

## **GIS for Integrated Pest Management**

Christina Hailey

Abstract:

At its formation in 1965, Harris County Mosquito Control (Houston, Texas) (HCMC) was primarily involved in the prevention and control of mosquito-borne diseases in particular SLE. With the introduction of West Nile virus (WNV) into the United States in 1999 and its eventual spread to Harris County in 2002, WNV quickly became another important disease concern.

In order to address these issues, HCMC incorporated integrated pest management (IPM). Key components of IPM include mosquito and bird surveillance, Geographic Information Systems (GIS) technology, insecticide resistance management, innovative applied research, and educational outreach. These components directly enhanced resource management for disease prevention and control activities.

HCMC has incorporated GIS applications such as ArcGIS and ArcPad. An ArcIMS application is being created for increased mapping capability in the field and for increased public participation.



## *Presentation Outline*

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#### **Background**

Harris County, Texas is the largest county in Texas and the third largest county in the United States with nearly 3.6 million residents and covering 1,777 square miles. Since the 1990s the population has increased by 17%, and from 2000 to 2003 the population increased by 5.7%.

For the most part, Harris County Public Health and Environmental Services (HCPHES) serves the entire county, except for the City of Houston. The Mosquito Control Division (formerly the Mosquito Control District) still serves the City of Houston area. The City of Houston encompasses almost 580 square miles, and is the 4th largest city in the United States with a population of almost 2 million.

Since 1965 the majority of spatial data used by HCPHES MC consisted of paper maps that were manually altered and passed on to each person. As technology became more available it was implemented. In 2002, with the emergence of West Nile virus in Harris County, the need for geographic information systems (GIS) became imperative, not only for operational purposes, but for public notification and outreach.

There were several challenges to implementing a GIS for Harris County. Several legacy datasets were combined with new datasets that required sorting. Many still remain in archival mode. This data consisted of:

- Surveillance Data (Mosquito and Avian)
- Virology Data (Mosquito and Avian)
- Citizen Requests (County and City)
- Inspection Data (County and City)
- Treatment Data (Ultra-Low Volume Spraying, Thermal Fogging and Aerial Application)

The key to managing these data sets was to update existing policies and procedures along with software and hardware. By consolidating these data and viewing more of it spatially, HCPHES MC was able to quickly and easily access data. This data was no longer only available as crude paper maps, but as custom digital maps in color to each employee and to the public. This use of technology has pushed the mosquito and vector control agency to the forefront of integrated pest and mosquito management.



## Integrated GIS

GIS is the integration of spatial and temporal data into a digital forum for analysis and dissemination. An integrated GIS allows for integration of legacy data sets, open access to data and integration of data on the desktop, increased geoprocessing capabilities and data interchange.

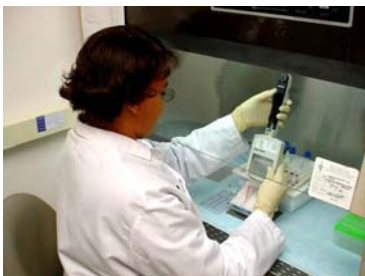
## Integrated Pest and Mosquito Management

Integrated Pest and Mosquito Management (IPM) is a comprehensive approach to pest and mosquito control that does not rely solely on killing adult mosquitoes with insecticides, but integrates all of these available control components:

- Mosquito Sampling, Surveillance and Mapping
- Disease Surveillance
- Control Strategies
  - Source Reduction
  - Biological Control
  - Chemical Suppression
- Insecticide Resistance Management
- Community Education
- Legal Control

## Why GIS for Integrated Pest and Mosquito Management?

- Surveillance and sampling are key to any program. GIS augments surveillance, which steers control tactics utilized.
- Integration of spatial and temporal data into a digital forum for analysis and dissemination.
- Global Positioning Systems (GPS) are now more accurate and user friendly than ever.
- The use of GIS and GPS technology is becoming integral in mosquito control and throughout public agencies.



## GIS Solutions

HCPHES MC has used GIS consistently since 2002. Since then there have been several solutions to a growing amount of data and public awareness. Data and maps now are used for public notification, disease tracking, treatment planning, and budget planning. Maps are created by displaying data spatially to see relationships and patterns. Spreadsheets and tables are no longer the only form of data reporting.

Currently ESRI's ArcGIS is the desktop software used by HCPHES MC, as well as other Harris County departments, which allows easier sharing of data. An Internet mapping services (IMS) is currently being developed for increased geospatial health data use via the Internet.

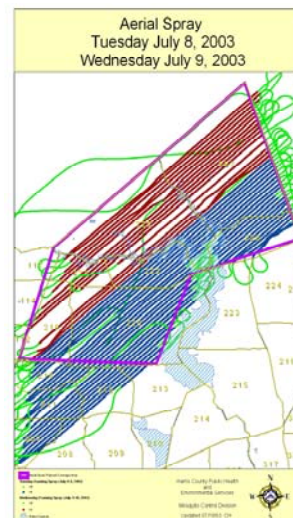
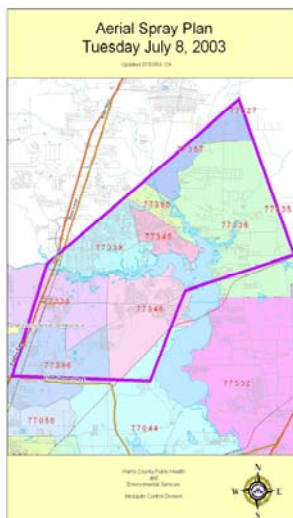
An increase in disease corresponds with the increase in treatment. As a government agency, HCPHES MC is bound to local taxpayers and must account for funding. Treatment analysis allows users to display data for quick analysis of Harris County disease occurrence and treatment data to better manage these resources.

The analysis of treatment is also very important to IPM in insecticide resistance management. This includes analyzing the spatial relationships of susceptibility analysis, cage testing and laboratory testing. With a thorough analysis of results from around the county, treatment options can be adjusted for each area.

## Integrated Resource Management

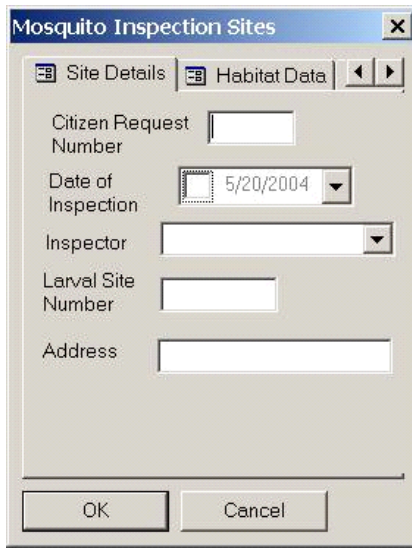
By using GIS to integrate all of the data being collected, resource management becomes streamlined. HCPHES MC uses real-time tracking of all ultra-low volume (ULV) spray trucks for increased quality control and asset management.

GIS also allows for faster and more accurate communication with aerial application contractors. The data is sent as a shapefile to be loaded into the spraying aircraft before the contracted application date. After the mission is complete the data from the aircraft is downloaded and submitted to HCPHES MC for approval. The contractor is not paid until the mission flight lines and spray drift model are confirmed for accuracy. This investment has saved thousands of dollars.



## Field Data Collection

Since mosquito and vector control includes a field component, HCPHES MC has deployed a field data collection utility using GIS. Besides using basic global positioning systems (GPS) in the field, inspection forms have been created using ESRI's ArcPad. These simple forms are used to collect data that was previously hand-written and entered into a database at the office. By using GIS the data is seamlessly incorporated into the existing dataset and provides the inspectors with an interactive map in the field.



The screenshot shows a software window titled "Mosquito Inspection Sites". It has two tabs: "Site Details" (selected) and "Habitat Data". The "Site Details" tab contains several input fields: "Citizen Request Number" (text box), "Date of Inspection" (calendar icon and dropdown menu showing "5/20/2004"), "Inspector" (dropdown menu), "Larval Site Number" (text box), and "Address" (text box). At the bottom of the window are "OK" and "Cancel" buttons.



## Community Involvement and Education

HCPHES MC has had a very active education program for over 10 years. The staff of this program consistently works with the public and other PHES and HC divisions. GIS has helped this section with outreach programs.

Since aerial applications are not common to Harris County, HCPHES MC provides important public notification of all scheduled aerial treatments. To help the public understand the treatment locations a map is made available through the local media and on the HCPHES website.



## Conclusion

Integrated pest and mosquito management techniques are ideal for any agency. Implementing a GIS addresses the major concerns of data collection and analysis. While IPM is a comprehensive approach to controlling pests and mosquitoes, GIS is a comprehensive strategy for managing and analyzing the data that has been collected for better decision making.

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