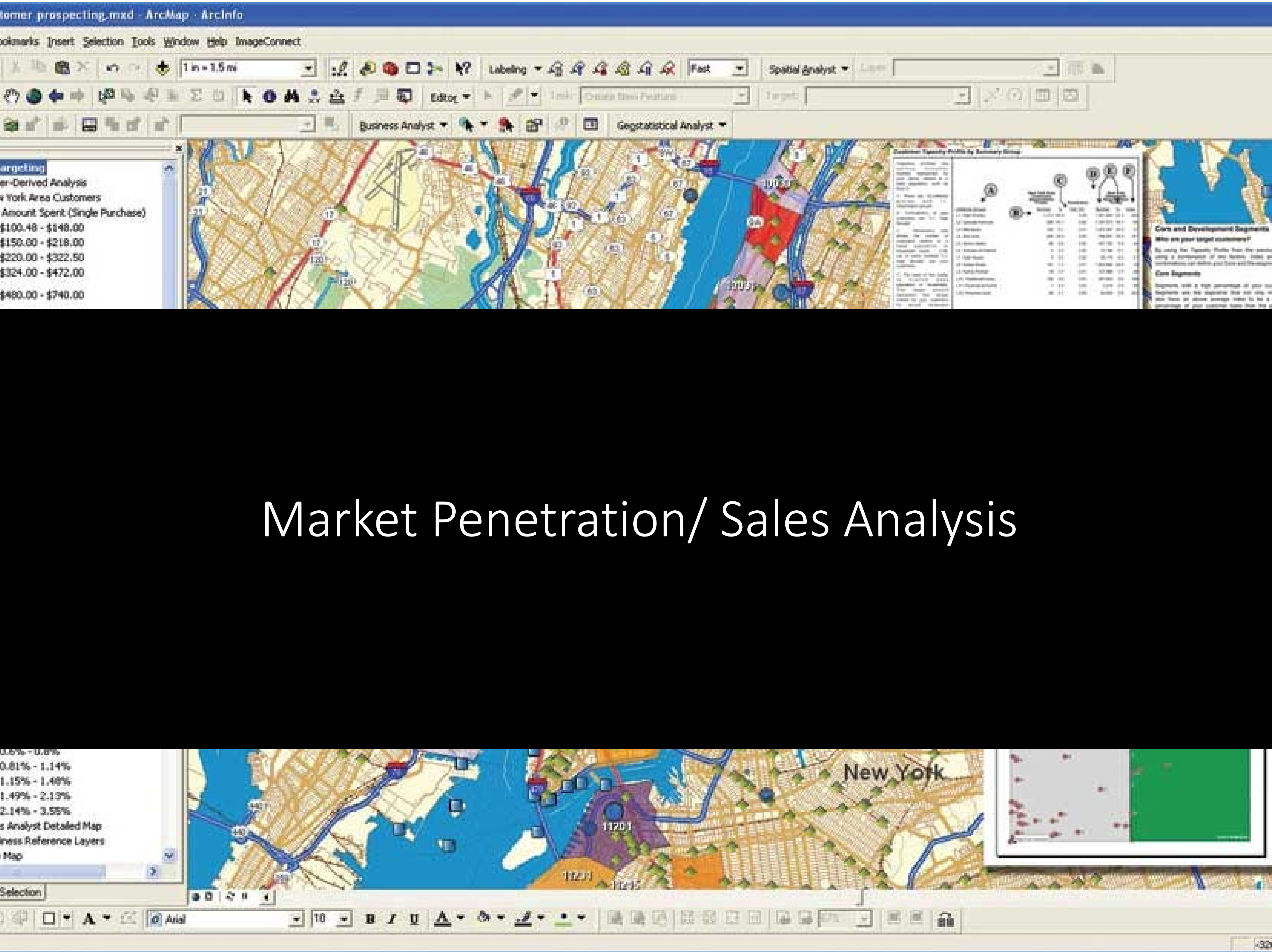



1172.94
10916.69
10847.17
Buy
OMXRGI
OMX RIGA GI
984.13
6025.9680
5993.7030
Buy

Business

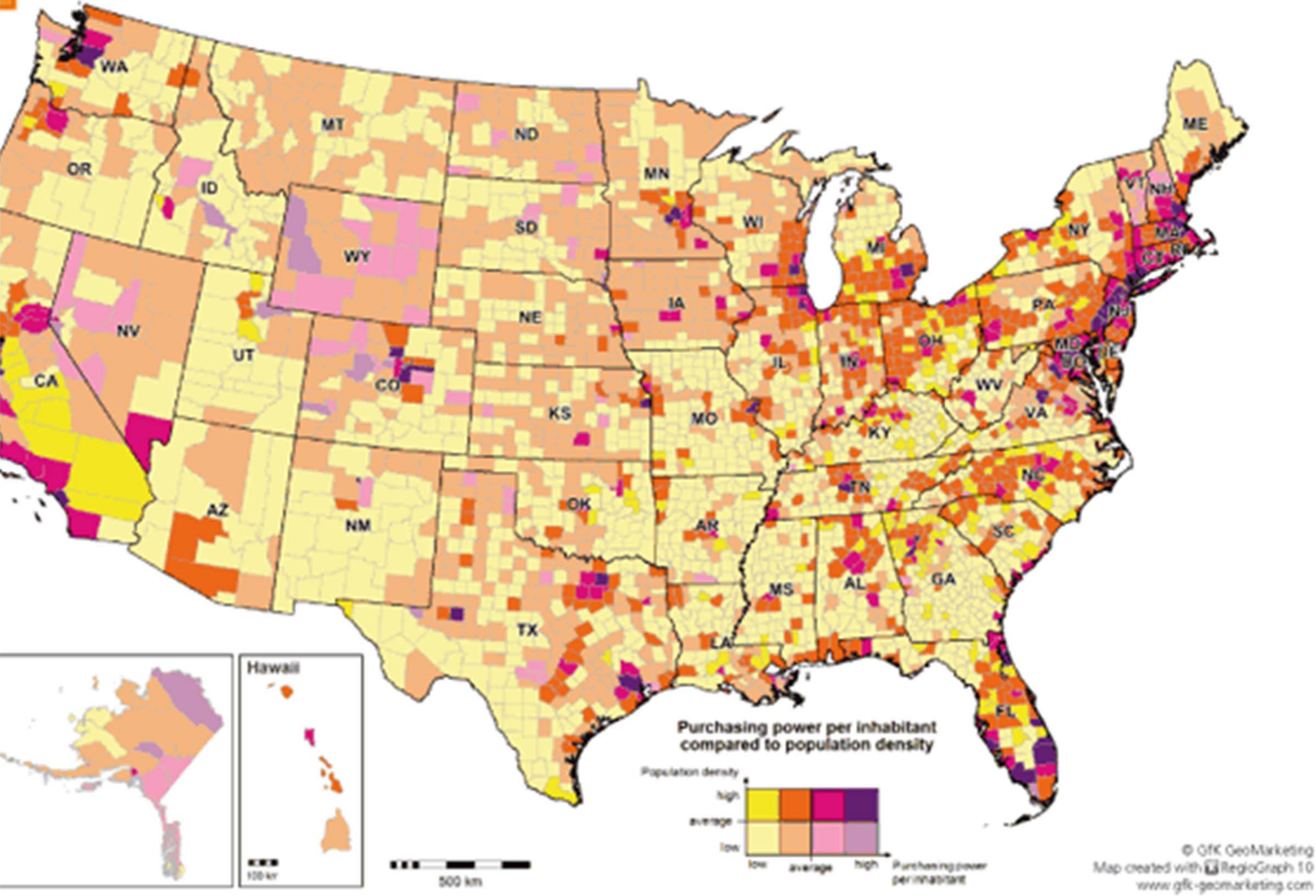

28289.06
1632.51
599.40
OMXI8
OMX ICELAND 8
Sell
6230.9
1172.94

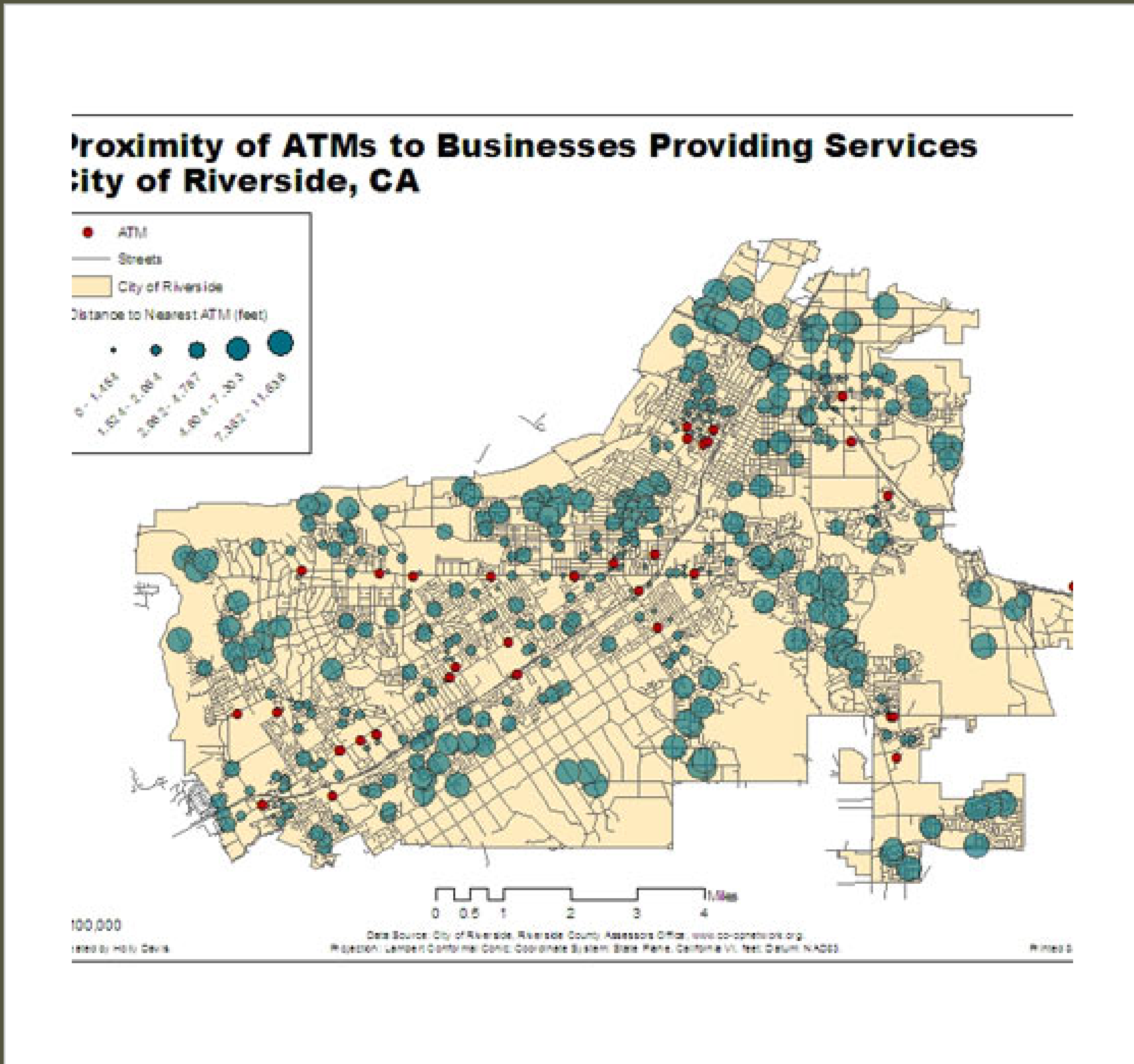
Market Penetration/ Sales Analysis



GfK GeoMarketing

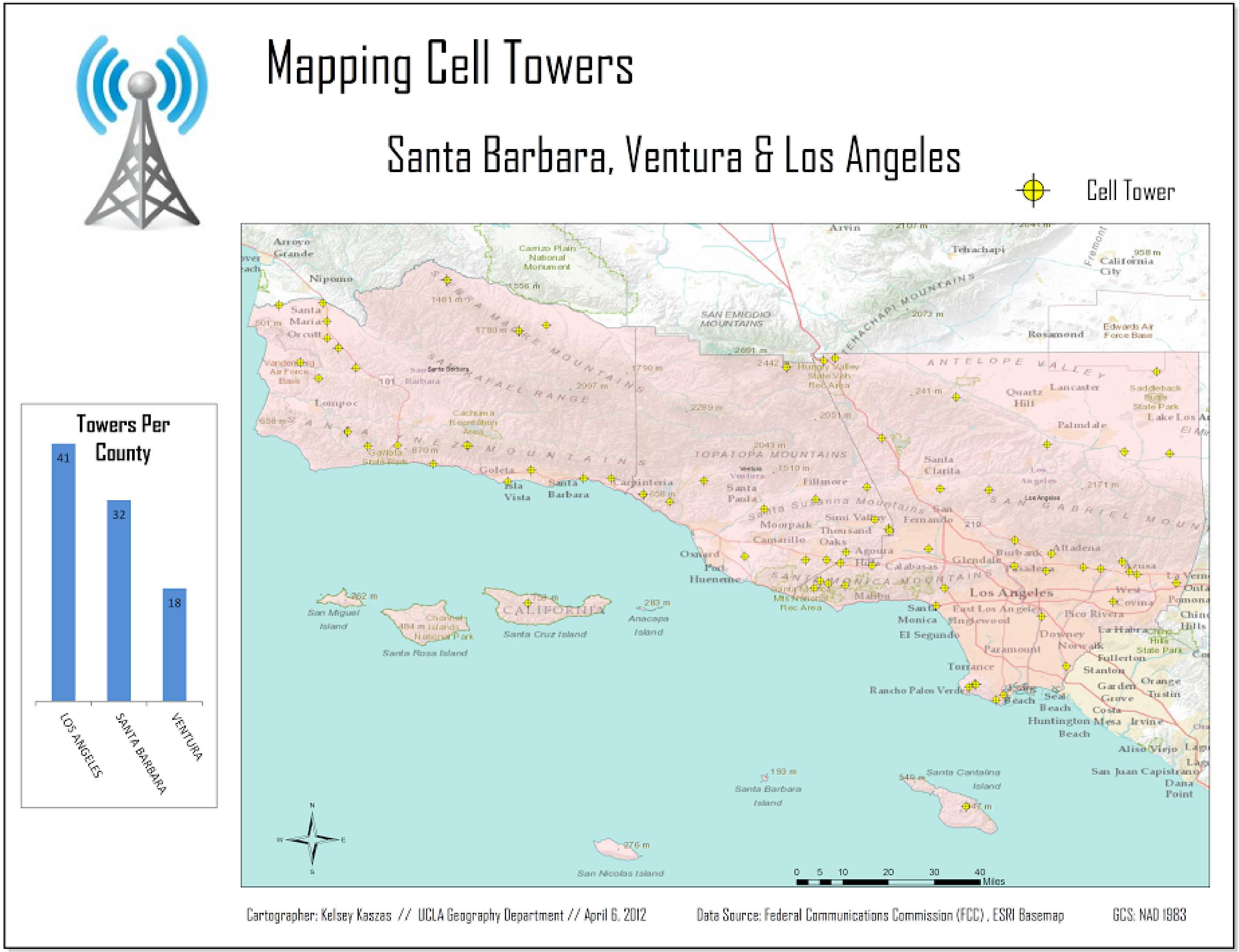
GfK Purchasing Power USA, 2009
Counties



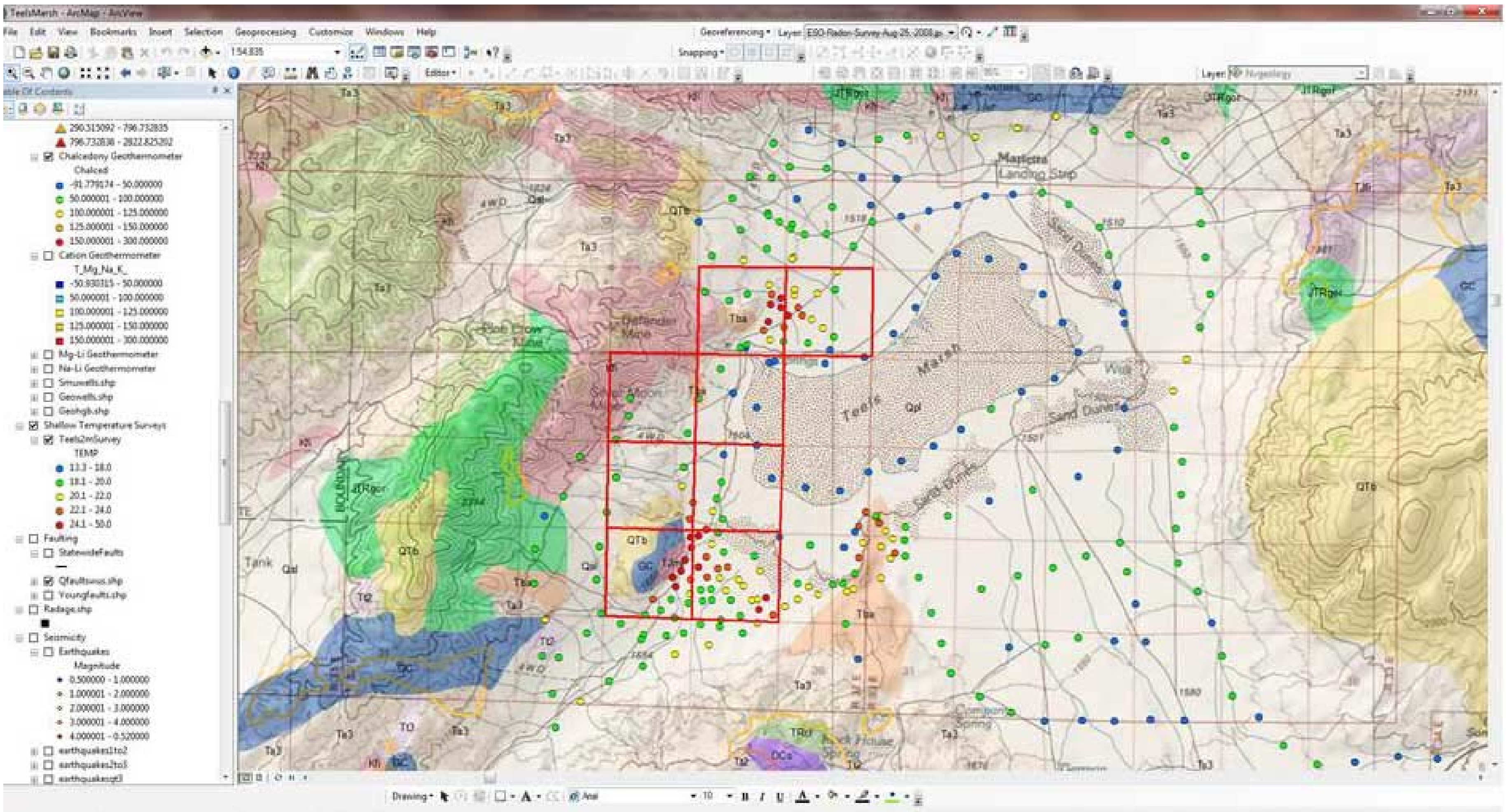


Identify Optimum ATM Locations

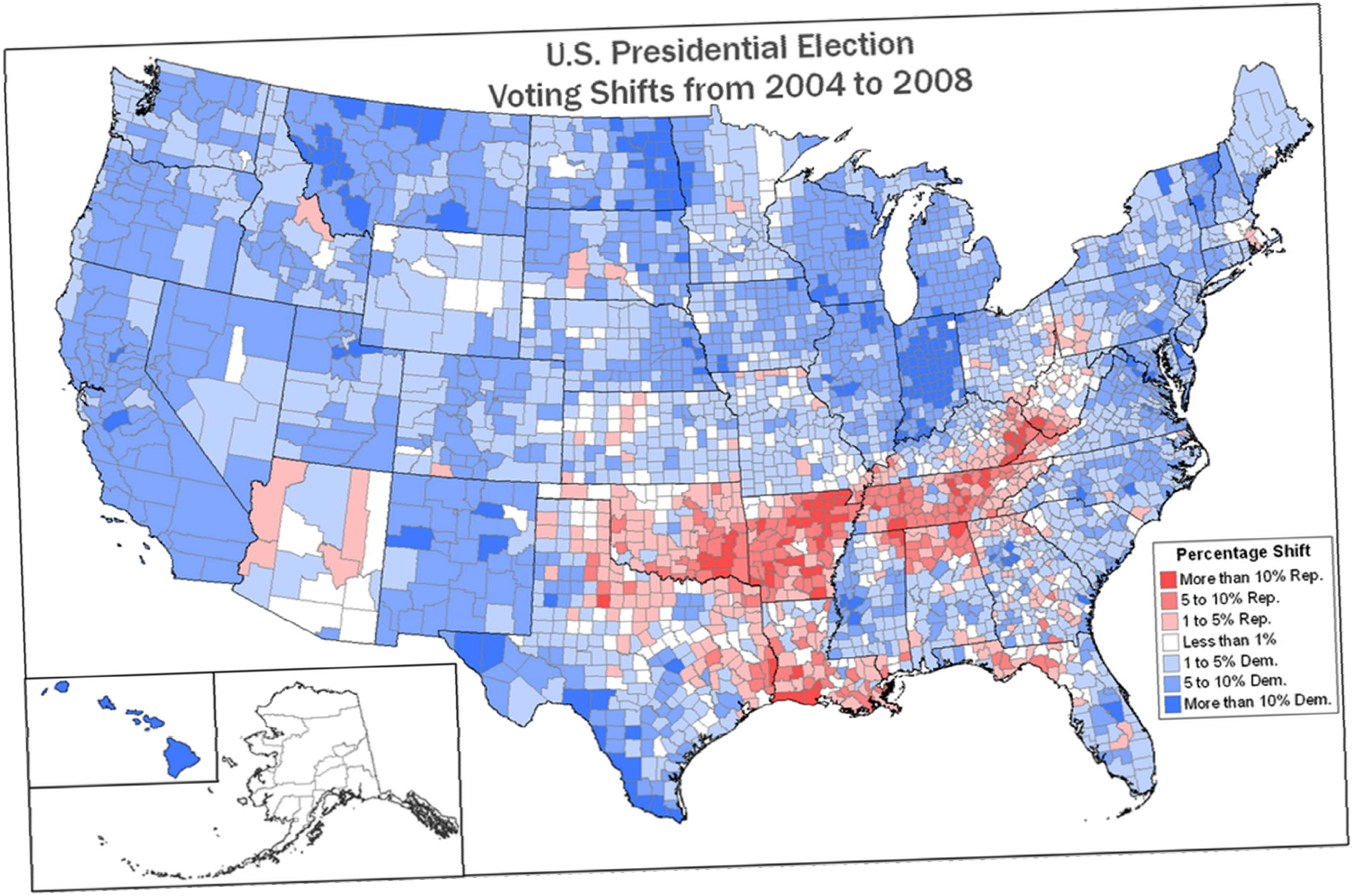
Cell Towers Location

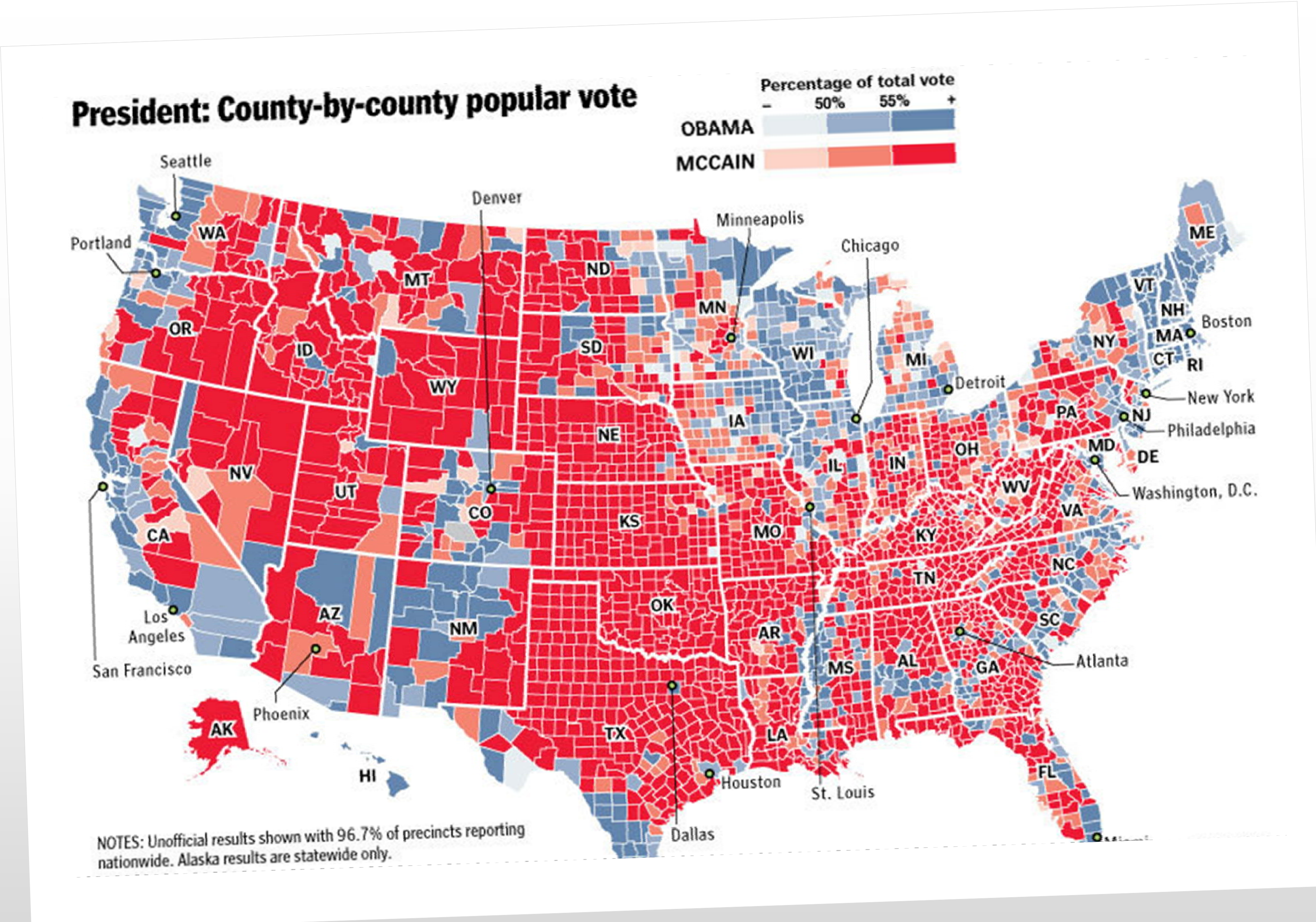


Oil Well Drilling - finding optimum location



Political Science

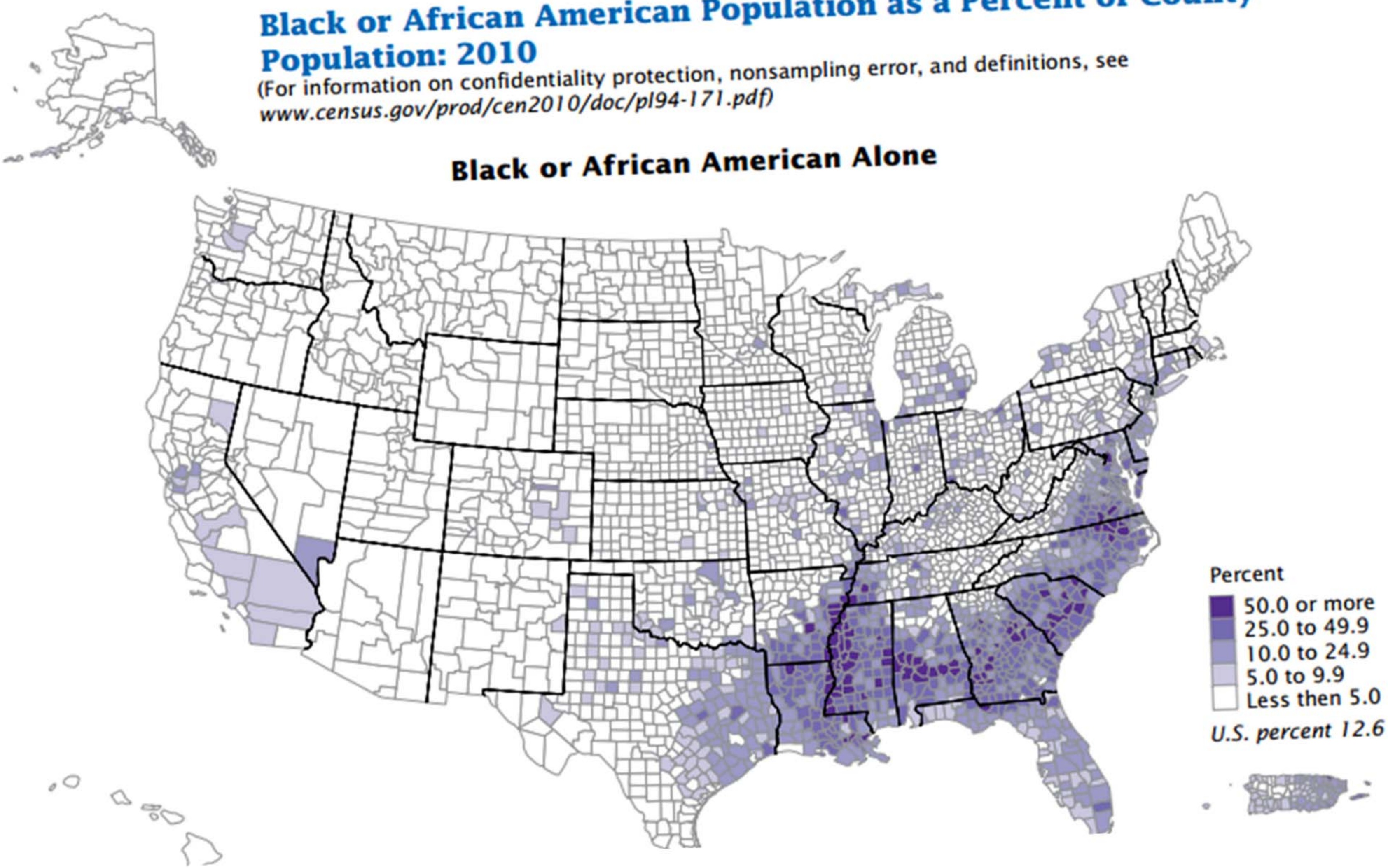

U.S. Presidential Election
Voting Shifts from 2004 to 2008
Percentage Shift
More than 10% Rep.
5 to 10% Rep.
1 to 5% Rep.
Less than 1%
1 to 5% Dem.
5 to 10% Dem.
More than 10% Dem.


President: County-by-county popular vote
Percentage of total vote
– 50% 55% +
OBAMA
MCCAIN
Seattle
Portland
Denver
Minneapolis
Chicago
Detroit
Boston
New York
Philadelphia
Washington, D.C.
Atlanta
St. Louis
Houston
Dallas
Phoenix
Los Angeles
San Francisco
WA
OR
CA
NV
ID
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MI
IN
OH
KY
TN
MS
AL
GA
FL
SC
NC
VA
WV
PA
NY
NJ
DE
MD
VT
NH
ME
MA
CT
RI
AK
HI
NOTES: Unofficial results shown with 96.7% of precincts reporting nationwide. Alaska results are statewide only.

Black or African American Population as a Percent of County Population: 2010

(For information on confidentiality protection, nonsampling error, and definitions, see *www.census.gov/prod/cen2010/doc/pl94-171.pdf)*

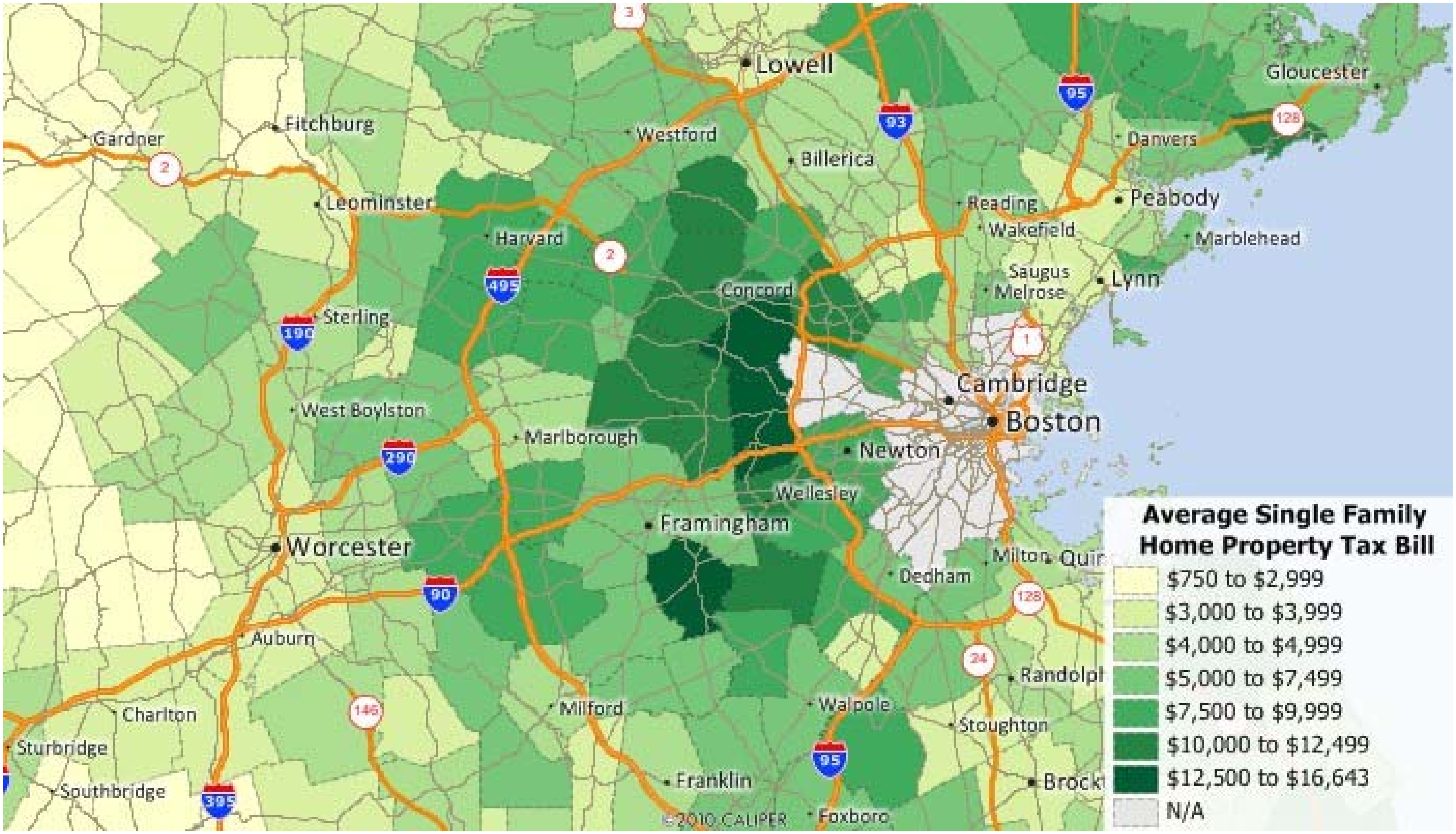
Black or African American Alone



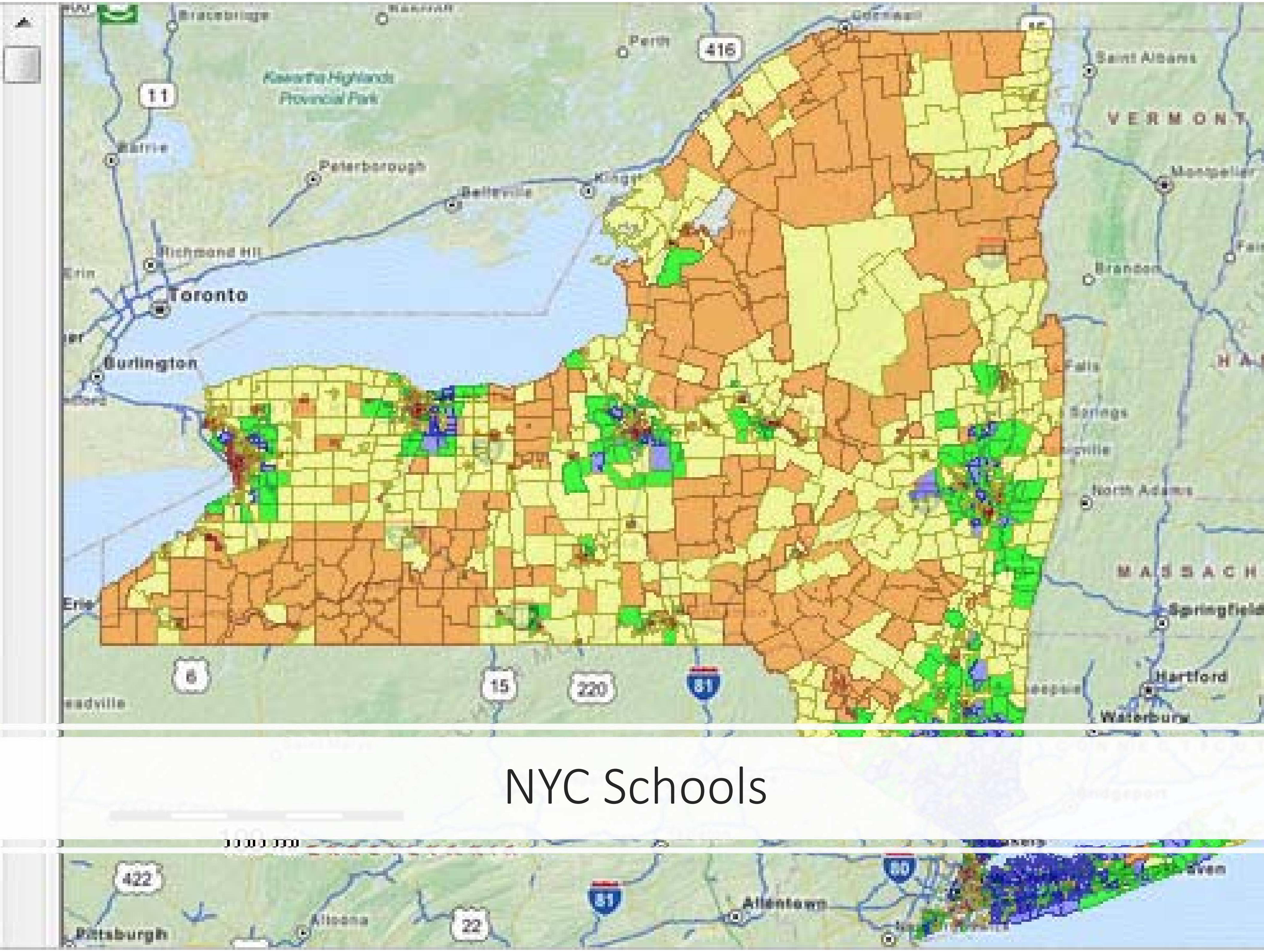
Real Estate

Housing Sales Prices

Property Tax



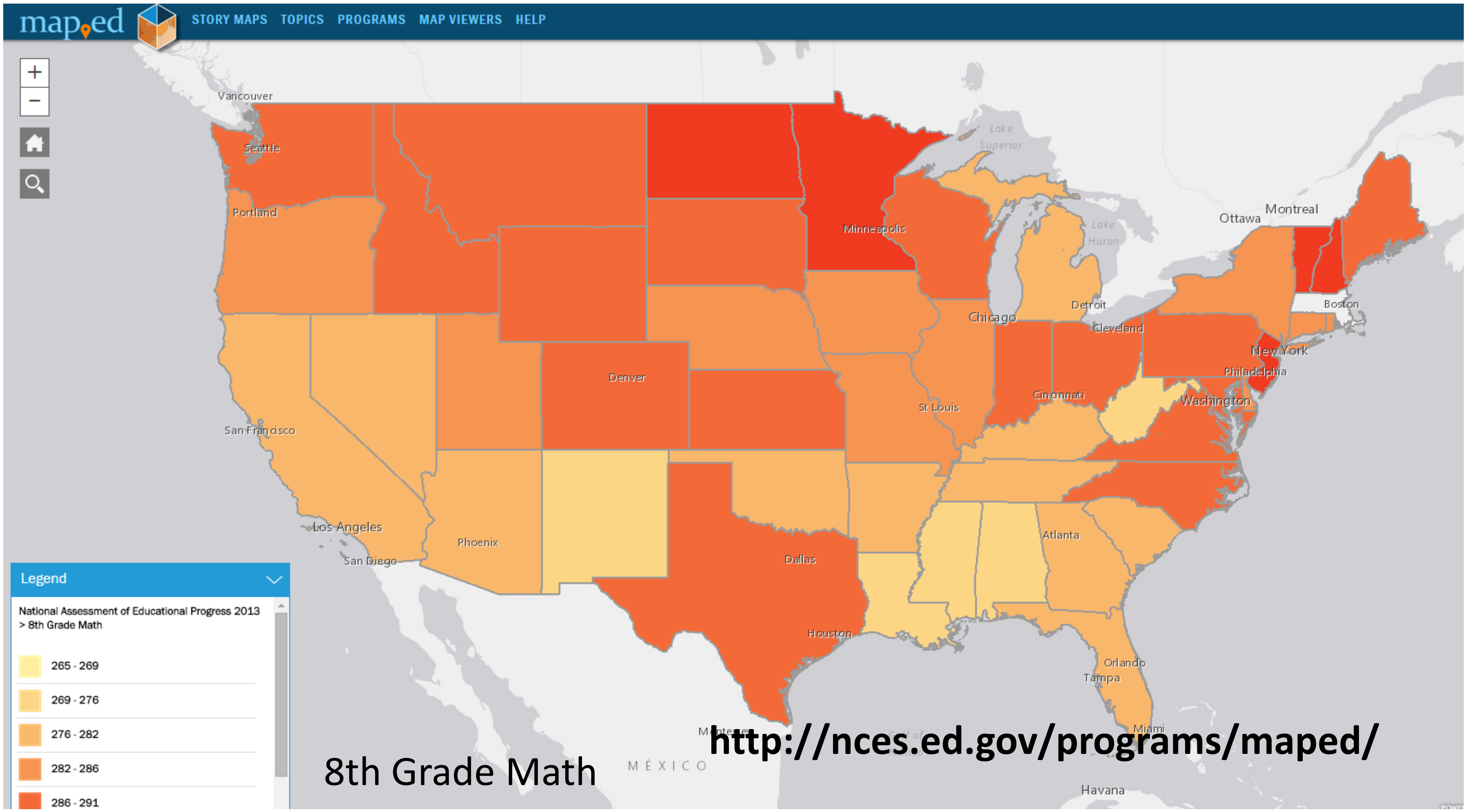
Education



Bracebridge
Perth
416
Saint Albans
Kawartha Highlands Provincial Park
11
VERMONT
Barrie
Peterborough
Belleville
Montpelier
Richmond Hill
Brandon
Toronto
Burlington
North Adams
Erie
Springfield
6
15
220
81
Hartford
Waterbury
422
80
81
Allentown
22
Pittsburgh
Altoona

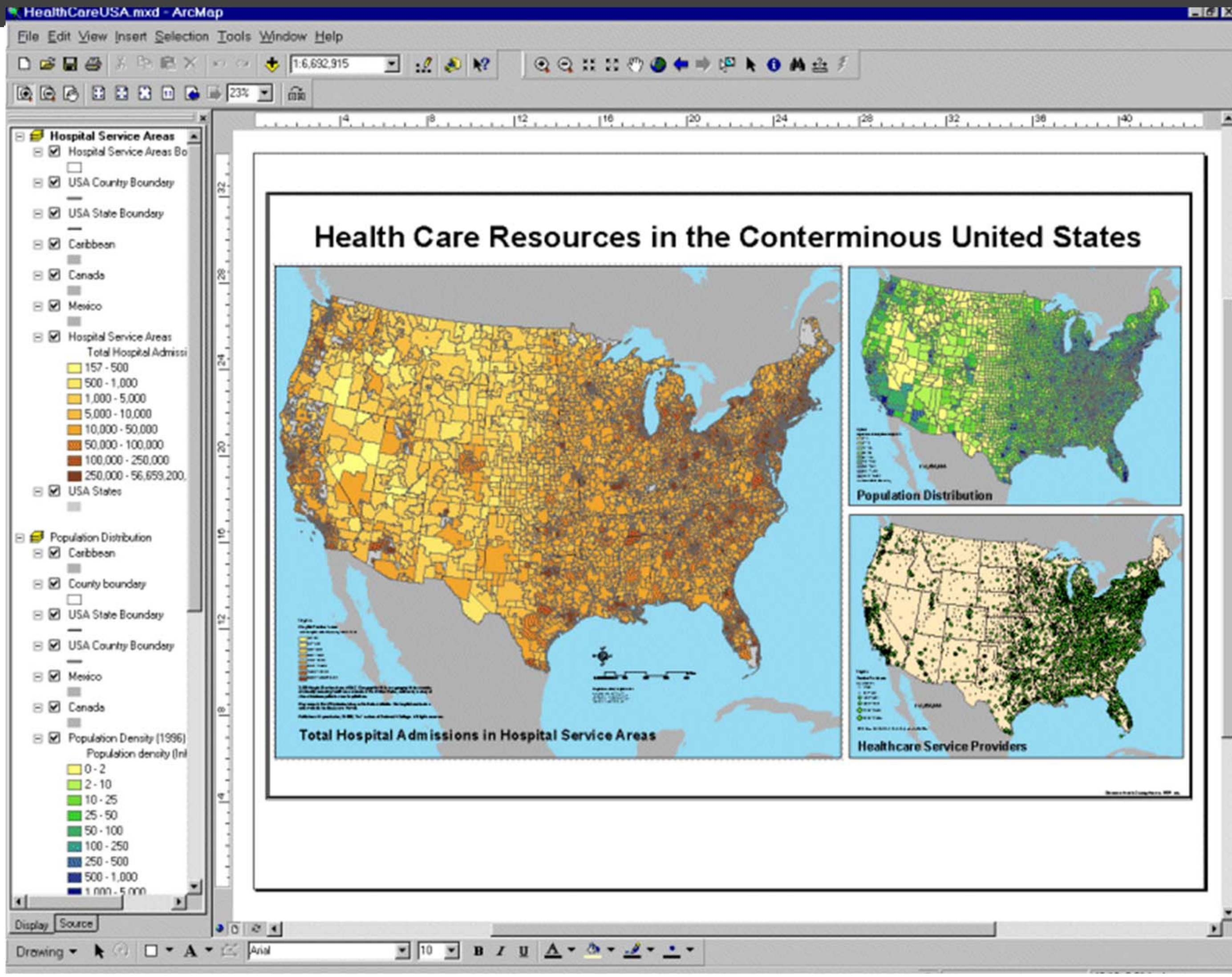
NYC Schools

National Assessment of Educational Progress 2013

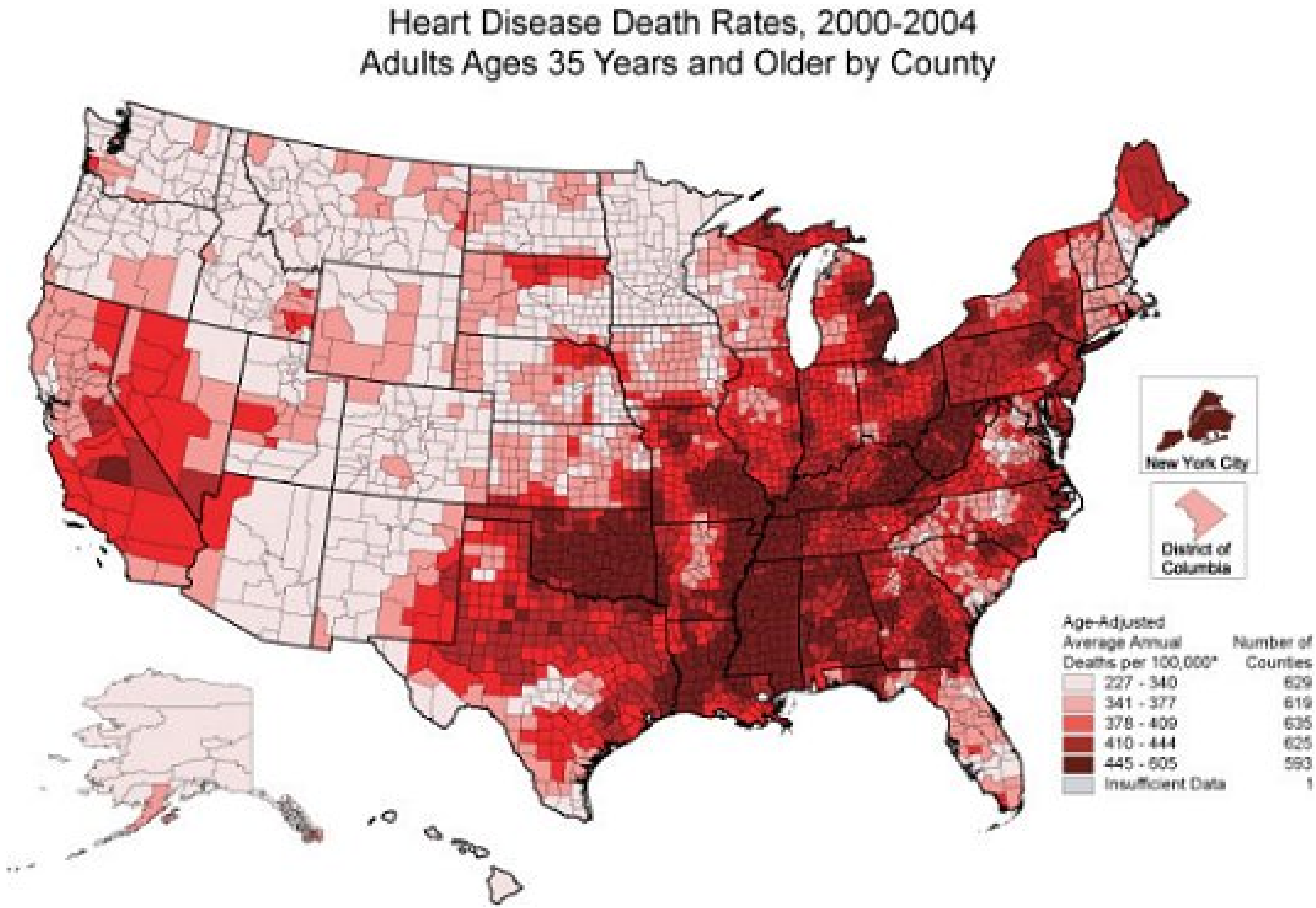


Health Care

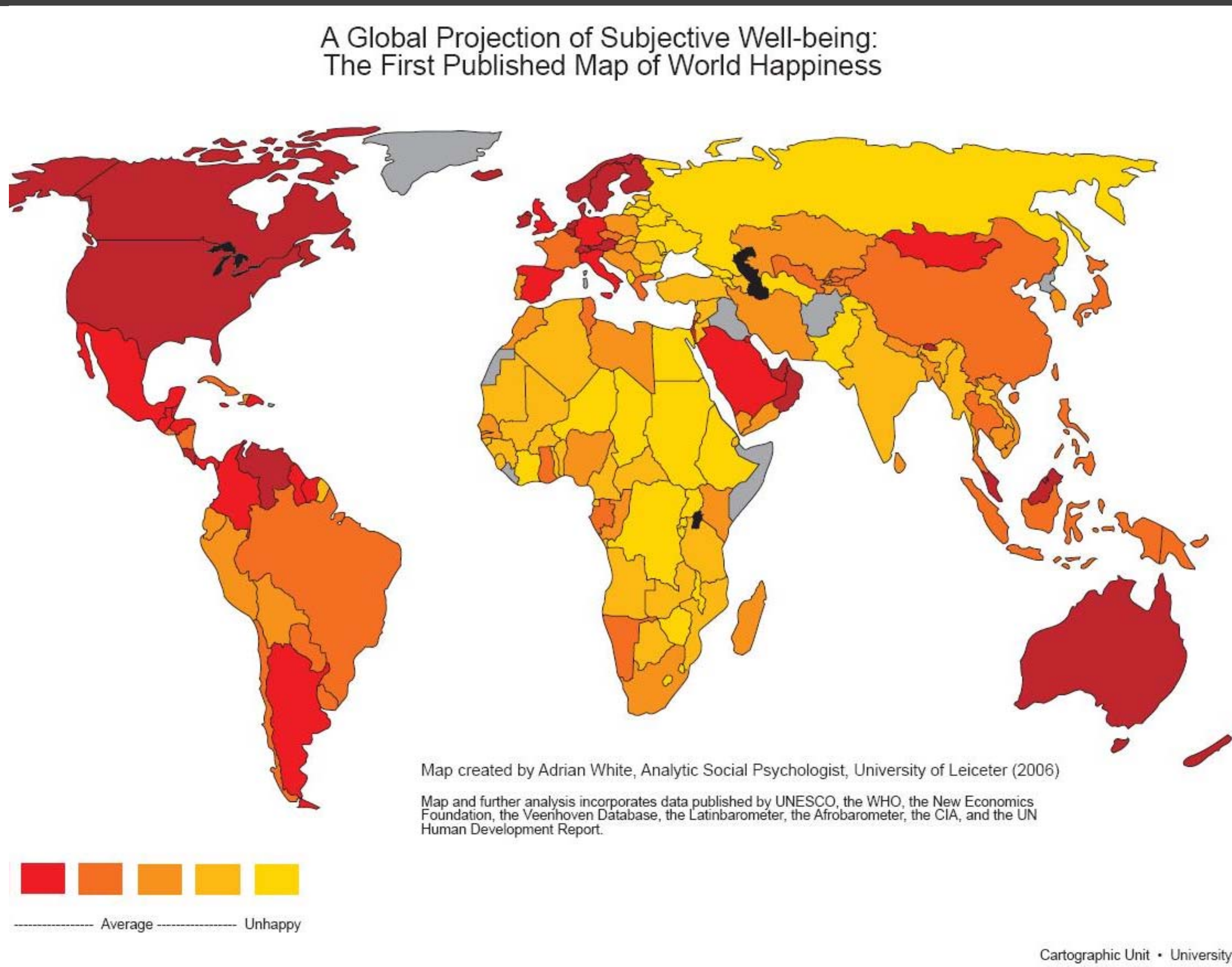
Sample Health Application

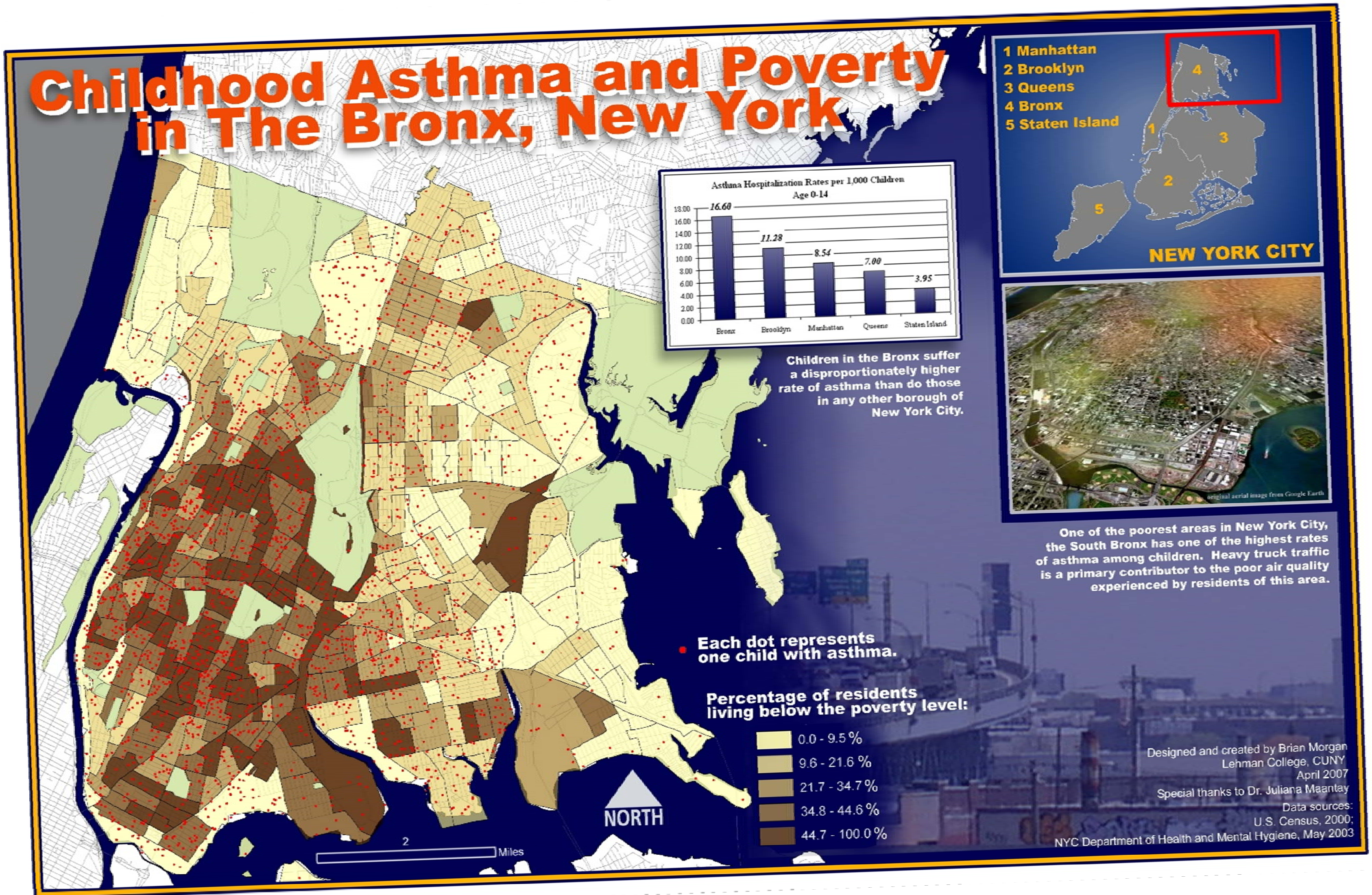


Human Health



World Happiness





Childhood Asthma and Poverty in The Bronx, New York
Asthma Hospitalization Rates per 1,000 Children
Age 0-14
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
16.60
11.28
8.54
7.00
3.95
Bronx
Brooklyn
Manhattan
Queens
Staten Island
Children in the Bronx suffer a disproportionately higher rate of asthma than do those in any other borough of New York City.
1 Manhattan
2 Brooklyn
3 Queens
4 Bronx
5 Staten Island
NEW YORK CITY
original aerial image from Google Earth
One of the poorest areas in New York City, the South Bronx has one of the highest rates of asthma among children. Heavy truck traffic is a primary contributor to the poor air quality experienced by residents of this area.
Each dot represents one child with asthma.
Percentage of residents living below the poverty level:
0.0 - 9.5 %
9.6 - 21.6 %
21.7 - 34.7 %
34.8 - 44.6 %
44.7 - 100.0 %
NORTH
2
Miles
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Data sources:
U.S. Census, 2000;
NYC Department of Health and Mental Hygiene, May 2003

Guess?