

**THE MISSISSIPPI COTTON BOLL  
WEEVIL GIS PROJECT - 1995 UPDATE**

**Glenn Wiygul  
USDA, ARS**

**Integrated Pest Management Research Unit  
Mississippi State, MS**

**Abstract**

This manuscript describes the use of a Geographic Information System (GIS) developed by the USDA-ARS, Integrated Pest Management Research Unit at Mississippi State, Mississippi. This project came from the need to make management decisions concerning the Boll Weevil Eradication Program. The GIS was custom developed to meet the needs of this program.

The goals which were to be met during the development of the software package are discussed. Considerations concerning the implementation of a state-wide insect monitoring program using this software are identified.

**Introduction**

USDA-ARS, the agency that developed the cotton insect Geographic Information System (GIS); USDA-APHIS, the action agency of the Boll Weevil Eradication Program; the Mississippi Cooperative Extension Service; and the Mississippi Boll Weevil Management Corporation, a coordinating entity composed of cotton producers; began a program to monitor boll weevil infestations in the cotton growing areas of the state. This three-year program has been extended and will begin its fifth year in 1996.

The use of GIS technology allows the display of a map on the computer screen that is linked to displayed tabular data and has become widespread. Harlow and Lang (1988) discussed the early development of the technology and listed some of the companies that were involved in that development. The use of this type of software in agricultural land use surveys was further described in a publication by the American Farmland Trust (Anon. 1985). Many of the concepts used in the development of GIS software were discussed in a publication by Joseph K. Berry (1988). In earlier GIS programs maps were commonly employed as the graphic images. Now satellite images with their extensive data are available to the GIS user. These data include longitude and latitude values for all points on the image and various bands of data from the electromagnetic spectrum.

The GIS is a decision management tool that has aided in the development of the Boll Weevil Eradication Program in Mississippi. The use of such computer software allows

management decisions to be made by overlaying maps and satellite images of physical features such as roads, geographic boundaries, and agricultural fields with survey maps presenting insect population densities.

**The Mississippi Boll Weevil Program**

During 1990 and 1991, a program was developed in Mississippi to manage the boll weevil and other insect species in cotton. This program has several objectives; two examples are: to eradicate/suppress/manage these insects using the best available technology, and to develop strategies best suited to the diverse and unique geographic and economic features of the state. To gather information on the boll weevil populations in the state, one boll weevil trap is used for each one hundred acres of cotton or one per field in fields of less than one hundred acres. These traps are distributed in the cotton growing counties of the state. Traps are placed and marked for locations on maps by the growers so that information can be entered into the GIS. Traps are checked and rebaited biweekly for 10 consecutive weeks during the cotton growing season. These growers report the boll weevil trap catches to their county extension office, and this data is transmitted to the Integrated Pest Management Research Unit where it is entered into the GIS. Even though the long-range goal of the program is suppression and control, the 1992 through 1995 efforts have been used to gather base line information for the eradication.

During the 1994 growing season this program was extended into western Tennessee with some changes in the trapping protocol developed in Mississippi. The value of this GIS as a decision management tool was confirmed when the Tennessee agriculture officials were quickly able to determine the location of boll weevil problem areas with the use of the software.

In 1995, other pheromone trap lines were added to the program to measure populations of cotton budworms, cotton bollworms, and beet armyworms. These traps were monitored by personnel from the Mississippi Cooperative Extension Service, and periodic maps showing populations of these insects were generated during the season using the GIS.

**Development of the GIS**

Development of the GIS to present linked tabular and spatial data began approximately five years ago in anticipation of the program such as the one outlined above. This effort has been described previously by Wiygul et al. (1994) and Wiygul and McCarty (1995). The development of the GIS has continued to the present in order to meet the changing needs of the program. The aspects of the program which are receiving the most attention for change are described below. County and state maps have been produced over the last four years showing boll weevil

populations in the cotton growing counties. Different colors have been used on the computer-generated maps to indicate different numbers of boll weevils per acre. The information presented on the maps has been compiled at the section level (640 acres). A section is usually one mile square, and is a legally defined area. The use of this geographic area as a basis for the maps used in this program has proven satisfactory for most purposes; however, there are some needs which have not been met by this level of definition. The use of maps presenting individual cotton fields, and the availability of tabular data to go with these maps, will increase the usefulness of data obtained from the GIS. The computerized generation of maps with this level of geographic definition is no small task and will probably only be realized with the aid of other technical developments.

Satellite imagery is available for any part of the United States and is probably the ultimate solution to the problem of availability of maps for GIS work. The U.S. Landsat satellite remote sensing project has provided a variety of satellite images for GIS work for years. Thematic Mapper data from seven different regions of the electromagnetic spectrum are available. These bands can be combined to provide information on water, vegetation, roads, etc. Computer software is available to manipulate these images. With these resources tailored to fit within the framework of our software, we should be able to increase the versatility and usefulness of our current GIS. The Mississippi Boll Weevil Management Corporation recently purchased satellite images of the cotton growing areas of the state. We are working on a protocol to use these images to locate cotton fields. The maps generated with the help of these images to produce boll weevil infestation data for individual cotton fields.

### In Review

Implications of the data obtained from the earlier years of the program were discussed by Smith and Wiygul (1994) and Wiygul and McCarty (1995). Differences have been observed in boll weevil populations (Fig. 1, 2, 3, & 4) in virtually all areas of the state in the four years of the program. This shows the value of the data that a program of this type can generate. Currently there are plans to continue operation of the program in 1996 in both Mississippi and Tennessee. The addition of satellite technology and software to manipulate these images should enable the Mississippi Boll Weevil GIS Project to provide even more useful data.

### References

Anon. 1985. A survey of geographic information systems for natural resources decision making. The American Farmland Trust. Washington DC.

Berry, Joseph K. 1988. Maps as data: Computer assisted map analysis. Berry & Associates, 19 Old Town Square, Fort Collins, CO 80524.

Harlow, C. and L. Lang. 1988. Geographic Information Systems. Federal Computer Week. Vol. 2:37.

Smith, J. W. and G. Wiygul. 1994. Implications of information gained from the Mississippi Boll Weevil Trapping and GIS Programs. Proc. Beltwide Cotton Prod. Conf. pp. 971-972.

Wiygul, G., J. W. Smith, and J. R. McCarty. 1994. The Mississippi Cotton Boll Weevil GIS Project - 1993 Update. Proc. Beltwide Cotton Prod. Res. Conf. pp. 1174-1175.

Wiygul, G. and J. McCarty. 1995. The Mississippi Cotton Boll Weevil GIS Project - 1994 Update. Proc. Beltwide Cotton Prod. Res. Conf. pp. 1060-1062.

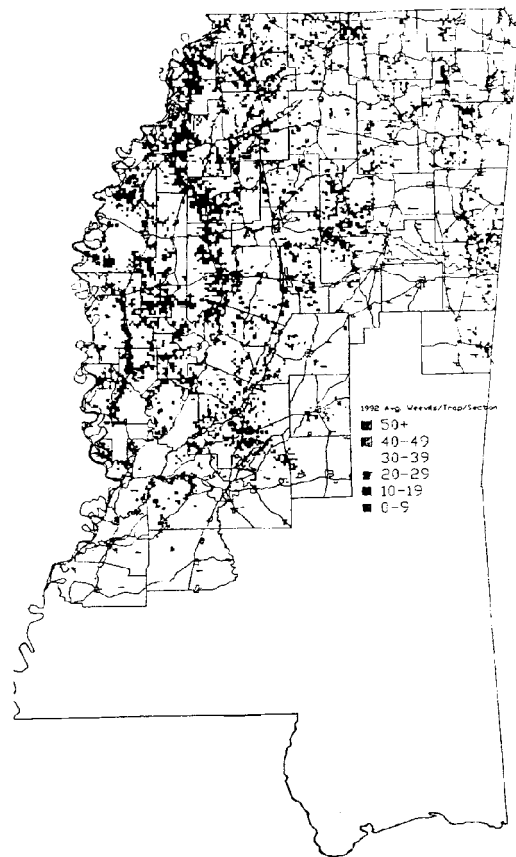


Figure 1. A GIS generated map of the cotton growing areas of Mississippi from 1992.

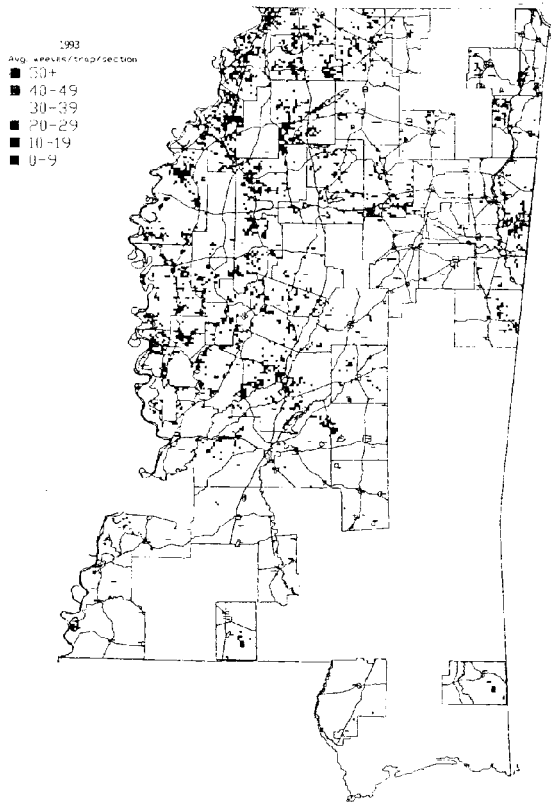


Figure 2. A GIS generated map of the cotton growing areas of Mississippi from 1993.

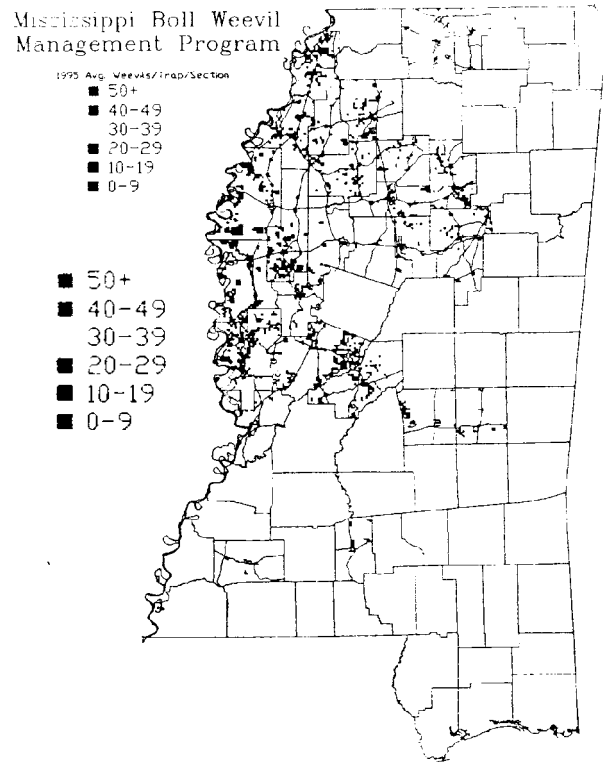


Figure 4. A GIS generated map of the cotton growing areas of Mississippi from 1995.

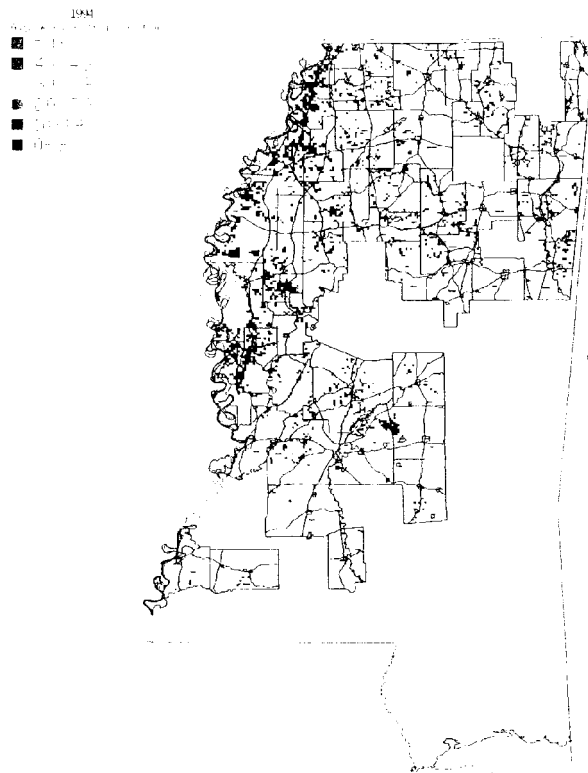


Figure 3. A GIS generated map of the cotton growing areas of Mississippi from 1994.