GIS/GPS-TECHNOLOGY BASED SPATIAL INVENTORY AND SPATIAL MODELING TRAINING FOR COLLEGE STUDENTS

Fulbert Namwamba, PhD

Southern University and A&M, College, Baton Rouge, LA
Learning goals were

a. Collation of pertinent data from various sources
b. Data transfer from GPS to a data warehouse
c. Development of data management system of the warehouse
d. Feedback and updating system and maintenance,
e. Application of data warehouse to support research initiatives
Objectives

- Explore the role of GIS and remote sensing in green infrastructure planning.
- To define the link between agro-forestry and urban forestry in green infrastructure.
- To identify and address shortcomings of grey infrastructure and create opportunities for leisure and recreation through green infrastructure.
- To design a green infrastructure database update for parts of East Baton Rouge Parish.
In this study an innovative tree inventory process using GIS and GPS technologies was developed to collect baseline data about trees.

The project utilized GIS technology to quantify areas that require systematic green infrastructure planning, evaluate the potential impact of its implementation, and avail the analysis to the public as a way of encouraging environmental stewardship of natural resources in Louisiana.
The project mapping campus facilities is ongoing. The principal investigator has been working with, baccalaureate and graduate students to address this issue.

CITYGREEN, a desktop GIS software package, provides the data to analyze the ecological and economic value of trees in relationship to storm water management, energy conservation, carbon storage, and air pollution.
METHODOLOGY
Conducting Tree Inventories

The baseline data for each tree was uploaded using a GPS data dictionary.

Tree inventories were conducted for one major project. The project involved Southern University students, who applied the methodology to carry out an inventory of the existing trees at Southern University.

In teams of five, students identified the campus tree species, diameter at breast height (DBH), height, health, and observed growing conditions.
**Downloading Images**

Data imagery files were acquired from: http://atlas.lsu.edu/. From this website maps of Baton Rouge could be downloaded.

The critical imagery was Digital Ortho Quadrangle Quarter maps (DOQQ). In the case of this research the image downloaded was the part of Baton Rouge where Southern University is located, which was the Scotlandville cartographic quadrangle.

The final step in this sub-procedure was to unzip the files and get the images that would open in ArcGIS.
Creation of Data Dictionary

Wireless technology was integrated and built into an application to be used on any mobile or handheld using ArcPad for GeoXM Trimble GPS receivers Bluetooth service.

Creating the data dictionary was the first step in that thesis research, and was created using the GPS Pathfinder TM software. The procedure to create the data dictionary is presented below.
Data for the study area is acquired from the DOQQ, LIDAR DEM’s and contour lines, with all the pertinent GIS data features for the surrounding area like streams, parishes, oil and gas wells, pipeline crossing, and roads.

All the data is projected to the UTM Zone 15 so as to overlap the rest of the GIS features and be available for project research utility.

These features are then rendered viewable through various websites using ArcGIS Server as HTML viewer or JAVA.
Study area
The student field workers added as many attributes and different field to each feature to match different data dictionary tables.

The Scotlandville data was used to test the system and to see how efficient this method was and test its capabilities.

Hence the attribute table for the Scotlandville area unique to the study needs. It all depended on the purpose of the research and the eventual use of the data.
Scotlandville land use and landcover

After looking at the land use inventory provided in the CityPlanners™ manual, a land use sheet was created and customized. A data dictionary for this research was hence crafted in Pathfinder Office Software.

The data dictionary was designed to be relevant the research for the Scotlandville area. The land cover inventory was done by selected undergraduate students in the GIS class.

The students were divided into groups and each group was given a GPS data logger with the same data dictionary file but with different land-use ID numbering for every group.
Scotlandville Area was divided into 4 major areas:

1. Area number 1: Southern University.
2. Area number 2: Scotlandville High School.
3. Area number 3: Metropolitan Airport.
4. Area number 2: Exxon Tank Farm.

Different groups were assigned for different areas and they had to go around Scotlandville area to collect the data.
Study area cont’
Rural Urban Interface

Peri-urban zones are considered transitional zones between urban and rural areas. Habitats of a diversity of populations, heterogeneity of land uses morphological conditions and densities of built up areas, complex functional relations and changing social structure are some characteristics of peri-urban areas (Rajesh and Yu 2007).

These characteristics of peri-urban area will be transformed to urban system. The transformation system decreases the cultivated area because of city sprawl to urban and peri-urban areas (Zeng et al. 2005).

As cities expand physically the frontiers between urban, peri-urban and rural activity distort and merge.
Methodology

This project documented the spatial factors relating to urban forests and watershed management in Montesano Bayou Watershed.

The investigator performed a green infrastructure master plan integrating majorly agro-forestry and urban forestry to produce opportunities for utilization of green spaces; with the aid of GIS and remote sensing to produce leisure, recreation, environmental and ecological benefits.

GIS and RS were essential tools in evaluating urban forests contents.
Montesano Bayou Watershed Hydrology.

The hydrological features within the watershed include bayous, streams, creeks and rivers. The hydrological locations are critical because they provide, unique opportunities for connecting the hubs, patches and corridors.

Green wedges and green corridors form an integrated ecological network by connecting the urban center, forest parks and other regional green spaces. The locations of the hydrology features can be used to examine potential flooding areas and water pathways to enhance a better understanding of the natural environment.
Montesano Bayou Watershed Urban Forest.

The urban forests are greenbelts; and mostly because they are narrow strips of parkland more or less encircling part of built up area or large urban area.

These areas are critical because greenbelts are mostly affected by urbanization because it is easily encroached on by the urban sprawl process and easily breached by urban leap fog growth.
RESULTS
CAMPUS TREE MAPPING

The location of 800 trees were referenced on each sector map with points and numbers and cross referenced on accompanying attribute data tables.

The result of the tree inventory showed the distribution of tree species.

The data collected was uploaded onto CITYGREEN to determine the benefits of campus trees.
Summary

The Montesano bayou watershed research area was divided into seven segments for a critical analysis. This project utilized already existing databases to integrate GIS into assessment or urban recreation issues in Louisiana.

The study used theory and practical application of GIS and remote sensing and simulation of green spaces. The research applied GIS and RS to environmental systems related to urban forest corridors, hydrology, and ecosystems.
Discussion of GIS Delineated Sectors

Sector 1
This sector cuts through Southern University and is adjacent to the Mississippi river to the right. It is on the North Western part of the Montesano Bayou Watershed next to the oil tank farms.

Sector 2
This sector lies within the Northern part of the map, it overlaps within Baton Rouge Metropolitan airport to the East and Scotlandville road to the West.
Sectors Cont’

**Sector 3**
This sector lies within the western part of the map mainly Scott’s Bluff, it is in large part Southern University and Scotlandville road, and stretches to the residential areas.

**Sector 4**
This sector lies within the North Western part of the map; it overlaps within Baton Rouge Metropolitan airport to the East, the interstate and airline highway.
Montesano Bayou Map

Figure 4: Montesano Bayou Watershed Sector 1.2 Map

Legend:
- Hydrography
- Buffer
- Urban forest
- Watershed Boundary

Patches
Recommendation

For patch configuration, the green network will follow along the buffer strips. By creating this network, the size, location and number of patches configuration will be improved through adjacency and connectivity.
Montesano Bayou sector 2
Sector 2 DOQQ
Recommendation

This scenario presents a green wedge; other than creating a buffer strip for connection and corridors, it is important to build counter measures to avoid ecological deterioration of sensitive areas by human development.
Discussion

The results show a canopy area of 1287.02 acres and a distribution of 207 green fragments which is still below the optimum green space potential according to the connectivity analysis.

Robust measures are recommended to reduce the fragmentation of the patches through connectivity with the hydrology buffer systems. This opportunity would ambitiously double the forest cover in Montesano Bayou Watershed; it will also guarantee the preservation of ecological functions, process and structure of the landscape.

The conceptual approach for the green spaces is believed to form a basis for organizing green infrastructure and building an eco-city.
CONCLUSION

The project produced and utilized maps and spatial data that would incorporate green infrastructure planning to natural resources management.

Students were exposed to state of-the-art research technology that will equip them with skills to utilize spatial technologies and sciences to tackle and address research problems in the food and agricultural sciences.