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Enhancing Mosquito-borne Disease Surveillance in Florida

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Introduction

The temperate and subtropical climates and abundance of water in Florida provide ideal conditions for mosquito reproduction. In addition to their annoying pest status, mosquitoes transmit viruses that can cause disease, sometimes fatal, in humans and animals. There have been several epidemics of the mosquito-borne St. Louis encephalitis virus in Florida; the earliest documented epidemic occurring in 1959. Other mosquito-borne diseases of concern to Florida citizens include eastern equine encephalitis and West Nile.

Beginning in 1978, mosquito control districts and health departments in the state of Florida started monitoring mosquito-borne disease transmission through the use of sentinel chickens. A small blood sample provides valuable information on the abundance of infected mosquitoes in a given area. Samples are processed by the Florida Department of Health (FDOH) and test results are summarized weekly and made available to participating agencies. The reports include tabular data summarizing the weekly test results. However, no interpretation of the results is provided. Because each agency is unique geographically, climatologically, and in the design and layout of their sentinel field sites, the interpretation of test results for individual programs is critical to understanding what is occurring on the local level.

Important information to be gleaned from the surveillance program includes the observation that an increase in virus transmission to sentinel chickens can indicate an increase in the risk of mosquito-borne disease transmission to humans. This type of early warning system allows mosquito control and health department employees to make timely decisions about mosquito control, Public Service Announcements, and medical alerts.

Identifying the Problem

The Florida Medical Entomology Laboratory (FMEL) sponsored two workshops on "Florida mosquito control response to West Nile virus" (Rutledge, Day, Lord, O'Meara, Rey, & Tabachnick, 2003) where we identified several problems with the Florida mosquito-borne disease surveillance program in use at the time.

- The time that elapses from when blood samples are sent to the FDOH and the time the results are known is 2 – 3 weeks. While this does provide some early warning, the time lag should be shortened to allow more timely decisions by mosquito control personnel.

- Results from the FDOH are provided on paper, or as an email attachment with a spread sheet. It is then up to the agencies to plot maps and graphs and interpret their individual results; this can be particularly daunting for new programs which lack experience, and for other programs that have large coverage areas in their county.
- Many small mosquito control programs and start-up programs with limited funding can only do “mosquito control.” They do not have enough resources to also monitor disease activity. Information from surrounding counties that have surveillance programs would still provide valuable information which may be utilized to help protect citizens in adjacent jurisdictions.

The overall need expressed by participants in the workshops was for more meaningful surveillance tools to improve real time decision-making by mosquito control districts and county health departments in Florida.

Addressing the Needs of the Mosquito Control Agencies of Florida

To address the needs of Florida mosquito control, the FMEL developed Geographic Information System (GIS) based maps with animation (video) used to bring surveillance results “to life” and therefore help decision makers see the real-time threats of mosquito-borne disease activity in individual counties as well as state-wide. The videos provide the spatial and temporal aspects of mosquito-borne virus transmission to sentinel chickens. This format is more easily interpreted and understood when visualized using an animation video than through traditional graphical and tabular data analysis and it provides the most efficient use of the data generated by the sentinel surveillance programs.

As soon as test results are available, data are entered into the GIS program to update the video maps which are posted on the FMEL website. This means that there is minimal re-plotting of maps and sites for each of the individual mosquito control and health departments in Florida. It is just a matter of logging on to the FMEL website to see the updated videos. The results are available to personnel from any official mosquito control district or health department who wants to view the data, regardless of whether or not they operate a surveillance program.

Reaching Our Target Audience

Demonstration CDs were produced for our target audiences to allow them to see what was available and the importance of the information to provide real-time information. We later developed a web-based video available on-demand. The web provides the best outlet for this visualization because of ease of access for end-users. Currently, the videos are updated weekly and remain on the FMEL, IFAS Mosquito Information Page at <http://mosquito.ifas.ufl.edu>.

A Unique Extension Product

This video is the first of its kind in mosquito-borne disease surveillance (Figure 1). The bottom of Figure 1 shows that this snapshot originated in mid-July, 2004. The line graph in the lower left provides a running total of numbers of positive sentinels in the state compared with historical long term seroconversion rates. The information provided by the FMEL is readily available on our website and provides state-wide information; there are many instances when the state-wide situation is critical to making mosquito control and human health decisions on the county level.

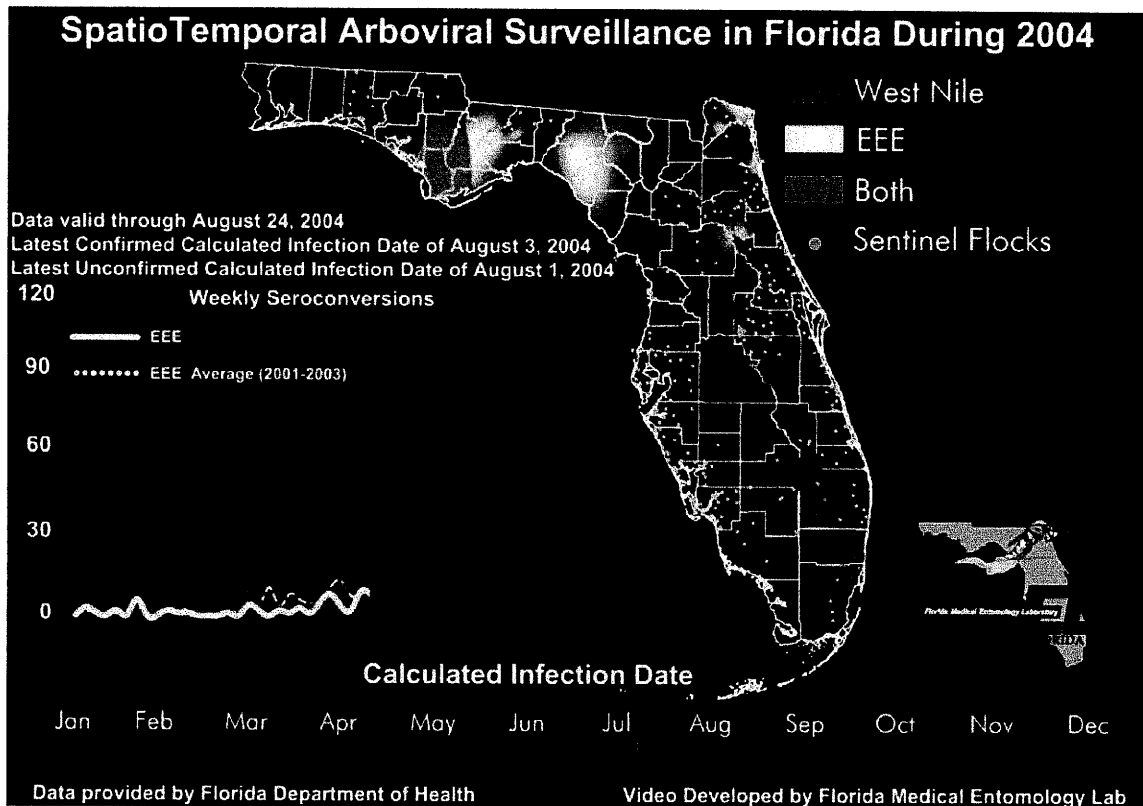


Figure 1. A snapshot showing one frame of the FMEL Online Mosquito-borne Disease Surveillance Video.

Impacts for Florida and Other States

- This project is the basis for more accurate predictions of mosquito-borne disease epidemics in Florida. We can now add other data layers into the GIS system to further refine the science of preventing mosquito-borne diseases outbreaks.
- By providing the tools to better understand surveillance results, mosquito control districts have the opportunity to optimize their own surveillance programs, save human lives and to protect the environment through judicious use of mosquito control strategies available to them.

Summary

This project was supported with funding from the Florida Department of Agriculture and Consumer Services (FDACS). The decision to provide FDACS funding for this project was due in part to the support from Florida mosquito control districts that clearly saw the value of the new system. We plan to continue this project and have begun further refining the system at the county level.

References

Rutledge, C. R., Day, J. F., Lord, C. C., O'Meara, G. F., Rey, J. R., & Tabachnick, W. J. (2003). Florida mosquito control response to West Nile virus workshop. *Technical Bulletin of the Florida Mosquito Control Association*. Florida: Florida Mosquito Control Association.

Acknowledgements

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Abstract

We developed online graphic visuals to assist Florida mosquito control districts and health departments in maximizing the potential of their individual surveillance programs for mosquito-borne diseases through a better understanding and interpretation of surveillance data. Using data generated by the Florida Department of Health, we developed Geographic Information System (GIS) based maps with animation (video) to bring surveillance results “to life”. Our GIS video is the first of its kind in mosquito-borne disease surveillance and will aid in further refinement of the science of preventing mosquito-borne diseases outbreaks. This technology is easily transferred to existing surveillance programs throughout the World.