The purpose of this study was to determine if spatial data associated with birds which tested positive for the West Nile Virus in Alabama during 2001 and 2002 provide meaningful patterns that might contribute to an understanding of the process of diffusion of the disease in the state. Data, collected from across the state, were compiled from Excel spreadsheets and loose sheet reports containing the following information: Results of pathology tests on dead birds, date submitted, date reported, bird species, and the address and zip code of discovery location.

Database preparation:
The following adjustments and selections were performed on the primary database:
1. Loose sheet reports with usable data were entered into the base spreadsheet.
2. Zip codes were extracted from the address field using a simple Excel substring function.
3. For 2001 and 2002, a variable “days since January 1” was computed from the date of discovery field.
4. Unnecessary fields were discarded. These included date when the pathology report was completed (date when the bird was discovery was used), full address, and a coding field.
5. Unusable observations, such as those without or with faulty zip codes, were also discarded.
6. The data were sorted by zip code and for each zip code area, all observations beyond the second positive bird test were discarded. This was done in order to maintain consistency in the data because, for many areas, testing was halted when a second positive was reported.
7. A field defining whether an observation was the first bird or the second bird tested positive in that zip code area was created using a simple Excel function.
8. After some consideration, the data for 2001 were discarded because the set contained few observations, and those were mostly from one or two locations around Birmingham. It was decided that these data would shed little light on any spatial patterning.
8. The final Excel table for 2002 was transferred into an Access database suitable for GIS analysis.

Geographical Analysis.
A. Setup.
Zip code spatial data usable in a GIS is available as Zip Code Tabulation Area (ZCTA) files at the U.S Census Bureau. Files for Alabama were downloaded and extracted into shape files readable by various GIS applications. Intergraph’s Geomedia-Pro v.4 was used to perform the fundamental analysis. Following the establishment of Workspace and Warehouse connections, the bird data were accessed and combined with the geographical files by creating a join on the zip code key (Figure 1). A scanned map image was also geo-referenced to the zip code and county data in order to provide an easy map reference featuring recognizable features such as highways, towns, etc. (Figure 2).
B. Analysis.
1) The data were queried by bird species and displayed. Figures 3 and 4 show the display for crows and blue jays respectively. No significant patterning could be detected.
2) A plot of all “first bird positive in a zip code area” was produced. These are areas for which at least one positive test has been received. No spatial patterning was discernable (Figure 5).
A similar display was generated for “second bird positive in a zip code area,” and the combined first and second bird distributions are shown in Figure 6. Second bird positives are shown in green. No significant patterning can be determined.
3) Thematic choropleth maps were generated for all “first bird in a zip code area” using the variable “days since January 1.” Ranges were set at 2-week intervals so that earliest dates would show in a light shade and become progressively darker as the collection date became later in the year. The results are displayed in Figure 7, and again, little spatial patterning can be observed.
The same procedure was used to plot a distribution for “second bird in a zip code area” with similar results (Figure 8)

Figure 8
4) Finally, an analysis of the collection zip code area relative to the location of settlements was undertaken. Places with a population greater than 5,000 inhabitants were plotted (Figure 9), and an 8-mile buffer was established (Figure 10).
A spatial query was used to identify which zip code areas with confirmed WNV (two positive bird tests) touched or overlapped the 8-mile buffer zones. These are plotted in purple in Figure 11.
Finally, this display was combined with Figure 6 (all “second bird in a zip code area”), so that zip code areas with positive second bird tests that do not overlap a buffer zone appear green (Figure 12). The results indicate a much larger number of overlap areas than non-overlaps.

Figure 12
Findings.
The preliminary conclusion drawn from this analysis is that spatial plotting of birds testing positive for WNV yields little insight into the patterns of diffusion of the disease in Alabama. While further analysis might attempt to correlate the data with the location of wetlands, mosquito populations, etc., I feel that the likelihood of obtaining meaningful information is slight. This is due to the easy movement of the birds and insect vectors across the landscape, irregularities in the size and shape of the zip code areas, the random nature of the time of collection, and other similar factors. The only significant pattern was the evident association between confirmation of the virus in birds and proximity to a populated settlement. It is my conclusion that the likelihood of a bird testing positive is primarily a function of 1) a carcass being spotted by a human being (higher probability near towns and cities where more people live), and 2) the population being somewhat aware of the dangers of the disease and of the presence of a testing program (also higher near cities). Further analysis might be undertaken to confirm these hypotheses.