Geographic Information Systems (GIS)

Tarendra Lakhankar

Why GIS?

- In last few classes we understand about
  - Environmental science system
  - How Environmental system works
  - How human interaction changes the earth system
- We understand system (some).. We understand how to measure some parameters..
- Now, it is important how to present this information effective way to society includes, people, scholars, media, policy makers, etc.

What is GIS and why it matters?

Almost everything happens somewhere and in most cases, knowing where some things happen is critically important.
Examples:

- Position of country boundaries
- Location of hospitals
- Routing delivery vehicles
- Management of forest stands
- Allocation of funds for sea defenses

Geographical Information Systems are a special class of information systems that keep track not only of events, activities, and things, but also of *where* these events, activities, and things happen or exist.

Geographic location is an important attribute of activities, policies, strategies, and plans.

Geographic problems involve an aspect of location, either in the information used to solve them, or in the solutions themselves.

What is GIS?

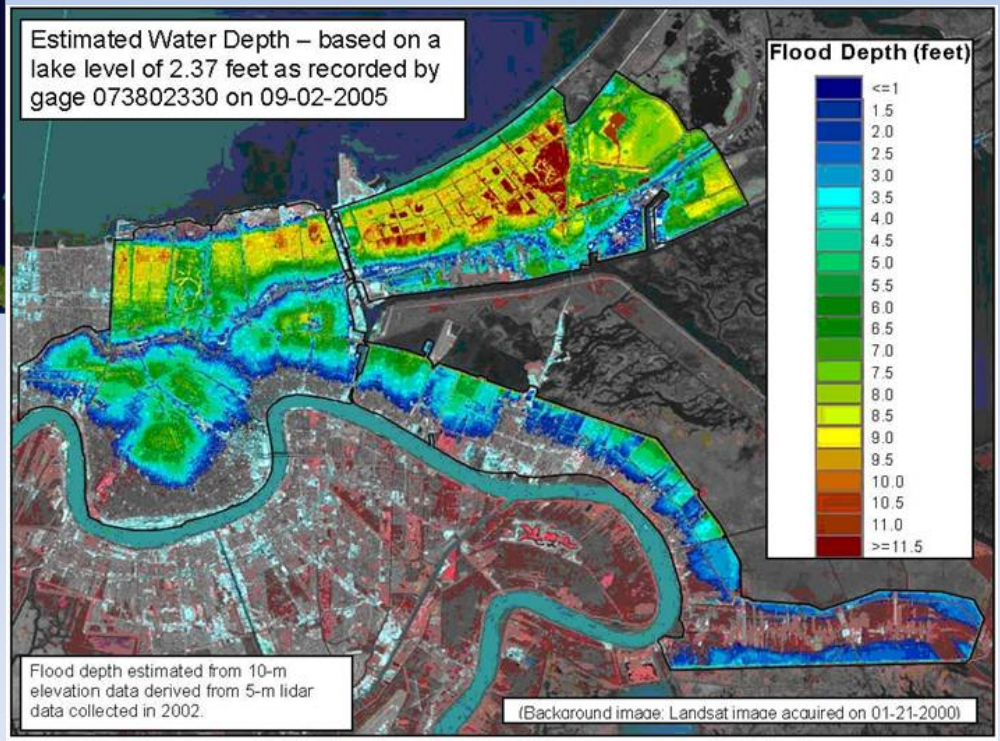
There are a number of definitions of GIS. Different groups of people (general public, planners, teachers, scientists) can find a different definition useful.

Here are some of them:

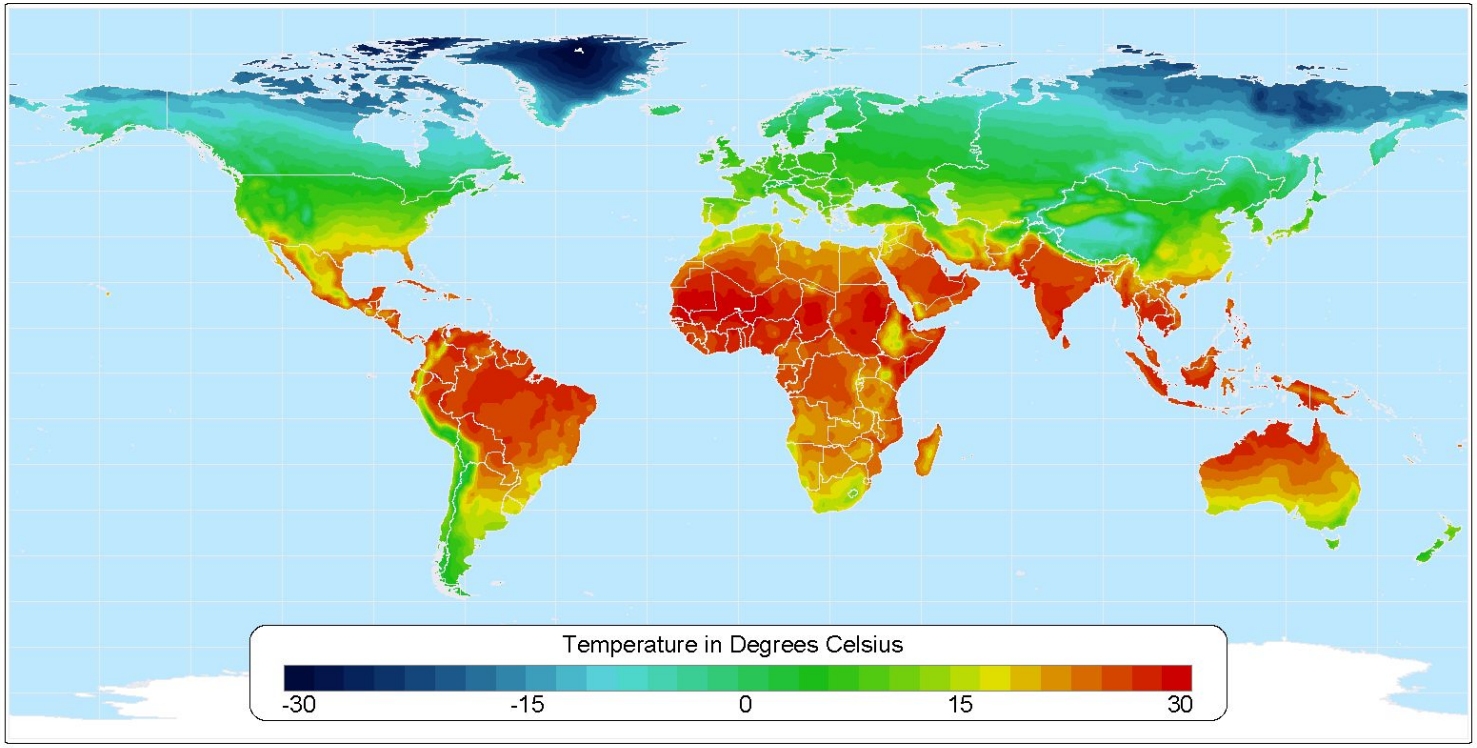
- "GIS is much more than a container of maps in digital form".
- "A GIS is a computerized tool for solving geographic problems"
- "GIS is a spatial decision support system"
- "GIS is a mechanized inventory of geographically distributed features and facilities"
- "GIS is a method for revealing patterns and processes in geographic information"
- "GIS is a tool to automate time-consuming tasks that are too tedious or expensive or inaccurate if performed by hand"
- "GIS is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information."

Text source: Longley et al (2005) *Geographic Information Systems and Science.* 2nd Edition. John Wiley and Sons Ltd. (Chapter 14, pages 317-319)

Hurricane Katrina



Average Annual Temperature



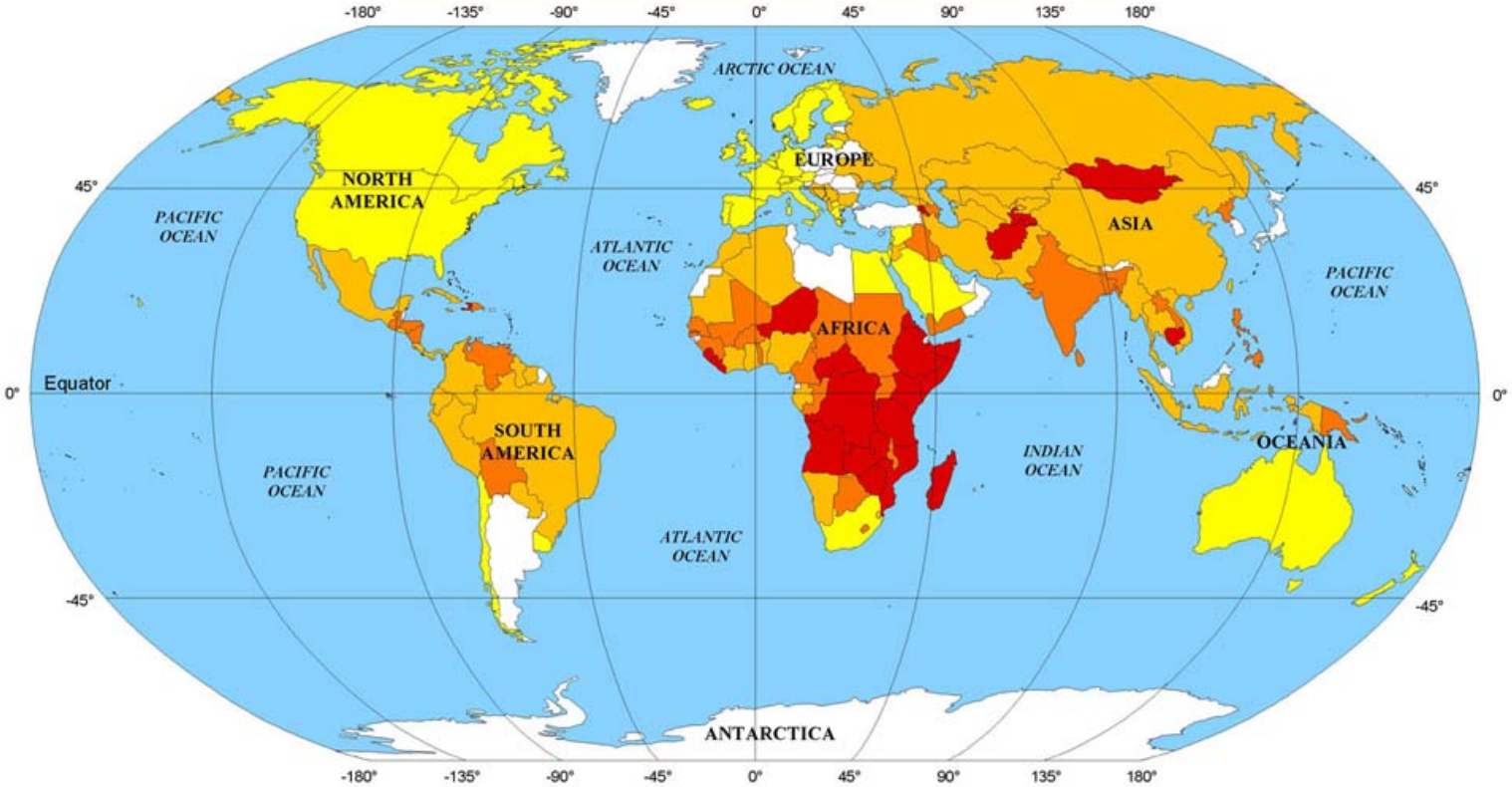
Data taken from: CRU 0.5 Degree Dataset (New, et al.)

Atlas of the Biosphere

Center for Sustainability and the Global Environment
University of Wisconsin - Madison

Map of World Hunger

Proportion of undernourished people (1998-2000)



Proportion in total population

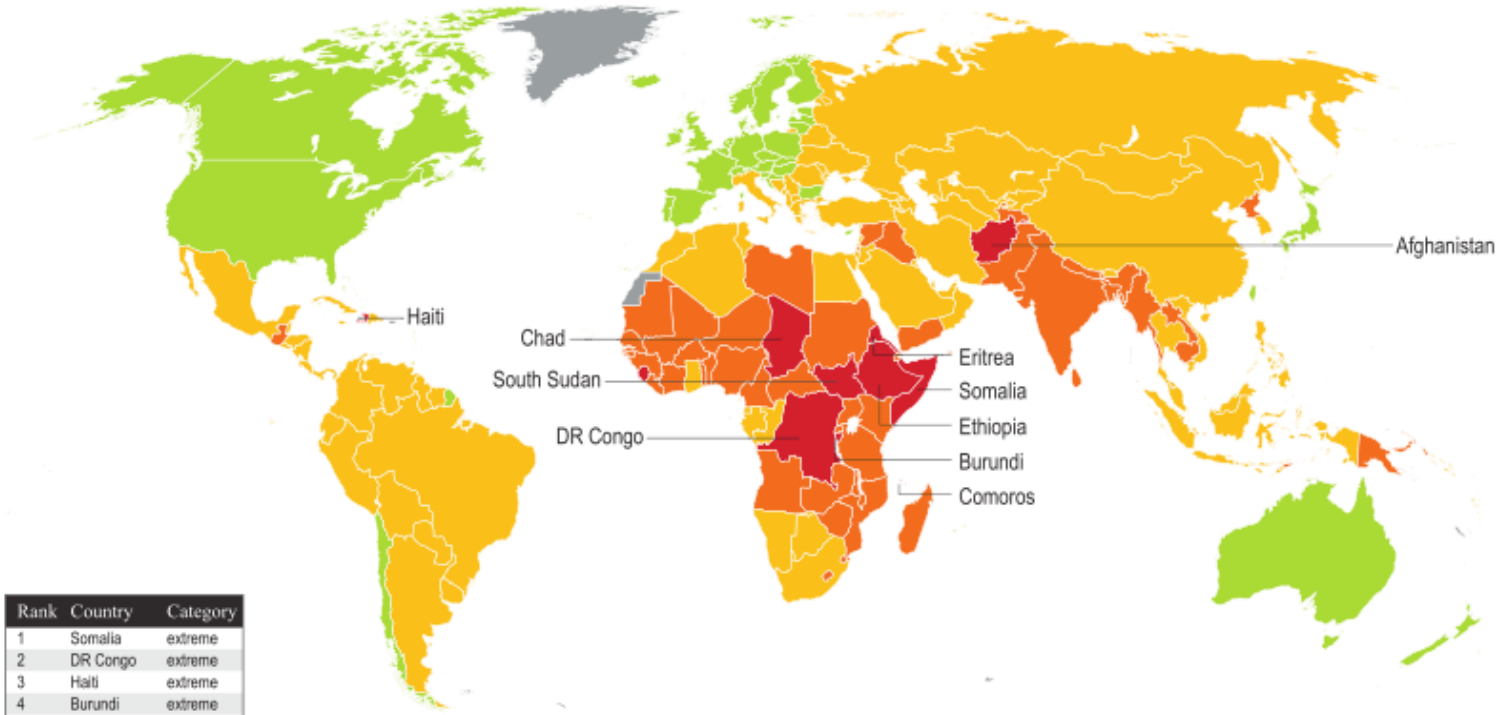
Percentage 1998 - 2000

< 5 % | 5 - 20 % | 20 - 35 % | > 35 % | No data available

FAO-GIS (ESNP / SDRN)

Food Security Risk Index 2013

maplecroft

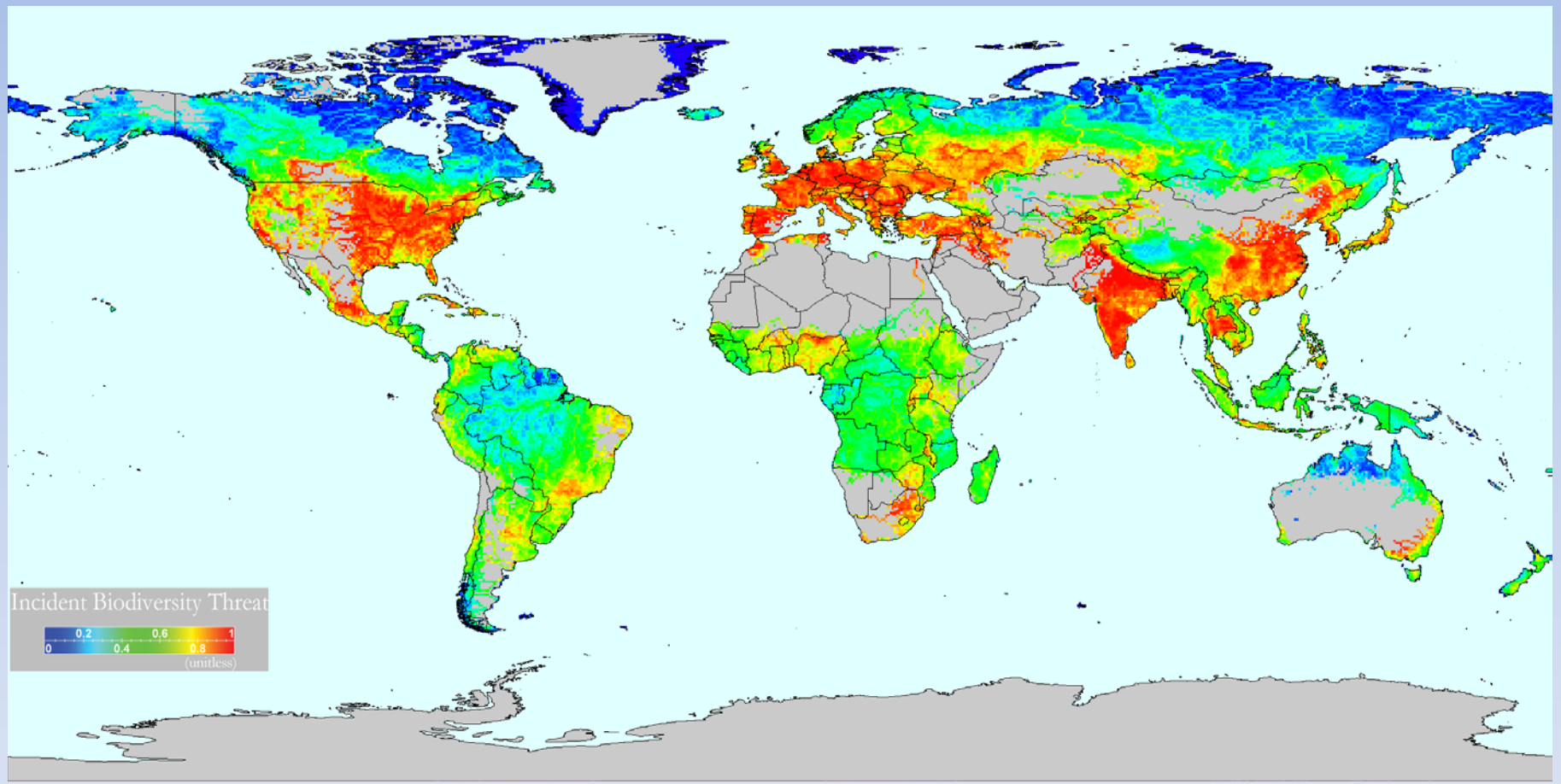


Rank	Country	Category
1	Somalia	extreme
2	DR Congo	extreme
3	Haiti	extreme
4	Burundi	extreme
5	Chad	extreme
6	Ethiopia	extreme
7	Eritrea	extreme
8	Afghanistan	extreme
9	South Sudan	extreme
10	Comoros	extreme

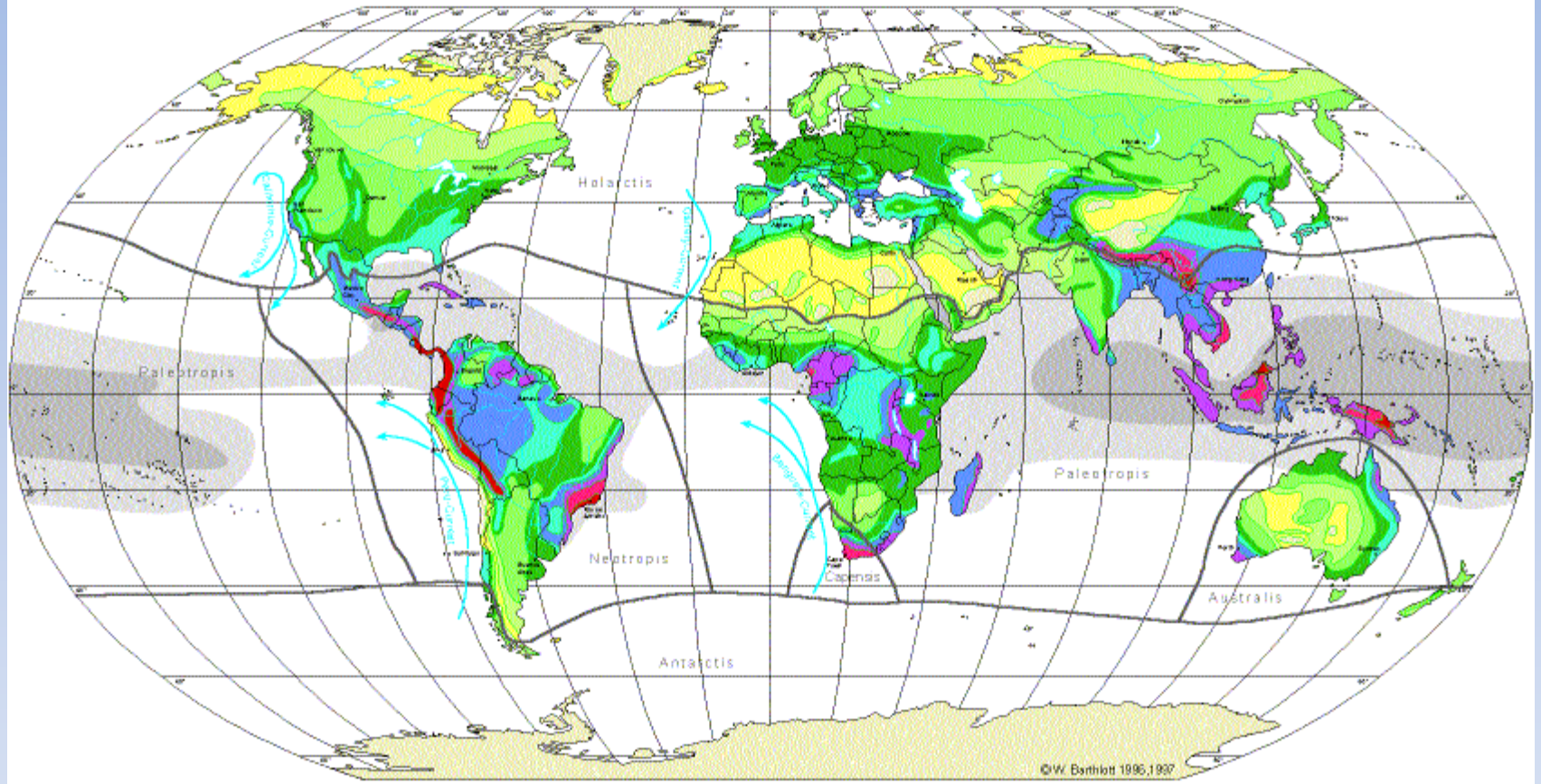
Legend

Extreme Risk	High Risk	Medium Risk	Low Risk	
0 - 2.5	>2.5 - 5	>5 - 7.5	>7.5 - 10	No data

Global Threats to Human Water Security and River Biodiversity



GLOBAL BIODIVERSITY: SPECIES NUMBERS OF VASCULAR PLANTS



Robinson Projection
Standard Parallels 35°N und 35°S
Scale 1: 85000000

Diversity Zones (DZ): Number of species per 10.000km²

- DZ 1 (<100)
- DZ 2 (100 - 200)
- DZ 3 (200 - 500)
- DZ 4 (500 - 1000)
- DZ 5 (1000 - 1500)
- DZ 6 (1500 - 2000)
- DZ 7 (2000 - 3000)
- DZ 8 (3000 - 4000)
- DZ 9 (4000 - 5000)
- DZ 10 (≥5000)

Capensis floristic regions

sea surface temperature
- >29°C
- >27°C

cold currents

W. Barthlott, N. Biedinger, G. Braun
F. Feig, G. Kier, W. Lauer & J. Mutke 1997
modified after
W. Barthlott, W. Lauer & A. Placke 1996
Department of Botany and Geography
University of Bonn
German Aerospace Research Establishment, Cologne

Cartography: M. Graf
Department of Geography
University of Bonn

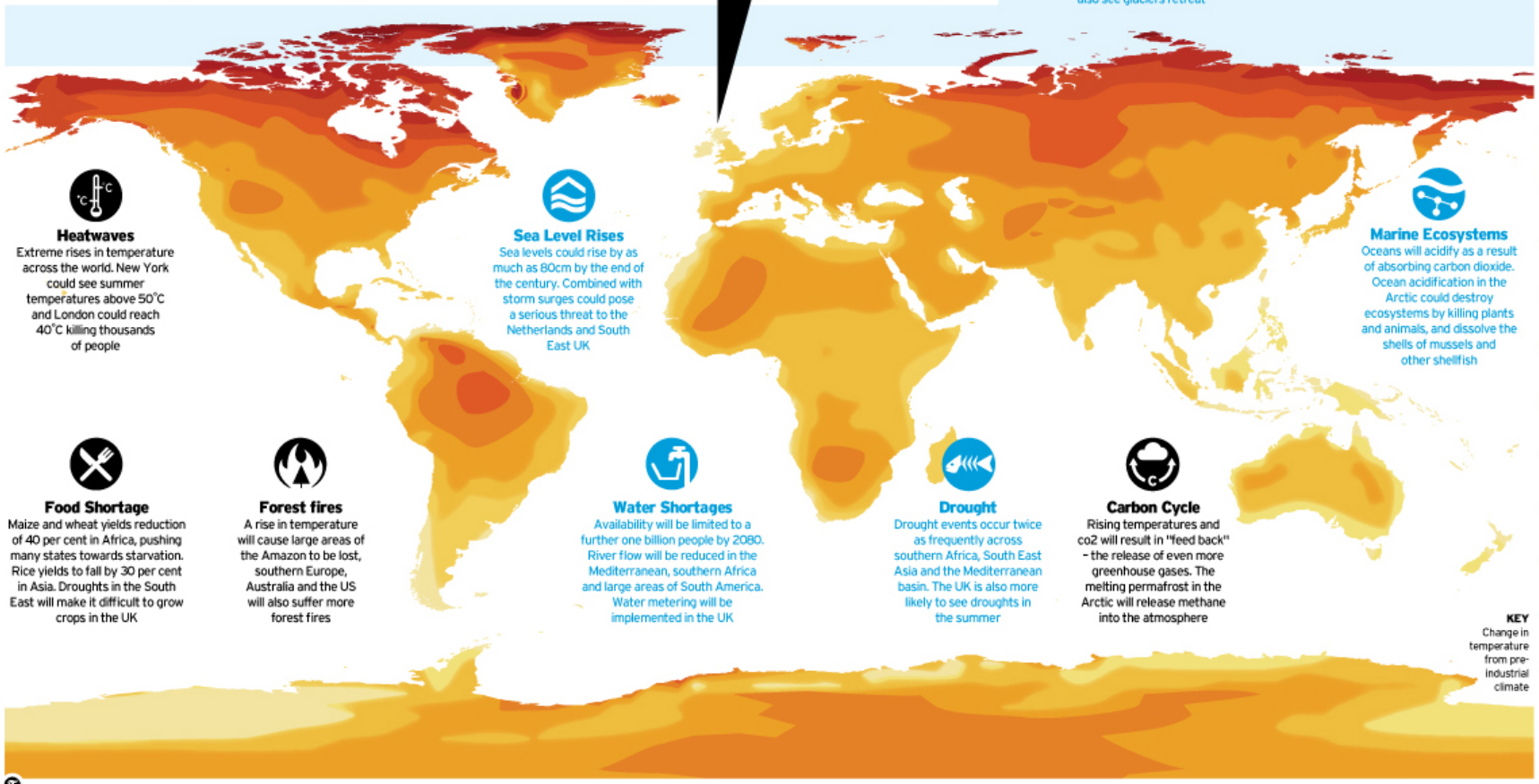
CLIMATE DESTABILISATION

The average temperature rise across the globe 4°C

The arctic rise will be as much as 16°C

Coastal areas of Britain and New Zealand will see temperatures rise by 2°C

Affects on the UK



Melting Glaciers
Himalayan glaciers will be significantly reduced by 2050 putting the water source of billions of people at risk. South America and the Alps will also see glaciers retreat

Heatwaves
Extreme rises in temperature across the world. New York could see summer temperatures above 50°C and London could reach 40°C killing thousands of people

Sea Level Rises
Sea levels could rise by as much as 80cm by the end of the century. Combined with storm surges could pose a serious threat to the Netherlands and South East UK

Marine Ecosystems
Oceans will acidify as a result of absorbing carbon dioxide. Ocean acidification in the Arctic could destroy ecosystems by killing plants and animals, and dissolve the shells of mussels and other shellfish

Food Shortage
Maize and wheat yields reduction of 40 per cent in Africa, pushing many states towards starvation. Rice yields to fall by 30 per cent in Asia. Droughts in the South East will make it difficult to grow crops in the UK

Forest fires
A rise in temperature will cause large areas of the Amazon to be lost, southern Europe, Australia and the US will also suffer more forest fires

Water Shortages
Availability will be limited to a further one billion people by 2080. River flow will be reduced in the Mediterranean, southern Africa and large areas of South America. Water metering will be implemented in the UK

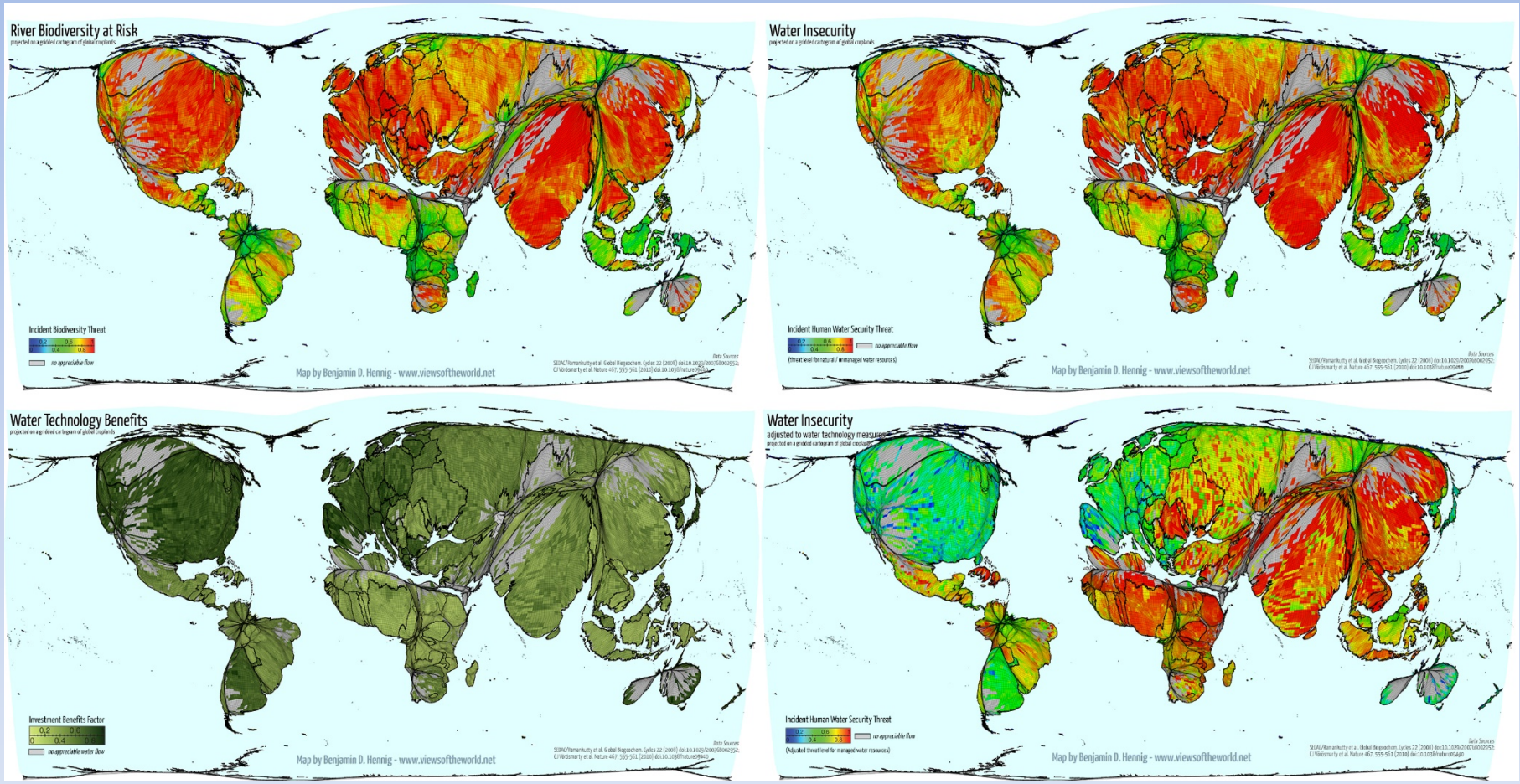
Drought
Drought events occur twice as frequently across southern Africa, South East Asia and the Mediterranean basin. The UK is also more likely to see droughts in the summer

Carbon Cycle
Rising temperatures and co2 will result in "feed back" – the release of even more greenhouse gases. The melting permafrost in the Arctic will release methane into the atmosphere

KEY
Change in temperature from pre-industrial climate

+16°C
+15°C
+14°C
+13°C
+12°C
+11°C
+10°C
+9°C
+8°C
+7°C
+6°C
+5°C
+4°C
+3°C
+2°C
+1°C

SOURCE MET OFFICE AND HM GOVERNMENT


River Biodiversity at Risk
projected on a gridded cartogram of global croplands
Incident Biodiversity Threat
0.2 0.6
0.4 0.8
no appreciable flow
Map by Benjamin D. Hennig - www.viewsoftheworld.net
Data Sources
SEWA/Ramankutty et al. Global Biogeochem. Cycles 22 (2008) doi:10.1029/2007GB002952.
C.J Vörösmarty et al. Nature 467, 555-561 (2010) doi:10.1038/nature09549.
Water Insecurity
projected on a gridded cartogram of global croplands
Incident Human Water Security Threat
0.2 0.6
0.4 0.8
no appreciable flow
(threat level for natural / unmanaged water resources)
Map by Benjamin D. Hennig - www.viewsoftheworld.net
Data Sources
SEWA/Ramankutty et al. Global Biogeochem. Cycles 22 (2008) doi:10.1029/2007GB002952.
C.J Vörösmarty et al. Nature 467, 555-561 (2010) doi:10.1038/nature09549.
Water Technology Benefits
projected on a gridded cartogram of global croplands
Investment Benefits Factor
0.2 0.6
0 0.4 0.8
no appreciable water flow
Map by Benjamin D. Hennig - www.viewsoftheworld.net
Data Sources
SEWA/Ramankutty et al. Global Biogeochem. Cycles 22 (2008) doi:10.1029/2007GB002952.
C.J Vörösmarty et al. Nature 467, 555-561 (2010) doi:10.1038/nature09549.
Water Insecurity
adjusted to water technology measures
projected on a gridded cartogram of global croplands
Incident Human Water Security Threat
0.2 0.6
0.4 0.8
no appreciable flow
(Adjusted threat level for managed water resources)
Map by Benjamin D. Hennig - www.viewsoftheworld.net
Data Sources
SEWA/Ramankutty et al. Global Biogeochem. Cycles 22 (2008) doi:10.1029/2007GB002952.
C.J Vörösmarty et al. Nature 467, 555-561 (2010) doi:10.1038/nature09549.

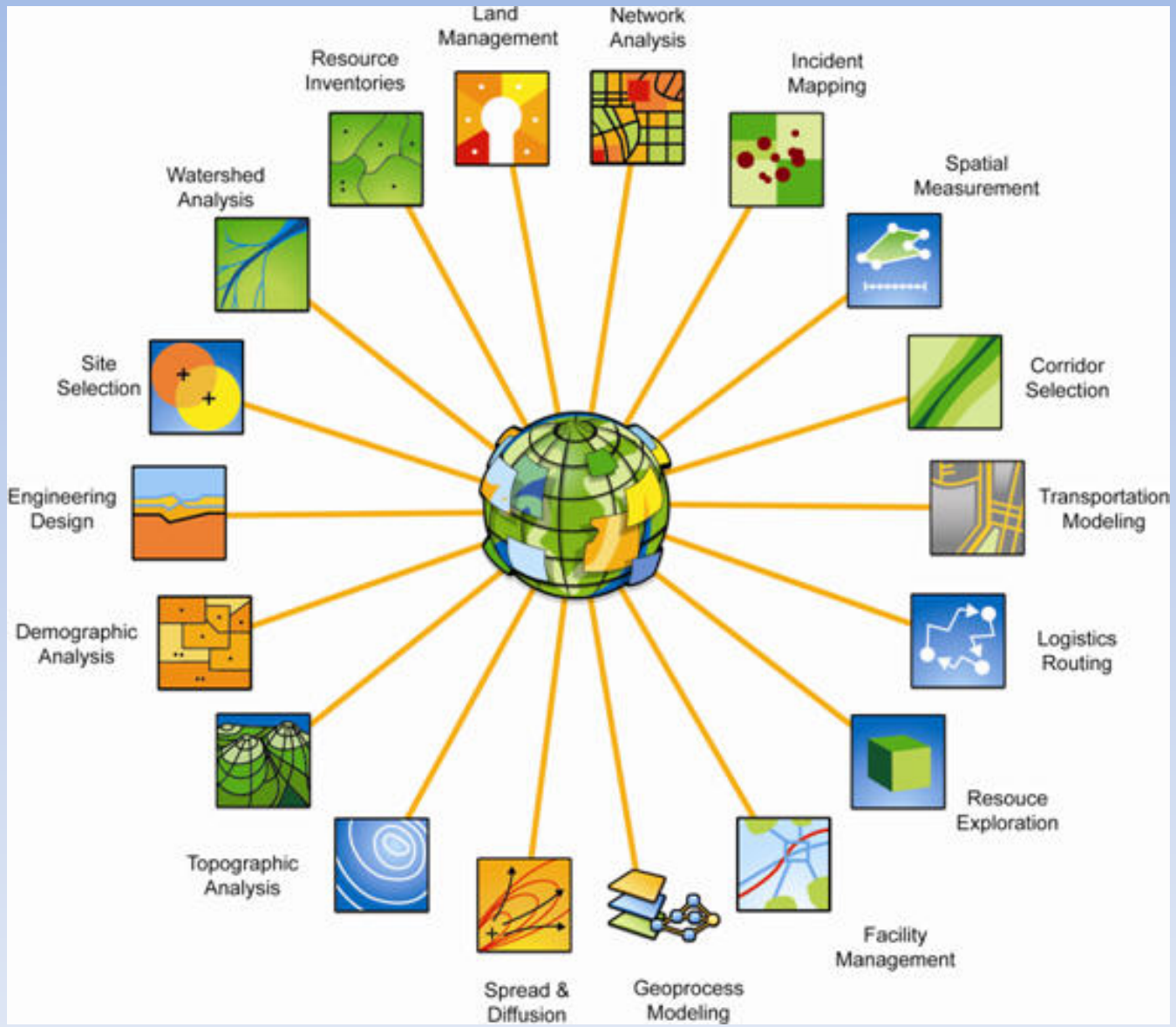
Geographic Information Systems (GIS)

- Geographic information systems are used to provide information and knowledge data in various forms to help resolve complex resource questions such as:
  - How does a community best use its natural resources?
  - What is the best location for a highway, given specific environmental, social, and economic constraints?
  - What will be the effect of locating a low-level hazardous waste disposal facility at a certain site?
  - What areas are likely to have the highest soil erosion?
  - What are the likely biological/physical impacts of global warming or ozone depletion?
- Geographic information systems are also enjoying greatly expanded application in business from siting retail stores, to real estate, logistics, and marketing.
- Together, photogrammetry, remote sensing, and GIS offer numerous employment opportunities throughout the private, governmental, and academic sectors and across the globe.

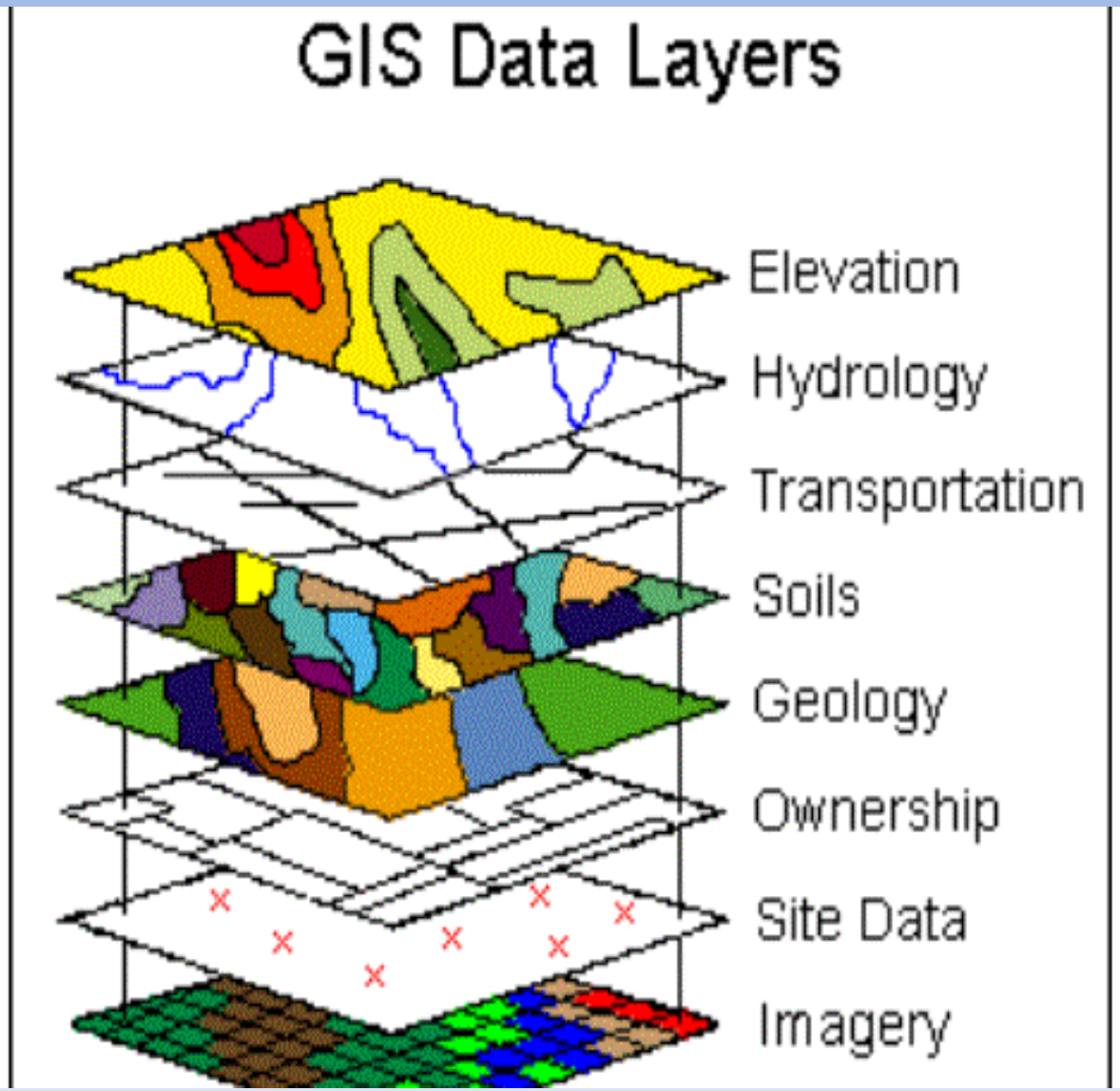
Application of GIS

- Geospatial information is increasingly becoming the driving force for decision making across the local to global continuum.
- Tasks as varied as:
  - planning urban growth,
  - managing a forest,
  - implementing "precision farming,"
  - assessing insurance claims,
  - siting an automatic teller machine,
  - routing 911 vehicles,
  - drilling a well,
  - assessing groundwater contamination,
  - designing a cellular phone network,
  - guiding "intelligent" vehicles,
  - assessing the market for manufactured goods,
  - managing a city, operating a utility,
  - improving wildlife habitat,
  - monitoring air quality,
  - assessing environmental impact,
  - designing a road,
  - studying human health statistics,
  - minimizing water pollution,
  - undertaking real estate transactions,
  - preserving wetlands,
  - mapping natural hazards and disasters,
  - providing famine relief, or studying the causes and consequences of global climate change, can be greatly enhanced by the use of some form of geospatial technology.
- The pioneers, builders, and specialists in geospatial information collection and management are trained in such fields as photogrammetry, remote sensing, and GIS.

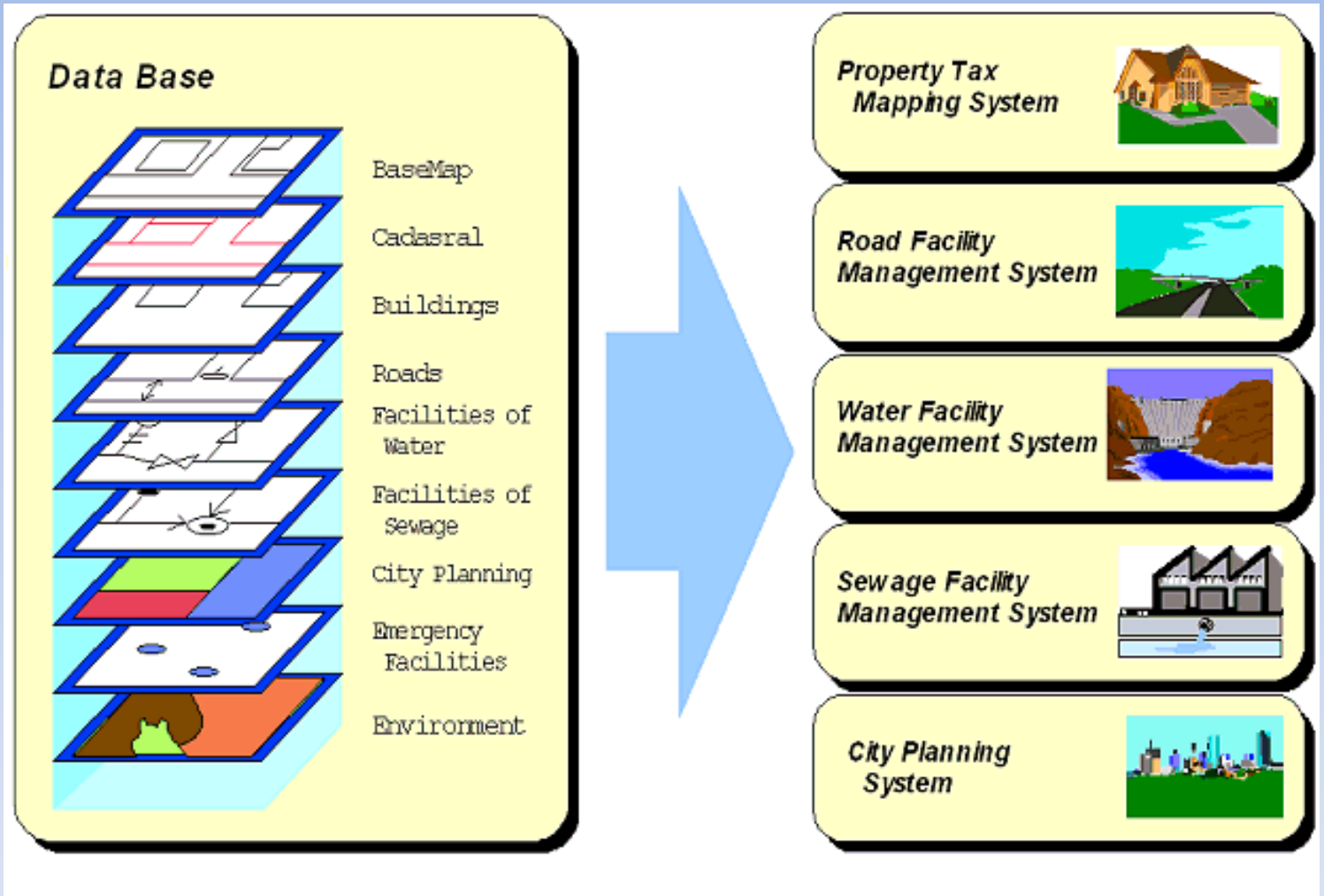
Application

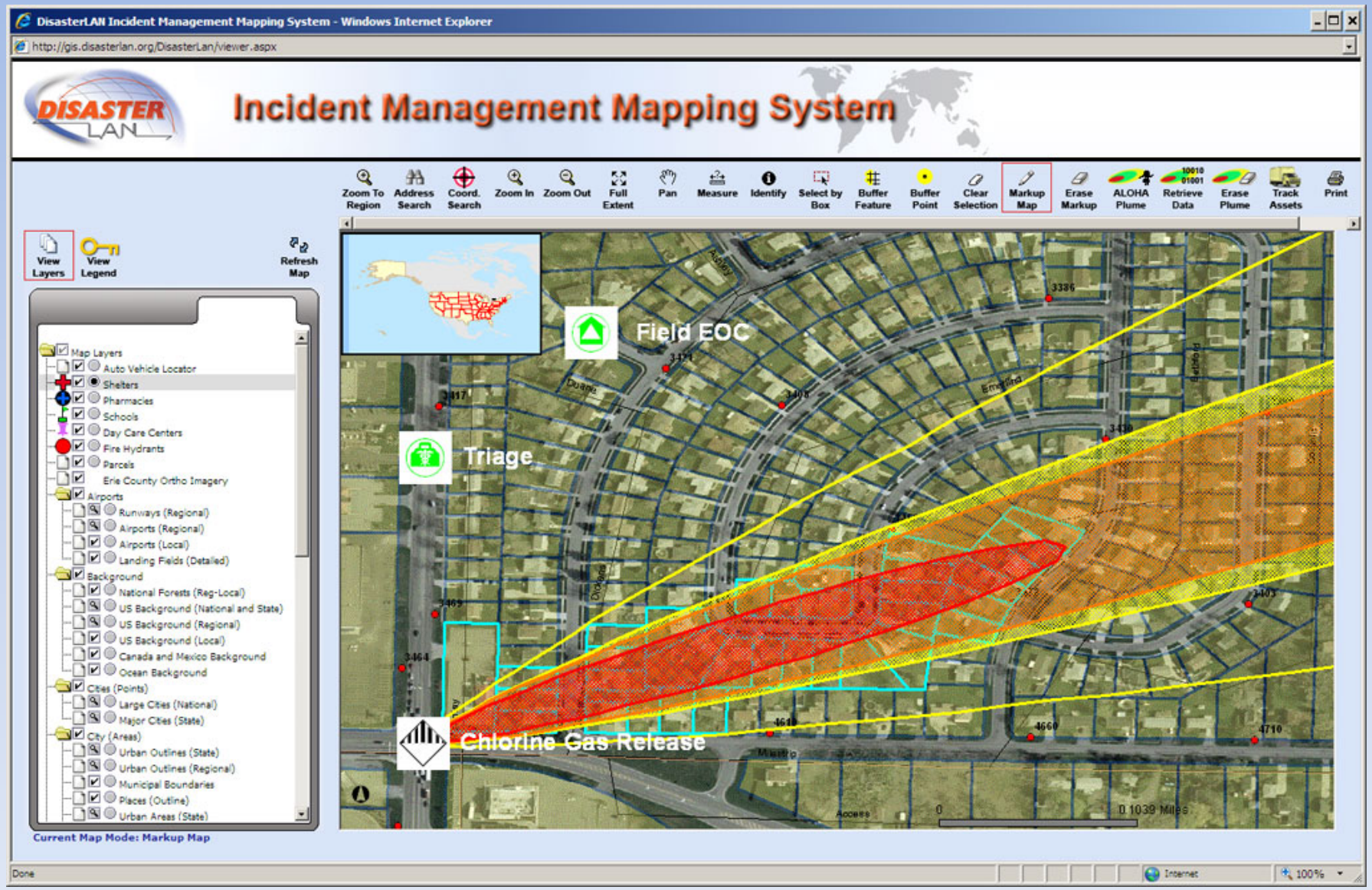


GIS Data

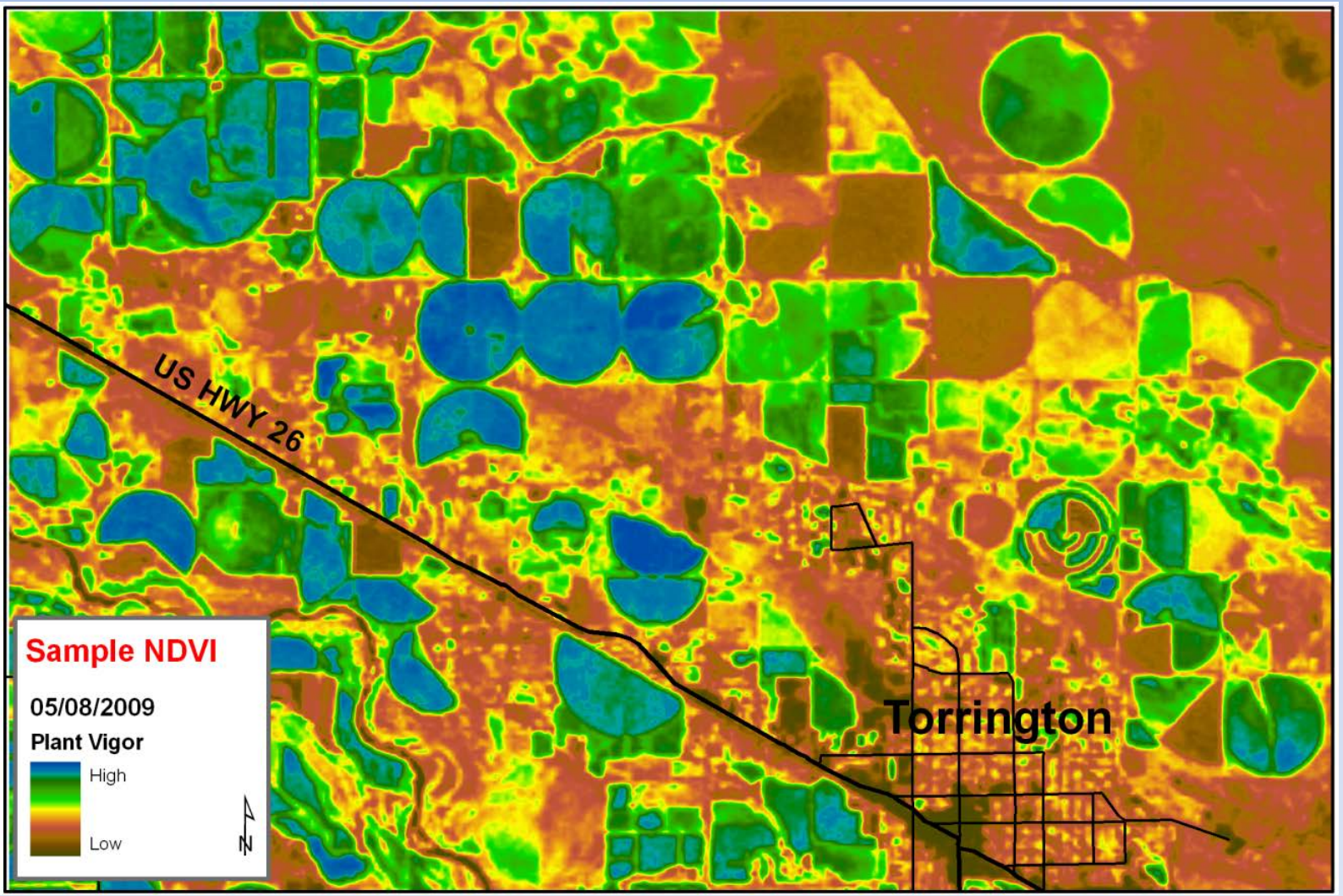

GIS Data Layers
Elevation
Hydrology
Transportation
Soils
Geology
Ownership
Site Data
Imagery

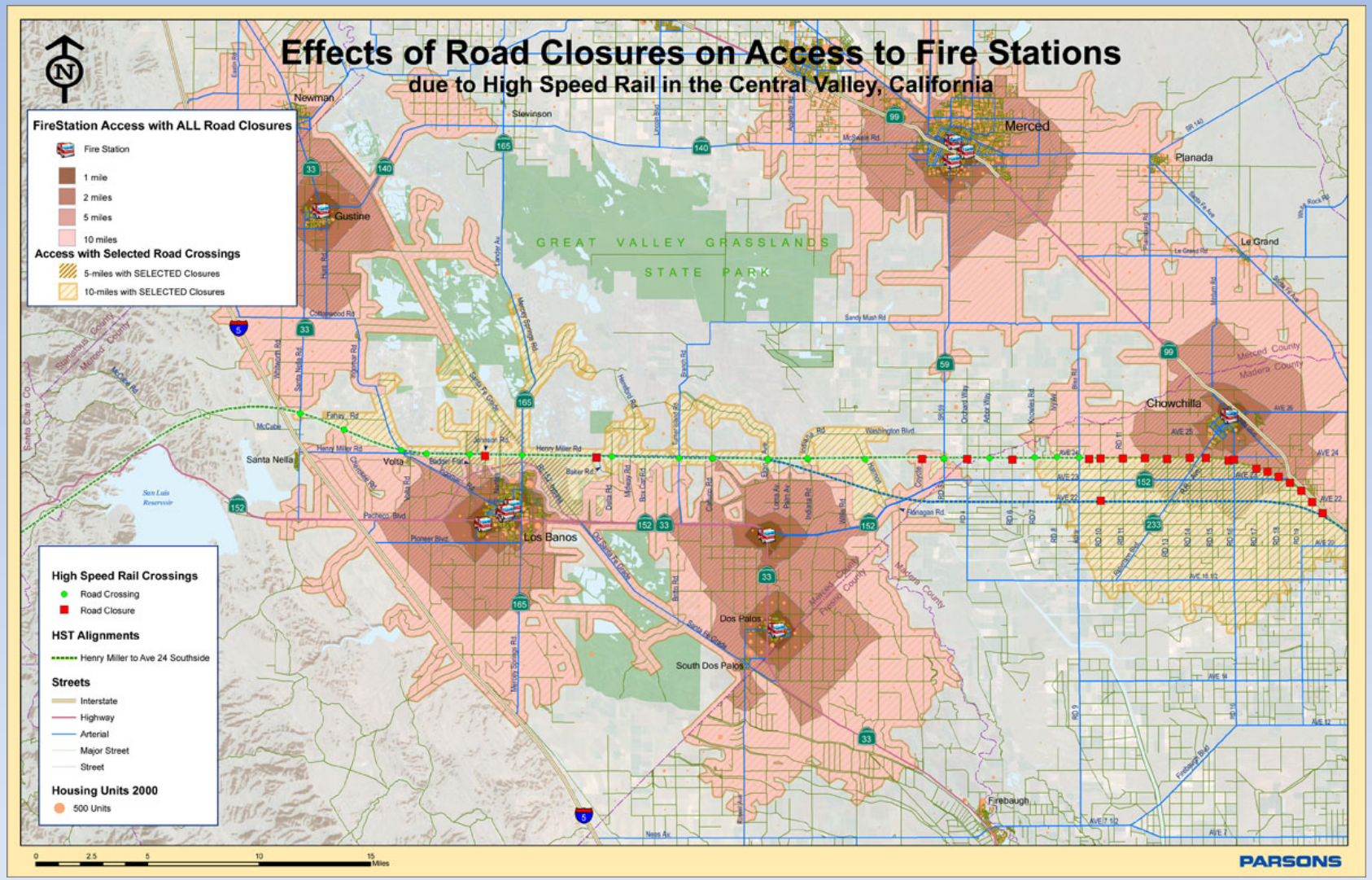
Overview

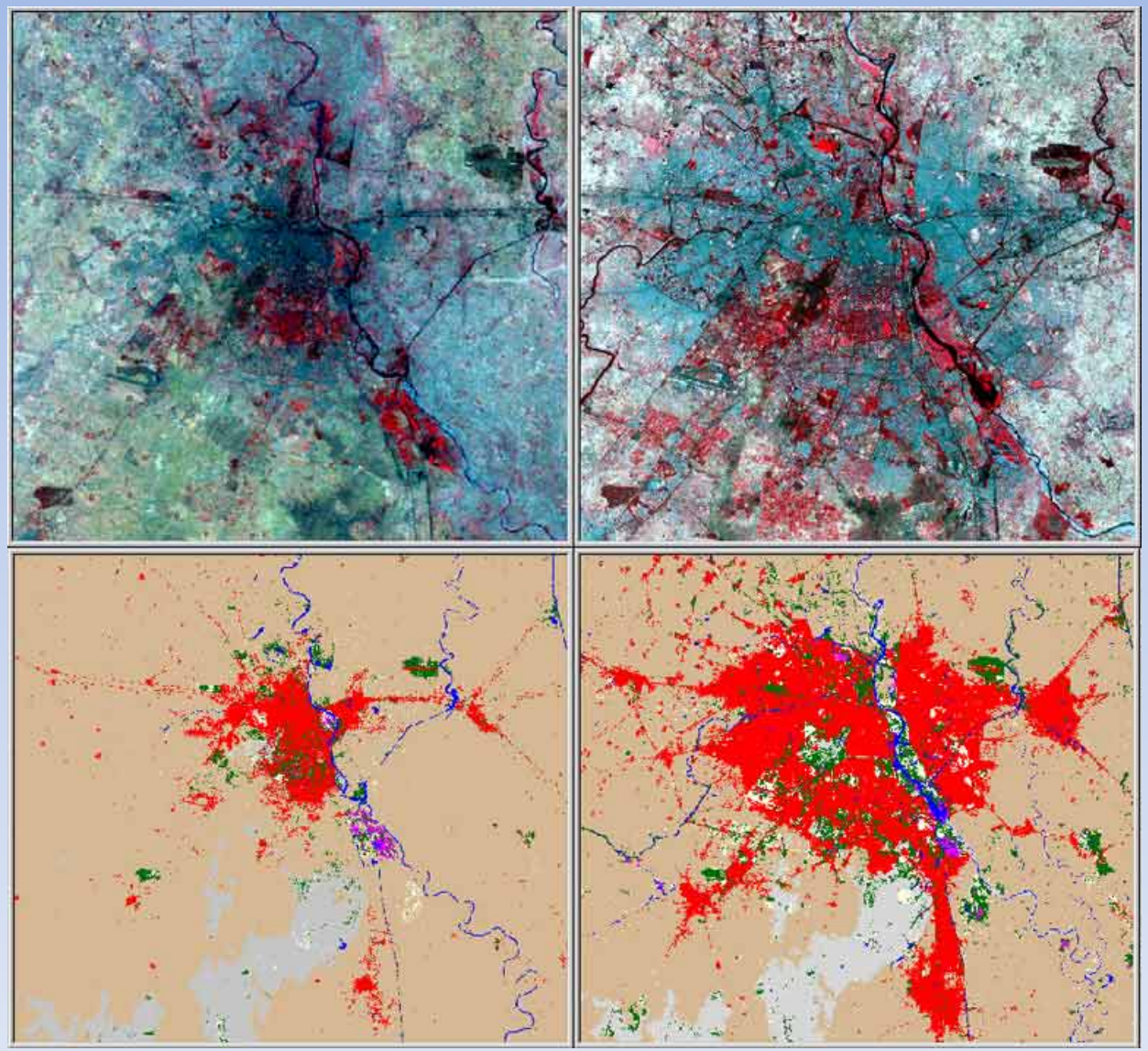

Data Base
BaseMap
Cadasral
Buildings
Roads
Facilities of Water
Facilities of Sewage
City Planning
Emergency Facilities
Enviroment
Property Tax Mapping System
Road Facility Management System
Water Facility Management System
Sewage Facility Management System
City Planning System


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%

Implementing "precision farming”



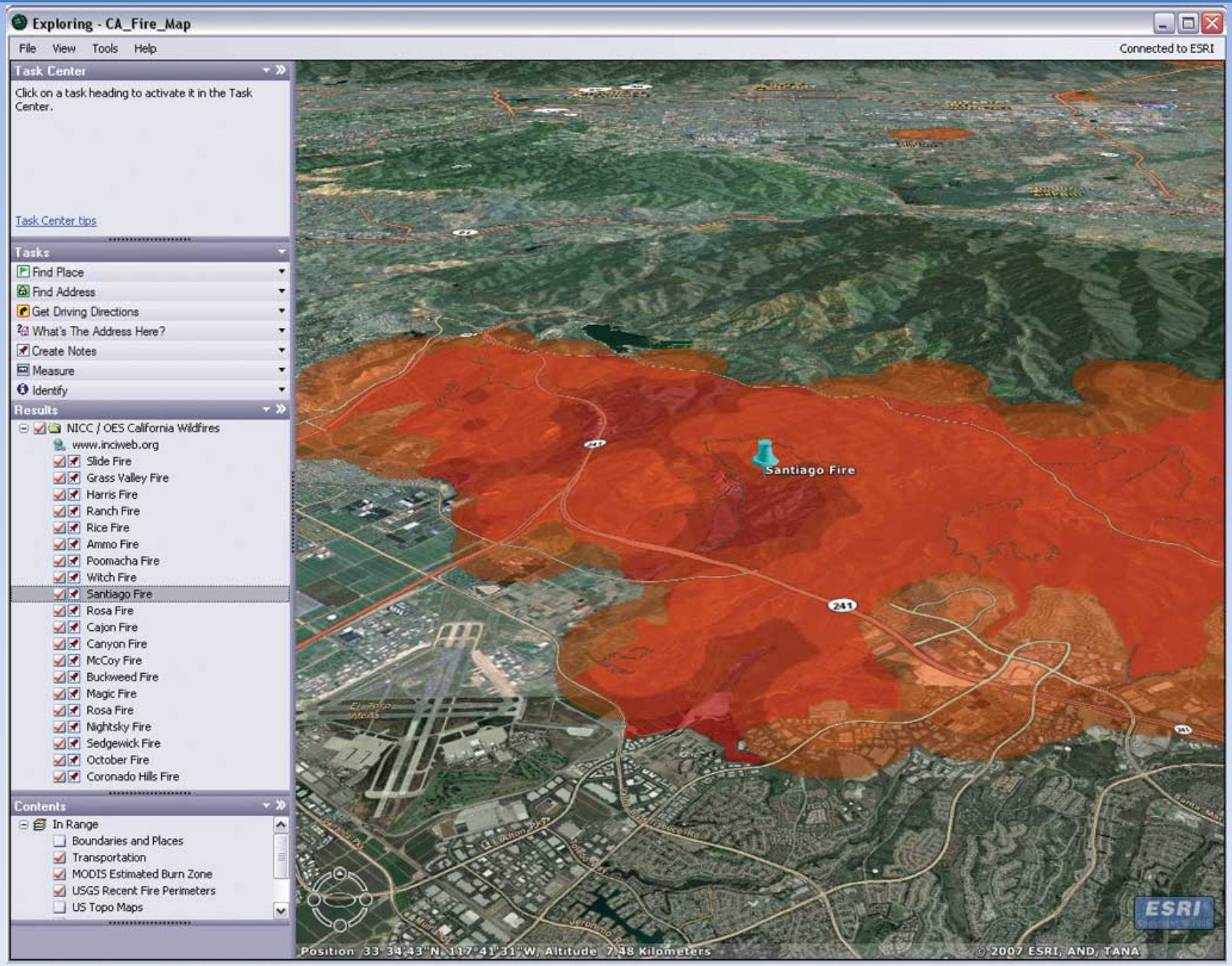

Effects of Road Closures on Access to Fire Stations
due to High Speed Rail in the Central Valley, California
FireStation Access with ALL Road Closures
Fire Station
1 mile
2 miles
5 miles
10 miles
Access with Selected Road Crossings
5-miles with SELECTED Closures
10-miles with SELECTED Closures
High Speed Rail Crossings
Road Crossing
Road Closure
HST Alignments
Henry Miller to Ave 24 Southside
Streets
Interstate
Highway
Arterial
Major Street
Street
Housing Units 2000
500 Units
GREAT VALLEY GRASSLANDS
STATE PARK
Newman
Stevinson
Merced
Planada
Gustine
Le Grand
Chowchilla
Santa Nella
Volta
Los Banos
Dos Palos
South Dos Palos
Firebaugh
Merced County
Madera County
Stanislaus County
Santa Clara Co
San Luis Reservoir
0
2.5
5
10
15
Miles
PARSONS



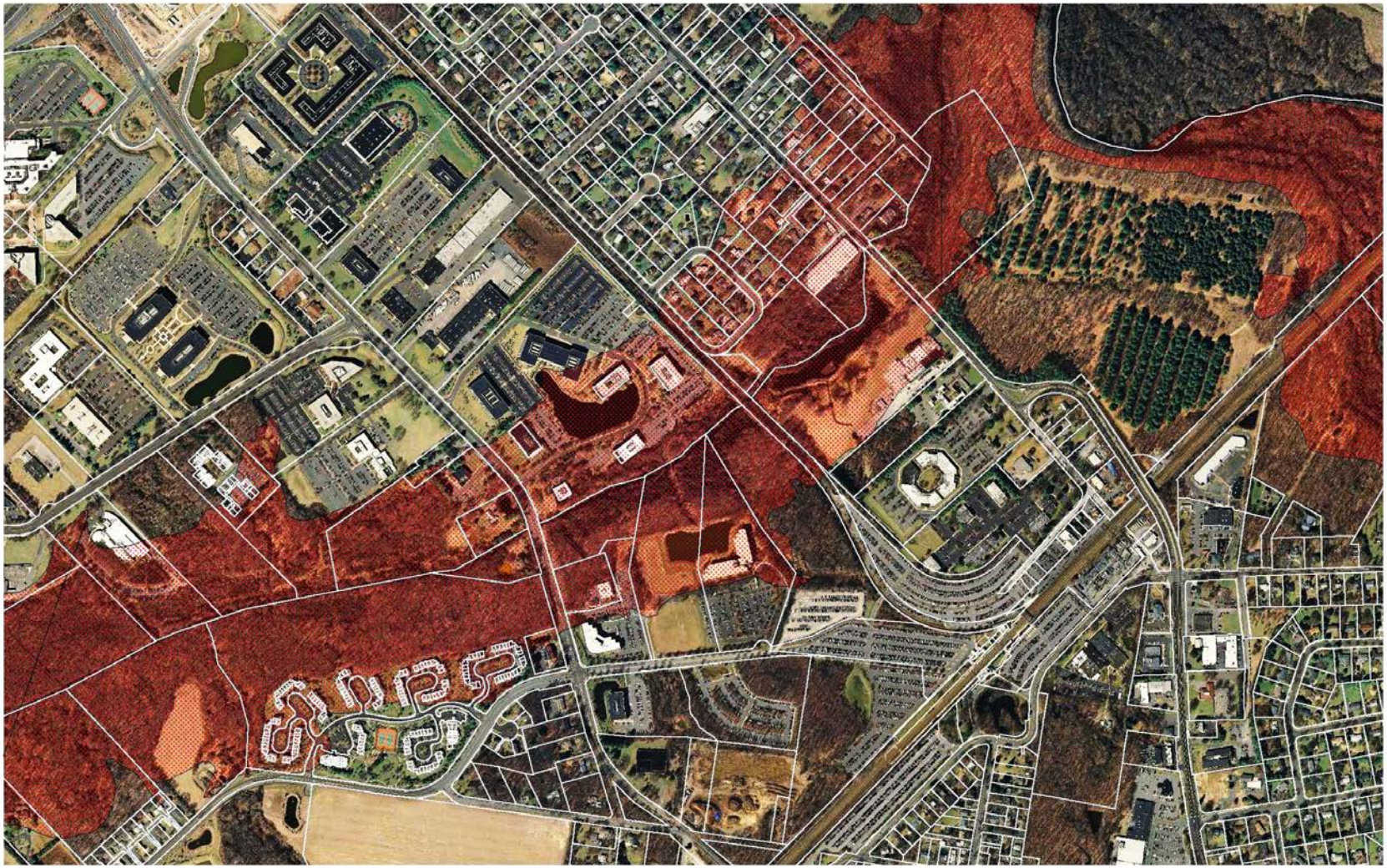
New Delhi Urban Growth

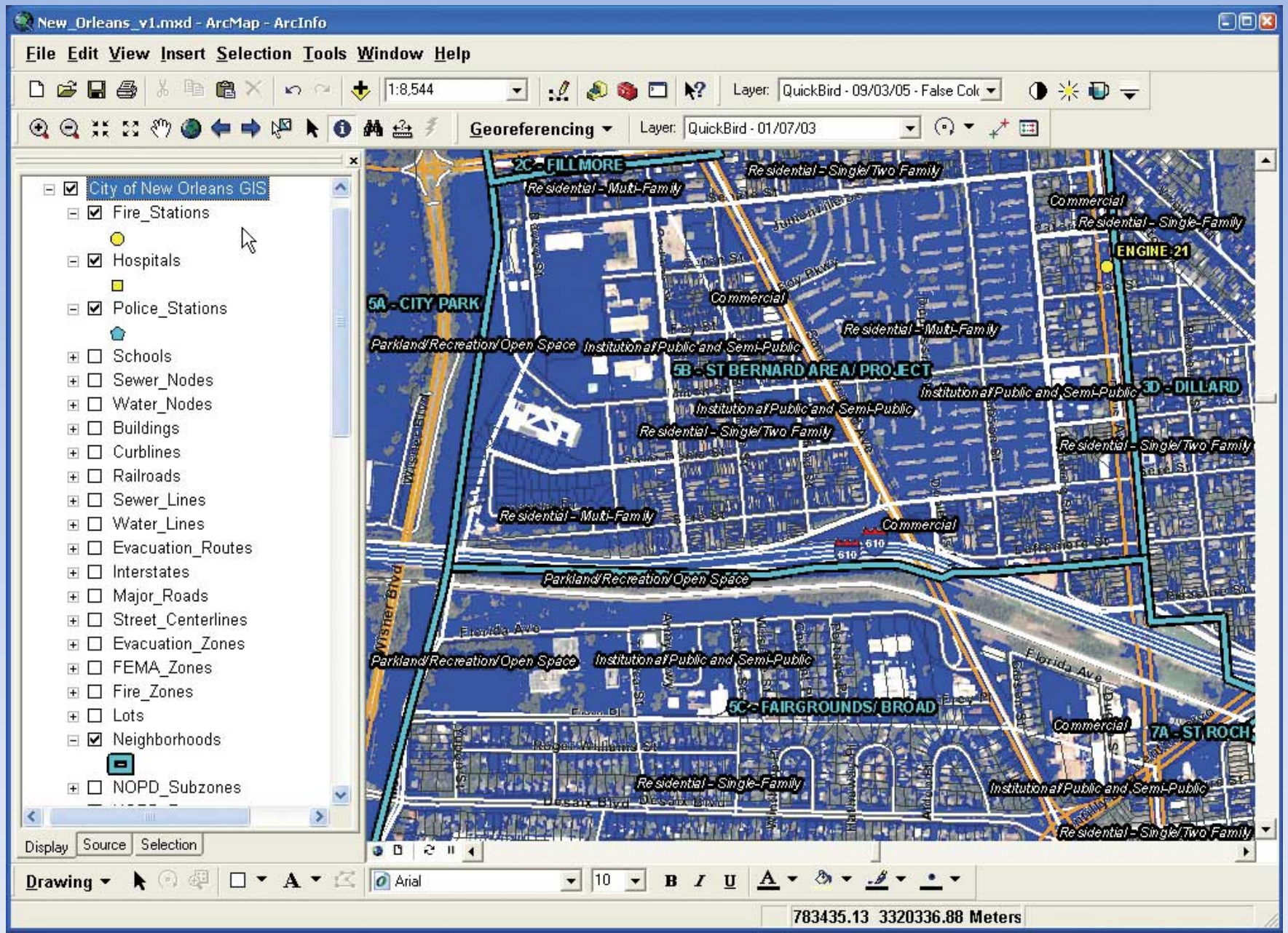
Forest Fire

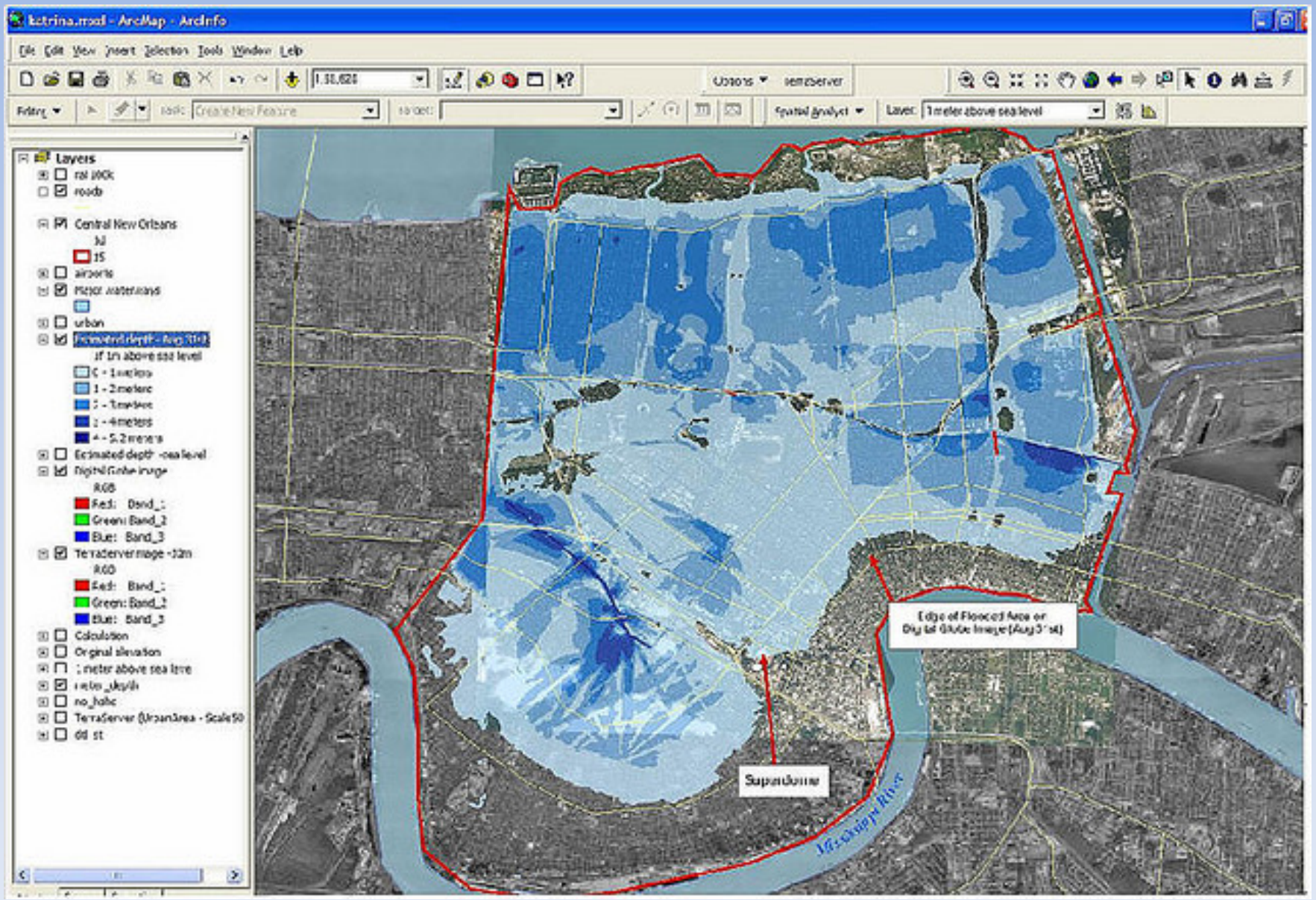
Forest Fire Impact



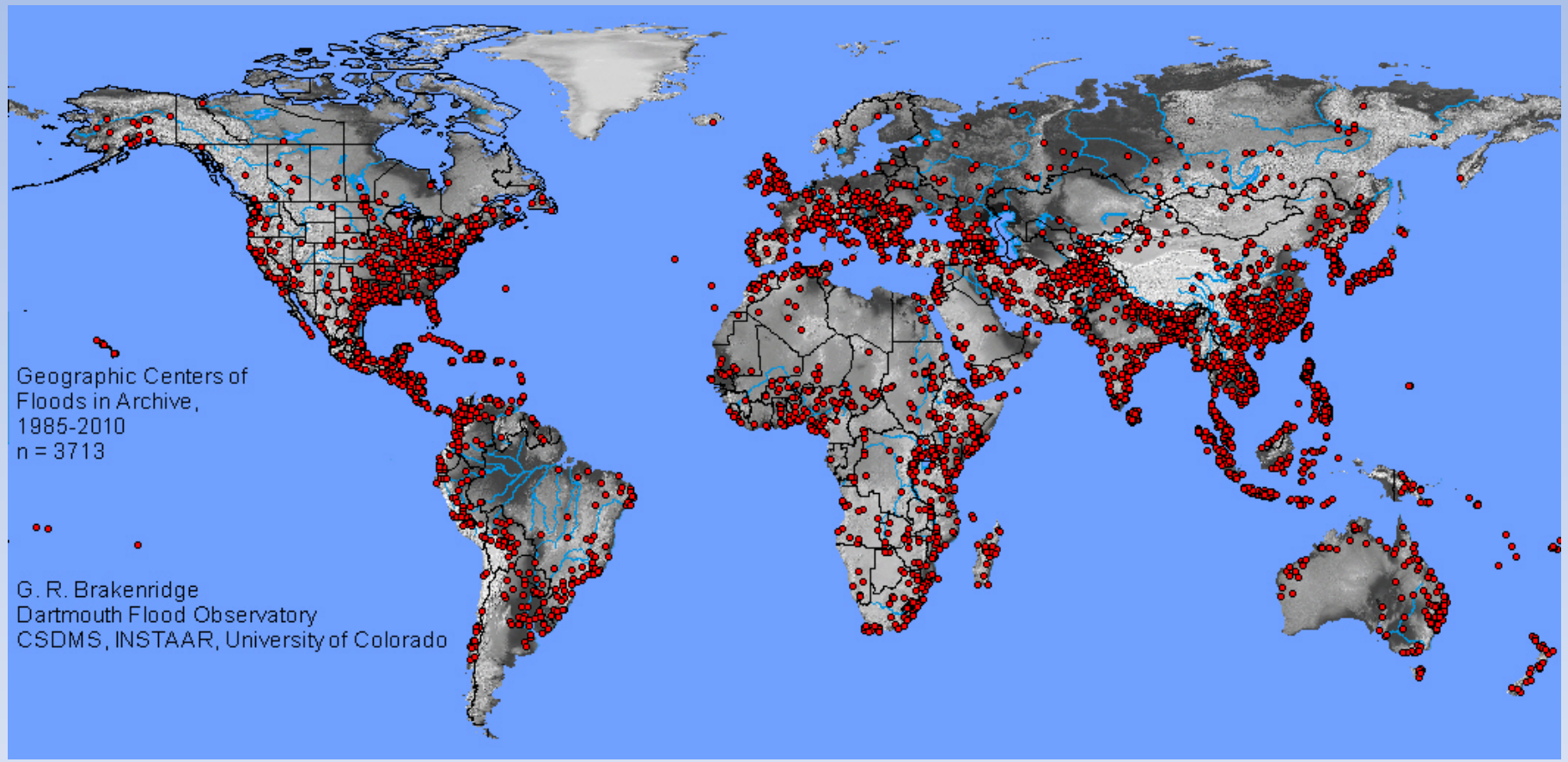

Washington
Gray Buildings © 2008 Sanborn
Gray Buildings © District of Columbia (DC GIS) & CyberCity
Gray Buildings © 2009 CyberCity
© 2009 Tele Atlas
lat 38.880509° lon -77.000400° elev 26 m
©2009 Google
Eye alt 1.48 km



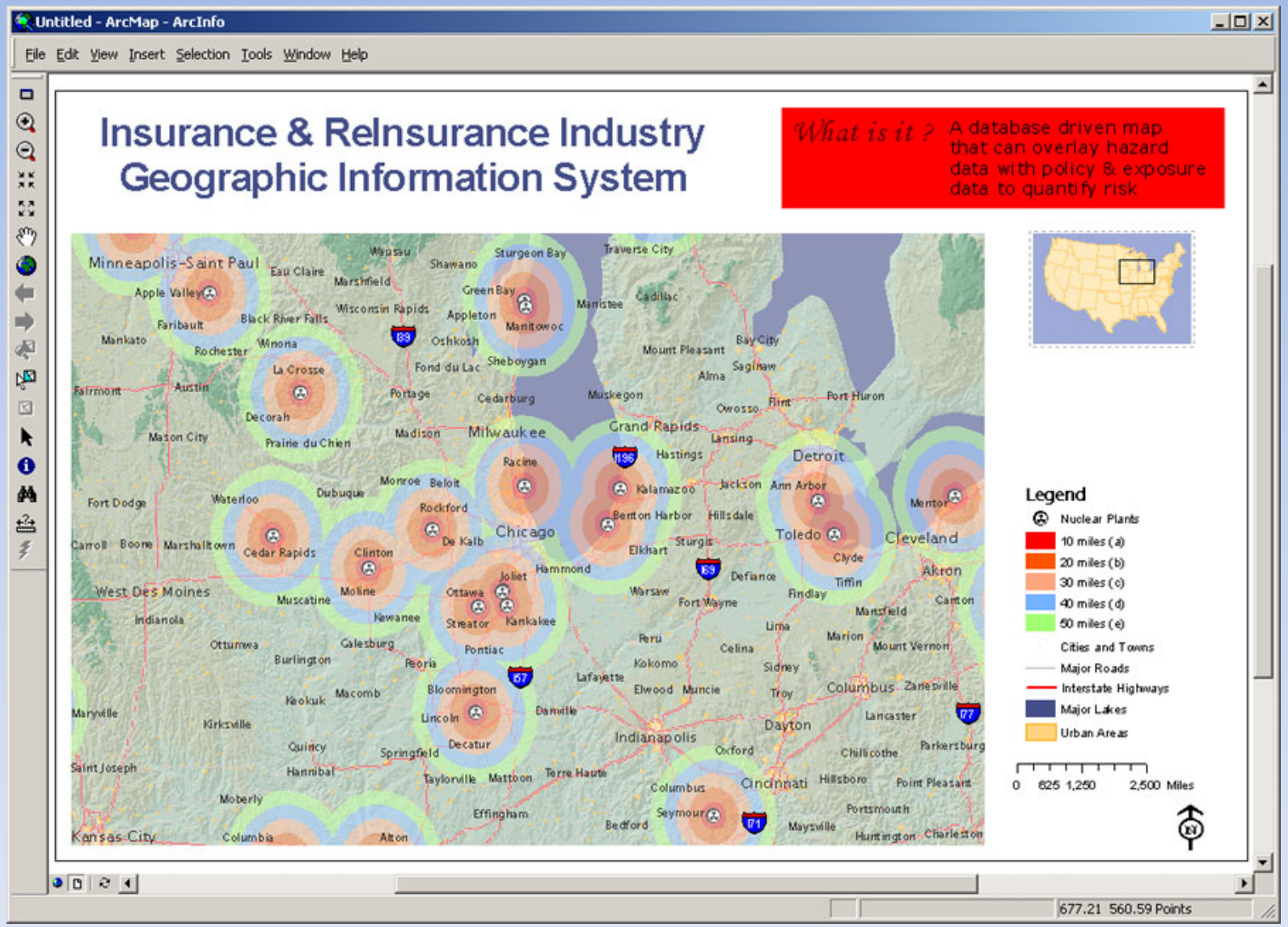

New_Orleans_v1.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:8,544
Layer: QuickBird - 09/03/05 - False Col
Georeferencing
Layer: QuickBird - 01/07/03
City of New Orleans GIS
Fire_Stations
Hospitals
Police_Stations
Schools
Sewer_Nodes
Water_Nodes
Buildings
Curblines
Railroads
Sewer_Lines
Water_Lines
Evacuation_Routes
Interstates
Major_Roads
Street_Centerlines
Evacuation_Zones
FEMA_Zones
Fire_Zones
Lots
Neighborhoods
NOPD_Subzones
Display
Source
Selection
2C - FILLMORE
Residential - Multi-Family
Residential - Single/Two Family
Commercial
Residential - Single-Family
ENGINE 21
5A - CITY PARK
Commercial
Residential - Multi-Family
Parkland/Recreation/Open Space
Institutional/Public and Semi-Public
5B - ST BERNARD AREA/ PROJECT
Institutional/Public and Semi-Public
3D - DILLARD
Institutional/Public and Semi-Public
Residential - Single/Two Family
Residential - Single/Two Family
Residential - Multi-Family
Commercial
610
Parkland/Recreation/Open Space
Wisner Blvd
Florida Ave
Parkland/Recreation/Open Space
Institutional/Public and Semi-Public
Florida Ave
5C - FAIRGROUNDS/ BROAD
Commercial
7A - ST ROCH
Residential - Single-Family
Institutional/Public and Semi-Public
Residential - Single/Two Family
Drawing
Arial
10
783435.13 3320336.88 Meters


katrina.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
Layers
roads
Central New Orleans
airports
urban
Estimated depth -sea level
Digital Globe image
Calculation
Original elevation
no_hole
Edge of Flooded Area on Digital Globe Image (Aug 31st)
Superdome

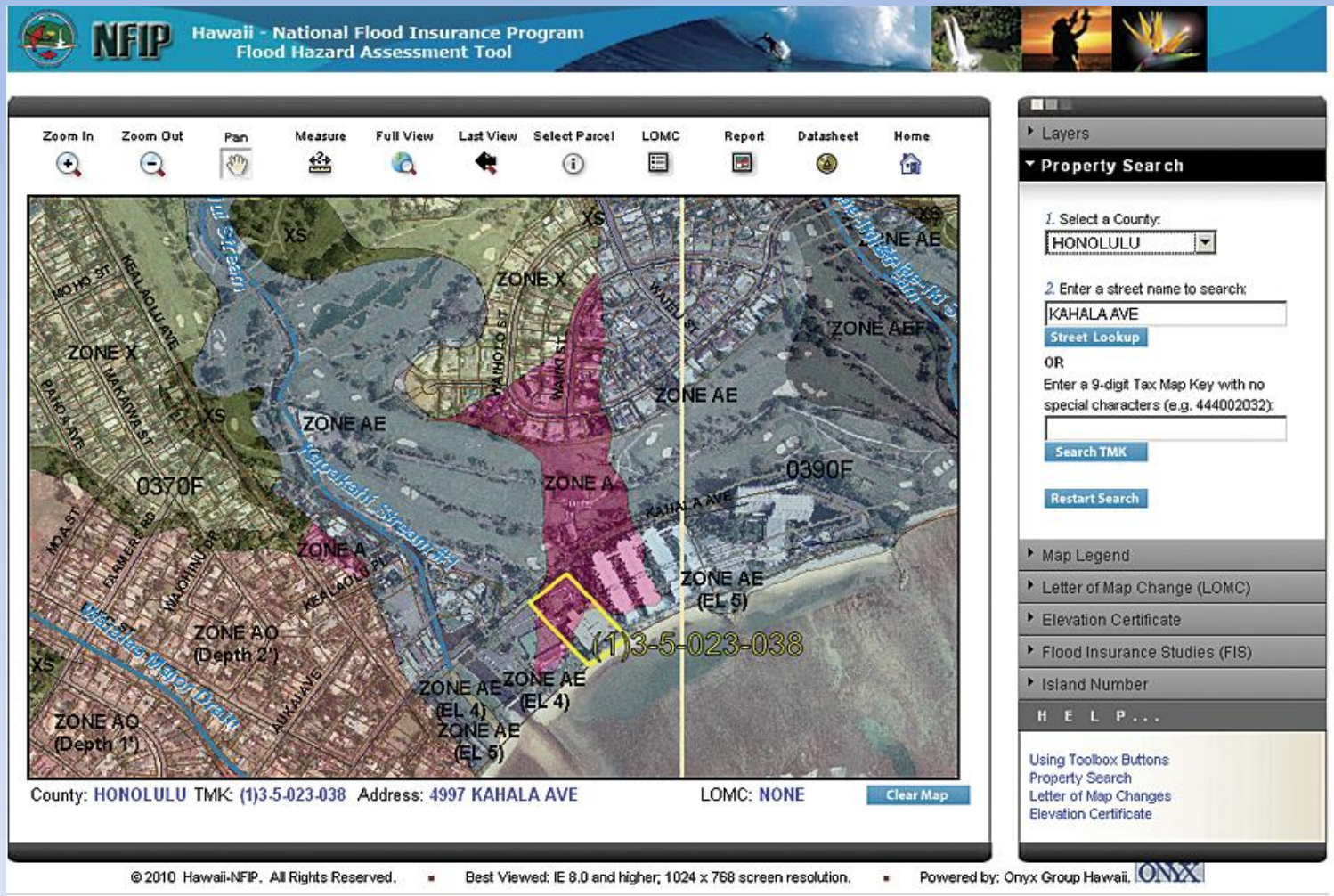
Floods


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

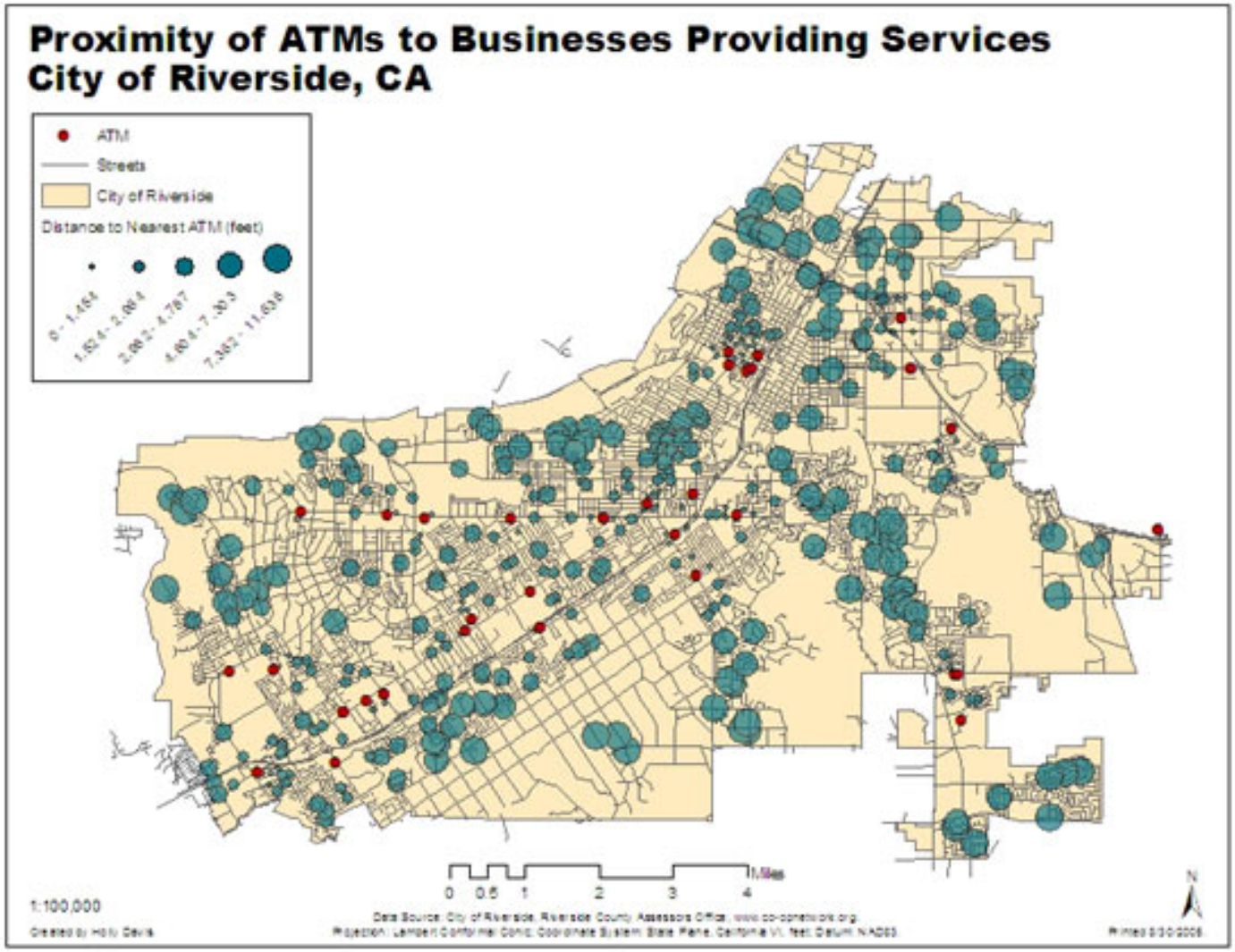
Insurance


Untitled - ArcMap - ArcInfo
File 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
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
Major Lakes
Urban Areas
0 625 1,250 2,500 Miles
Minneapolis-Saint Paul
Milwaukee
Chicago
Grand Rapids
Detroit
Toledo
Cleveland
Akron
Indianapolis
Columbus
Dayton
Cincinnati
Kansas City
677.21 560.59 Points

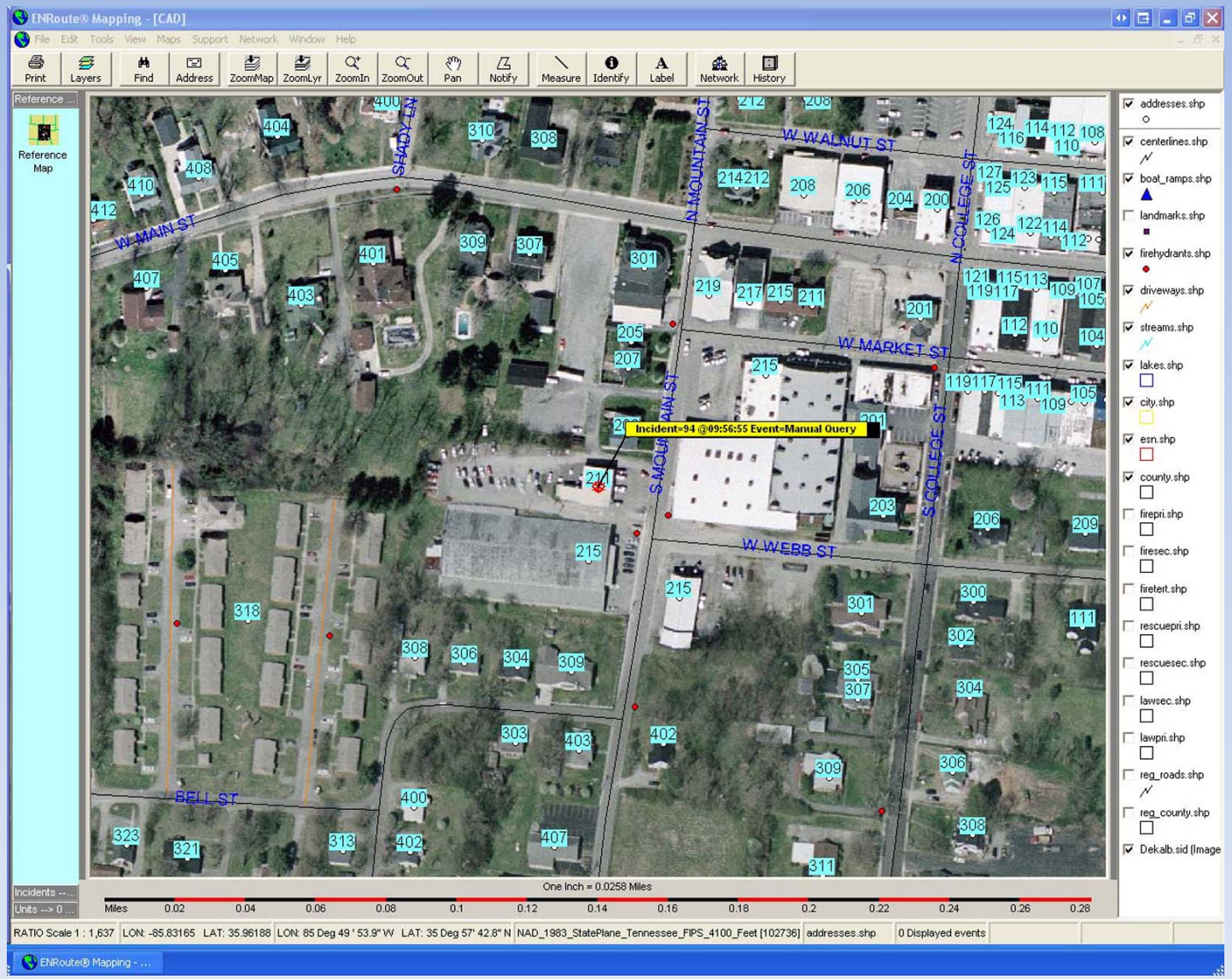
National Flood Insurance Program



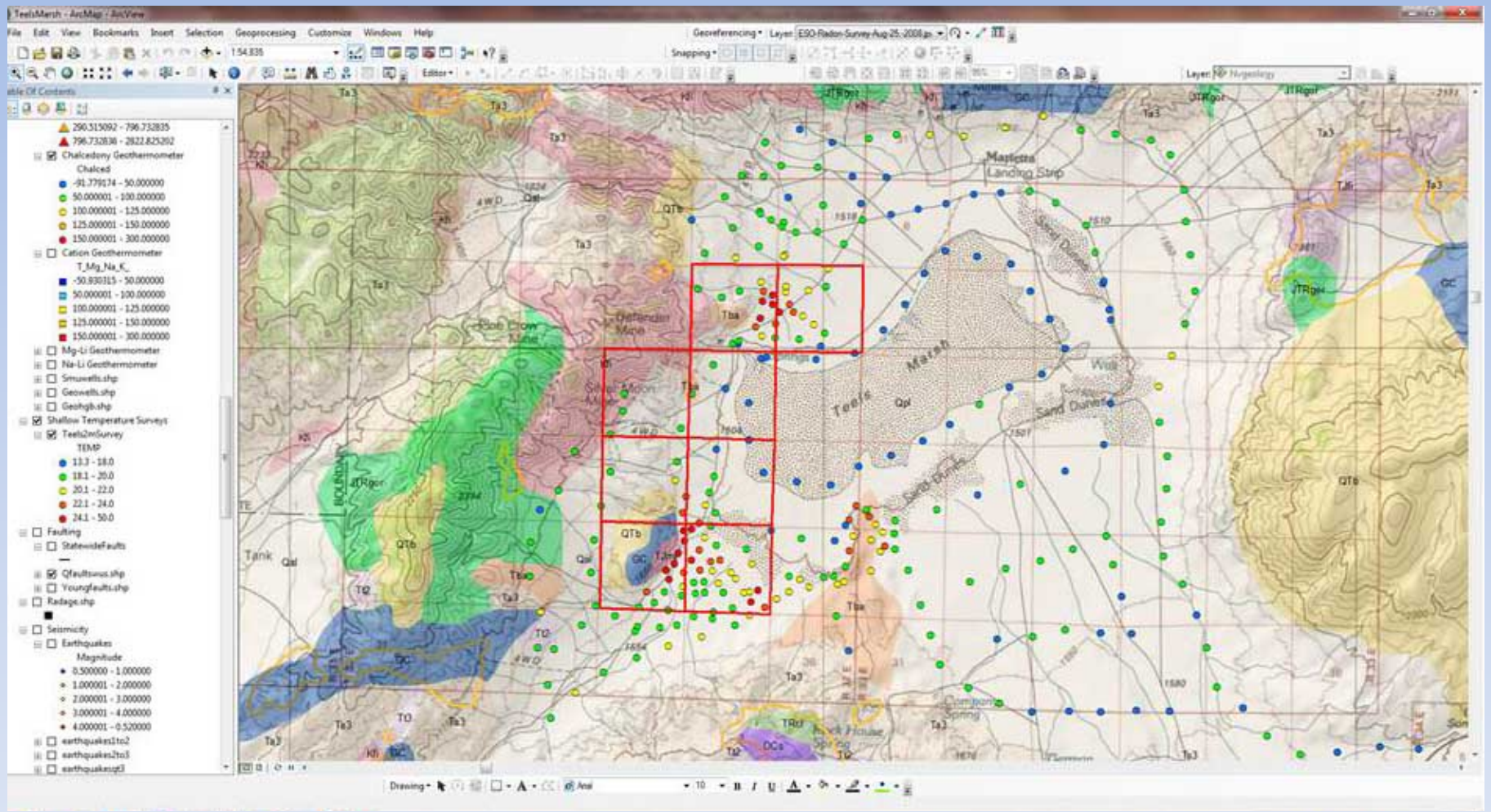
Identify Optimum ATM Locations



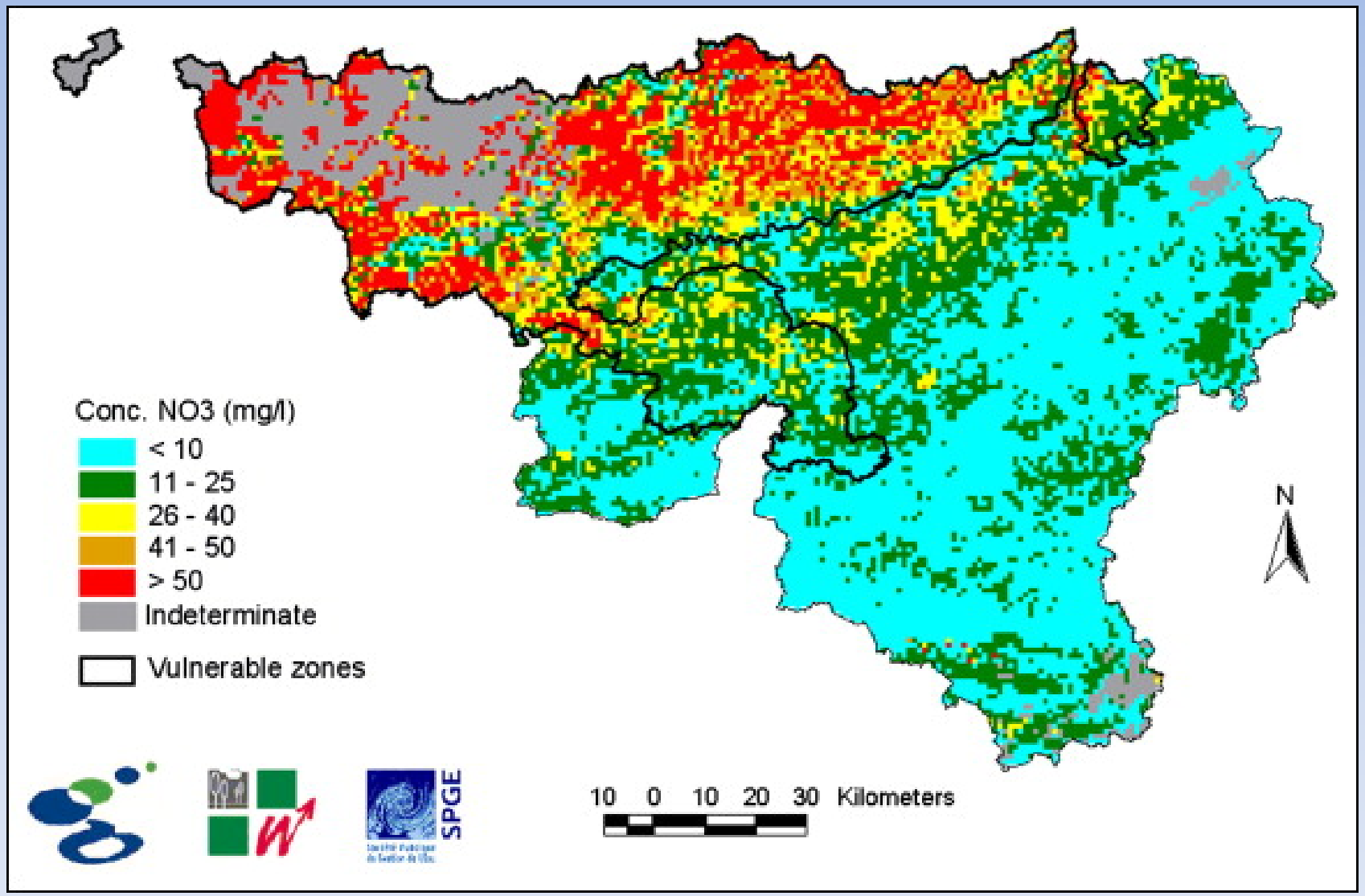
911 - GIS Integration



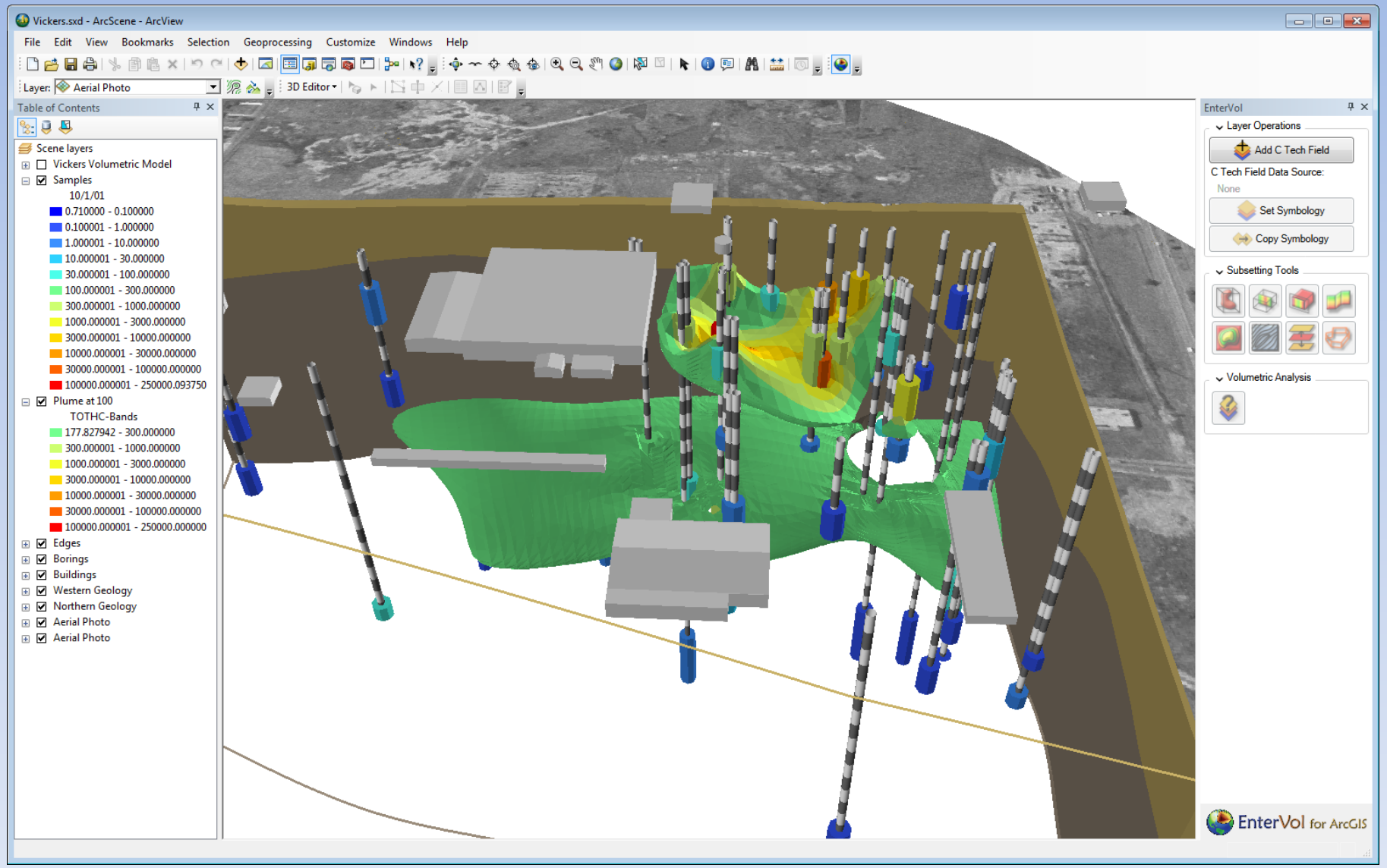
Oil Well Drilling - finding optimum location



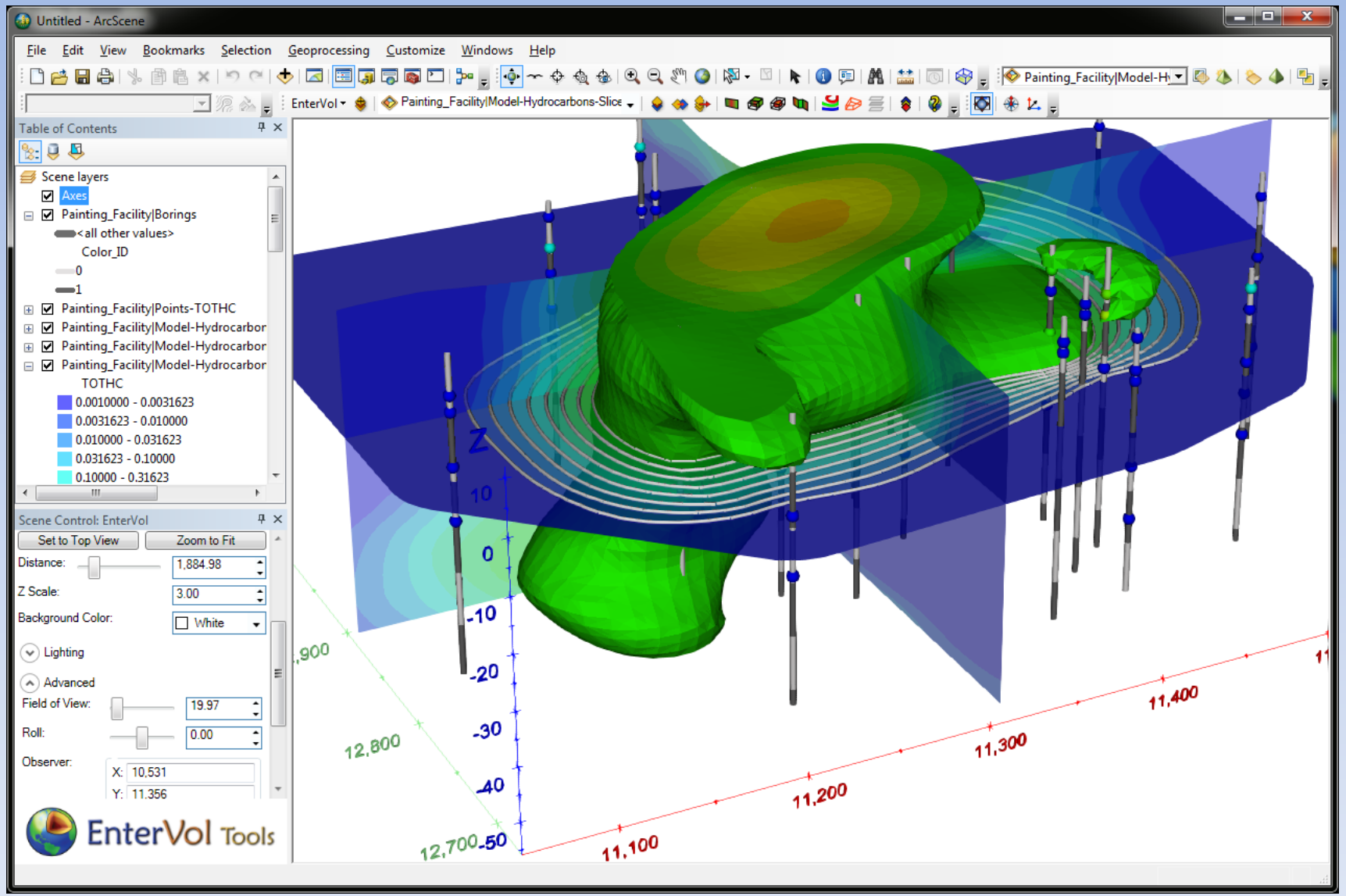
Groundwater Contamination



Groundwater Contamination



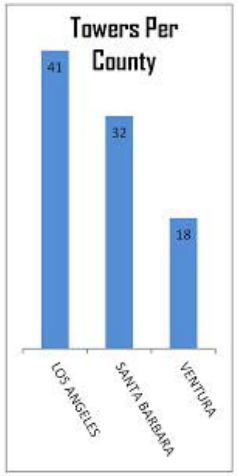
Groundwater Contamination



Mapping Cell Towers

Santa Barbara, Ventura & Los Angeles

Cell Tower

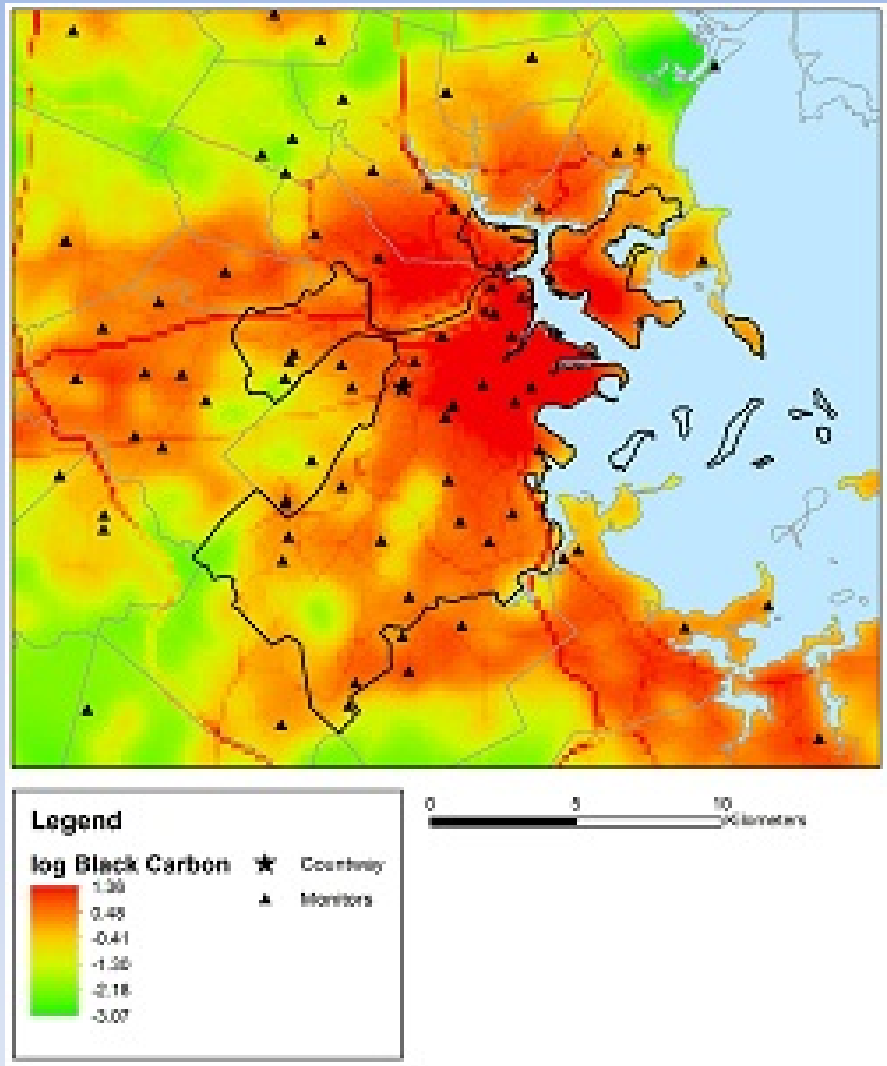


Cartographer: Kelsey Kaszas // UCLA Geography Department // April 6, 2012

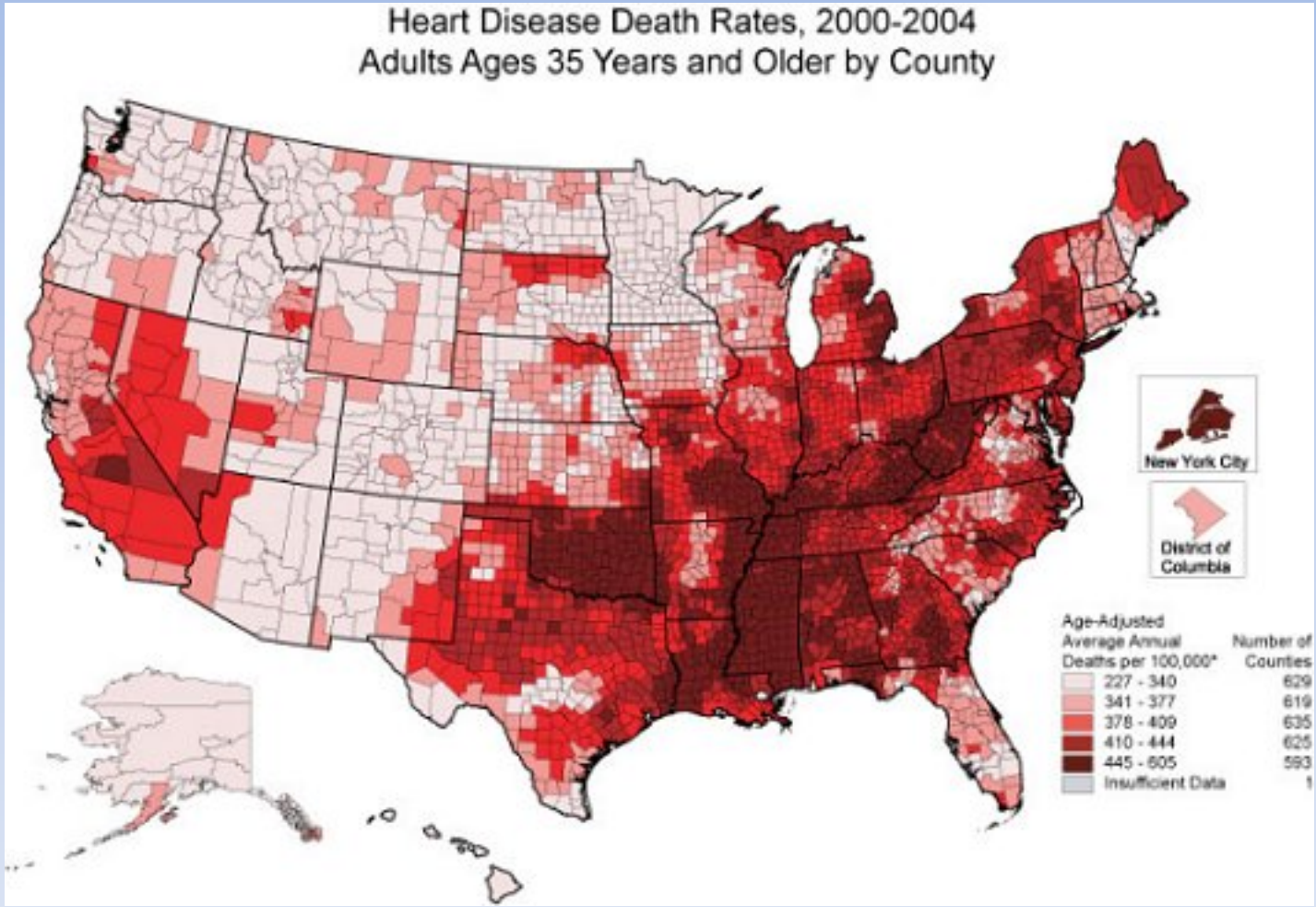
Data Source: Federal Communications Commission (FCC), ESRI Basemap

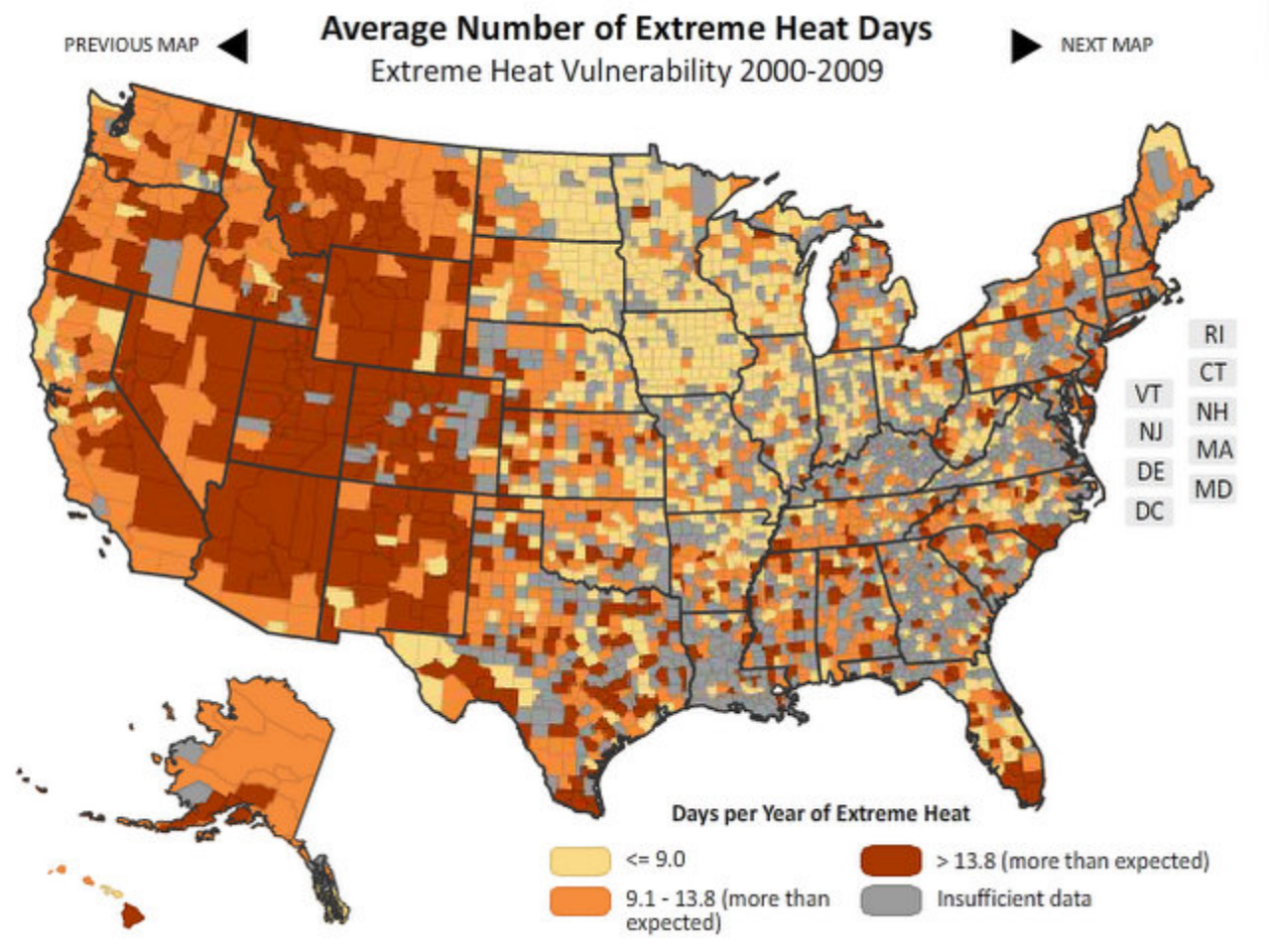
GCS: NAD 1983

Air Quality

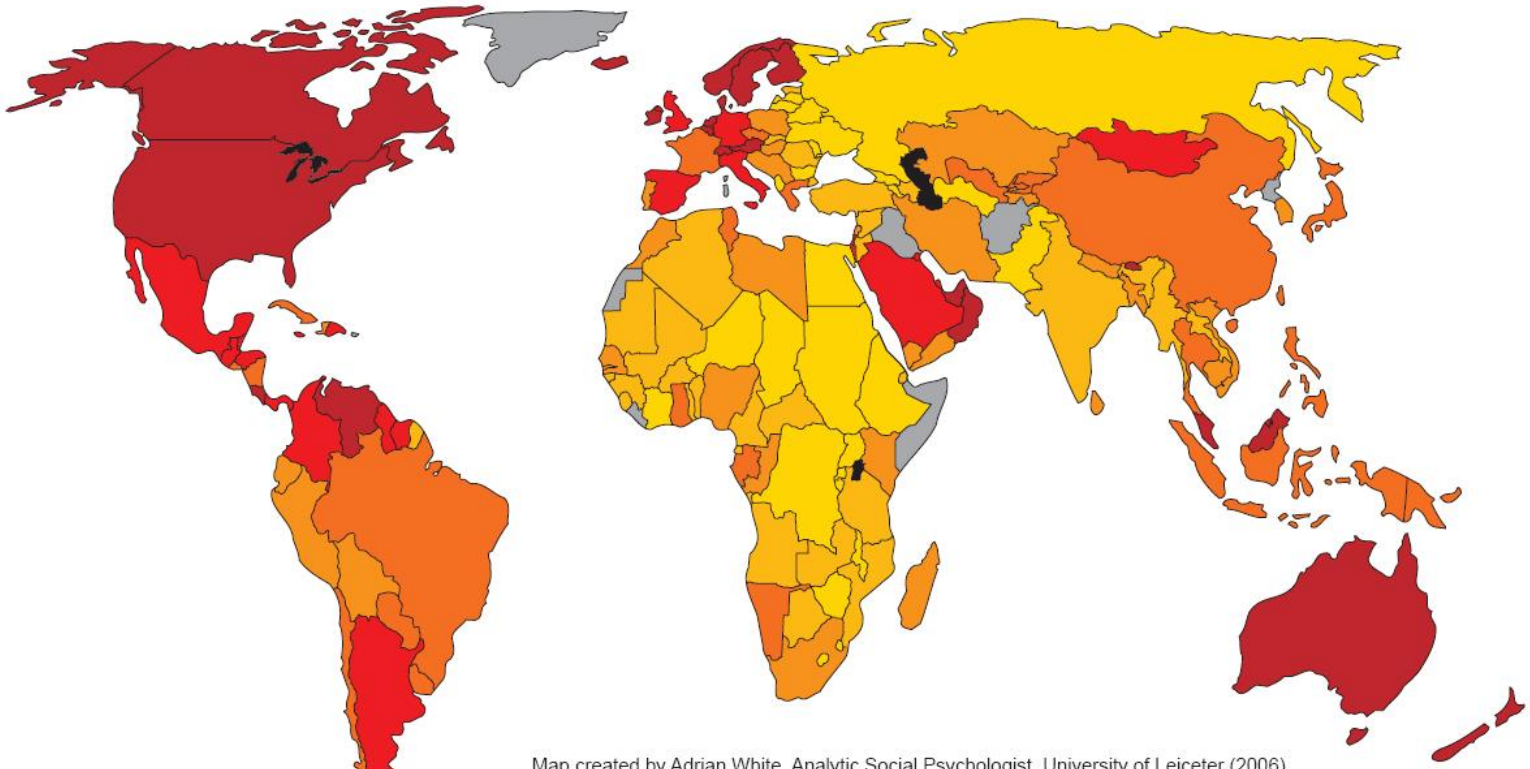

Legend
log Black Carbon
1.36
0.45
-0.41
-1.28
-2.18
-3.07
Courthouse
Monitors
0
5
10
Kilometers

Human Health




PREVIOUS MAP
Average Number of Extreme Heat Days
Extreme Heat Vulnerability 2000-2009
NEXT MAP
RI
CT
VT
NH
NJ
MA
DE
MD
DC
Days per Year of Extreme Heat
<= 9.0
9.1 - 13.8 (more than expected)
> 13.8 (more than expected)
Insufficient data

A Global Projection of Subjective Well-being: The First Published Map of World Happiness



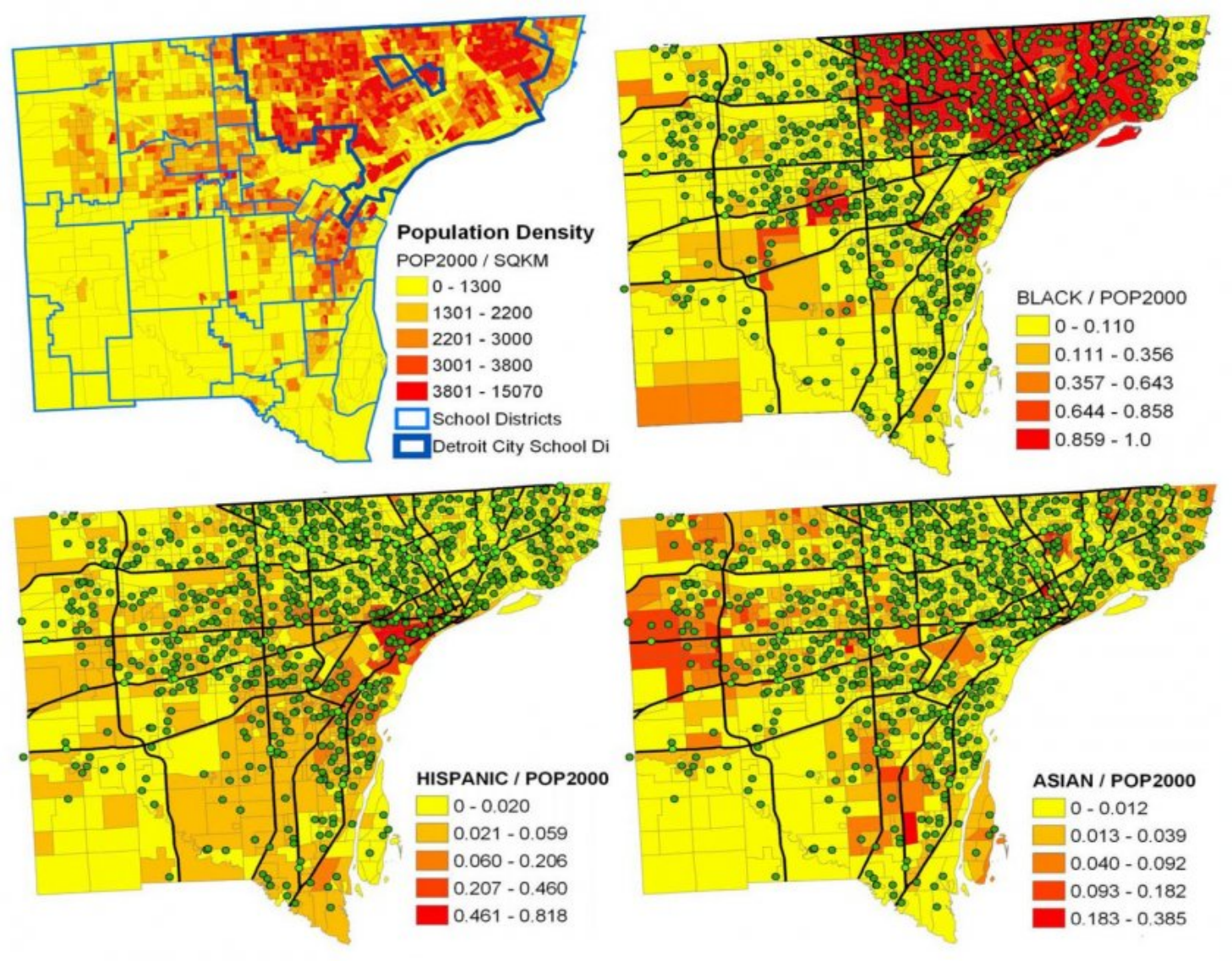
Map created by Adrian White, Analytic Social Psychologist, University of Leiceter (2006)

Map and further analysis incorporates data published by UNESCO, the WHO, the New Economics Foundation, the Veenhoven Database, the Latinbarometer, the Afrobarometer, the CIA, and the UN Human Development Report.

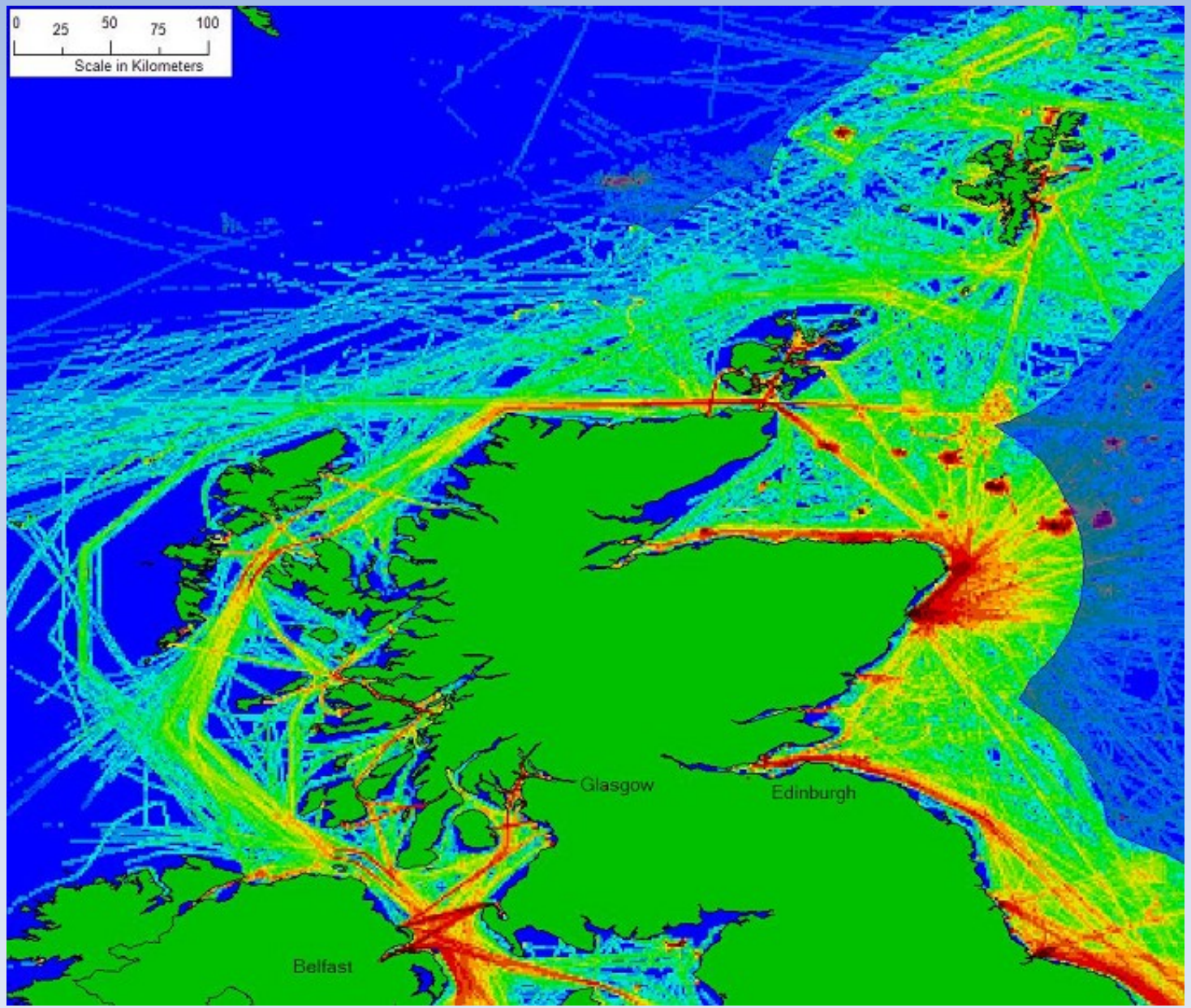
Happy ---------- Average ---------- Unhappy

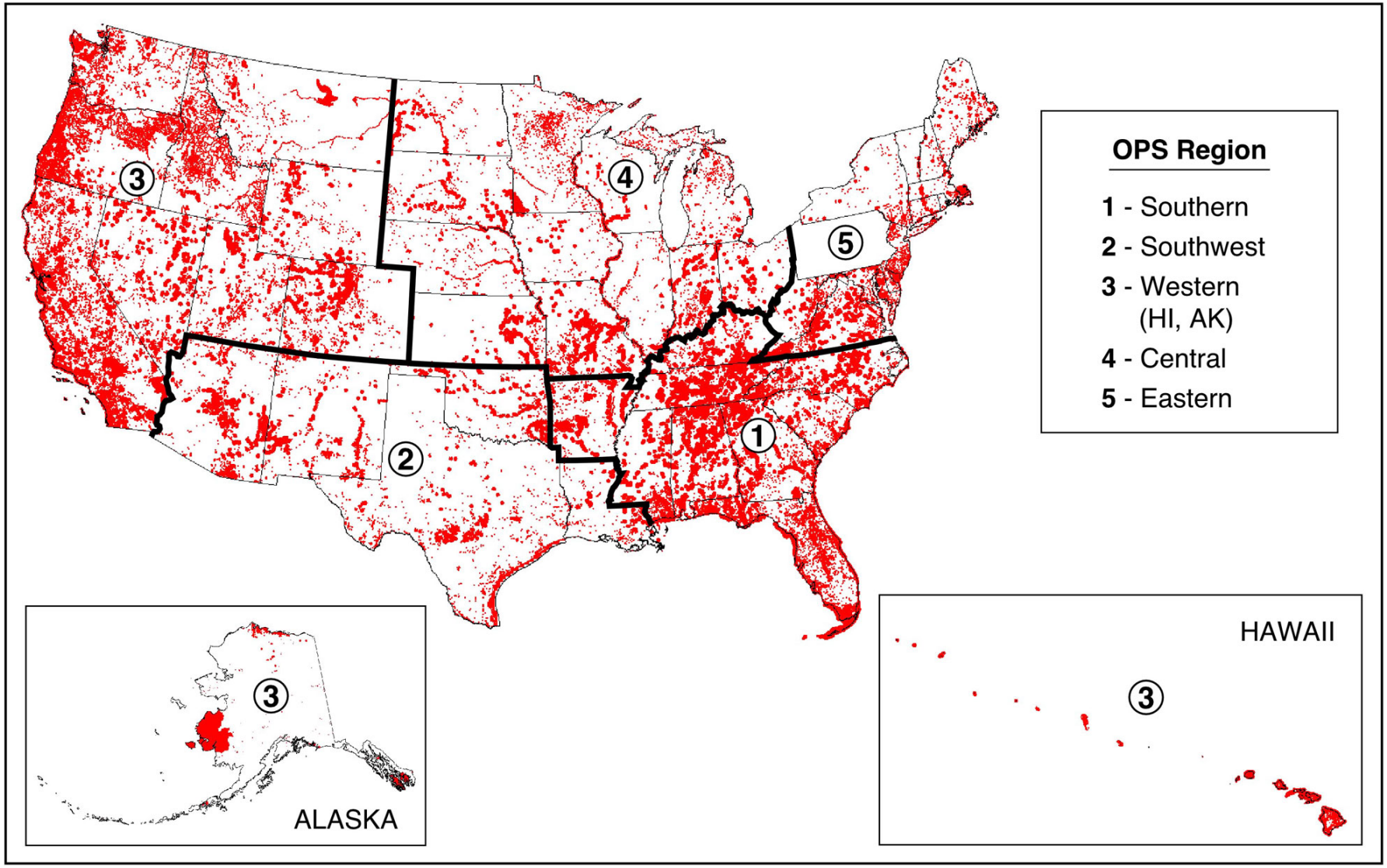
Cartographic Unit • University of Leicester

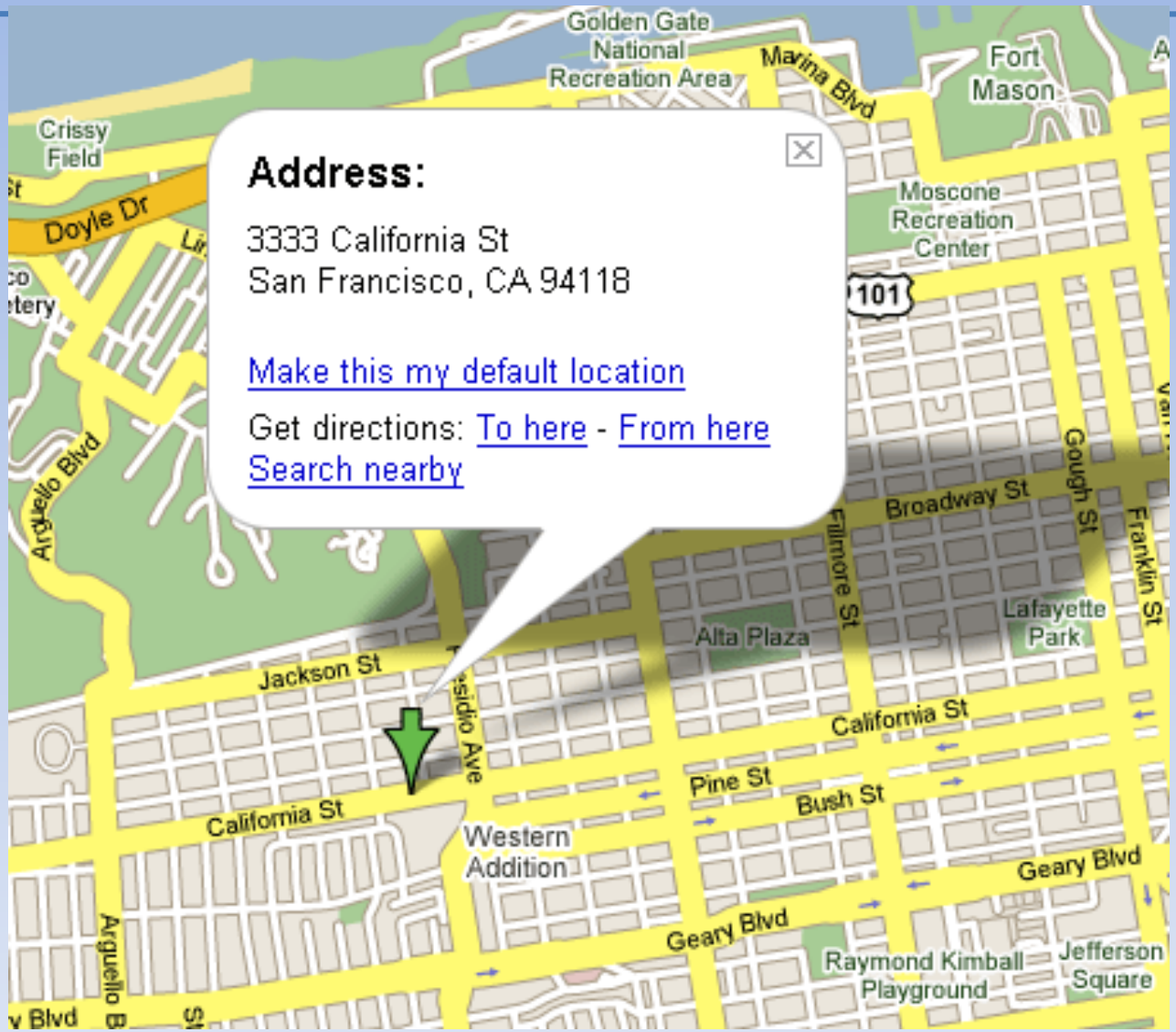

Median sales price for
California counties
Jun - Aug '06
HIGH
$532K and up
$475K to $532K
$418K to $475K
AVG
$342K to $418K
$285K to $342K
$228K to $285K
LOW
$228K and below
trulia
real estate search
Nevada
Las Vegas
Salinas


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
0.207 - 0.460
0.461 - 0.818
ASIAN / POP2000
0 - 0.012
0.013 - 0.039
0.040 - 0.092
0.093 - 0.182
0.183 - 0.385

Guess?


0 25 50 75 100
Scale in Kilometers
Glasgow
Edinburgh
Belfast


OPS Region
1 - Southern
2 - Southwest
3 - Western (HI, AK)
4 - Central
5 - Eastern
ALASKA
HAWAII


Address:
3333 California St
San Francisco, CA 94118
Make this my default location
Get directions: To here - From here
Search nearby
Golden Gate National Recreation Area
Marina Blvd
Fort Mason
Crissy Field
Doyle Dr
Moscone Recreation Center
101
Arguello Blvd
Broadway St
Gough St
Franklin St
Fillmore St
Lafayette Park
Alta Plaza
Jackson St
Presidio Ave
California St
Pine St
Bush St
Western Addition
Geary Blvd
Raymond Kimball Playground
Jefferson Square

Online tools

- http://www.highcharts.com/maps/demo
- https://cartodb.com/
- https://www.mapbox.com/
- http://www.flashearth.com/
- http://www.naturalearthdata.com/

Introduction to Maps

What is a map?

- A **map** is any concrete or abstract representation of the features that occur on or near the surface of the earth or other celestial bodies
- **Cartography** is the art, science, and technology of making maps, together with their study as scientific documents and works of art

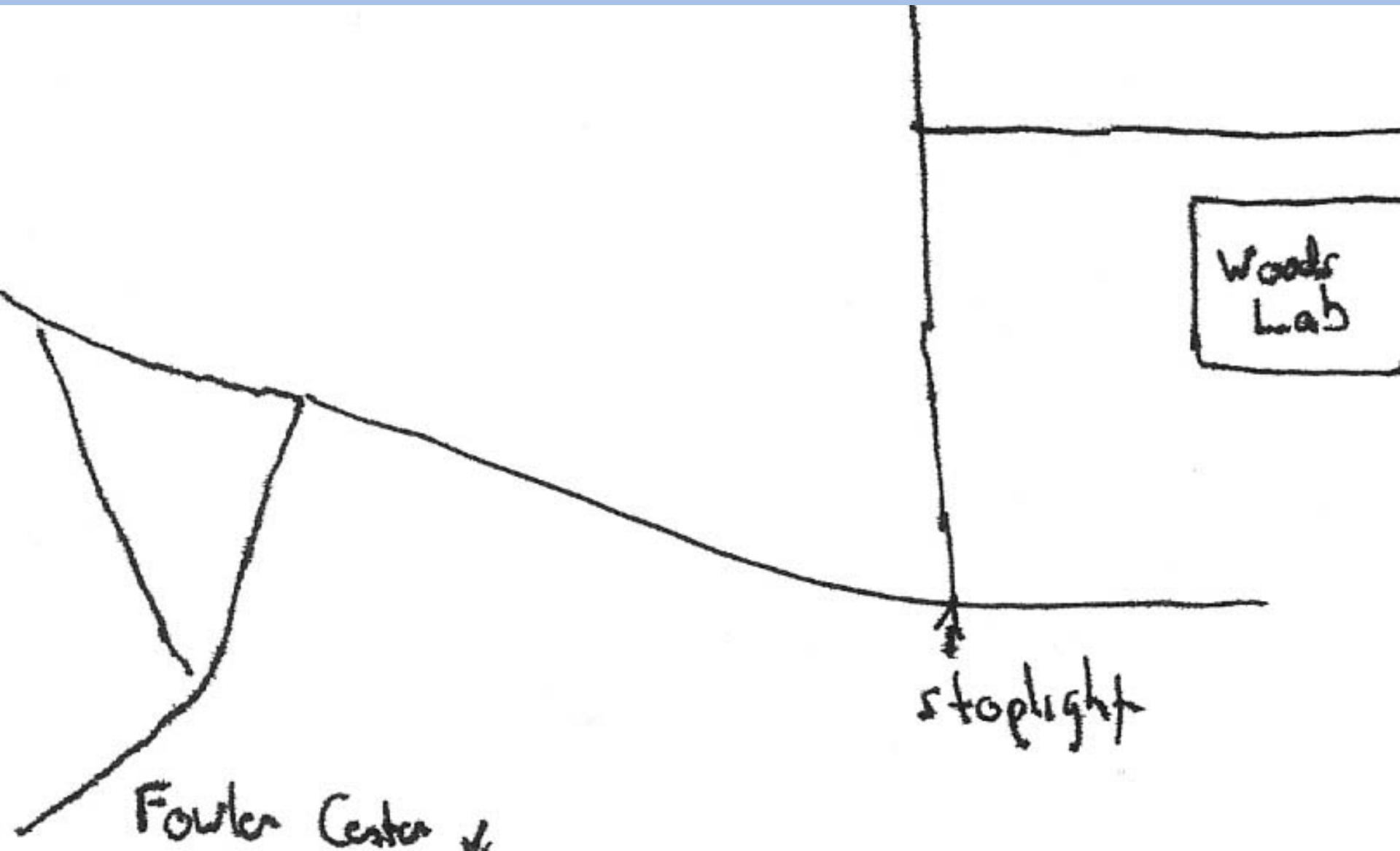
Maps can be real or virtual

- A **real map (cartographic map)** is any tangible map product that has a permanent form and that can be directly viewed (hard copy)
- Virtual maps do not physically exist, but can be converted into hard copy

Types of virtual maps

- Images that can be directly viewed but aren't permanent (e.g. on a computer screen)
- Mental images (mental maps)
- Map data – information gathered by researchers or remote sensing that is stored in tabular form (but may be viewed as an image)

Mental Image



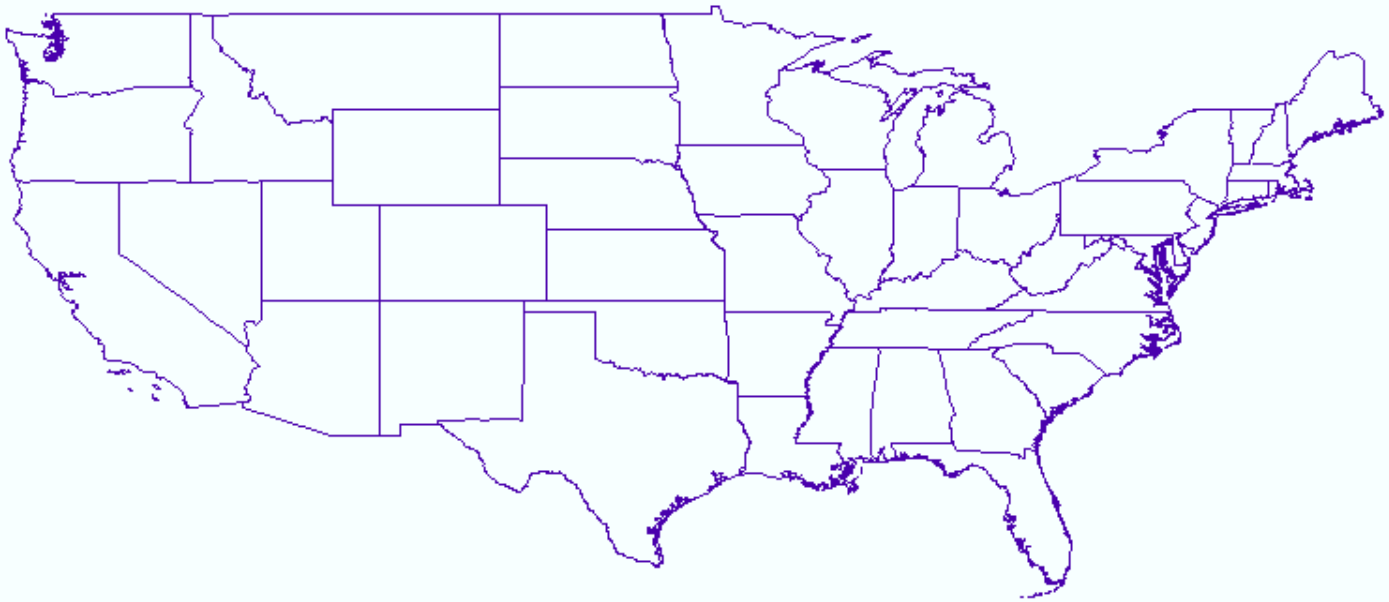
Untitled - ArcMap - ArcInfo

File Edit View Insert Selection Tools Window Help

1:33,055,269

Layers

usa arc



Display Source

Drawing Arial 10

119°45'21.22"W 45°10'42.92"N

Start Eudora - [In] USATODAY.c... Microsoft Pow... GIS and Ecolo... Lab 2.doc - Mi... Untitled - Ar... 9:38 AM

Common Map Elements

- Titles
- legends
- Neat line
- Scale
- Orientation
- Insets

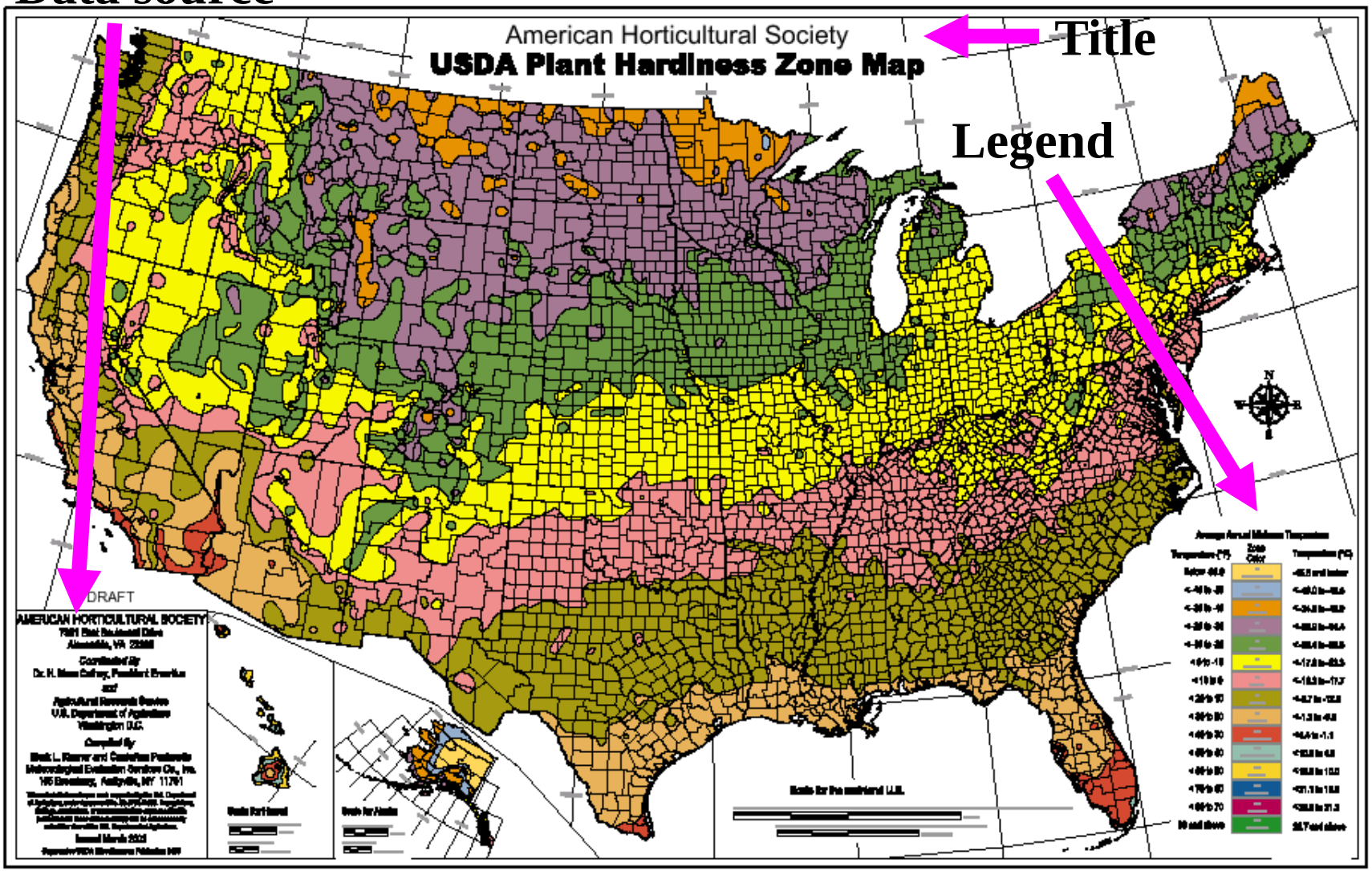
Typographical Information

- Title (and subtitles) indicates the purpose for which a map was created
  - Should state the subject of the map, time period & other relevant information
- Legends show map symbols and explain their meaning
- Names of the feature types on the map
- Source of information

Acrobat Reader - [USDA_Map_3.03.pdf]

File Edit Document View Window Help

Data source



80% 1 of 1 17 x 11 in

Start 10:00 AM

Neatline

- A **neatline** is a narrow line that frames the mapped area
- A **border** is similar to a neatline but is typically more elaborate (may have single or double lines or designs)
- Not all maps have neatlines
- The presence of a neatline is not essential, but it makes the map look nice

Atlas: Tennessee - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://www.infoplease.com/atlas/state/tennessee.html Go Links

Google map of tennessee Search Web PageRank 868 blocked AutoFill Options map of tennessee

Message Alert

You have **1 message** waiting for you. OK

HOTWORDS CITE PRINT EMAIL

infoplease All the knowledge you need.

Enter search term in All Infoplease Search

Home | Almanacs | Atlas | Dictionary | Encyclopedia | February 3, 2004 »

- World
- United States
- History & Gov't
- Biography
- Sports
- Arts & Ent.
- Business
- Society & Culture
- Health & Science
- Homework Center

Fact Monster
Kid's reference, games, quizzes

Daily Almanac »
- This Day in History
- Today's Birthday
- Word of the Day

Editor's Favorites
- Black History
- 2004 Calendar

Infoplease Atlas

Tennessee

Neatline

Tennessee Profile

More Geographic Information

- Country Profiles
- Flags
- World Geography
- World Statistics
- U.S. State Profiles
- U.S. Cities
- U.S. Geography
- U.S. Statistics

Internet

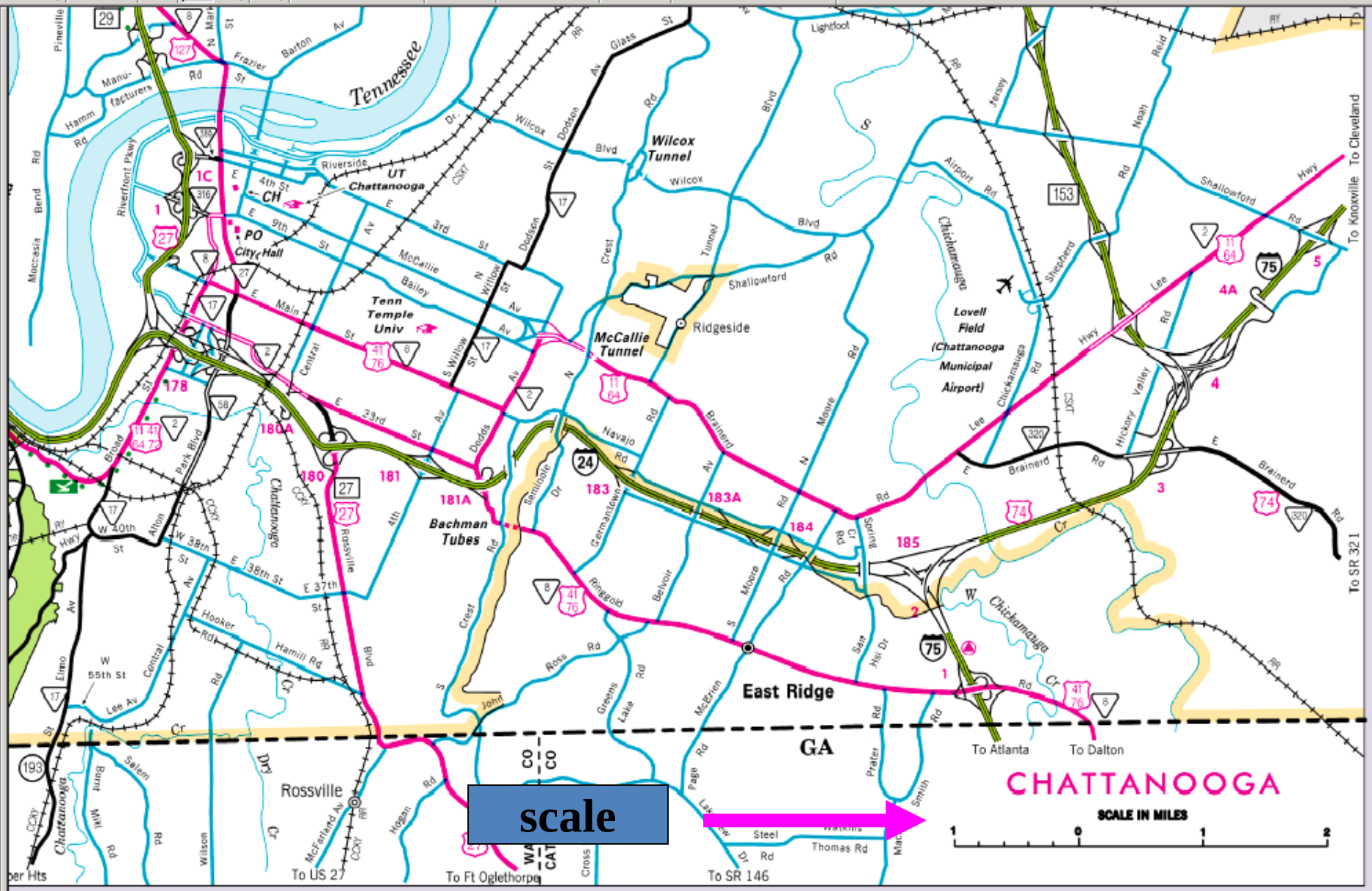
Start 10:10 AM

Scale

- **Scale** is the ratio between the size of features on the map and the size of the same feature on the ground
- Scales can be…
  - **Representative fraction**: 1:24,000
  - **Word statement**: “One to twenty-four thousand”
  - **Graphic scale**:

Acrobat Reader - [Chattanooga.pdf]

File Edit Document View Window Help



200% 1 of 1 8.75 x 8.29 in

Start

Tuesday, February 03, 2004

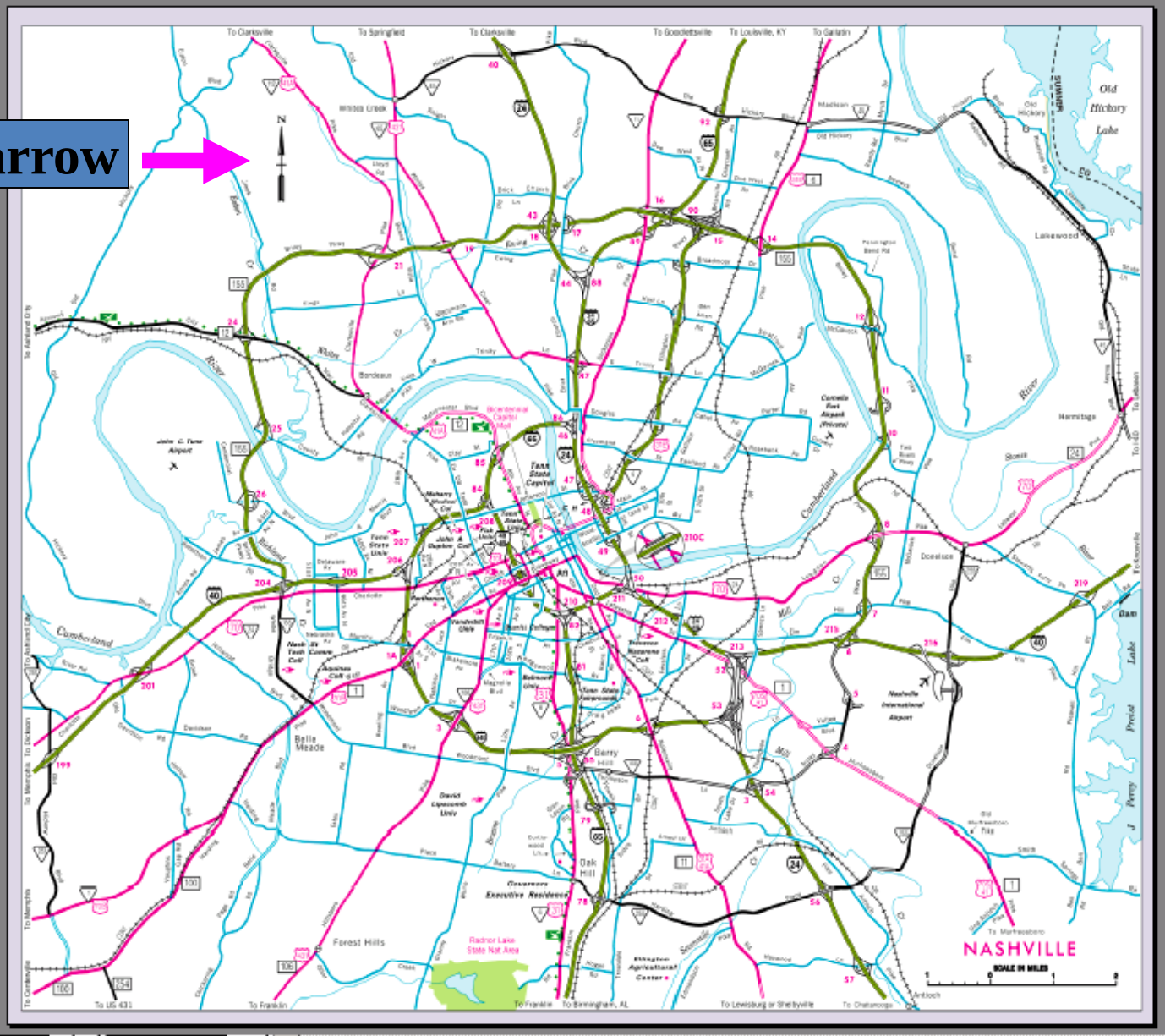
Orientation

- **Orientation** is the way that the map is aligned relative to the earth's surface
- Typically (but not always) oriented with north at the top
- North is usually shown with a north arrow

Acrobat Reader - [Nashville.pdf]

File Edit Document View Window Help

North arrow



106% 1 of 1 9.46 x 8.4 in

Start 10:25 AM

Insets

- **Insets** are small additional maps included in the main map
  - Enlargement of the portion of the mapped area
  - Locator map, showing where the mapped region lies in relation to a larger, better known region
  - Areas that are related to the main map (e.g. Alaska, Hawaii, etc.)
  - Additional information

Inset example

- Insets often include their own legend, scale, orientation, and other features as needed

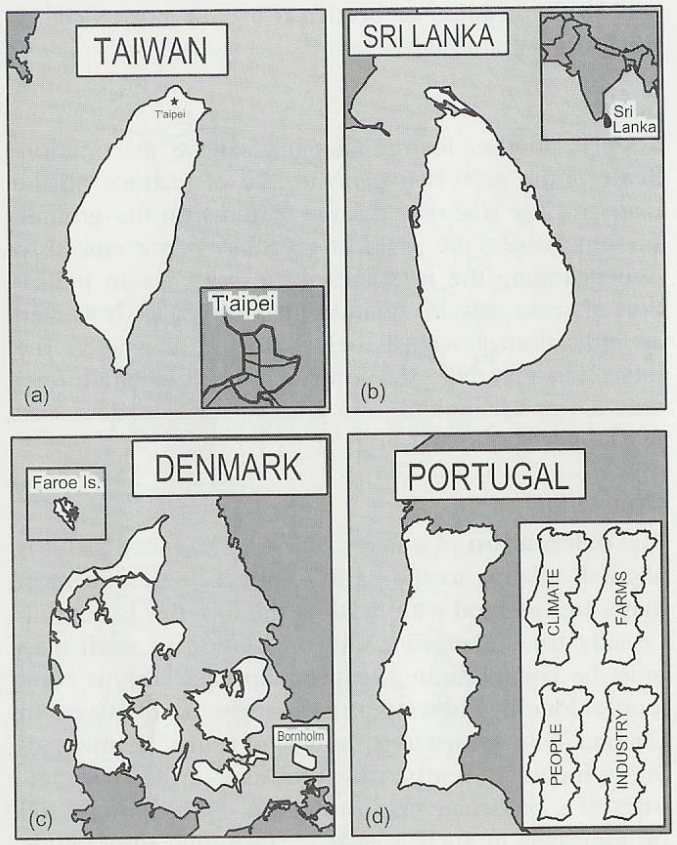


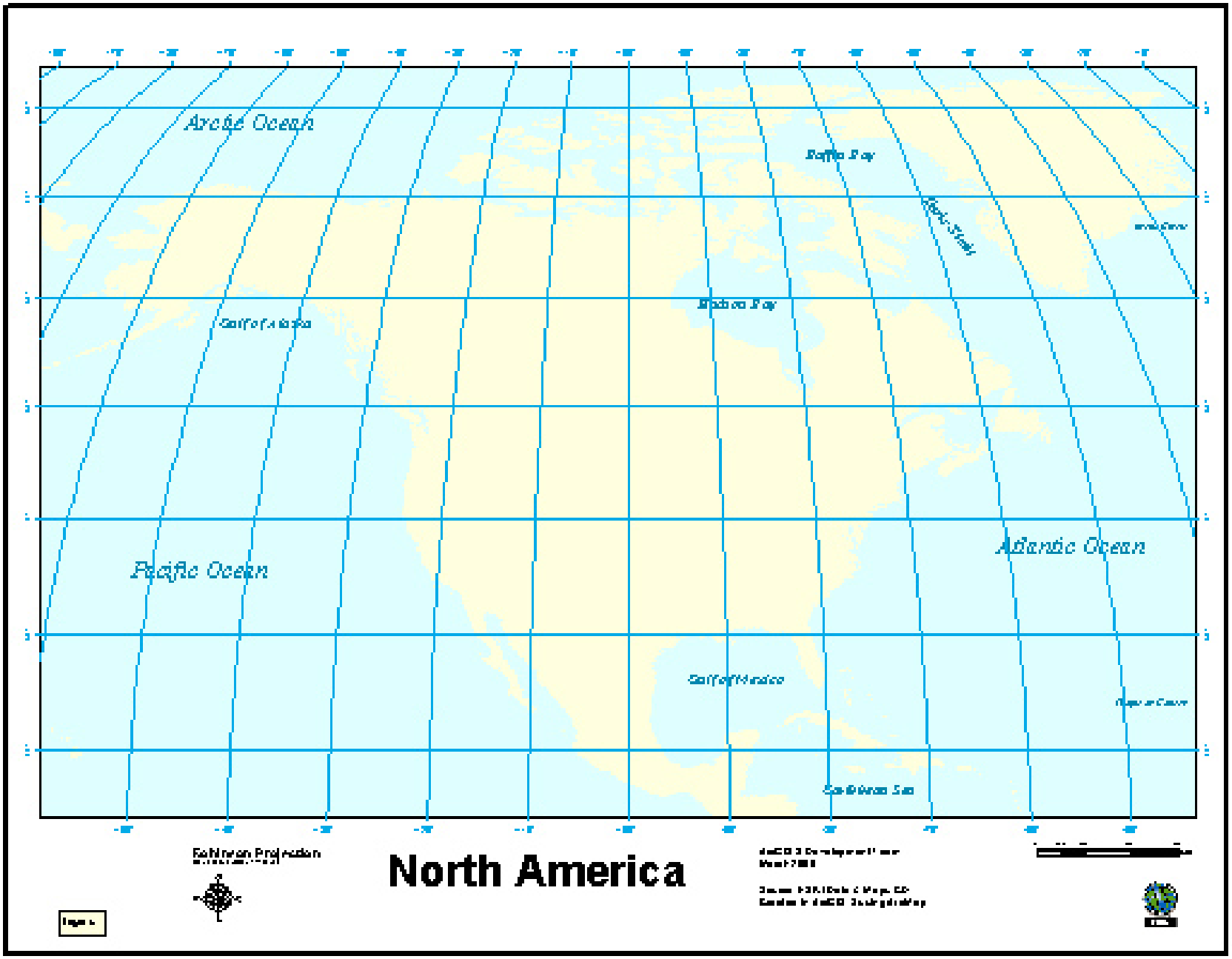
Figure 1.5 Types of insets. (*a*) Enlargement of important region. (*b*) Area locator. (*c*) Related areas. (*d*) Additional information.

Map Categories

1) Planimetric Maps
2) Topographic Maps
3) Thematic Maps
4) Cartograms
5) Remotely sensed images

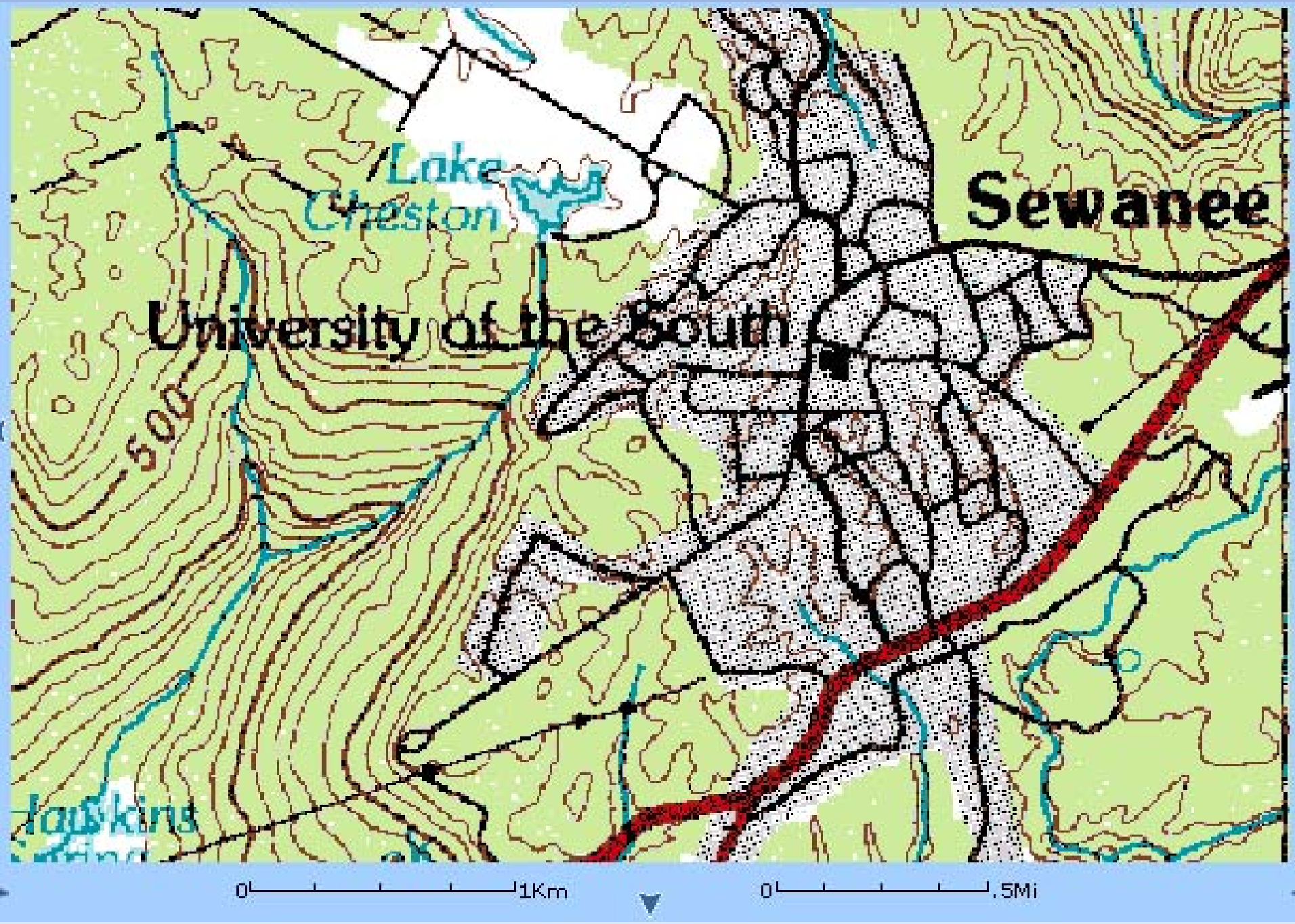
Planimetric Maps

- Planimetric maps do not show relief features (e.g. elevation)
- Planimetric **base maps** are used to provide the framework for thematic maps (which present information about some special subject)


Arctic Ocean
Baffin Bay
Hudson Bay
Gulf of Alaska
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
Caribbean Sea
Eckert IV Projection
North America

Topographic Maps

- Maps that show shape and elevation of terrain are called **topographic maps**
  - Ex: Engineering maps, flood-prone area maps, landscape maps, etc.
- Maps that show water depth and the configuration of underwater topography are called **bathymetric maps**


Lake
Cheston
Sewanee
University of the South
500
Jaukins
0
1Km
0
.5Mi

Thematic Maps

- Show information about special topics superimposed on a base map
- Types of thematic maps include geologic, forestry, soil, land-use, slope, and historical

Thematic Maps

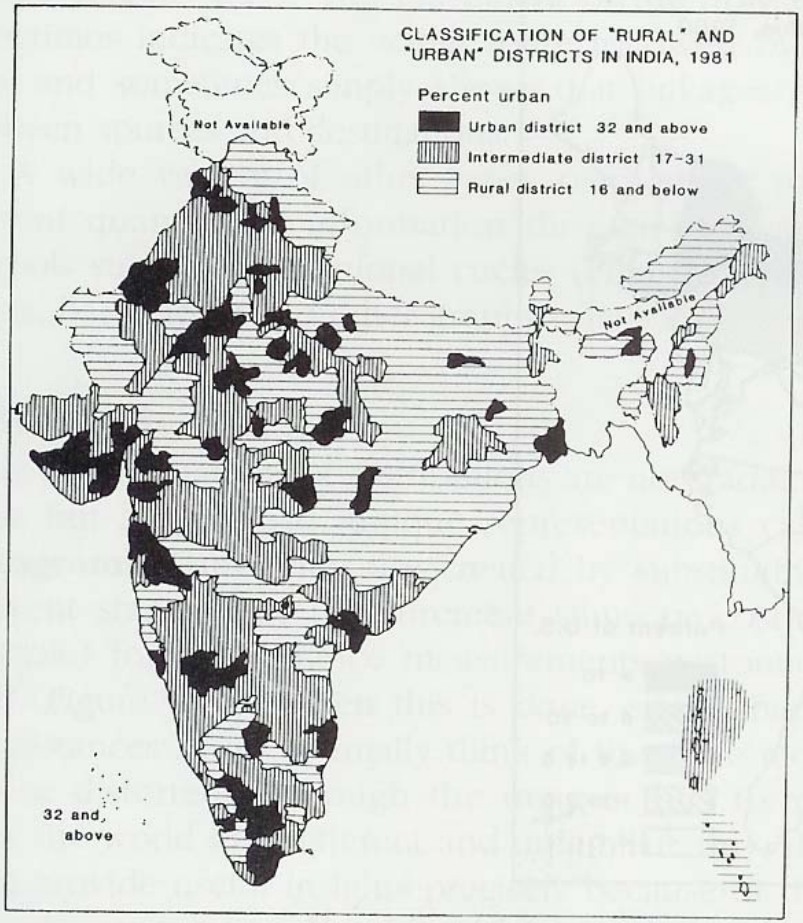


Figure 1.13 Example of a typical thematic map.

Source: From Ashok K. Dutt, Charles B. Monroe, and Ramesh Vakamundi, "Rural-Urban Correlates for Indian Urbanization," *The Geographical Review* 76, no. 2 (April 1986): 173–83. Reproduced by permission of The American Geographical Society.

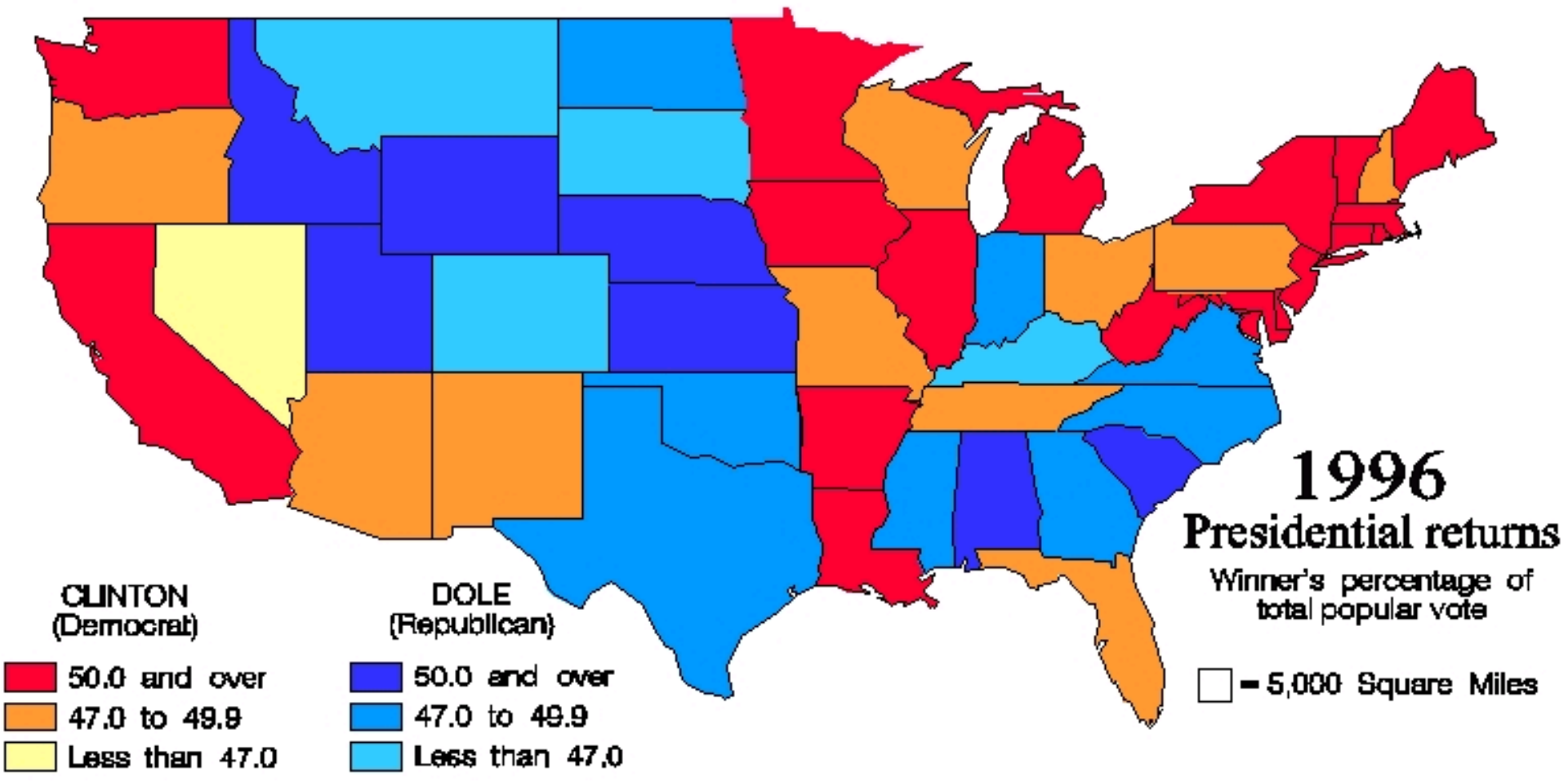
Thematic Map Data

- Data may be represented by:
  - Dot-distribution maps
  - Choropleth maps
  - Isoline maps
  - Flow maps
  - Other symbols (e.g. proportional circles, bar graphs, etc.)

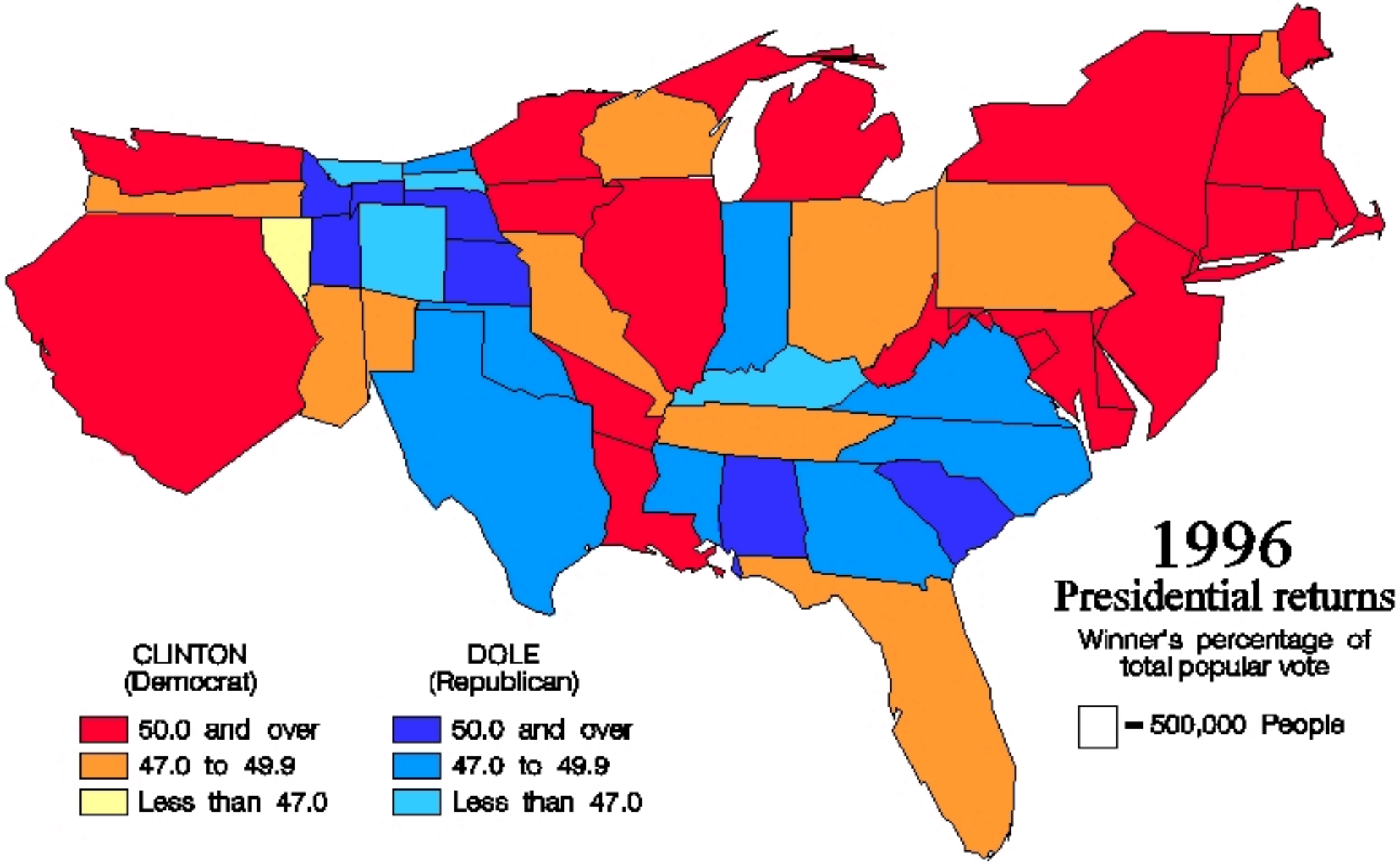
Cartograms

- **Cartograms** are created by substituting a different standard of measurement (time or cost, for example) for the distance measurements customarily used.
- This modifies size, shapes, and distances

Thematic map example



Cartogram example2



Remotely sensed images

- Will discuss in near future
- Major types are
  - Aerial photographs
  - Satellite images

ArcCatalog - ArcInfo - C:\Tennessee\Data\usa

File Edit View Go Tools Help

Location: C:\Tennessee\Data\usa

Stylesheet: FGDC ESRI

- Tennessee
  - ArcGIS
  - Bio131Lab
  - BIOL 341
  - Biology - Web
  - Data
    - usa
  - Environmental Stud
  - GIS and Ecology
  - Old Files
  - Photos for Henriett
  - Scanned
  - STAR
  - Student labs
  - Work Study
  - Chris Butler
  - Oct 30 2003 - First
  - signature
  - signature2
  - Tennessee Countie
  - Water Garden map
- Thesis
- WINNT
- WorkSpace
- WUTemp
- Xircom
- ~IntelliMover Files
- BOOTLOG
- COPYDIRS
- hpfr5550
- Database Connections
- Geocoding Services
- Internet Servers
- Search Results

Contents | Preview | Metadata

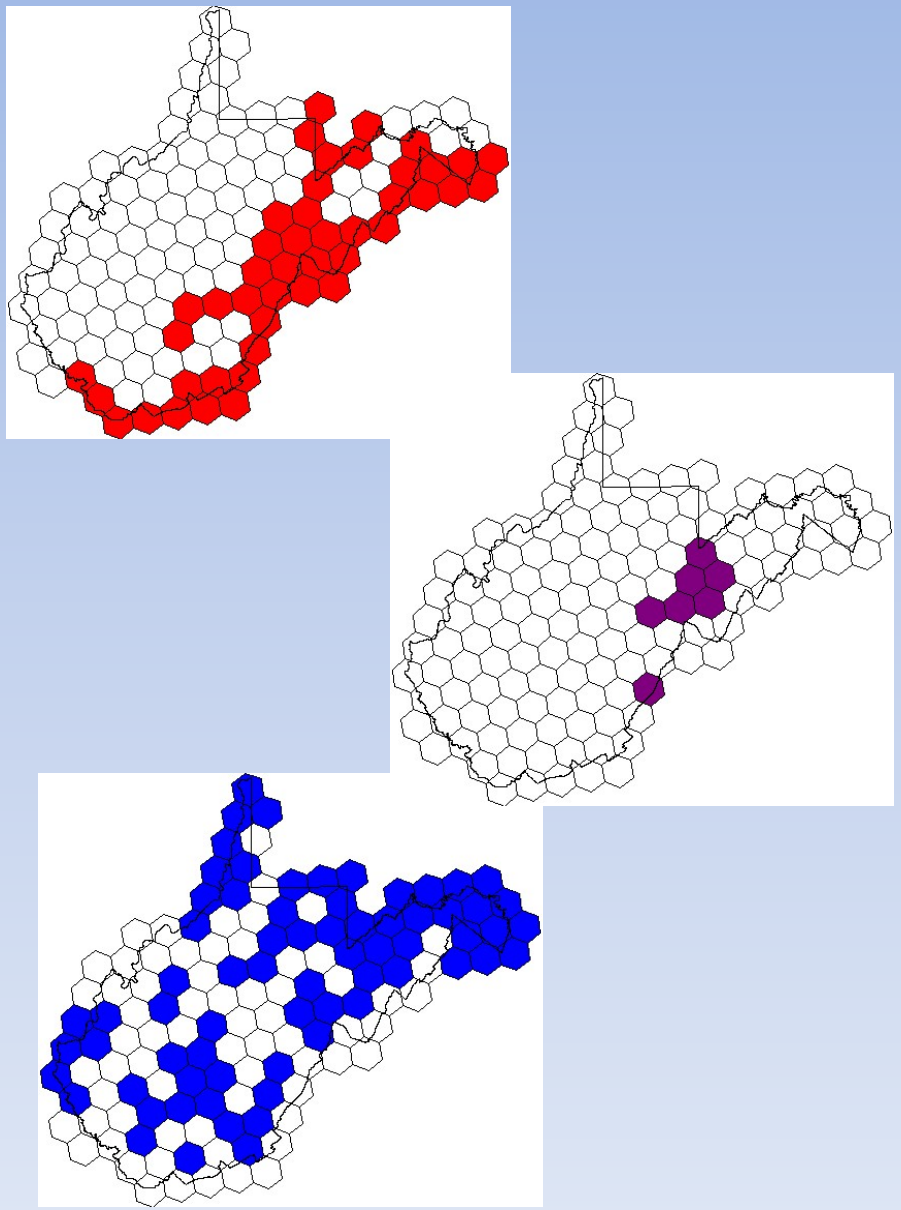
FID	Shape	FNODE#	TNODE#	LPOLY#	RPOLY#	LENGTH	USA#	USA-ID
1	Polyline	1	2	3	17	337873.1	1	1
2	Polyline	3	4	18	17	1007758	2	1
3	Polyline	5	6	26	28	383877.9	3	1
4	Polyline	7	8	18	28	338077	4	1
5	Polyline	9	1	3	29	571309.3	5	1
6	Polyline	10	1	29	17	511344.2	6	1
7	Polyline	11	12	20	39	249516.1	7	1
8	Polyline	13	14	39	44	302750.3	8	1
9	Polyline	15	15	20	73	36243.89	9	1
10	Polyline	16	15	77	20	1139.821	10	1
11	Polyline	15	16	77	20	1286.317	11	1
12	Polyline	17	18	66	44	284089.1	12	1
13	Polyline	19	20	58	26	459082.3	13	1
14	Polyline	21	22	41	58	352623.4	14	1
15	Polyline	23	7	18	86	106377.9	15	1
16	Polyline	6	7	86	28	581125.5	16	1
17	Polyline	6	24	26	86	89363.63	17	1
18	Polyline	4	23	18	91	608875.9	18	1
19	Polyline	24	25	107	86	1413.481	19	1
20	Polyline	24	25	26	107	1408.406	20	1
21	Polyline	25	26	26	86	204179.9	21	1
22	Polyline	27	14	108	39	148185	22	1
23	Polyline	28	29	29	109	346479.3	23	1
24	Polyline	30	4	17	91	276589.9	24	1
25	Polyline	31	23	91	86	222558.9	25	1
26	Polyline	17	14	44	108	65346.09	26	1
27	Polyline	32	17	66	108	80875.16	27	1
28	Polyline	33	34	108	111	77860.06	28	1

Record: 1 Show: All Selected Records (of 622) Options

Preview: Table

Start | Eudor... | USAT... | Micros... | GIS an... | Lab 2.... | Untitle... | HP Dir... | hp sca... | ArcCa... | 9:42 AM

GIS Database Acquisition, Creation, and Editing; and Analytical Processes



GIS Database Acquisition

How can GIS databases be acquired?

- **Over the Internet (free)**
  - **Through an "ftp" connection (free)**
- **From another organization (free?, on tape, CD, or ftp)**
- **From a consultant ($$, on tape or CD)**
- **Create a database in house**

GIS Database Acquisition

Information Associated with a GIS Database Acquisition

- GIS database requested (theme)
- Location (Township/Range/Section, Topographic quad index number (or name))
- File format (e.g., Spatial Data Transfer Standard (SDTS), ArcInfo export format)
- Map projection / coordinate system / datum
- Delivery method (CD, tape, e-mail, FTP, etc.)
- Database compression format (None, Zipped, MrSID, TAR, etc.)
- Billing information
- Product license agreements

GIS Database Acquisition

Example Internet Sites - Gifford Pinchot National Forest (Washington State)

http://www.fs.fed.us/gpnf/forest-research/gis/

Vector GIS databases are available in ArcInfo (ESRI, 2001) export format.
Databases can either be downloaded directly from this web site, or obtained on a compact disc or 8 mm tape, yet the cost of obtaining the data by this method is $40.
Some metadata related to each GIS database can be accessed through this web site.

The data related to the forest trail system, for example, indicates:

- The source scale was 1:24,000.
- It was last updated in 1999.
- The projection system is Transverse Mercator, using the Clarke 1866 spheroid.
- The coordinate system is the UTM system.
- The datum is NAD 27.
- The data units that GIS users will see are represented in meters.

GIS Database Creation

How can GIS databases be created?

(1) Traditional digitizing

(2) Heads-up digitizing

(3) Scanning

(4) As a result of spatial analysis operations

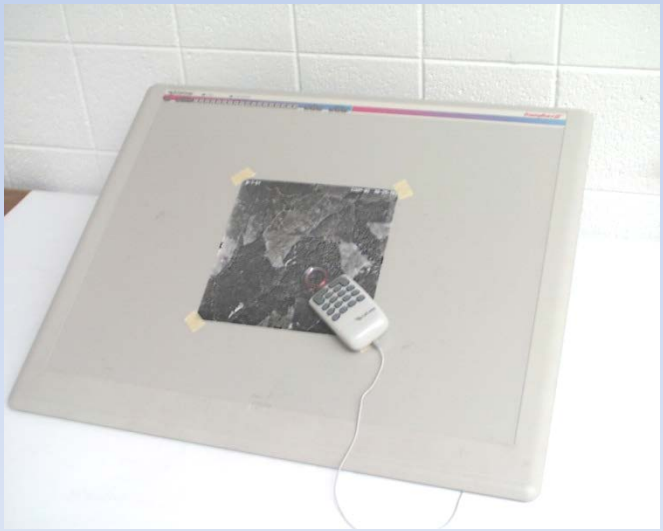
All GIS data must be converted to a digital form.

GIS Database Creation

GIS data sources

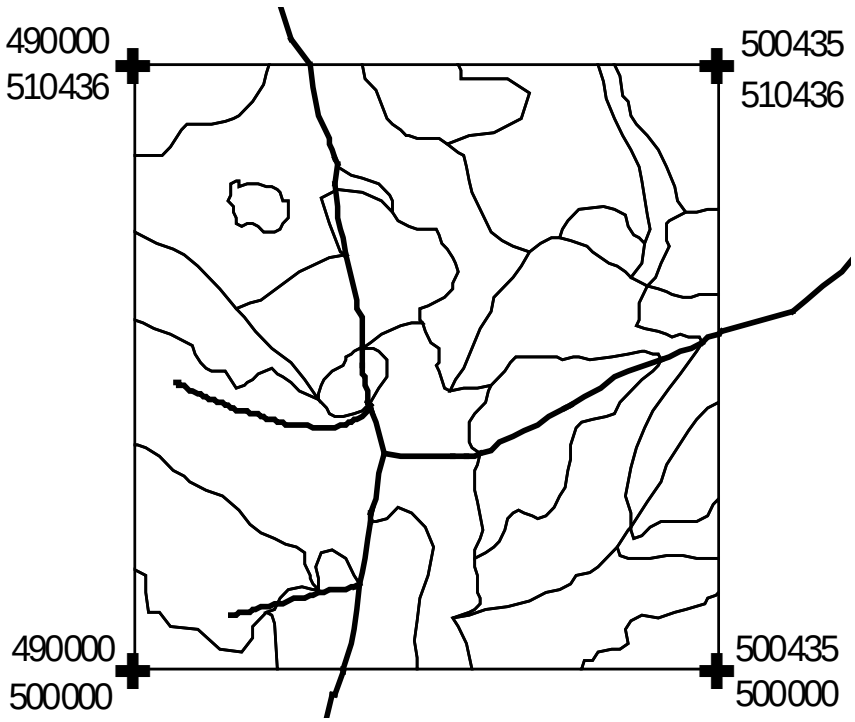
Digitizing: the conversion of spatial information to computer-readable form.
Can account for 60% or more of the time and energy spent on GIS.

(1) Traditional method using a digitizing table.
Requires registration locations (tics)



GIS Database Creation

GIS data sources



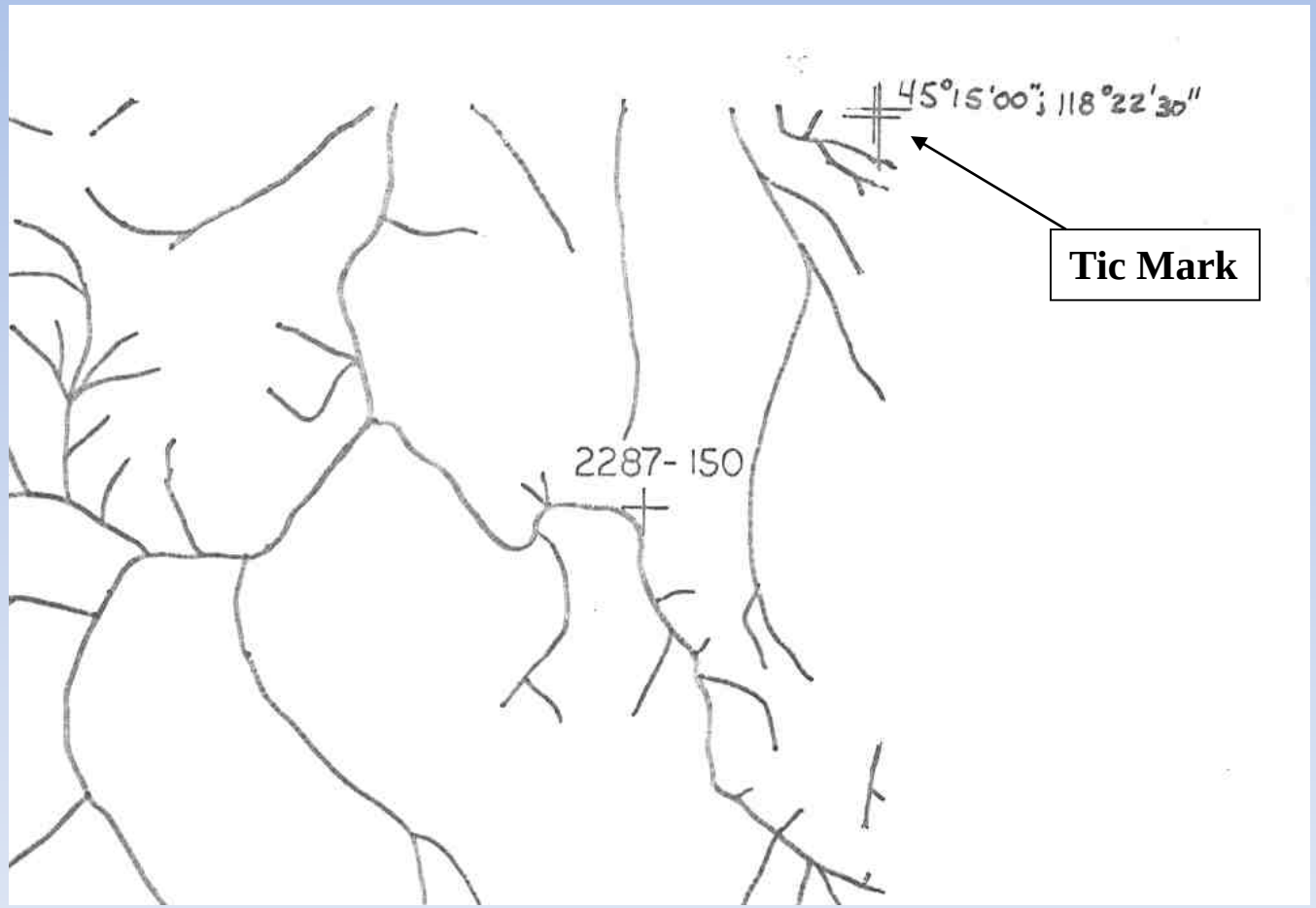
Roads

Stands

Tic marks
(with associated
X and Y
coordinates)

GIS Database Creation

GIS data sources



GIS data sources

(2) "Heads-up" method (on-screen digitizing).

GIS Database Creation

GIS data sources

(3) Scanning.

- Not as precise
- Not as accurate
- Requires registration locations (tics)

Queries

Where are the thinnable stands?

Age ≥ 30 and Age ≤ 40

Age ≥ 30 and Age ≤ 40 and MBF ≥ 9

Queries

Structured Query Language (SQL)

- Uses standard operators
  - e.g. = > < + - *
  - "and" "or" "not"

- Standard order of operations
  - add/subtract before multiply/divide
  - use parentheses to "isolate" terms

Example:
Select stands greater than 30 acres with grass understories and a mean quadratic diameter less than 20 inches.

Query for above:
(area > 30) and (understory = "grass") and (QMD < 20)

GIS Analytical Processes

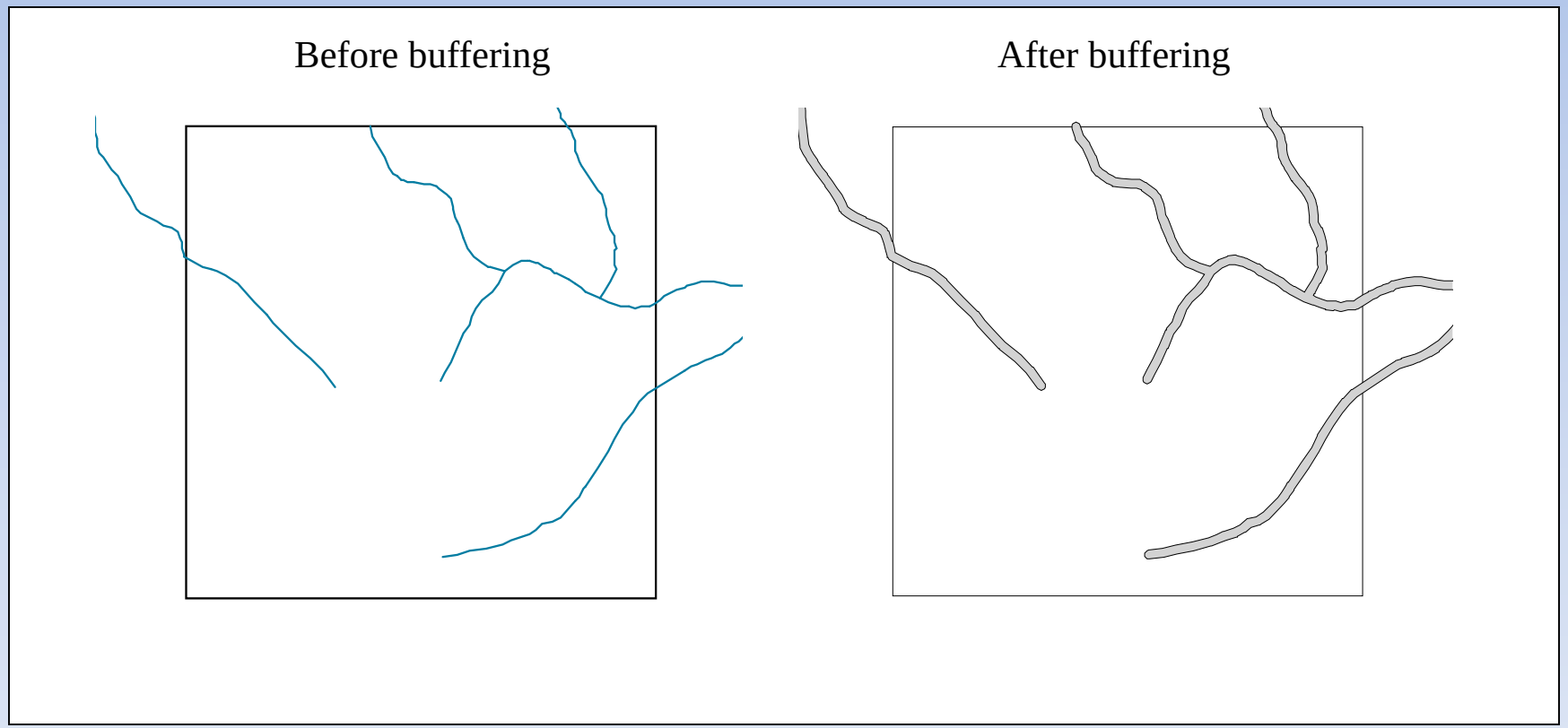
Buffering

Defining closed areas (polygons) within a certain distance of selected landscape features:

- **What do the riparian buffer zones look like?**
- **How far around an owl nest location is 70 acres?**
- **What do the visually sensitive areas around trails encompass?**

Buffering

Buffering streams



GIS Analytical Processes

Overlay Operations

Processes involving two (or more) layers:

Merging is a simple overlay process that combines two or more layers into one. It leaves overlapping regions and does not create new attributed polygons where there is overlap.

Three overlay processes are considered here:

- **Union**
- **Intersect**
- **Identity**

In contrast to a simple merge, each of these operations will produce a new layer with unique combinations of the input database polygons.