Integrating GIS into Public Health Education

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ABSTRACT

- GIS offers a spatial framework that may be utilized in the five subfields of public health education: Biostatistics, Epidemiology, Environmental health sciences, Health services administration, and Social and behavioral sciences. We discuss how GIS education was integrated into the curricula for students enrolled in Master of Public Health programs at Louisiana State University, Health Sciences Center, School of Public Health. The major goal was to build the school's capacity for research and training, by using GIS software and education materials in the classroom. Other objectives include training students for leadership roles in public health, to improve decision making, and for research program development among faculty, across the public health subfields to collaborate in problem solving.

Background

- It was only decades ago that tools for geographic analysis became widely available and affordable. Since that time, public health and academic institutions have begun using GIS in varied research and 'applied' milieus. New tools and methods to incorporate GIS and geospatial analysis into public health topics have developed, and public health workers are being called upon to approach issues of public health with geographical and/or spatial perspectives.

School of Public Health, LSUHSC

The School of Public Health, Louisiana State University Health Sciences Center was established in July, 2003. It consists of five programs:

- Biostatistics;
- Epidemiology;
- Environmental and Occupational Health Science;
- Health Policy and System Management, and
- Behavioral and Community Health Science

Purpose of the Course

- This course provides a solid foundation in Geographic Information System (GIS), explaining basic concepts and demonstrating how to implement core data analysis techniques. In this course, students will learn what GIS are; why GIS should be used in public health, and how GIS can be used to map and analyze the geographical distributions of populations at risk, health outcomes, and risk factors, to explore associations between risk factors and health outcomes.

Rationale of the Course

- Geographic information systems (GIS) are computer-based systems for integrating and analyzing spatial data. The systems provide a digital lens for exploring the dynamic connections among people, health and well-being, and our changing physical and social environments. As such they have the potential to be tremendously useful tools for analyzing and addressing public health problems.

Text and Materials

- GIS and Public Health, *By E. K. Cromley and S. L. McLafferty, Guilford Press, 2002*
- GIS Tutorial for Health, *Kristen S. Kurland, Wilpen L. Gorr, ESRI Press, 2007*
- GIS for Health Organizations, *Laura Lang, ESRI Press, 2000*

Instructional Objectives

- Develop a theoretical framework for geographic information sciences. This will incorporate uses of analysis for disease epidemiology of chronic and infectious disease, and issues of environmental health.
- Understand underlying database structure for successful GIS project management.
- Learn to perform project needs assessment, obtain appropriate data and metadata, and transform data as necessary to answer a research question.
- Gain hands-on experience using surveillance data in a geographic analysis.

Instructional Objectives (cont.)

- Gain hands-on experience performing geo-statistical analysis on data, and interpreting the results.
- Build a geo-database and perform spatial analysis on a topic of interest to the student.
- Communicate results of individual analysis.

Content Outline

- GIS & Spatial Data Overview
- Basic Knowledge of GIS
- Uses of GIS in Health Practice and Research
- Needs Assessment & Data Management using a GIS
- Characterizing Environmental Hazards Spatially and Lab-Incorporating Field Data into a GIS
- Characterizing Health Care Access Spatially

Content Outline (cont.)

- GIS Applications for Health
- Visualizing Health Data
- Designing Maps for a Health Study
- Preparing Spatial Data
- Advanced Spatial Analysis
- Approximate Methods for Transferring Data
- Case Studies

Evaluation

Students will be evaluated by written examinations and a student presentation in the following manner:

- Written examinations

  There will be one mid-term examination and one final examination.
- Students will develop a project on spatial analyses in public health settings and give presentation to the class.

Grading

Exam #1	Midterm	30%
Exam #2	Final	30%
Student Project		30%
Homework, Attendance and Class Participation		10%

- A=90-100%
- B=80-89%
- C=75-79%
- D=70-74%
- F=Below 70%

Homework and Attendance

- In some classes, homework may be assigned. It is important for both the instructor and the students. The instructor can estimate how much and how well the students learn in classes; while students can practice and enhance what they learn. The attendance at lectures & labs and participation in classroom discussion is also expected. 10% of the final grade will reflect both homework and class participation.

Students

- Half are ‘non-degree’ students.
- Of the full-time students, one is from Epidemiology; one from Health Polity and System Management; and one from Environmental Health.

Example of practical project

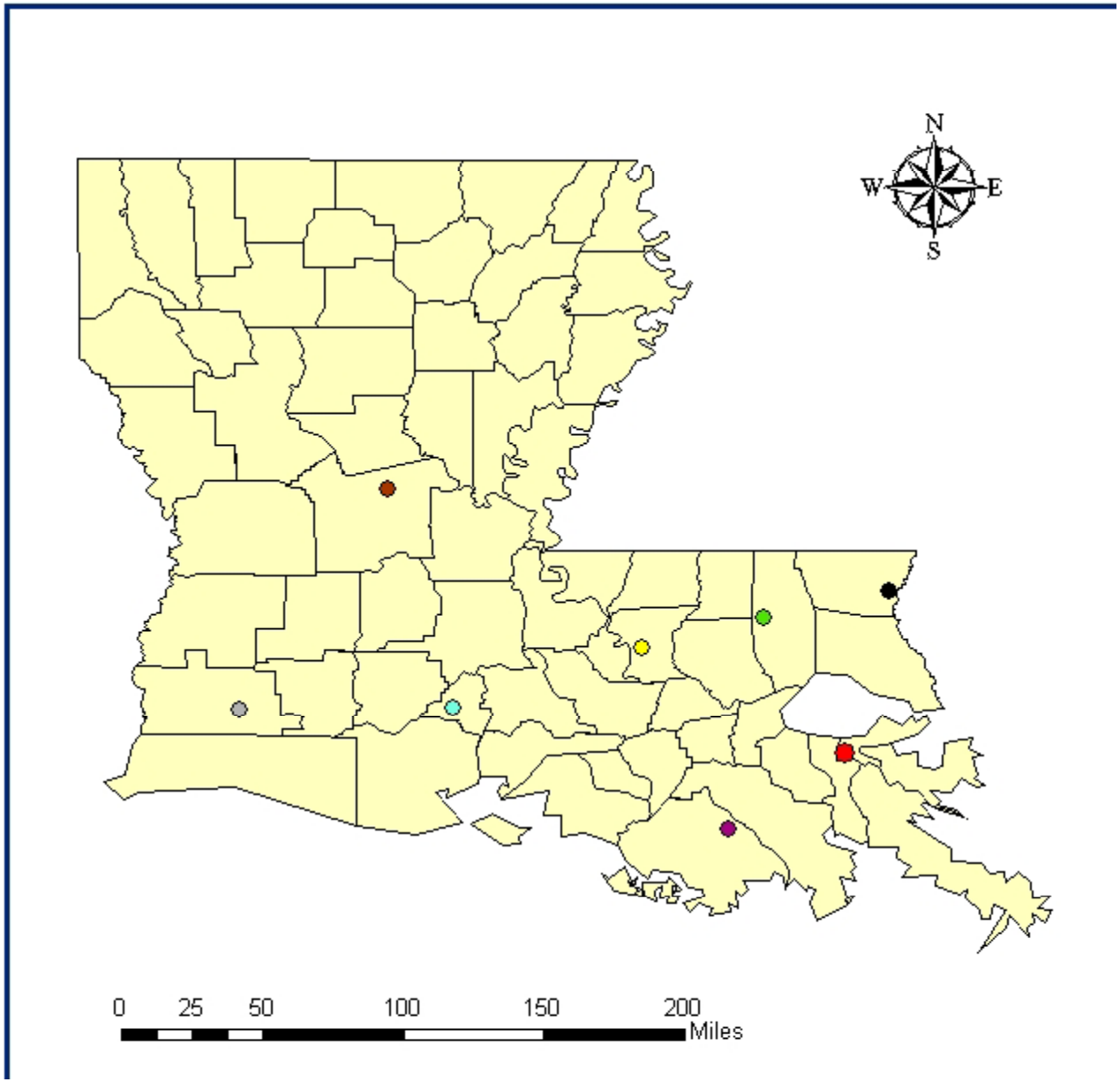
Tracking Patients Evacuated After Hurricane Katrina: Disease Management with GIS in Louisiana's Public Hospitals

- Hurricane Katrina made landfall in Plaquemines Parish, Louisiana as a category 3 storm on August 29, 2005.
- Hurricane Rita made landfall near Sabine Pass, Texas as a category 3 storm on September 24, 2005.
- Preliminary data analysis shows Hurricane Rita had little or no effect on LSU Hospitals.

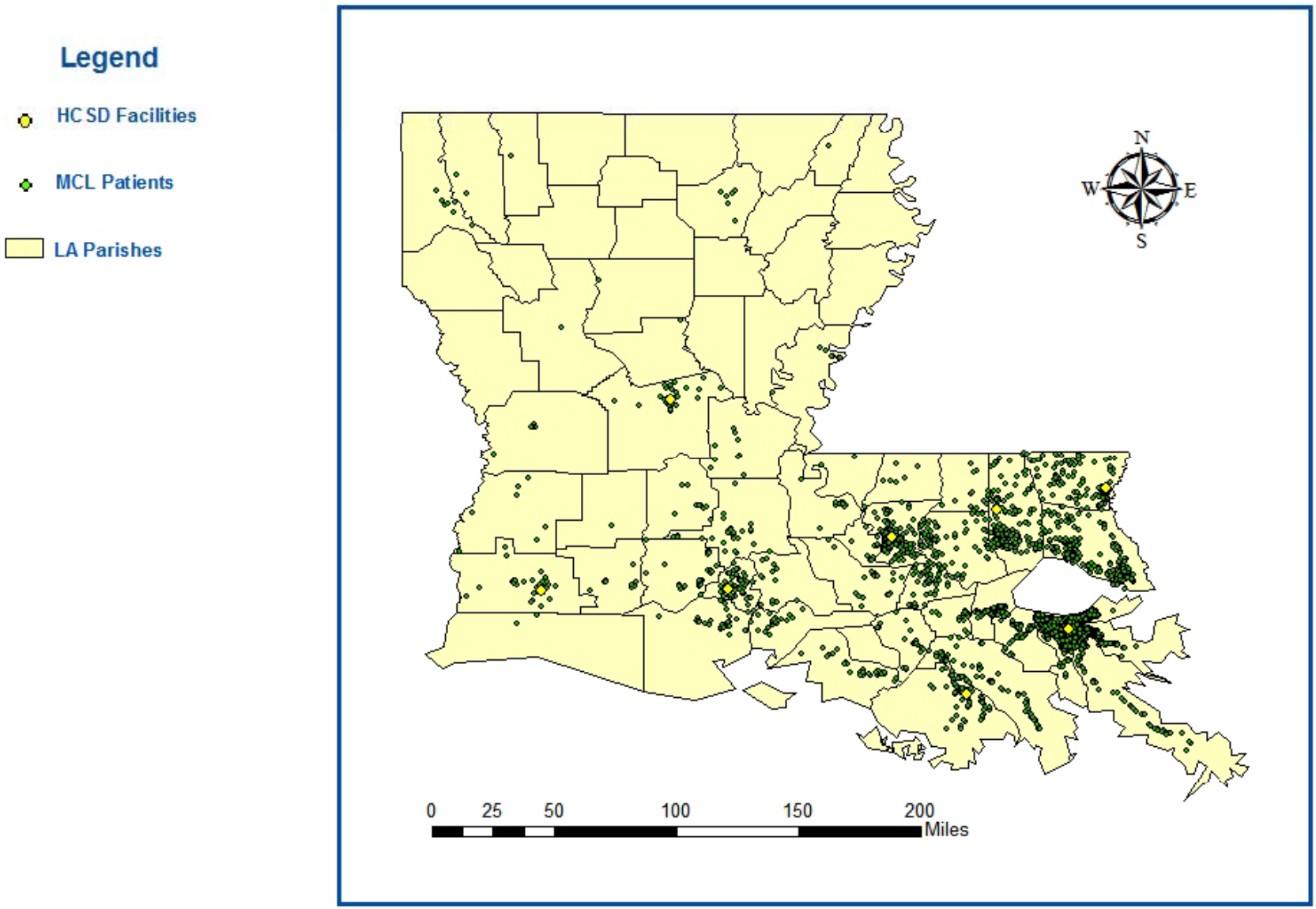
HCSD (LA Public Hospitals)

Legend

- BMC
- EKL
- HPL
- LAK
- LJC
- MCL
- UMC
- WOM
- LA Parishes



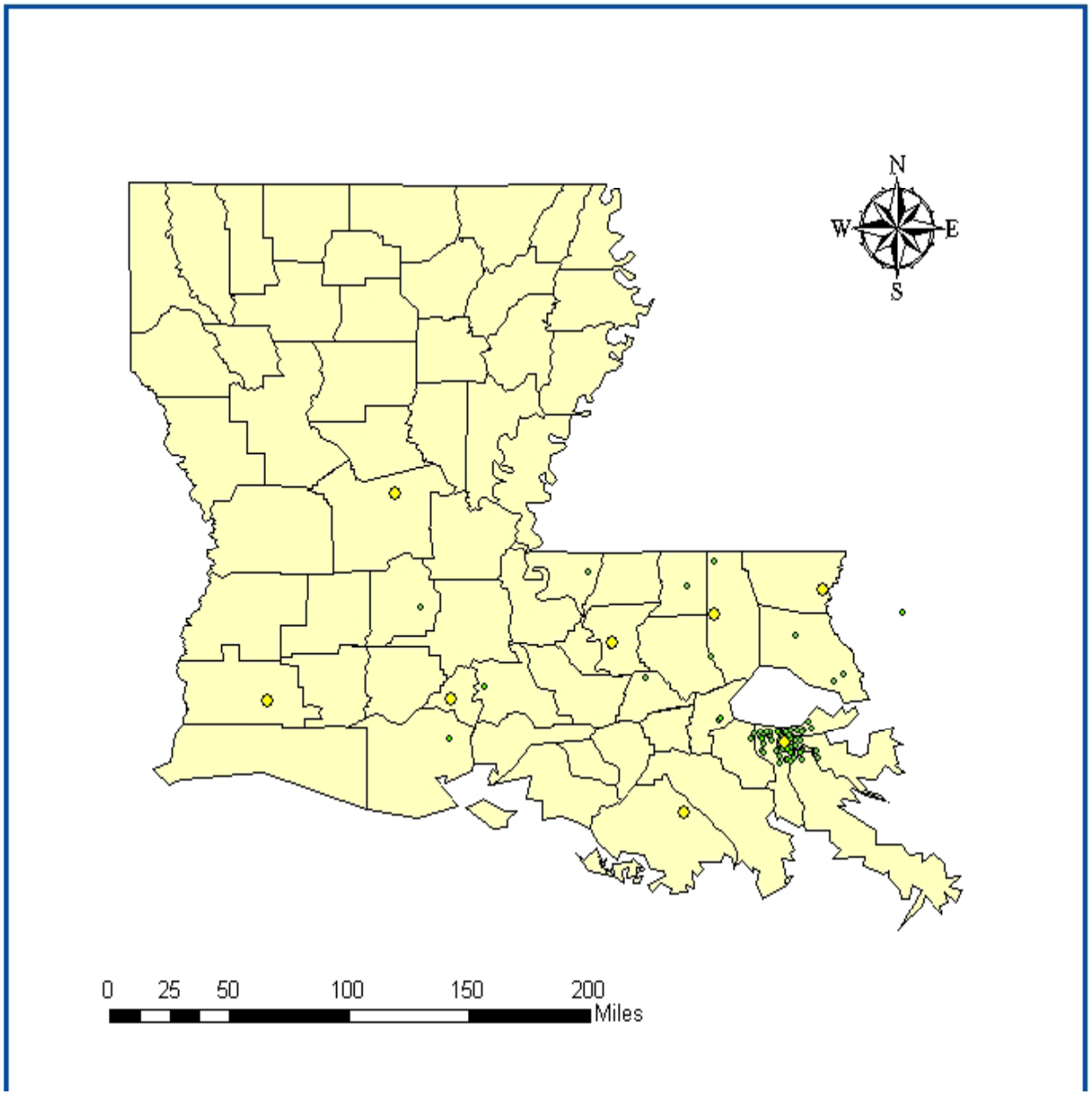
MCL Patients Distribution in Aug. 2005



MCL Patients Distribution in Sept. 2005

Legend

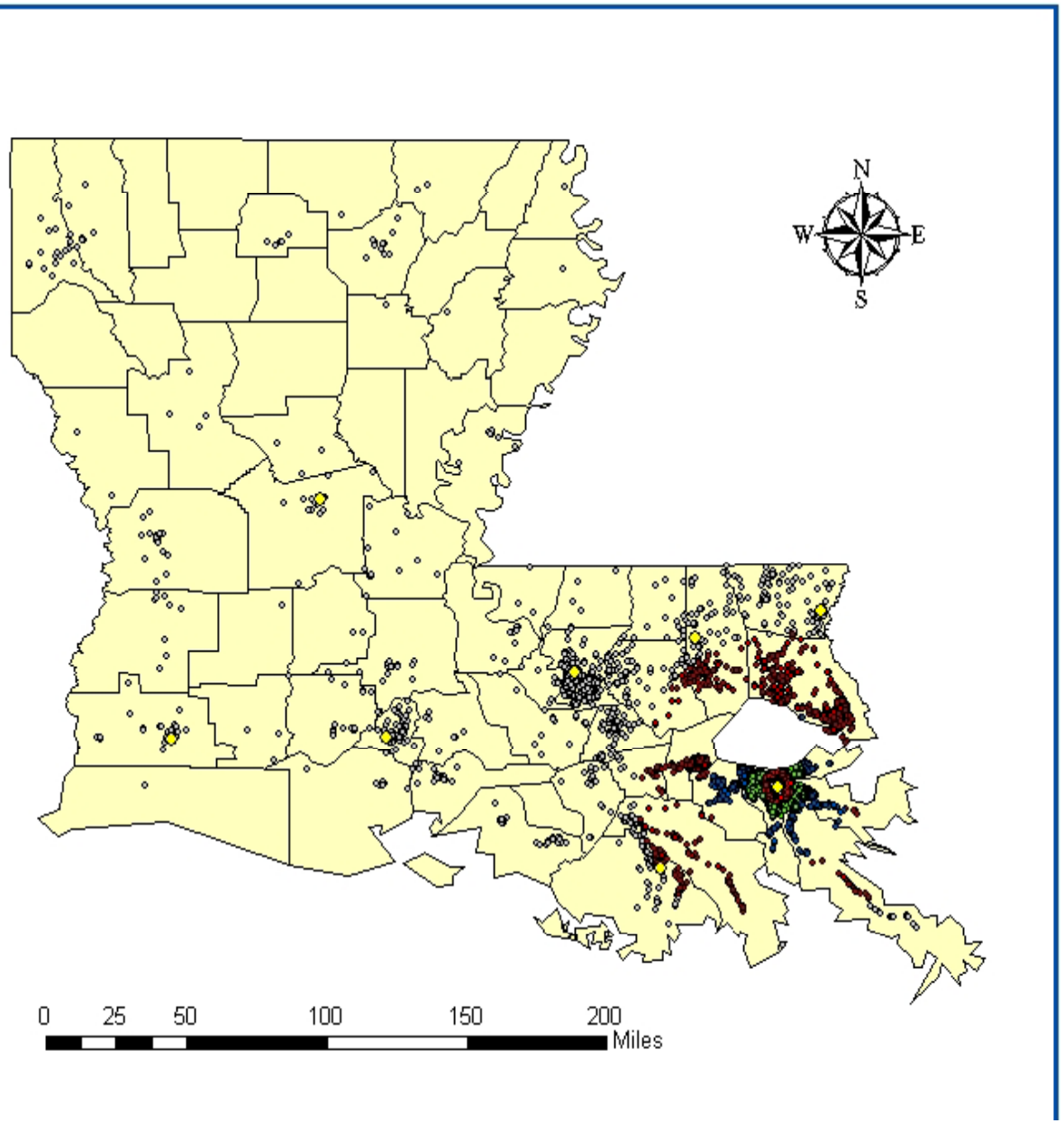
- HCSD Facilities
- MCL Patients
- LA Parishes



MCL Patients Distribution in Fiscal 2007

Legend

- HCSD Facilities
- Patients Within 2 Miles
- Patients Between 2 and 5 Miles
- Patients Between 5 and 10 Miles
- Patients Between 10 and 25 Miles
- Patients Between 25 and 50 Miles
- Patients Beyond 50 Miles
- LA Parishes



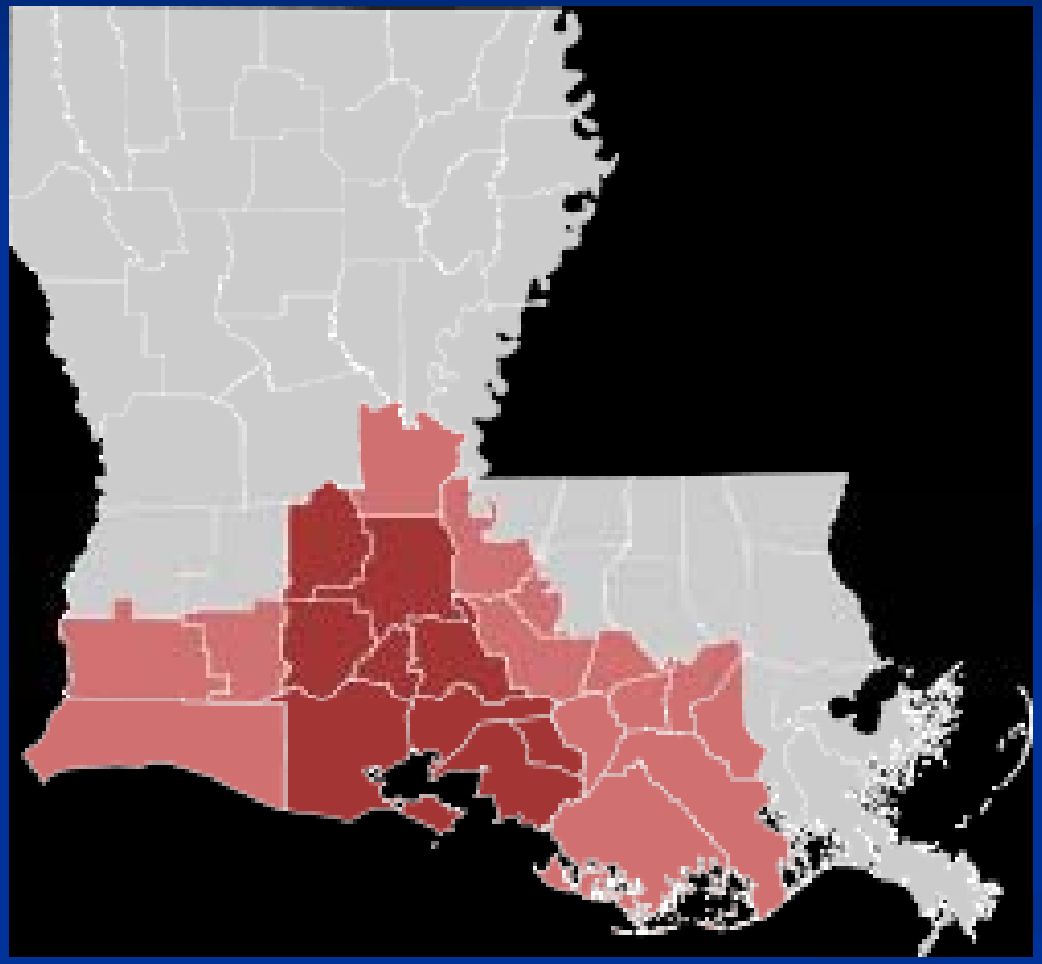
Selected Students' Projects

- **GIS Study of Pancreatic Cancer in Acadian**
- Examining Transportation Inequities
- Region 2 Prison Data January 2007-June 2007
- The Effects of Hurricane Katrina on the Screening Rates for the Louisiana Breast and Cervical Health Program
- GIS Final Project:
  911 Data Collected after Hurricane Katrina for Orleans Parish

Introduction

- Pancreatic cancer is by far the 4th most common cause of cancer death in USA with only the 10th most common cancer diagnosis.
- Each year, there are 33,000 individuals diagnosed with pancreatic cancer in USA.
- The prognosis for pancreatic cancer patients is very poor because the early detection is not optimistic, leading to more advanced and metastatic pancreatic cancer.

Acadiana (Cajun County)

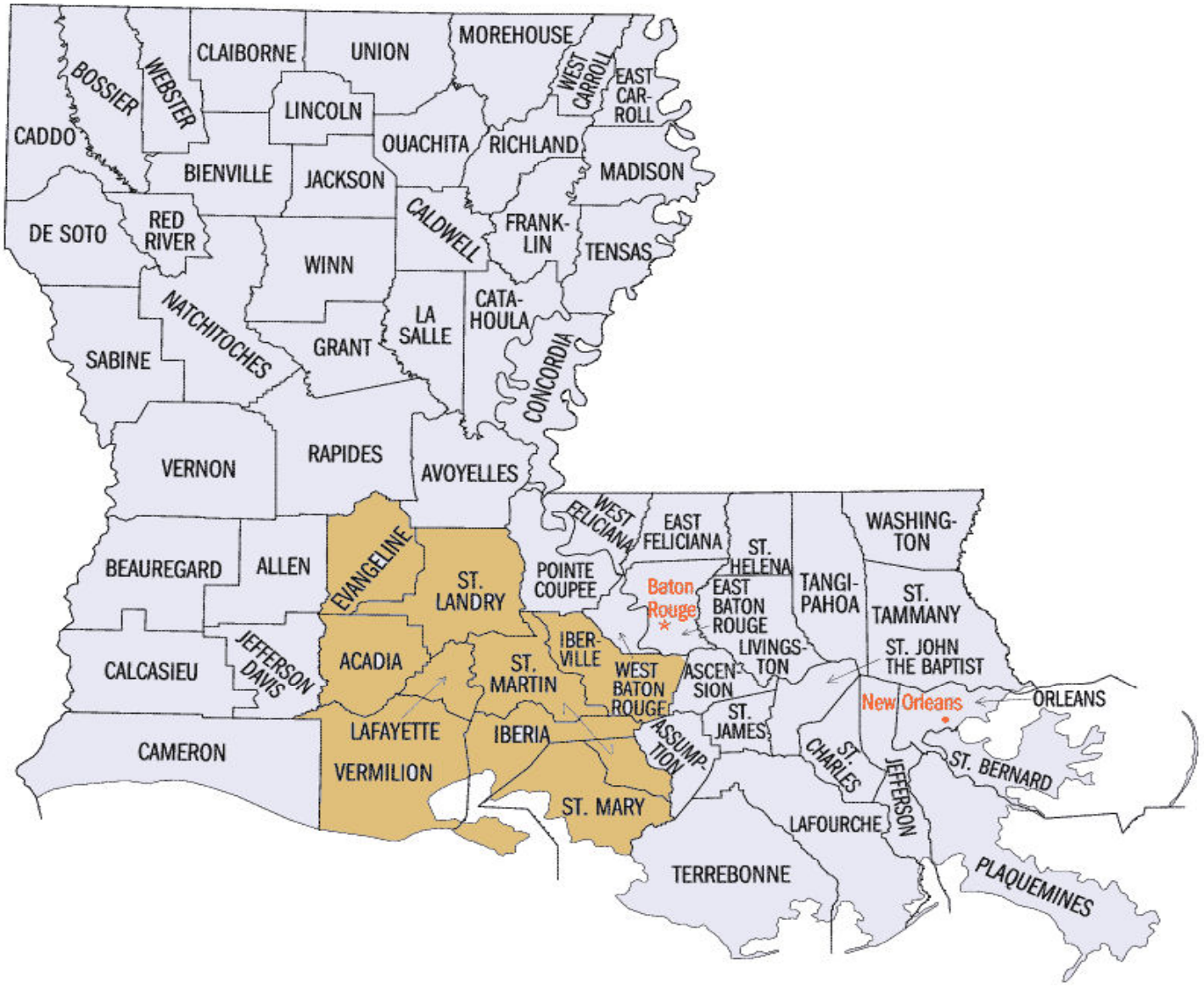


- Acadiana is the official name given to the French Louisiana region that is home to a large Cajun population. Of the 64 parishes that comprise Louisiana, 22 parishes, or about one-third of the total, make up

Acadiana Parishes Involved in Pancreatic Cancer Study

- 1.Evangeline
- 2.Acadia
- 3.Vermilion
- 4.St.Landry
- 5.Lafayette
- 6.Iberia
- 7.St.Martin
- 8.Iberville
- 9.St.Mary

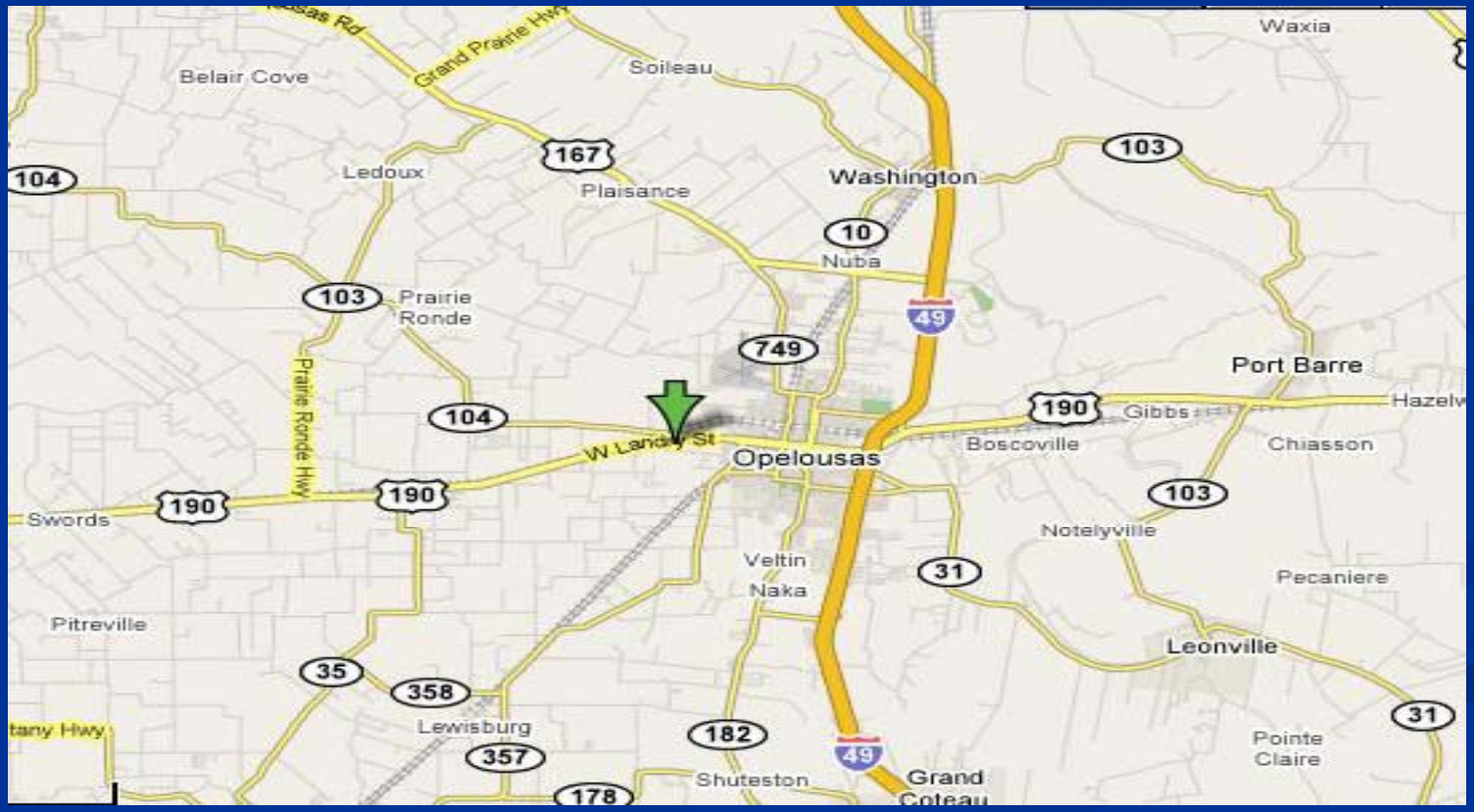
Pancreatic Cancer Incidence Rate in LA



, 1999-2003

a	Acadiana
6	15.6
1	14.1*
8	13.9*
3	20.6
9	17.7

Opelousas, LA 70570, USA



Possible risk factors Cont.

- 3-Nitrobenzathrone (3-NBA) seems to be largely absent from other sources of airborne pollution.

- The main metabolite of 3-NBA has been found in urine samples of salt-mine workers who are exposed through their work to diesel emissions, demonstrating that human exposure to 3-NBA in diesel emissions can be significant and is detectable.

Two main possible routes in this study

- 1. Salt mine industry workers who use machines with diesel engine could get exposed to 3-NBA.
- 2. Residents living around heavy freeways may get exposed to 3-NBA emitted from vehicles using diesel fuel.

Possible risk factors Cont.

- These 3 places (Lafayette, New Iberia and Opelousas) are either highly possible to be involved in salt-mine industry or centered around major highway intersection with more transportation vehicles passing by.

- People in these places are highly possible to be exposed to diesel exhaust which can generate a lot of 3-NBA.

Future

- Additional research is needed to investigate various risk factors including 3-NBA on pancreatic cancer.

Conclusion

- GIS is a very useful tool in the areas of public health: epidemiology, environmental health, behavior health, and health policy.
- In the area of public health, the course is a practical one rather than a theoretical one.
- Students have got the skills and knowledge of GIS and its applications through the course.

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