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Enhancing Mosquito-Borne Disease Surveillance in Florida

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Enhancing Mosquito-Borne Disease Surveillance in Florida

Abstract

The University of Florida, IFAS, Florida Medical Entomology Laboratory 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 refining the science of preventing mosquito-borne diseases outbreaks.

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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). 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 layout of their sentinel field sites, improving 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 between when blood samples are sent to the FDOH and the release of results 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, allowing them to attempt focused, intense vector control in temporally and geographically focused regions.
- Results from the FDOH are provided on paper or as an email attachment containing an accompanying spreadsheet. Agencies are required to plot their own maps and graphs, and interpret individual results. This can be particularly daunting for new programs that lack experience and for programs covering large areas.
- Many small mosquito control programs have limited funding and 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 to help protect citizens in adjacent jurisdictions.

Workshop participants expressed a need for more meaningful surveillance tools to improve real time decision-making.

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 video animation to bring surveillance results "to life." These tools help decision makers see the real-time threats of mosquito-borne disease activity in individual counties as well as statewide. 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.

As soon as test results are available, data are entered into the GIS program. Video maps are updated and posted to the FMEL Web site. This results in minimal re-plotting of maps and the establishment of sites for each of the individual mosquito control and health departments in Florida. It is simple for visitors to log into the FMEL Web site to view 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

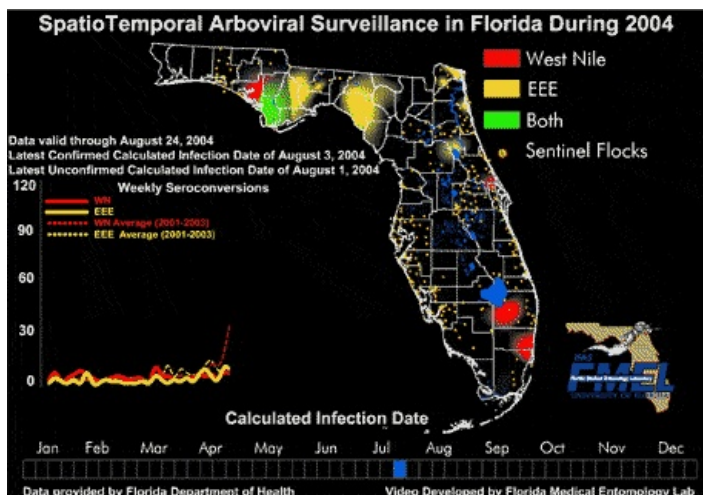
Demonstration CDs were produced for our target audiences to allow them to see what was available and to learn the importance of providing real-time information. We later developed a Web-based video. The Web provides the best outlet for this visualization because it is easy for end users to access. Currently, 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 a snapshot of information from mid-July, 2004. The line graph in the lower left provides a running total of numbers of viral antibody-positive sentinels in the state compared with historical long-term number of positive sentinels maintained at the same site.

Figure 1.

A Snapshot Showing One Frame of the FMEL Online Mosquito-borne Disease Surveillance Video



The information provided by the FMEL is readily available on our Web site and provides statewide information; there are many instances when the statewide situation is critical to making mosquito control and human health decisions on the county level. The system can be used as an Extension tool to increase awareness of mosquito-borne diseases and the use of personal protection (repellents, clothing) during times of high risk.

Impacts for Florida and Other States

This project enables more accurate predictions of mosquito-borne disease epidemics in Florida. We plan to add data layers, including city boundaries, at-risk populations, and areas with historically high positive sentinel rates to refine the predictions for more focal mosquito-borne disease outbreaks.

By providing the tools to better understand surveillance results, mosquito control districts can optimize their own surveillance programs. Extension personnel can use the system for educating the public and potentially save human lives.

Conclusion

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.

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