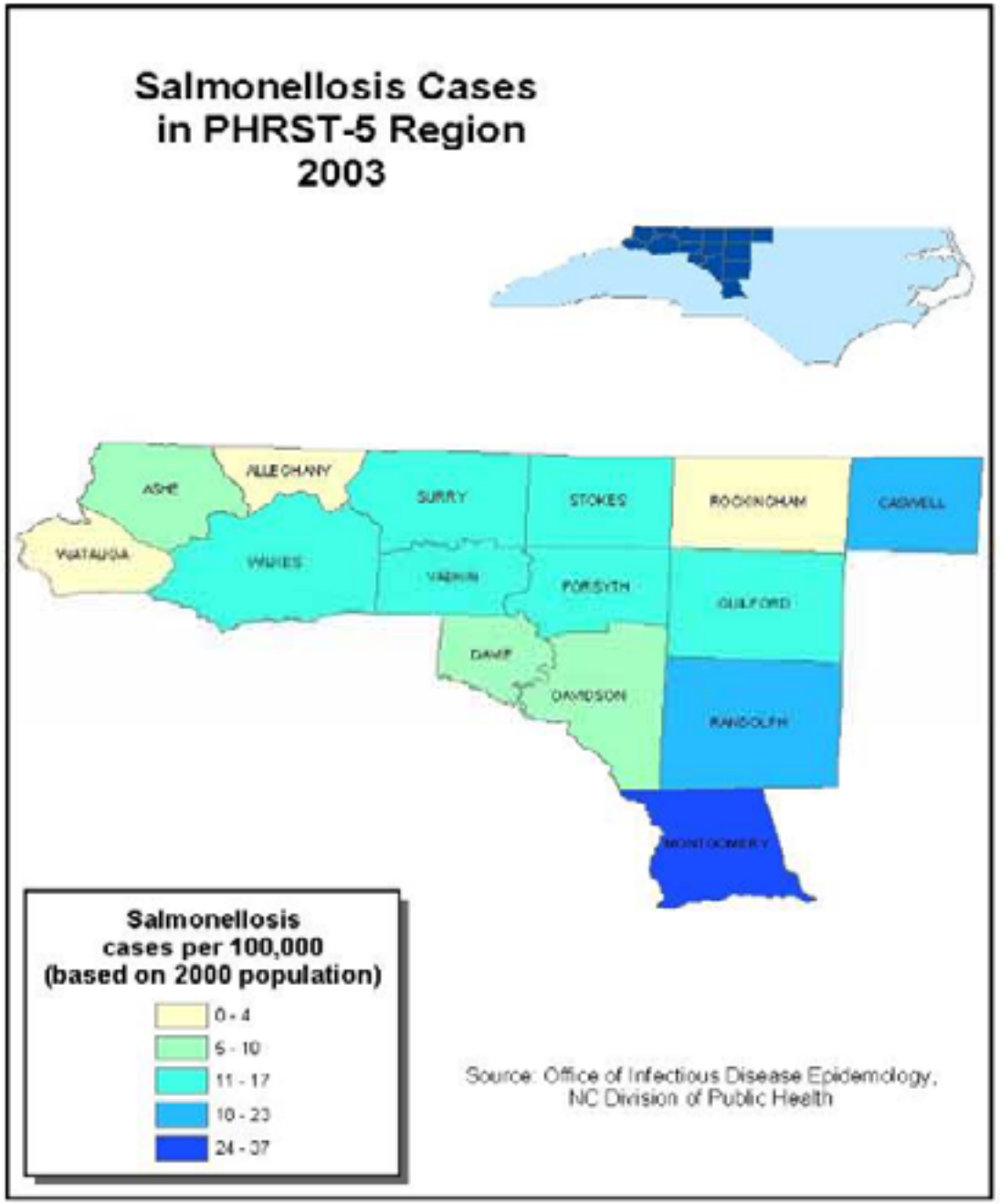
Using GIS to Streamline Public Health Response

Presented by:

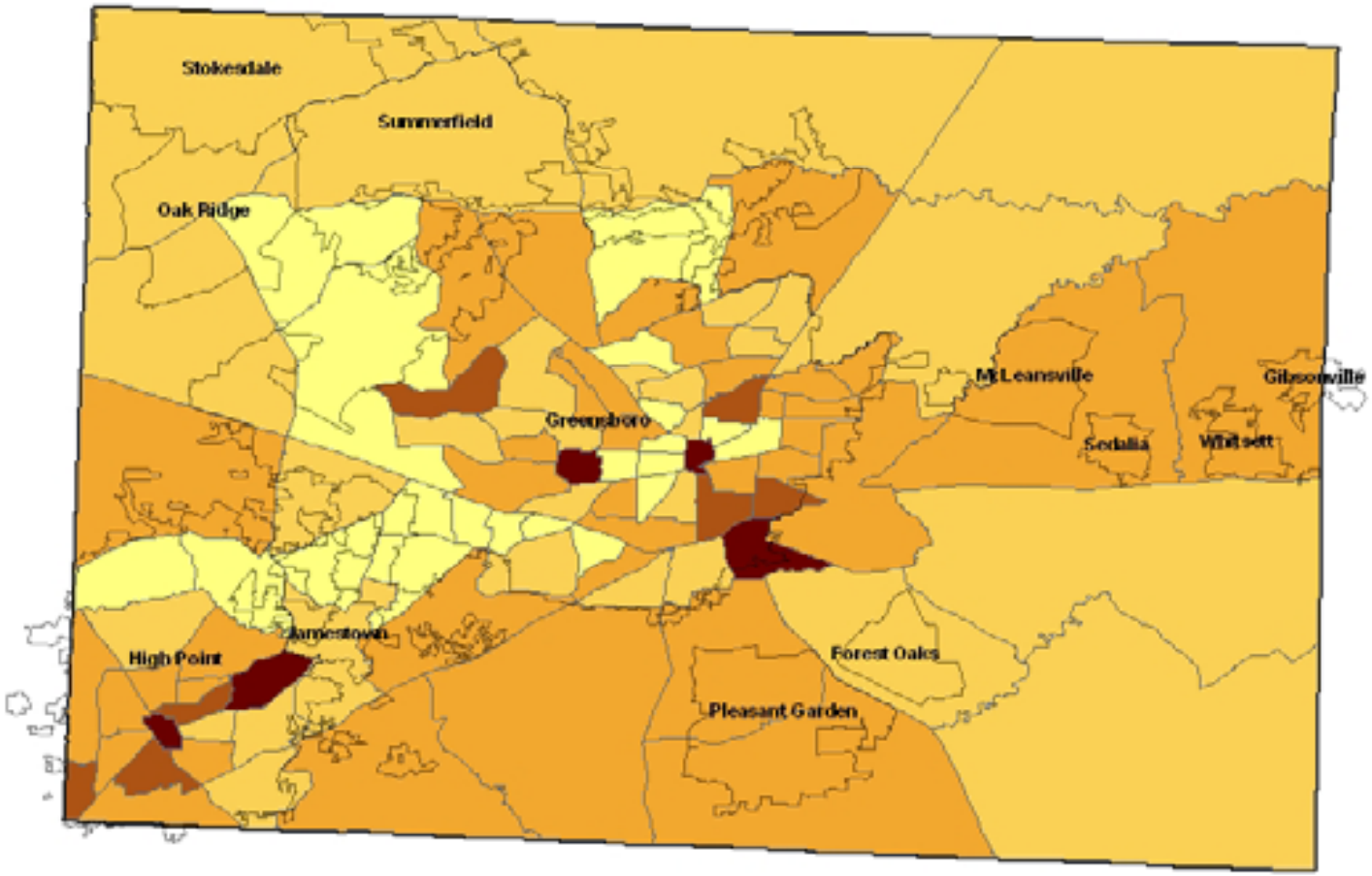
Steven Ramsey, RS

North Carolina Public Health
PREPAREDNESS & RESPONSE
PHP&R

GIS and Epi Response

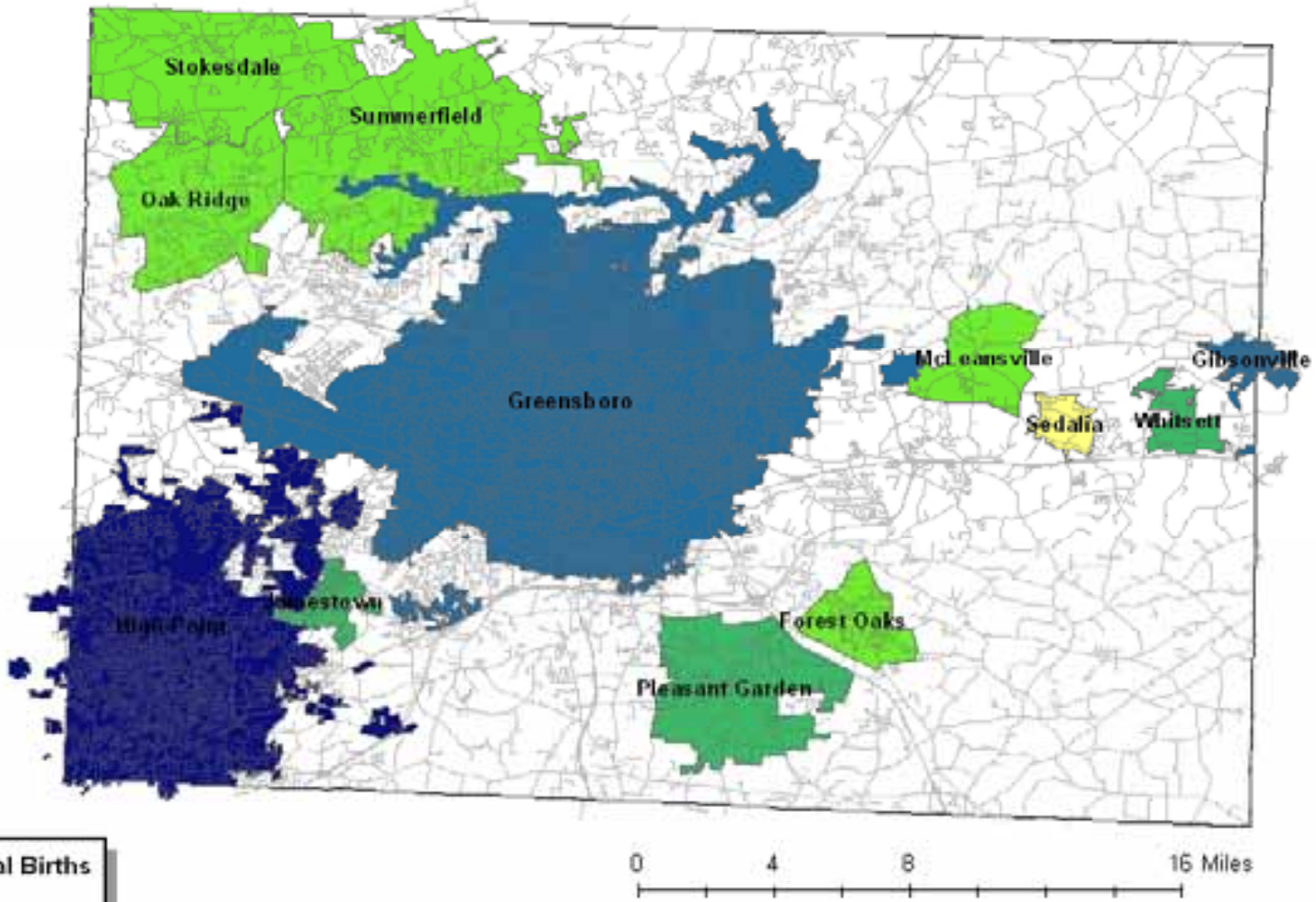

Salmonellosis Cases
in PHRST-5 Region
2003
ASHE
ALLEGHANY
SURRY
STOKES
ROCKINGHAM
CASWELL
WATAUGA
WILKES
YADKIN
FORSYTH
GUILFORD
DAVIE
DAVIDSON
RANDOLPH
Salmonellosis
cases per 100,000
(based on 2000 population)
0 - 4
5 - 10
11 - 17
18 - 23
24 - 37
Source: Office of Infectious Disease Epidemiology,
NC Division of Public Health

Heart Disease
Mortality Rates by Census Tract
Guilford County, NC 2002-2006



Souce: US Census Bureau, 2000; NC State Center for Health Statistics, NC Mortality Files, 2002-2006

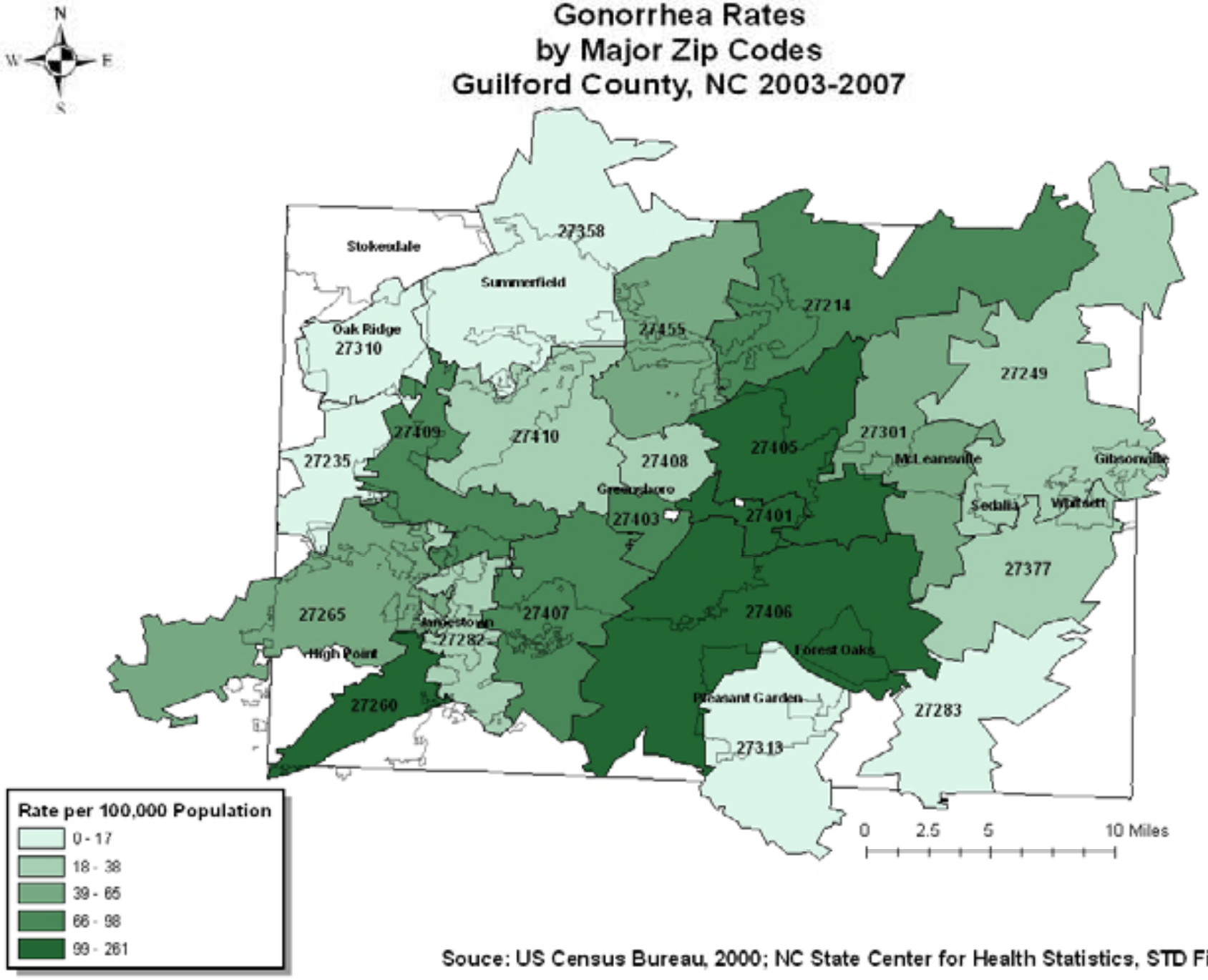
Percent Late or No Prenatal Care by Municipalities Guilford County, NC 2002-2006



Note: Late prenatal care refers to prenatal care initiated after the first trimester (first three months) of pregnancy.

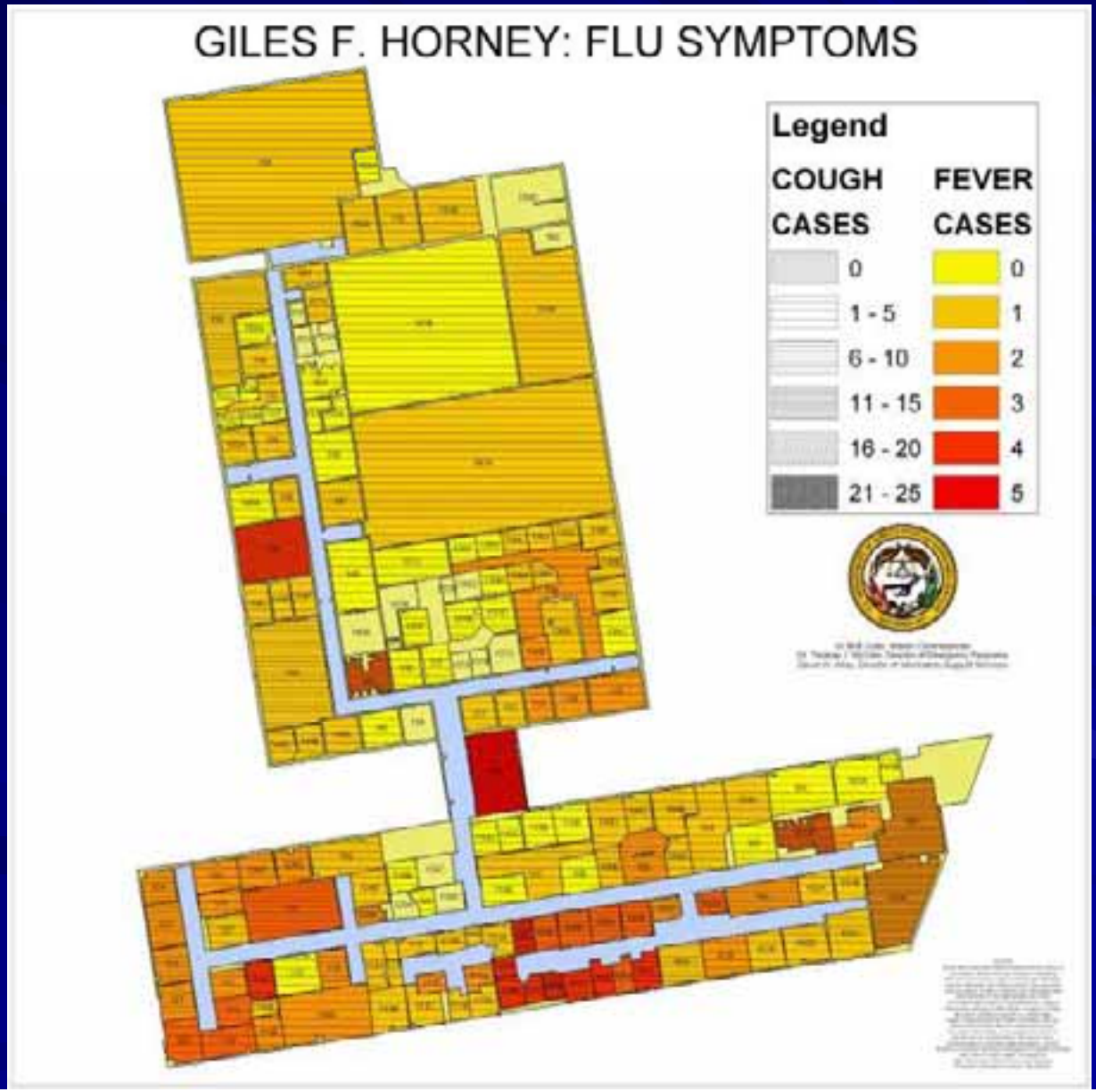
Souce: NC State Center for Health Statistics, NC Birth Files, 2002-2006

Gonorrhea Rates
by Major Zip Codes
Guilford County, NC 2003-2007



Souce: US Census Bureau, 2000; NC State Center for Health Statistics, STD File, 2007

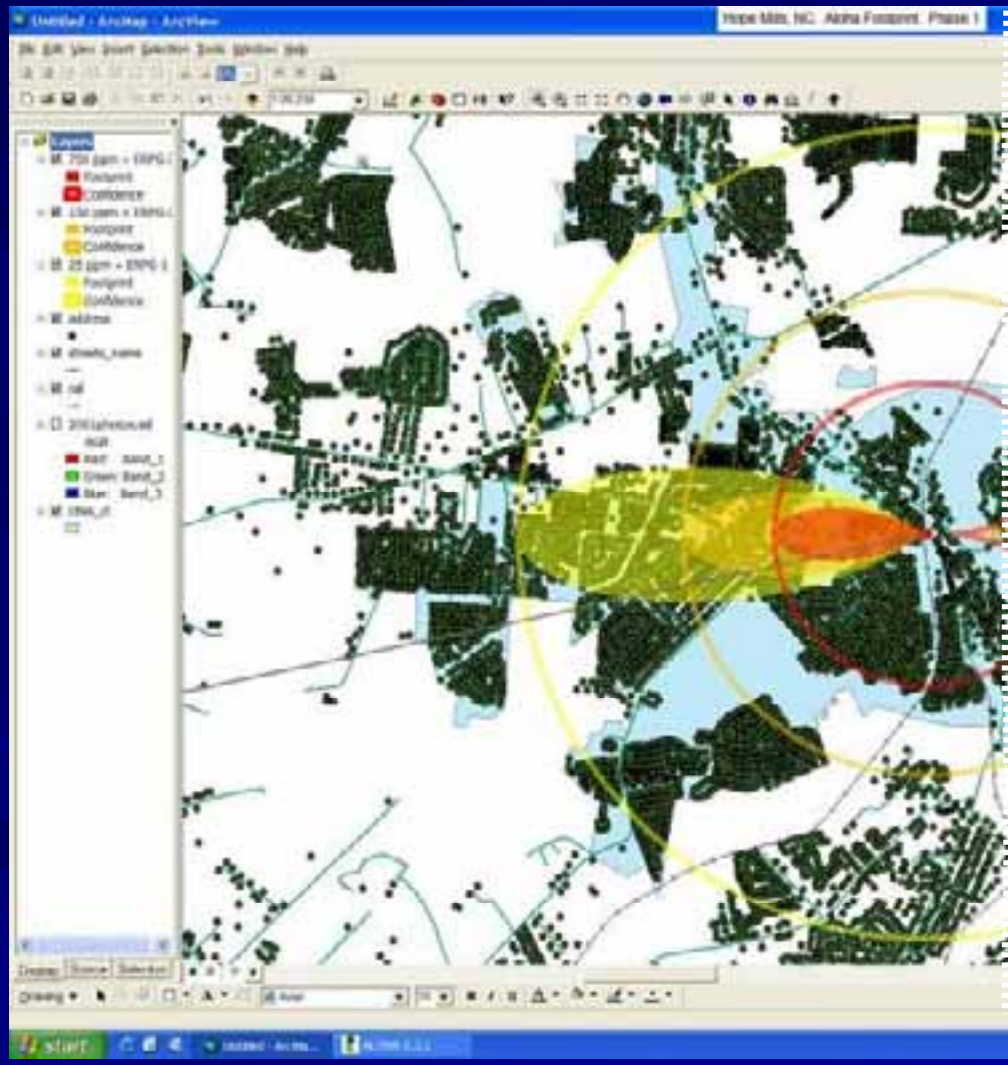
SARS Mapping



Communicable Disease Field Investigation with Mobile GIS

- GPS can be used for location finding, data collection, and navigation
- Customized user-friendly data collection forms
- Eliminate paper forms and double data entry, reduce errors, speed response
- Centralized data with geographic distributions

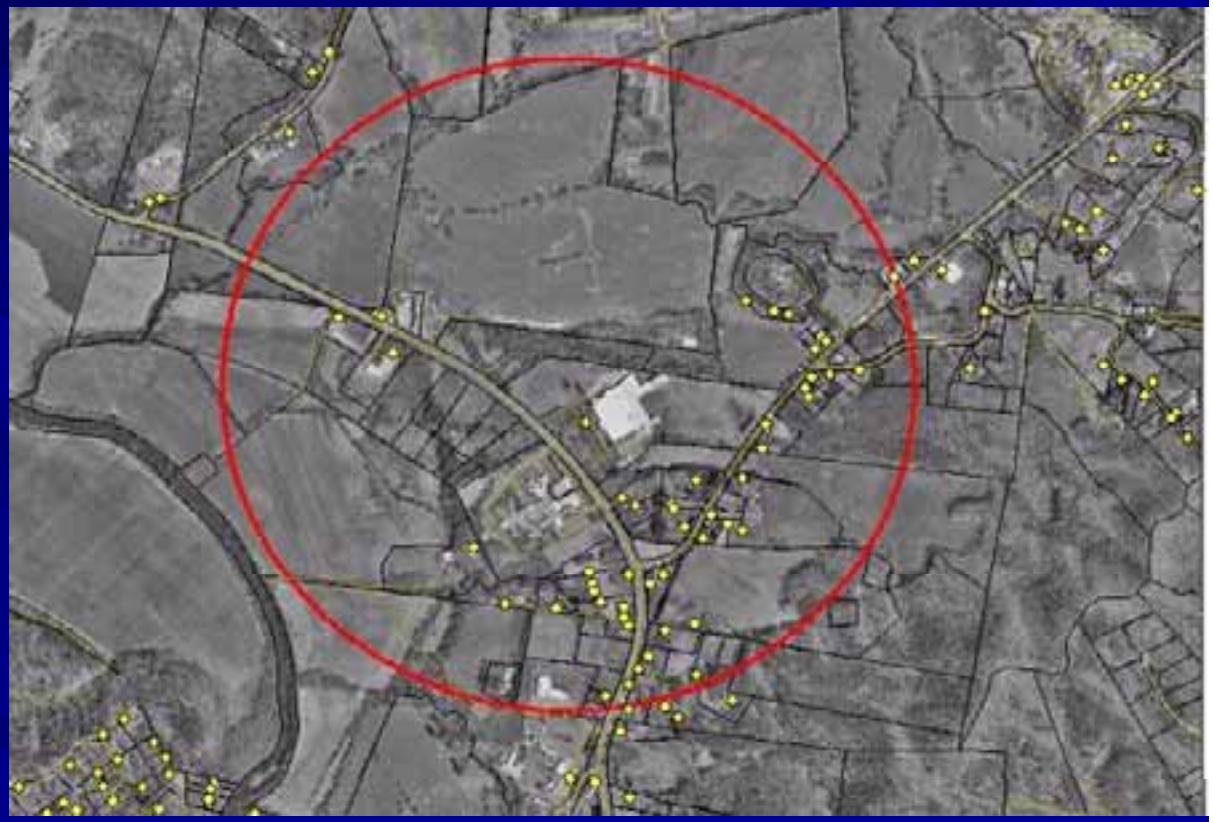
Modeling in GIS

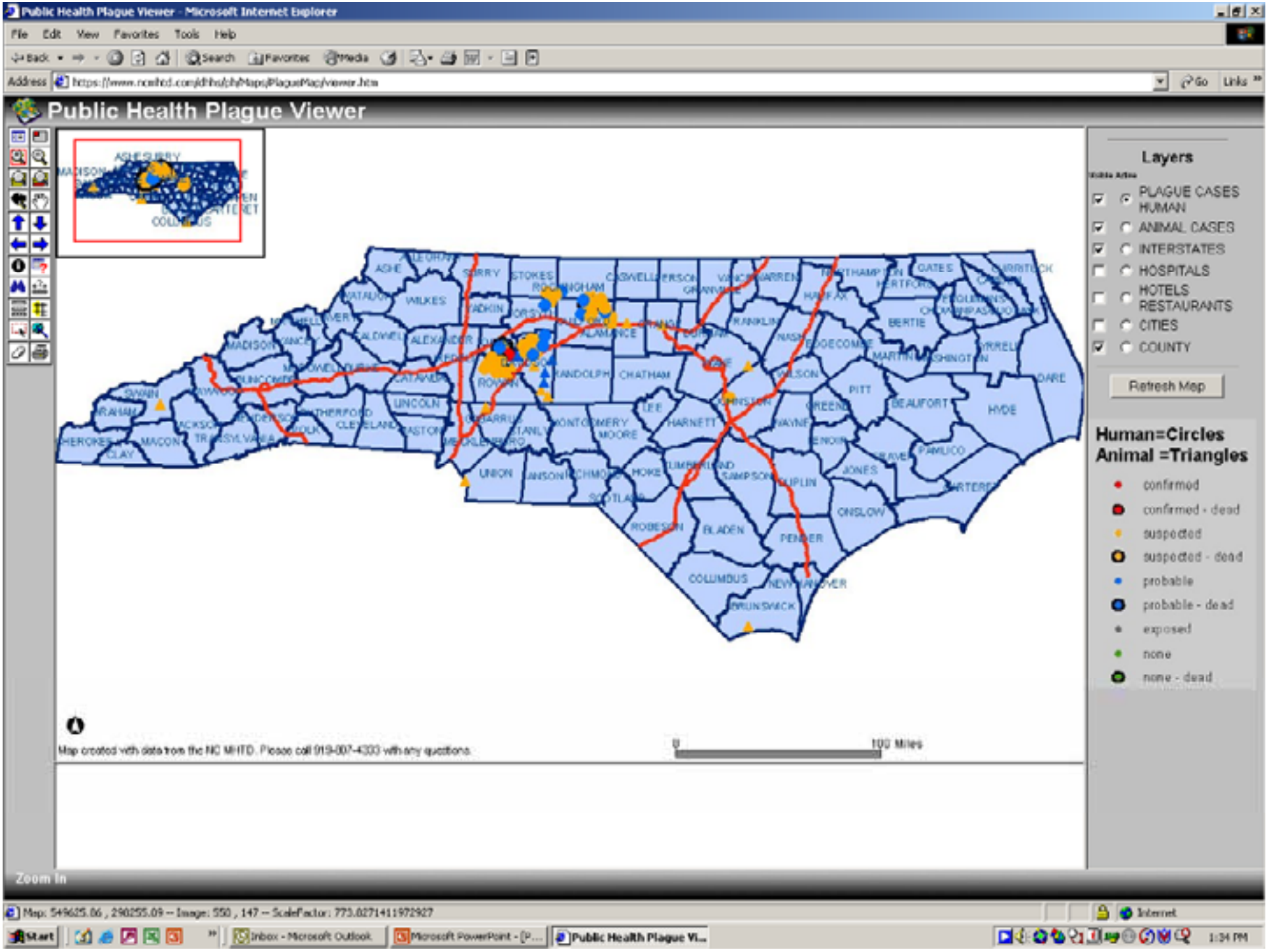


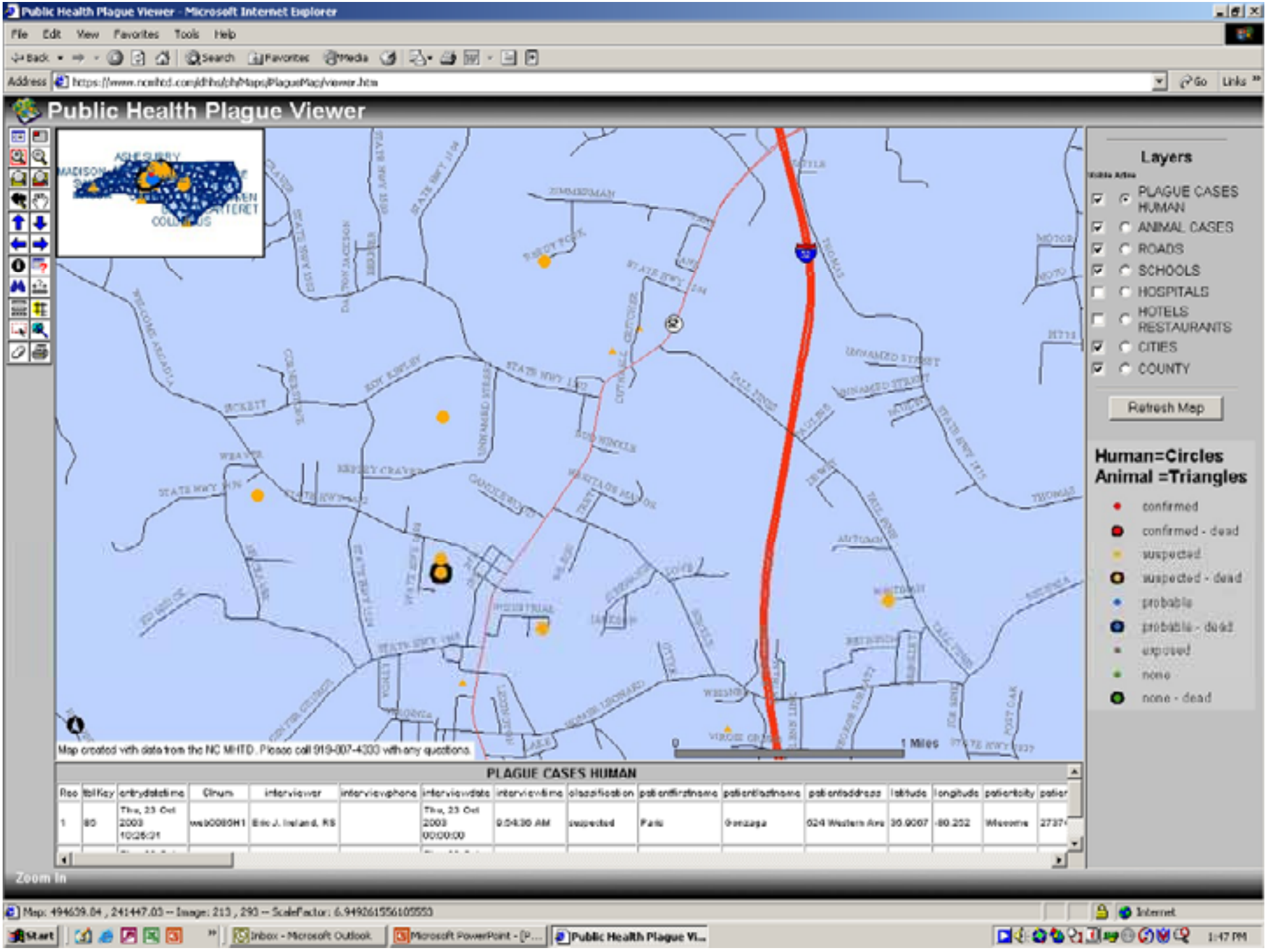
- Program to predict dispersion pattern of various chemicals based on input variables such as wind speed, amount of chemical, size of puncture, etc.

Western NC Legionellosis Outbreak Investigation

- Infectious disease investigation
- Community canvassing/case finding

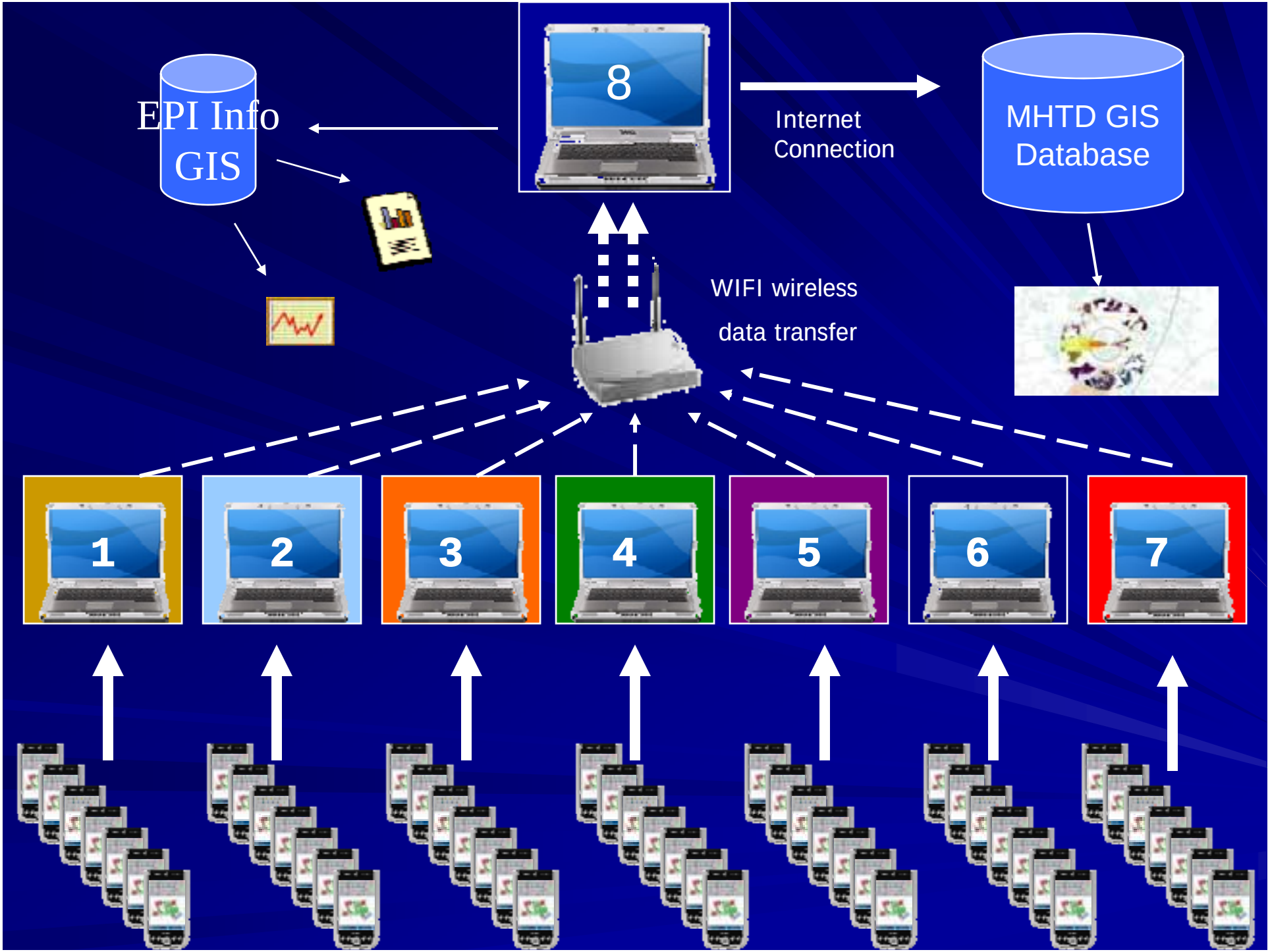



Public Health Plague Viewer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address https://www.ncmhd.com/dhhs/phMaps/PlagueMap/viewer.htm
Public Health Plague Viewer
Layers
PLAGUE CASES HUMAN
ANIMAL CASES
INTERSTATES
HOSPITALS
HOTELS RESTAURANTS
CITIES
COUNTY
Refresh Map
Human=Circles
Animal =Triangles
confirmed
confirmed - dead
suspected
suspected - dead
probable
probable - dead
exposed
none
none - dead
Map created with data from the NC MHTD. Please call 919-807-4300 with any questions.
0
100 Miles
Zoom In
Map: 549625.06 , 290255.09 -- Image: 550 , 147 -- ScaleFactor: 773.0271411972927
Internet
Start
Inbox - Microsoft Outlook
Microsoft PowerPoint - [P...
Public Health Plague Vi...
1:34 PM


Public Health Plague Viewer - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address https://www.ncahtd.com/dhhs/phMaps/PlagueMap/viewer.htm
Public Health Plague Viewer
Layers
PLAGUE CASES HUMAN
ANIMAL CASES
ROADS
SCHOOLS
HOSPITALS
HOTELS RESTAURANTS
CITIES
COUNTY
Refresh Map
Human=Circles
Animal =Triangles
confirmed
confirmed - dead
suspected
suspected - dead
probable
probable - dead
exposed
none
none - dead
Map created with data from the NC MHTD. Please call 919-807-4300 with any questions.
0
1 Miles
PLAGUE CASES HUMAN
Zoom In
Start
Inbox - Microsoft Outlook
Microsoft PowerPoint - [P...
Public Health Plague Vi...
1:47 PM

NC Office of Public Health Preparedness and Response

Public Health Regional Surveillance Teams (PHRST)


EPI Info
GIS
8
Internet
Connection
MHTD GIS
Database
WIFI wireless
data transfer
1
2
3
4
5
6
7

Rapid Response Project 516

- Mobile GIS and Electronic Data Capture project

Public Health Disaster Epidemiology

- Injury and Illness Surveillance
- Mortality Surveillance
- *Community Surveillance*
  - Information for Public Health emergencies
    - Response
    - Recovery
    - *Mitigation*

Community Assessment for Public Health Emergency Response (CASPER)

- Population (Census) Based Random Sample
  - modified from WHO EPI (Expanded Programme on Immunization)
- Household Interviews to Determine Human Needs and Impact
- Conducted and Reported Rapidly to Guide Response Efforts
  - <72 hours post-event
- Target Audience:
  - Public Health, Emergency Management

CASPER

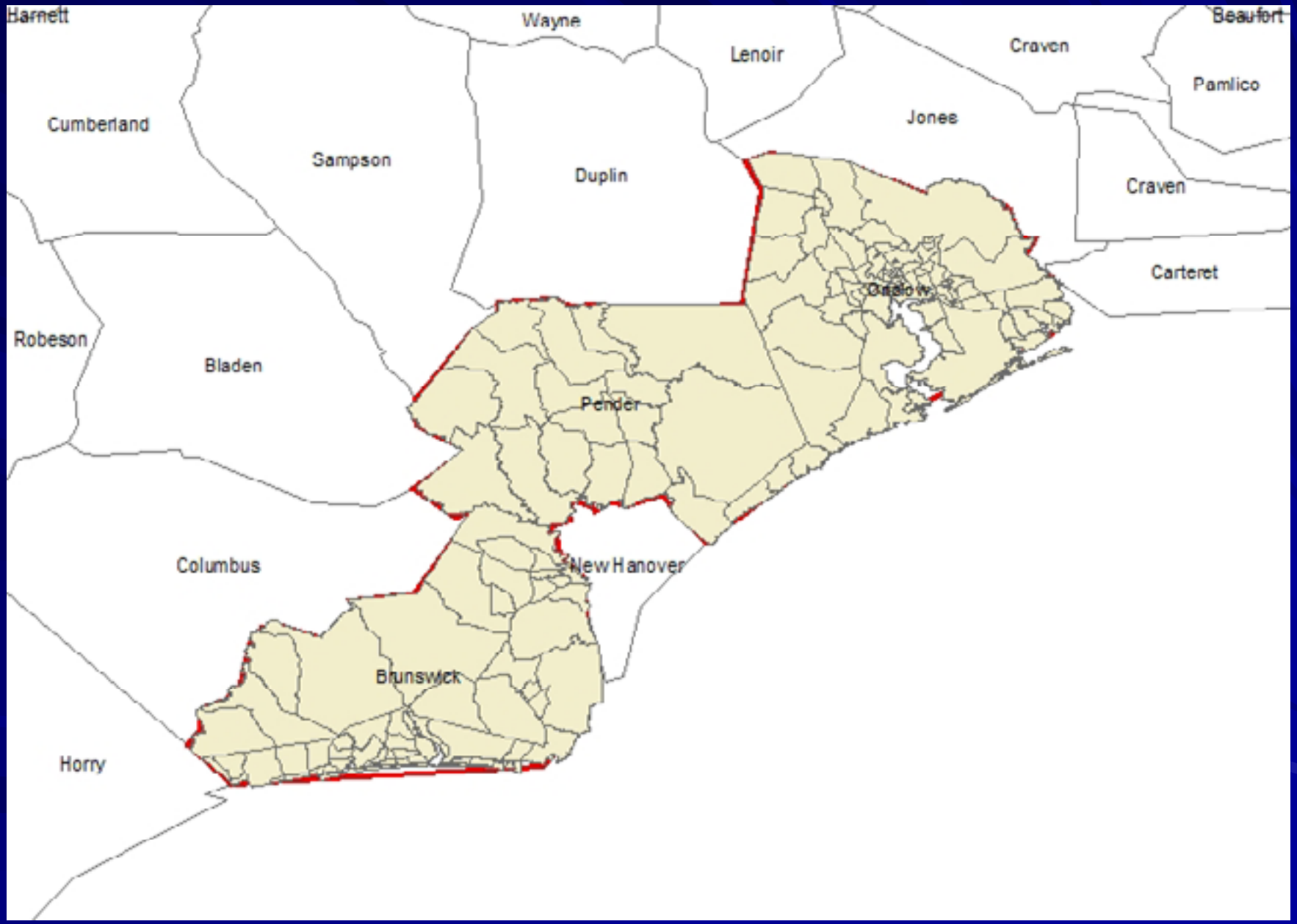
- Identify needs and impact by Population Proportion
- Define the magnitude of the need
  - population estimates using census data
- Characterize Need
  - most needs are known (water, electricity)
  - some may be unanticipated (food, use of generators)
- May be conducted in series
  - Recovery
  - After Action

Historical Approach

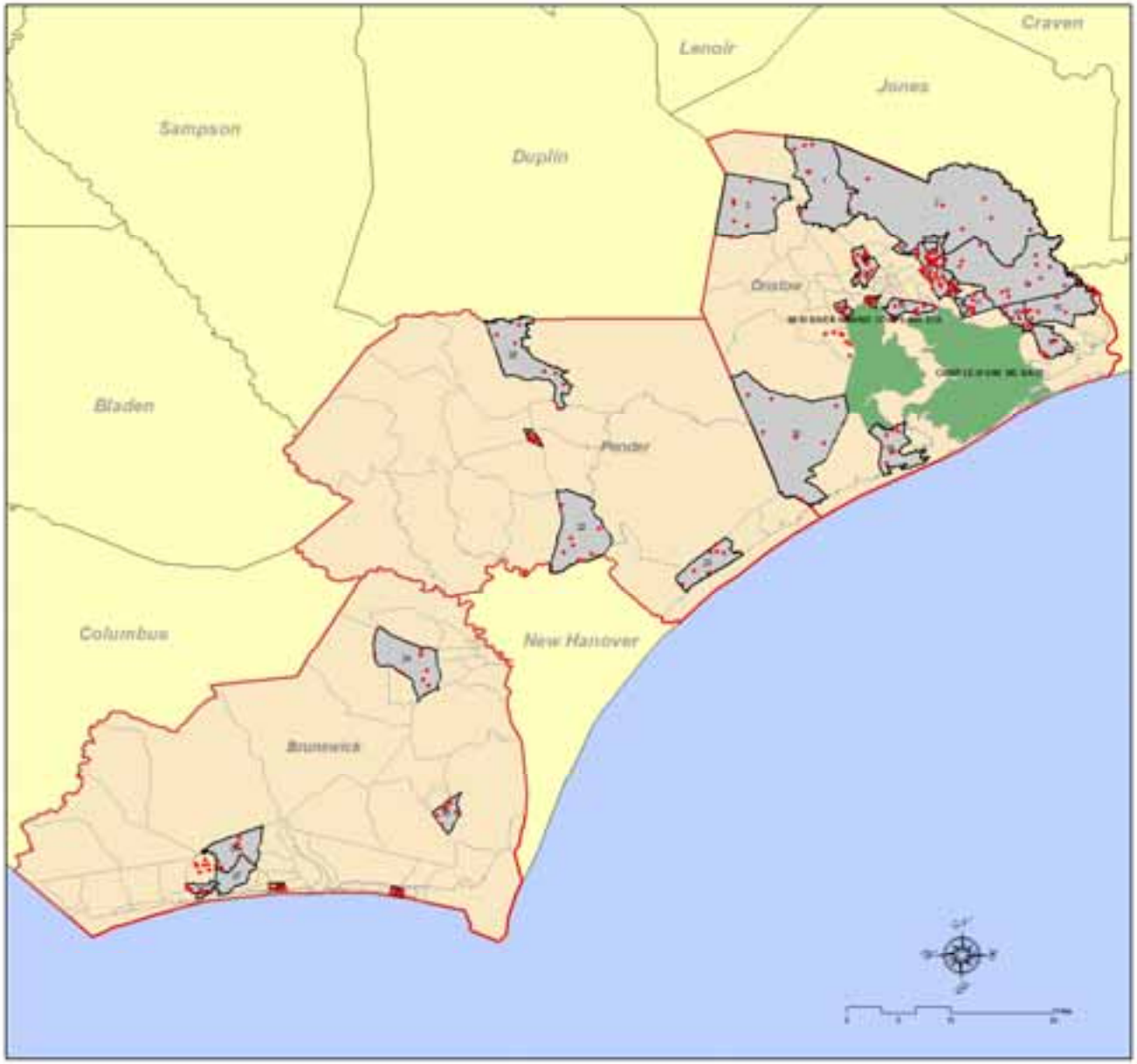
Historical Approach

CASPER Sample

- Randomly select 30 population weighted census blocks (clusters) from all of the census blocks in the assessment area
- 7 geographically random points generated per census block
- Teams navigate to the point
- Conduct interviews at 7 households within the census block (210 total)
- Questionnaire administered and data collected


Harnett
Wayne
Lenoir
Craven
Beaufort
Pamlico
Cumberland
Sampson
Duplin
Jones
Craven
Carteret
Onslow
Robeson
Bladen
Pender
Columbus
New Hanover
Brunswick
Horry

Hurricane Charley Rapid Needs Assessment



Legend

- Interview Site Locations
- Hurricane Charley Clusters
- Assessment Area Census Blocks
- Camp Lejeune
- Hurricane Charley Impacted Counties
- NC Counties

North Carolina Public Health Preparedness & Response
PHP&R

This map illustrates the Hurricane Charley assessment area. The RNA survey sample methodology involves a two-stage randomization process. Gray-shaded polygons represent first-stage randomly-selected census block-groups. The red dots show the location of household interview sites selected using a random point-in-polygon script in the second-stage randomization procedure.

Interviews were conducted to assess the magnitude of needs in the assessment area relating to health, housing and utilities.

Hurricane Charley Community Health and Needs Assessment

Date of report: 8/17/04
Time of report: 0900

Summary

A human health and needs assessment was conducted in Brunswick, Onslow and Pender counties by the North Carolina Division of Public Health as part of the state's response to Hurricane Charley. Individuals residing in 203 randomly selected households were interviewed on August 16, 2004 to estimate the condition and needs of the population in the three counties.

Data collected from this assessment indicate that the human health and needs were not significantly impacted in these three counties by this hurricane. For example, on the date of the survey:

- An estimated 1.4 % of households (or 1,325 households) were without power. The 95% confidence interval (95% CI) was 0% to 3.2%.
- 6% of occupied households were damaged but habitable (5,677 households). No respondents reported that the residence was damaged but uninhabitable.
- An estimated 2.5 % (95% CI 0.2% to 4.8%) of homes were flooded with 1 inch to 12 inches of floodwater in the dwelling.
- Hurricane related injuries were reported in 0.6% of households (95% CI 0 to 1.5%).
- Less than 1% of households reported that the hurricane was preventing an occupant from obtaining medical care.
- Less than 2% of households or 1,325 households projected (95% CI 0 to 2,838) were using bottled water.
- Less than 3% of households or 2,555 households projected (95% CI 0 to 5,014) reported being without access to a 3 day supply of food.

Recommendations

Survey results and field reports indicate that the hurricane's impact on public health in the three-county assessment area is not widespread. These recommendations are offered to address on-going recovery efforts:

- Provide outreach information to the public to address clean up of flooded homes, and the safe operation of portable generators to prevent fires, electrocution and carbon monoxide poisoning.

Table 1. Results of a Community Health and Needs Assessment Following Hurricane Charley. Brunswick, Pender, and Onslow Counties, North Carolina, 2004

	Household (%)	95% CI	Households Projected* (n)	95% CI
Damage to home				
External damage due to hurricane				
None or minimal	94.3	89.8-98.8	89,221	84,963-93,479
Damaged, but habitable	5.7	1.2-10.1	5,393	1,135-9,556
Damaged, but uninhabitable	0		0	
Flood water in home due to hurricane				
None	97.5	95.2-99.8	92,249	90,072-94,425-
1 to 12 inches	2.5	0.2-4.8	2,365	189-4,541
13-36 inches	0			
>3 feet	0			
Flooding, but unknown level	0			
Household utilities				
No running water	0.4	0-1.2	378	0-1,135
No electricity	1.4	0-3.2	1,325	0-3,028
No working telephone	3.1	0.3-5.9	2,933	284-5,582
No battery operated radio	21.4	-	20,247	-
Generator used following hurricane	9.4	3.6-15.3	8,894	3,406-14,476
Hurricane-related illness and injury				
Injury in household due to hurricane	0.6	0-1.5	568	0-1,419-
Illness in household since hurricane	2.2	0.1-4.2	20,815	94.6-3,974
Experiencing stress due to hurricane	6.6	3.1-10.1	6,244	2,933-9,556
Requiring medical care	4.2	0.5-7.8	3,974	473-7,380
Problems obtaining medical care	0.5	0-1.5	473	0-1,419
Problems obtaining medication	0.7	0-1.8	662	0-1,703
Food and water				
Current source of drinking water				
Well	23.8	11.2-36.4	22,518	10,597-34,439
Public	73.7	60.3-87.1	69,731	57,052-82,409
Bottled	1.4	0-3.0	1,325	0-2,838
Households without access to a 3-day food supply	2.7	0-5.3	2555	0-5,014

Community Assessment for Public Health Emergency Response (CASPER)

- Limitations
  - Access to assessment areas
  - Unoccupied households
  - Confidence intervals
    - Estimates
  - Some data may be available for other sources
    - Utilities, etc
  - Users must be prepared to receive assessment information

Community Health and Needs Assessment

- Strengths
  - Objective, representative data from a large population
  - Generated very quickly (72 hours)
  - Population proportion
    - Estimated percentage of households
  - Population magnitude
    - Estimated number of households

NC DPH
CASPER Experience

- Hurricane Isabel, Charley (NC)
- Hurricane Wilma (FL)
- Hurricane Katrina AAR (MS)
- Iowa Floods 2008
- Carteret County Prehurricane Assessment (NC)
- 19 LHD CHA's

Types of Survey Instruments Convenience vs. Random

- Paper-based/Self-administered surveys
- Telephone surveys
- Web-based surveys
- Face-to-Face interviews

Comparison of CHA Sample and Census Demographics

CHA County	% White	% White Census	% Black	% Black Census	% Male	% Male Census	% Female	% Female Census	% Over 65	% Over 65 Census
Ashe	97.1	97.2	0.7	0.7	33.3	49.3	66.7	50.9	34.3	18
Alleghany	96	95.7	0	1.2	32	49.3	68	50.7	37	19.2
Watauga	97.4	96.5	1	1.6	44.8	49.8	55.2	50.2	25.3	11
Davidson	82.9	87.1	11.6	8.6	39.2	48.7	60.8	51.3	31.5	13
Caldwell	88.6	89.3	5.9	4.2	40.3	49.2	59.7	50.8	35.8	14.1
Pitt	69	60.8	28.1	33.7	38.6	47.8	61.4	52.2	20.8	9.9
Davie	88.4	90.4	5.8	6.8	32.7	49.2	67.3	50.8	35.3	13.8
Surry	90.4	94.6	4.2	2.9	46.9	39.5	51.1	60.5	35.6	15.4
Yadkin	92.5	92.5	3.4	5	49.1	35.9	50.9	64.1	34.2	14.2
Rockingham	70.6	75.6	24.6	19.2	35.5	48.9	64	51.1	30.3	14.8
Average % Point Difference		**0.68**		**-0.14**		**7.32**		**-7.25**		**-17.7**

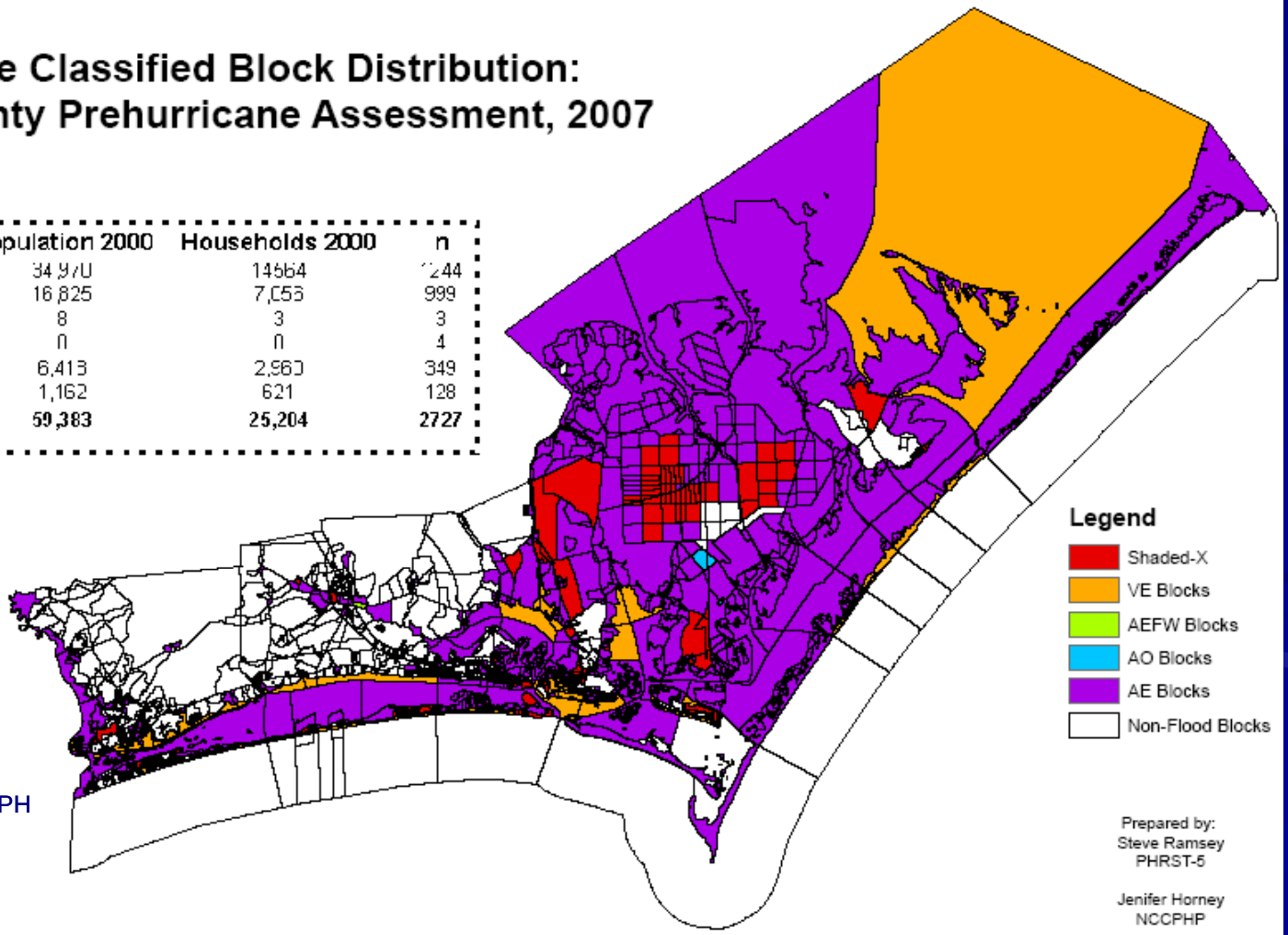
Preparedness in CHA

- Survey instrument
  - Household plans and preparedness?
  - Communication/contact plan?
  - Food/water/fuel?
  - Awareness
    - Generator use, food safety, water safety, driving
- Using the data
  - Messages
  - Communication methods

Factors Associated with Hurricane Preparedness: Results of a Pre-Hurricane Assessment

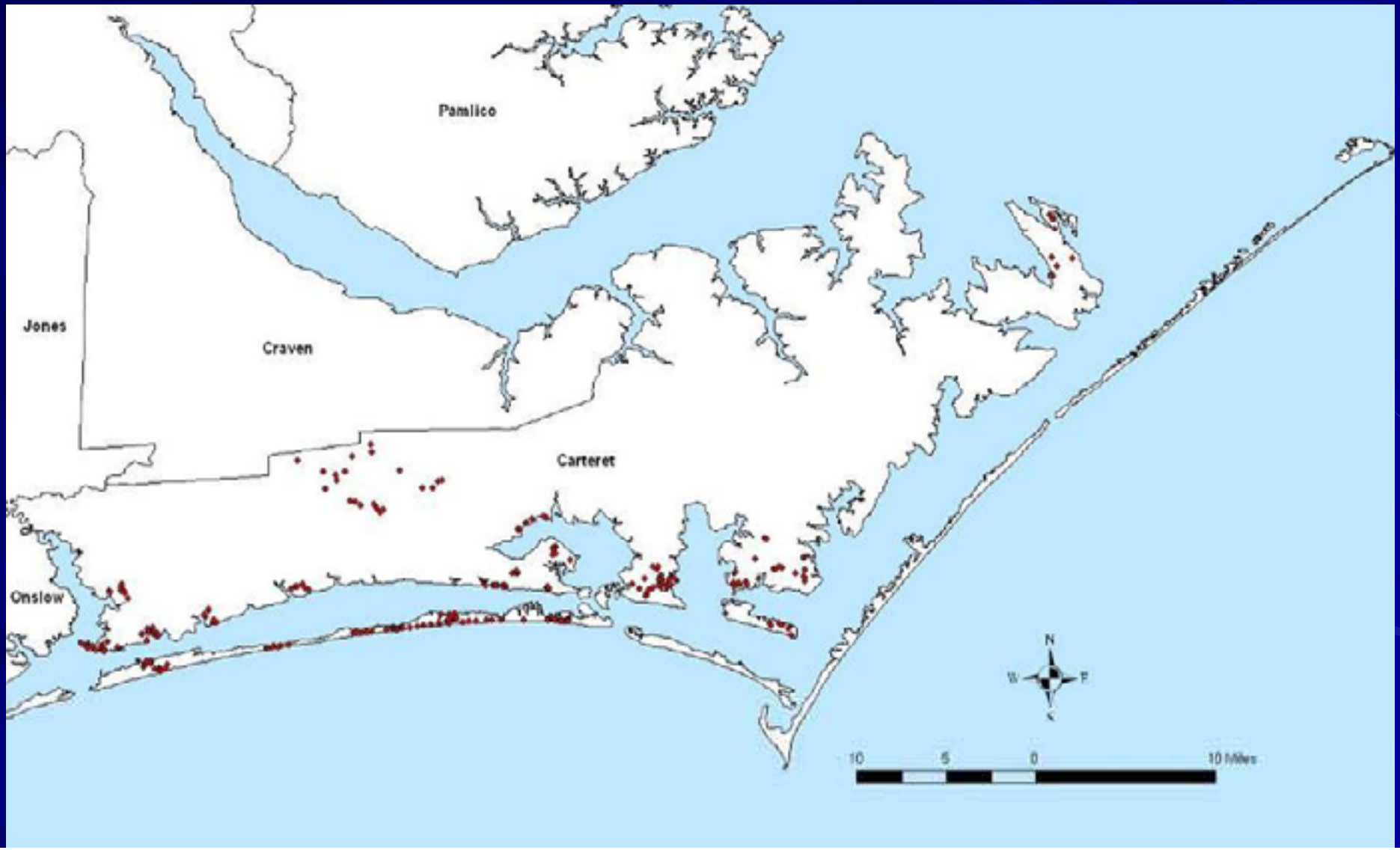
Floodzone Classified Block Distribution: Carteret County Prehurricane Assessment, 2007

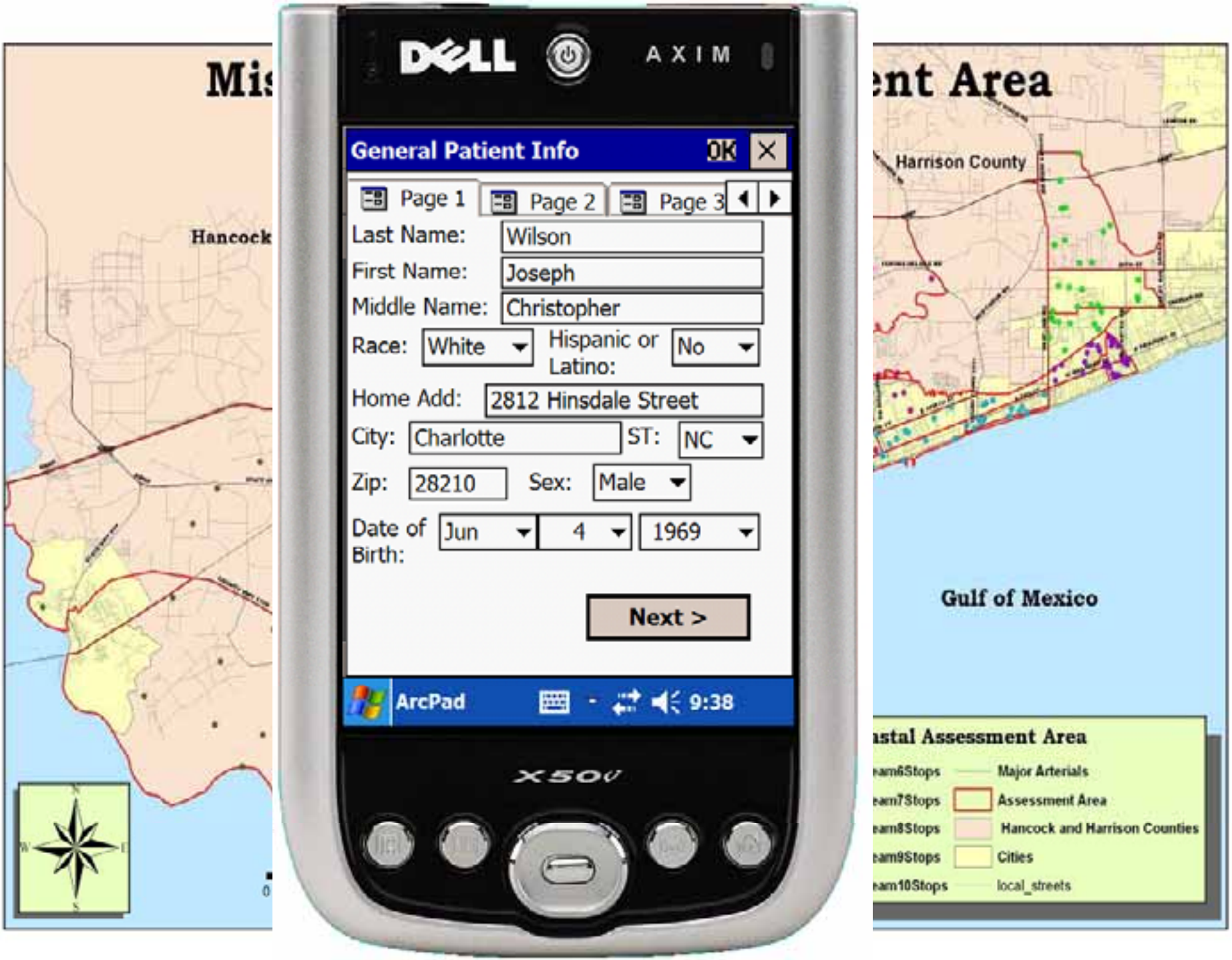
Area of Interest	Population 2000	Households 2000	n
Non-Flooded Blocks	34,970	14664	1244
AE Blocks	16,825	7,053	999
AEFW Blocks	8	3	3
AO Blocks	0	0	4
Shaded-X Blocks	6,413	2,960	349
VE Blocks	1,162	621	128
Totals	**59,383**	**25,204**	**2727**



Jennifer Horney, MA, MPH
Cynthia Snider, MHS
Sandra Malone
Laura Gammons
Steve Ramsey

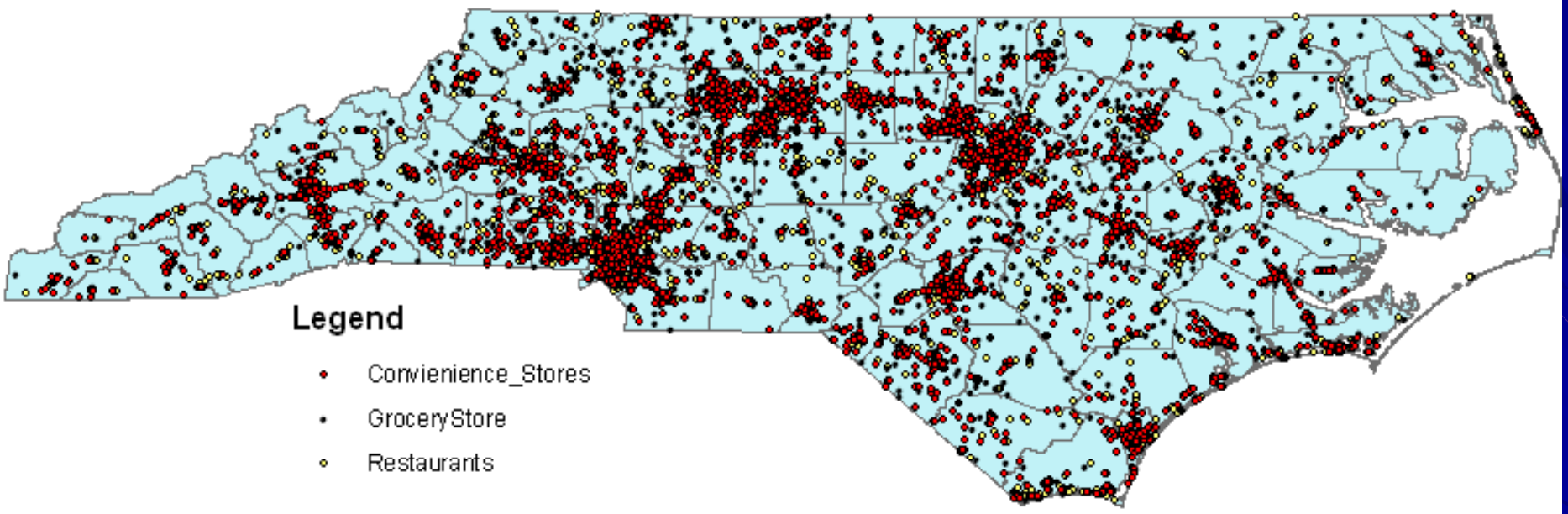
Interview Locations




DELL
AXIM
General Patient Info
OK
Page 1
Page 2
Page 3
Last Name: Wilson
First Name: Joseph
Middle Name: Christopher
Race: White
Hispanic or Latino: No
Home Add: 2812 Hinsdale Street
City: Charlotte
ST: NC
Zip: 28210
Sex: Male
Date of Birth: Jun 4 1969
Next >
ArcPad
9:38
X50v
Hancock
Harrison County
Gulf of Mexico
Major Arterials
Assessment Area
Hancock and Harrison Counties
Cities
local_streets

Project 516 and the Food Recall

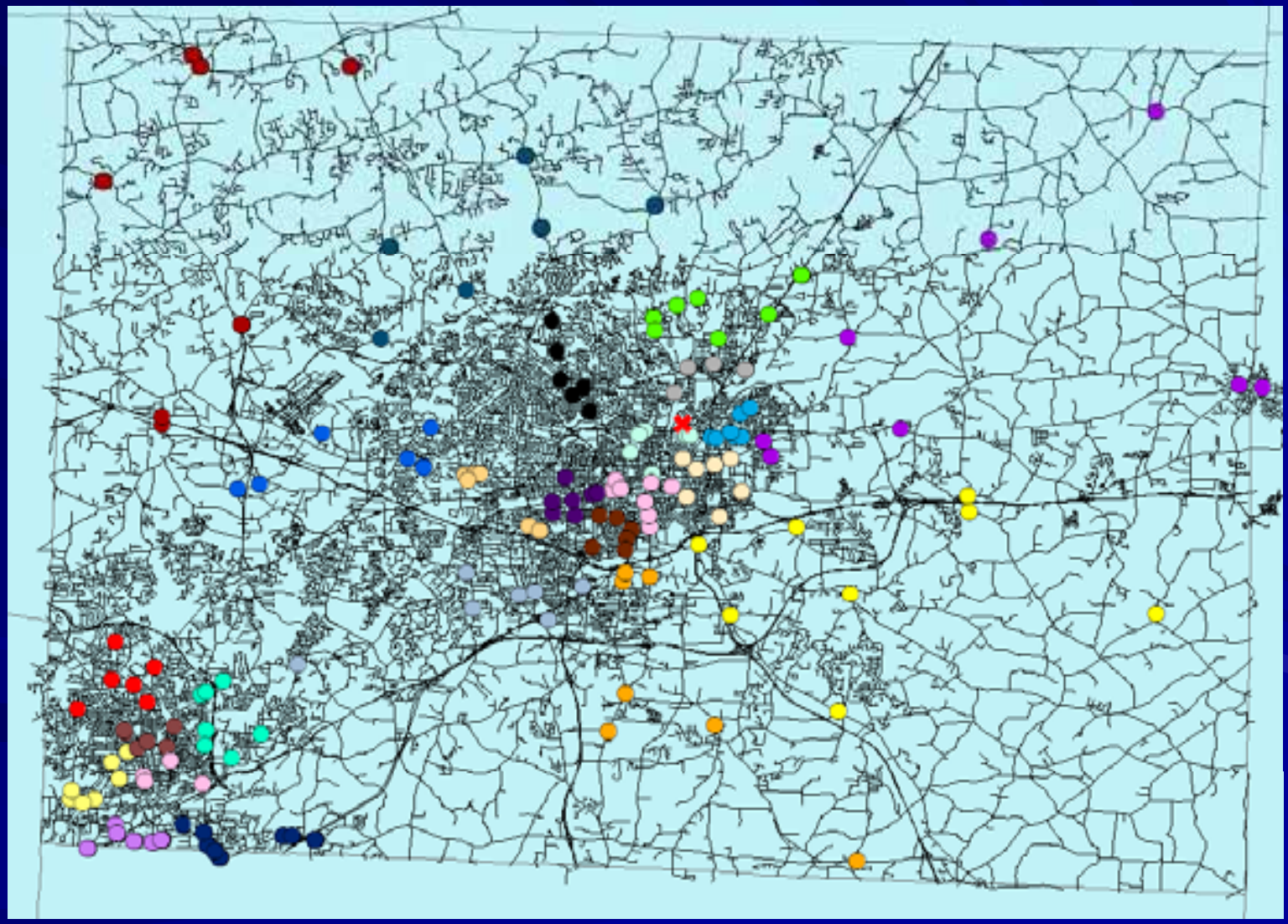
MHTD



WIC Vendors to Geocode

STORE_NAME	#	SUITE	DIRECTION	ADDRESS	SUFFIX	CITY	ZIP
Burton's Valurite Pharma	120		E	120 E LINDSAY St	St	Greensboro	27401
Bestway	2113			2113 E WALKER Ave	Ave	Greensboro	27403
CVS Pharmacy #4431	1615			1615 SPRING GARDEN St	St	Greensboro	27403
Compare Food Market	1040			1040 SUMMIT Ave	Ave	Greensboro	27405
Save A Lot #281	3111			3111 YANCEYVILLE St	St	Greensboro	27405
Tip Top Grocery	4608			4608 SUMMIT Ave	Ave	Greensboro	27405
CVS Pharmacy #5593	3341			3341 RANDLEMAN Rd	Rd	Greensboro	27406
Fairway One Stop #8	1301		S	1301 S EUGENE St	St	Greensboro	27406
Florida Grocery	803		W	803 W FLORIDA St	St	Greensboro	27406
Key Food Market Place	1050			1050 ALAMANCE CHURCH Rd	Rd	Greensboro	27406
Save A Lot #280	429		W	429 W MEADOWVIEW Rd	Rd	Greensboro	27406
99¢ and Food Center	4925	1110	W	4925 W MARKET St	St	Greensboro	27407
Abarrotes El Azteca	4131	D		4131 SPRING GARDEN St	St	Greensboro	27407
Hispanica	2200	C		2200 MEADOWVIEW Rd	Rd	Greensboro	27407
La Preciosa	4614		W	4614 W MARKET St	St	Greensboro	27407
La Vaca Ramona	4516		W	4516 W MARKET St	St	Greensboro	27407
Super K-Mart Center	1302			1302 BRIDFORD PKWY	PKWY	Greensboro	27407
Kerr Drugs #332	2190			2190 LAWNDALE Dr	Dr	Greensboro	27408
Randy's Produce	5416	A	W	5416 W MARKET St	St	Greensboro	27409
Bottom Dollar	3136			3136 KIVETT Dr	Dr	High Point	27260
Cloverleaf	133			133 MONTLIEU Ave	Ave	High Point	27260
Green Street Grocery	1924		E	1924 E GREEN St	St	High Point	27260
Horn Red Dot	345			345 ENNIS St	St	High Point	27260
Kerr Drugs #3315	912		E	912 E GREEN Dr	Dr	High Point	27260
La Fabulosa #3	810			810 MAIN St	St	High Point	27260
Pantry Shop #4	3000		W	3000 W ENGLISH St	St	High Point	27260
Pequeno Mexico	800		S	800 S MAIN St	St	High Point	27260
Save A Lot #285	131			131 GREENSBORO Rd	Rd	High Point	27260
CVS Pharmacy #3988	2200			2200 WESTCHESTER Dr	Dr	High Point	27262
Stokesdale Bi Rite	8632			8632 MAIN St	St	Stokesdale	27357

Staging and team configuration



Team map and written directions

TEAM EIGHT

Driving distance: 14.4 mile(s) Driving time: 22 minute(s)

1: Depart Graphical Pick: -79.74, 36.08

2: Go West on E Bessemer Ave toward Huffine Mill Rd 0.1 mile(s) < 1 minute

3: Turn right on Elwell Ave 0.2 mile(s) < 1 minute

4: Turn left on USHY 70 (E Wendover Ave) 1.2 mile(s) 1 minute(s)

5: Turn right onto ramp and go South West on USHY 29 (N Ohenry Blvd) 4.4 mile(s) 4 minute(s)

6: Take ramp to S Elm Eugene St 0.1 mile(s) < 1 minute

7: Turn right on S Elm Eugene St 0.7 mile(s) 1 minute(s)

8: Turn left on W Terrell St 0.4 mile(s) < 1 minute

9: Arrive at FAIRWAY ONE STOP 2

10: Depart FAIRWAY ONE STOP 2

11: Continue West on W Terrell St < 0.1 mile(s) < 1 minute

12: Arrive at SIMPLY KWIC

13: Depart SIMPLY KWIC

14: Go back East on W Terrell St < 0.1 mile(s) < 1 minute

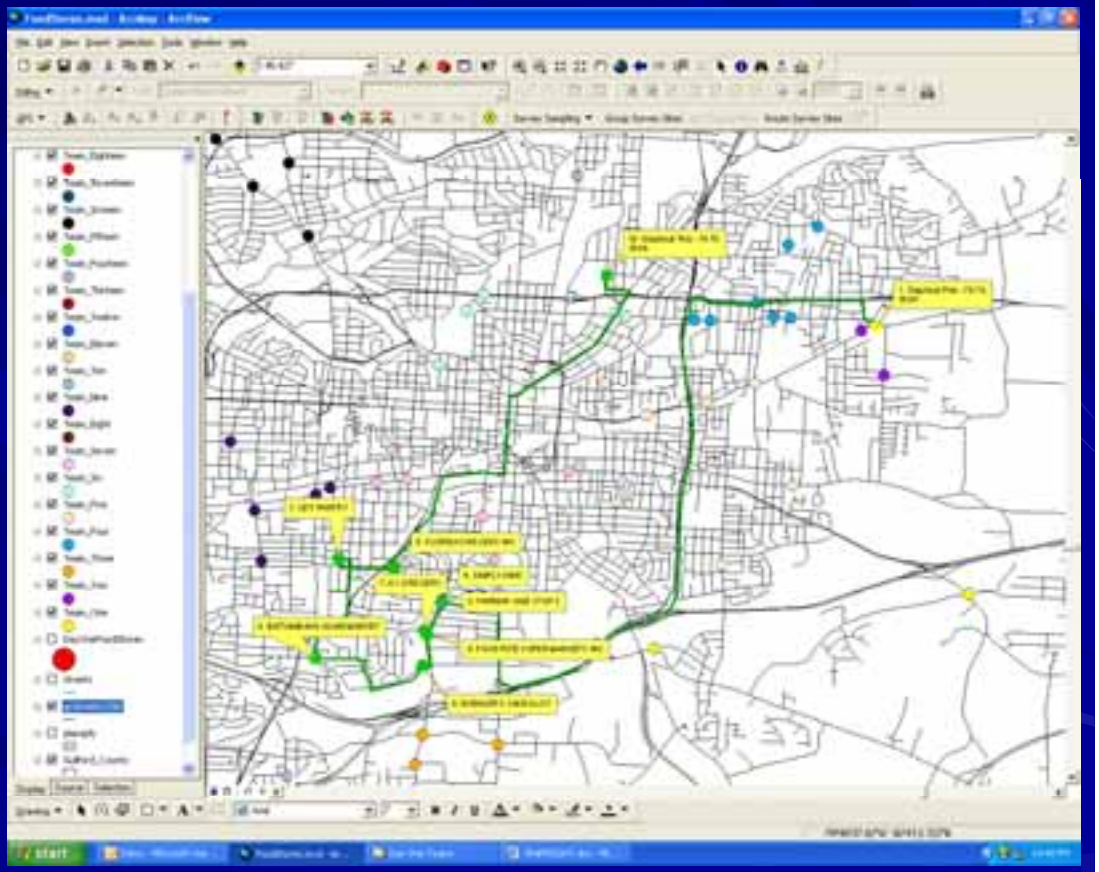
15: Make sharp right on Randleman Rd 0.3 mile(s) < 1 minute

16: Turn right on Mobile St < 0.1 mile(s) < 1 minute

17: Arrive at A 1 GROCERY

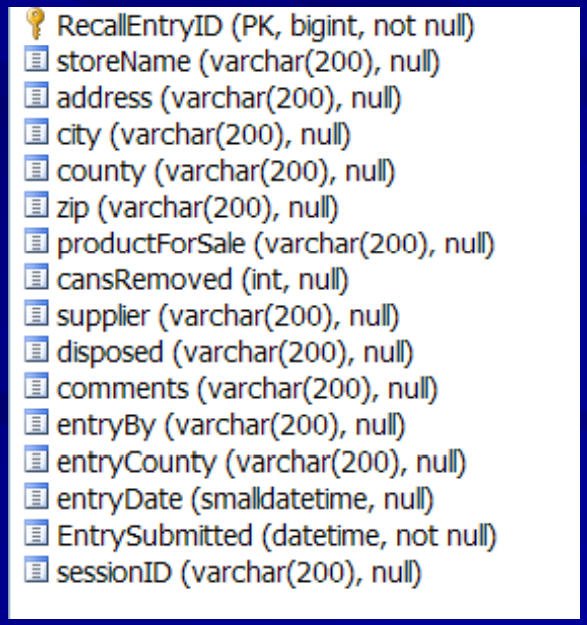
18: Depart A 1 GROCERY

19: Go back East on Mobile St < 0.1 mile(s) < 1 minute



Database schema standardization

- Worked with NCDA Emergency Programs to use the same database schema being collected on their web-based data collection form.



Food and Drug Form 100 for Arcpad

Summary

- Day 1 – 262 inspections (34 people)
- Day 2 – 345 inspections (28 people)
- Day 3 – 263 inspections (22 people)
- Day 4 – 54 inspections (7 people)
- Total – 924 inspections

For further questions, please contact: 336-641-7777

Steve Ramsey, RS **Regional Surveillance Team Leader** sramsey@co.guilford.nc.us	Jared Hill, CHES Statistical Research Assistant jhill@co.guilford.nc.us
Mark H. Smith, Ph.D. Epidemiologist msmith@co.guilford.nc.us	