

# **DIFFUSION OF GIS USE IN A PUBLIC POLICY DOCTORAL PROGRAM**

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## **ABSTRACT**

The development of GIS began in Ottawa, Ontario in 1967. With the development of micro-computer hardware, the Canadian GIS was quickly expanded into commercial applications in the United States. This research paper will demonstrate how GIS was introduced in the Public Policy Doctoral Program at Southern University, Baton Rouge. Rather than establishing a GIS concentration in the doctoral program, this research demonstrates how GIS is linked to the doctoral program's core advanced research methods course. All public policy doctoral students must complete it. Moreover, all public policy doctoral students are equally required to incorporate GIS in their dissertation research. How this policy change was engineered with a minimum of political resistance is a model other graduate programs can replicate.

## **INTRODUCTION**

### *Public Policy Program History*

The Nelson Mandela School of Public Policy and Urban Affairs provides programs that enable undergraduate and graduate students to understand major social, political and economic developments in society. These programs familiarize students with the values associated with positive and effective leadership in a democratic society, and will provide a framework for lifelong personal and professional growth. Students of the school gain the knowledge and skills they need in order to pursue and excel in graduate education or professional careers. The School's newest program, the Doctor of Philosophy in Public Policy, not only supports the university's historical mission to prepare and train outstanding African-American scholars, professionals and citizens, but explicitly broadens that mission by actively seeking outstanding graduate students of other races. Keeping with the mission of the university, the program has 3 pivotal goals namely 1) Education 2) Research and 3) Outreach. Geographic Information Systems plays a major role in all the three pivotal roles. The program has 4 full time faculty, 2 adjunct faculty and 3 staff.

The teaching projects have focused on innovative use of computers and modern equipment to enhance teaching and recruitment while the research projects have focused on using state of the art technology to develop technological-based public facilities management methods from innovative scientific techniques. This technology-based approach has a good potential of contributing to economic development. The role of Geographic Information Systems (GIS) and Remote Sensing (RS) in Public Policy was incorporated into the curriculum as a vital component. The program has a fully fledged GIS/RS laboratories and initiatives which have resulted into one of the leading GIS initiative at Southern University.

### *GIS at SUBR Public Policy Program*

As an education tool GIS is critical as a training tool in all aspects of public policy. GIS fulfills the role of a vital computer skill required for maintaining public policy spatial inventories and databases. Because of this, Southern University's Public policy graduates acquire the required computer skills to compete in the job market, as well as perform complex tasks required of a 21<sup>st</sup> century public policy professional. SUBR Public policy equips graduate who opt to do GIS with basic skills in desktop GIS, spatial analysis, image analysis and the basics of remote sensing. The research at the Department involves the following areas, Environmental Policy, International Studies, Finance, and Health Studies options. Even though GIS is defined as a research area, in reality GIS is also a useful tool in all other research areas. GIS is useful for preparing spatial inventories. In the outreach initiative, GIS has been utilized in projects in the City of Baton Rouge, the state of Louisiana, and internationally.

### STATUS OF GIS EDUCATION AT HBCUS

#### *What is A GIS?*

Geographic Information Systems is a set of computer hardware, software and databases for the capture, storage, analysis, and display of spatial data. Godfrey (2001) reports that unlike a CAD map, a GIS map has the power of a database behind it; with GIS, the database can be queried. For example, with public facilities detailed information attached to a GIS map, it could be queried to find what facilities are in poor condition or any other attribute that is recorded in the database. The facilities in question will highlight in color. Visualizing the public facilities data is easier, making GIS a very powerful tool for the management of public data.

#### *What is Remote Sensing?*

The Earth is continuously monitored from dozens of satellites orbiting the planet and collecting data. Other responsible imaging vehicles are airplanes and space shuttles. This process is called remote sensing (RS). There are many public policy applications that remote sensing can be used for. Some of these applications include terrain analysis, public facilities management, re-cultivation, updating of existing public-facilities inventories, public facilities cover type discrimination, the delineation of burned areas, and mapping of cleared areas. The ability of satellites to image the earth is well known but there are some limitations to this process, like the effects of rain and cloud cover.

#### *GIS Development at HBCUs*

The development of GIS in HBCU Education curricula is emphasized by the 2002 White House Initiative on HBCU's/US Department of Education. GIS development at SUBR Public policy program can be put in context by considering the development of GIS at other HBCUs. Padgett (2000), reports that by the year 2000, a number of historically Black institutions employ GIS tools and technologies in their academic departments. In addition to Tennessee State, Clark Atlanta University, Alabama A&M University and Southern University-Baton Rouge are among a small group of historically Black institutions that make extensive use of GIS tools and techniques. Of the HBCUs offering public facilities sciences curricula, Alabama A&M, Florida A&M, and SUBR all have fully fledged GIS programs.

At Alabama A & M University, the GIS program is centered at the University's HSCaRS and its predecessor, the Alabama Center for Applications of Remote Sensing (ACARS) is the oldest of the Centers within the department. It is currently involved in research related to hydrology, soil climatology and remote sensing. To develop a comprehensive research program investigating hydrologic processes with emphasis on remote sensing measurements and modeling of soil moisture utilizing microwave and multispectral radiometric data; Utilization of airborne and space-borne platform data in surface soil classification, land use classification, environmental assessment, nutrient stress detection, and natural resource inventory and management. Howard University has been carrying out a HBCU GIS Training workshop for 20 years to this date. From the SOFSEC initiative North Carolina A & T has published materials (in Microsoft PowerPoint) for GIS instruction.

At the 18th annual HBCU GIS Summer Faculty Workshop, Dr. David Padgett announced that he had undertaken the GIS survey to nearly 50 HBCU faculty members (Padgett, 2001). The conference, hosted by the Howard University Continuing Education Urban Environmental Institute this past July, was held in Washington and Silver Spring, Md. In a study carried out by Padgett (2000) preliminary findings of the 85 schools surveyed by Tennessee State University include the following: a) 6 percent offer degrees in geography, b) 60 percent offer geography courses, c) 12 percent offer courses with the words "GIS" in the course title, d) 20 percent offer courses that use GIS in their content, e) 20 percent are actively using GIS in research, f) 19 percent have some presence of GPS and/or Remote Sensing technology. Padgett, who is director of the geographic information sciences lab at Tennessee State, says the survey results will be published on a Web site by the end of this month. The intention of the survey and its publication is to spread awareness of GIS technology and curriculum within the HBCU community, according to Padgett. Padgett (2000) added that GIS is quite popular in agriculture programs at HBCUs. "GIS is something that farmers can utilize to improve cultivation of their fields. They can pinpoint through satellite imagery how to efficiently spread fertilizer and to conduct other tasks," he says. Detailed information was available at a website. Padgett stated that the Web site survey would be updated periodically.

## GIS/RS AND PUBLIC POLICY RELATIONSHIP

### *GIS, RS and Public policy*

GIS (Geographic Information Systems) are increasingly used by policy analysts and bureaucratic decision makers, but they are seldom used or discussed in political science. This presentation illustrates the power of GIS to analyze policy questions through a case study of forest management from an environmental politics class. According to (<http://www.ces.ncsu.edu/depts/design/research/WECO/policyGIS/education.html>) GIS can be used for a wide variety of tasks. It can be used for simple tasks such as public facilities mapping, which is useful for address matching as well as making evacuation plans. GIS can be used for natural resources management. With a GIS, one can see in detail the different types of natural resource areas, including wildlife habitation, forests, rivers, streams, and wetlands. For facilities management, one can show exactly where such items as underground cables and sewer pipes are, in relation to their geographic location, as well as where they are located in relation to other items, such as public facilities addresses. Land management is also made easier by GIS, which

can give exact detail to the location of zoning areas, give ownership details, as well as help with such tasks as water quality management and environmental impact studies.

### *Traditional Urban Public Facilities Spatial Analysis versus GIS*

GIS is a very important tool for the policy maker. It can show as little or as much detail as needed in a form most people can understand. With its ability to be easily understood, GIS enables policy makers to take the information to the public. This allows the public the opportunity not only to understand what is going on, but enables the public to be able to offer informed feedback, which is as important to the policy politician as it is to the policy analyst. State-of-the-art public facilities management software packages like GIS allow for entry of public facilities information, tracking of work requests and work histories, and facilitating the creation of custom reports for urban public facilities resource management purposes. Utilization of GIS allows municipal arborists to take inventories one step further they can map facilities and work with their information.

Hence, GIS programs allow municipal arborists to, a) Map facilities while allowing quick visual surveys. b) make it easier to locate a public facilities in the field when a map is provided to indicate its location. c) utilize maps as powerful tools to illustrate needs and situations, and d) utilize a GIS capability to excel at powerful queries with visual results.

In policy areas that voters consistently say concern them most, such as education, public safety, and the environment, GIS is making a difference that forward-thinking policy makers cannot ignore. GIS can not only implement legislators' and voters' decisions with remarkable effectiveness--its ability to analyze and to demonstrate graphically the policy decisions themselves makes it an indispensable tool of good governing.

### *GIS and Public Health*

Researchers, public health professionals, policy makers, and others use GIS to better understand geographic relationships that affect health outcomes, public health risks, disease transmission, access to health care, and other public health concerns. GIS is being used with greater frequency to address neighborhood, local, State,national, and international public health issues.

### *Public Policy Data Entry with GIS*

Godfrey (2003) recommends that in order to effectively incorporate a GIS program into an public policy management program, several questions have to be addressed. The firsts question is whether the facilities already in a management software program? Secondly one has to consider whether an institution already has a GIS program? Thirdly one has to consider what kind of system it is and what kind of base map it uses? Even more critical is its coordinate system? Finally the last question to be considered is how accurate, and how old the base maps are.

With good organization in a municipal authority information technology or planning departments can provide the answers to some of these questions. This information is crucial because it can

have a profound affect on how public facilities location data can be handled. The data must be collected in the most cost-effective manner, so it is important to know what is already available.

### *Global Positioning Systems (GPS) and Public Facilities Inventories*

A popular method of public facilities position entry is to locate the facilities using GPS -- Global Positioning Systems. GPS is a network of satellites. Their ground station receivers are used to triangulate positions on the earth. Facilities can be located to within a meter with proper data handling. Inexpensive GPS units can locate public facilities to within 10-20 feet. To obtain data accurate enough for practical public policy map use, higher-end GPS hardware and software is necessary. Many public policy consulting firms will provide a qualified urban public facilities to evaluate the public facilities and collect the GPS data with proper processing for accurate locations.

It is to the urban public facilities manager's advantage to collect this data in a public facilities management program for future use in generating reports and queries, and handling maintenance and resident calls. In a typical survey, the public facilities manager evaluates the public facilities and enters the information into a management software. The software assigns a unique identifying number to the public facilities. The public facilities manager then collects GPS data and assigns that same unique ID number to it. The public facilities data and the public facilities location are imported into the GIS software and their data tables joined together on the field they have in common -- the identifying number.

A very efficient method for surveying the urban public facilities is to map the public facilities at the same time it is being inventoried. The public facilities location can be recorded using GPS while the public facilities data is collected. A public facilities manager will have to inspect each public facility in order to inventory it and can map the public facilities at the same time.

When developing a new urban public facilities inventory to include a GIS by using GPS, one has to examine all the options. After reviewing available public facilities management software for compatibility with desired aims and goals, one has to consider these urban public facilities inventory options. The first option is how the public facilities management software deals with GIS programs. The second issue is whether it is compatible with current municipal public facilities software. The third issue is how public facilities GPS data would be collected and how accurate its position would be. And finally the larger question is how public facilities GPS data and public facilities information be would moved into the GIS software. These steps should allow for the use of resources already available within the system, getting more out of the municipality's software investment.

## ESTABLISHMENT AND PRESENT STATUS OF SUBR GIS LAB

### *Issues Considered When Creating the Public Facilities GIS*

The process of creating a GIS, is essentially the same, whatever institution is in question (Godfrey, 2003). This process required the examination of five criteria which centered on the users of the proposed system. These were: 1) Needs/Requirements of the end users 2)

Hardware/Software Requirements 3) Requirements of the GIS 4) Database Design Requirements 5) System Maintenance/Updating Requirements.

The needs and requirements of the end users were usually the first criteria to be examined when creating SUBR's public policy GIS. It was important to outline and understand exactly the type of information the faculty, staff and students would put into the system and utilize on a regular basis. The needs were identified through the use of a questionnaire, and personal interviews that helped identify the needs. Many times the specific conditions of urban public facilities in Baton Rouge and Louisiana as whole, played a role in defining the characteristics of the required GIS.

#### *SUBR Public Policy GIS/RS Laboratories Hardware*

SUBR's Public policy program presently has three GIS/RS laboratories. The nucleus of hardware was acquired from a USDA capacity building grant. From the initial grant the initial SUBR's GIS facility was setup with a Gateway AL-9200 server, hosting a network of eight Gateway E-520 workstations. Data acquisition is through two Calcomp III digitizers. The laboratory is networked with the rest of Southern University's internet network. The lab has a Hewlett-Packard network printer, coupled with a HP 1220 Inkjet color printer for class exercises. For high quality laser publishing the laboratory has a Canon CLC 900 color printer that also serves as a color copier. High quality maps and photo-glossy posters are produced using a wide format Colorspan DM 4200 Plotter. The Agricultural Center GIS Laboratory has 4 high performance computers, including and SGI-Octane workstation for high quality graphics. It also houses the GIS Library (with about 50 volumes and manuals), and 4 Trimble GPS units. In addition to the Trimble GPS units the laboratory houses a Red-Hen Video GPS unit. SUBR's latest GIS/RS laboratory is under development. It is Southern University's CCZARS's GIS/RS laboratory and will house a computer server with 20 Dell-Precision workstations.

#### *GIS/RS Software*

SUBR's Public policy GIS program uses the popular ESRI's suite of GIS products. Software used presently includes 20 ARCVIEW 3.2 licenses and ArcGIS software 9.2. The university has site licenses from ESRI. For Remote Sensing, SUBR Public policy program has 25 ERDAS Imagine licenses from ERDAS Inc. The program will also soon host and Integraph Geo-media GIS laboratory, as well as host Micro-Station GIS.

#### DISCUSSION

In the PhD program, GIS and Spatial Analysis has been offered as an advanced research methods elective course option *PPOL 720. Advanced Research Methods* . GIS is used to equip the students with necessary analytical skills. Advanced training in analytical policy research methods will contribute to the strength and significant of the students doctoral research, and should enhance opportunities for the student upon graduation. The course covers advanced design issues, methods for exploring data, and advanced geo-statistical techniques. Public policy researchers are able to understand, appreciate, and use diverse research methods in order to conduct ethical and accountable research. The employment of a variety of qualitative and quantitative methods, along with the use of computers is now critical to the conduct of

scientifically sound research. Therefore, the course integrates the foundations of advanced research methodology with use of computers and appropriate statistical procedures in order to prepare students to meet the increasing demands for conducting policy-relevant research.

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