SPATIAL ASPECTS OF FORMOSAN SUBTERRANEAN TERMITE, *COPTOTERMES FORMOSANUS* (ISOPTERA: RHINOTERMITIDAE) ECOLOGY IN AN URBAN CENTER

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Abstract - The French Quarter of New Orleans is the site for a new national campaign against the Formosan subterranean termite, *Coptotermes formosanus*, an exotic species that now infests 13 states. The campaign includes the U.S. Department of Agriculture's Agricultural Research Service, the Louisiana State University Agricultural Center, and the New Orleans Mosquito and Termite Control Board. The goal is to reduce *C. formosanus* numbers and colonies. Along with that should come a marked reduction in the $1 billion per year cost in property damage, repairs and control measures. A geographical information system was developed to monitor insecticidal treatments, flight and foraging activity of *C. formosanus* within a 15 city block area of the French Quarter of New Orleans. Sticky traps for monitoring flight activity were systematically placed within the study site. Spatially explicit data, such as building and vegetation patterns, concerning *C. formosanus* were collected from the study area. These data on insect distribution and abundance as well as environmental factors are being used to determine conditions that influence termite abundance and distribution in urban areas. Future development of a hazard rating system, based on preferred environmental factors, will be used to predict areas at risk for *C. formosanus*.
Key words - Geographic information system, distribution, populations

INTRODUCTION

New Orleans is the site for a new national campaign against the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, an exotic species that now infests 13 states. The campaign includes the U.S. Department of Agriculture's Agricultural Research Service, the Louisiana State University Agricultural Center, and the New Orleans Mosquito and Termite Control Board. The goal is to reduce the *C. formosanus* numbers and colonies. Along with that should come a marked reduction in the $1 billion per year cost in property damage, repairs and control measures.

There is an inherently spatial component to many aspects of pest management. Incorporating geographic information systems (GIS) into these activities provides a significant analytical tool. Presenting monitoring records with damage and conducive conditions increases the value of the data. By combining GIS with traditional methods of data analysis, monitoring programs, and pesticide treatments managers are able to use GIS as a decision support tool and better understand the relationships between pest infestations and geographic areas. Here we report the development of a geographic information system *C. formosanus*, developed to track infestations, remedial treatments, alate swarms, subterranean foraging activities, and environmental data.

MATERIALS AND METHODS

ArcView (1996) was used to develop the geographic information system. Properties within the 15-block management area were entered into the database and records kept on infestations, type of treatments, and inspections. Pest control contracts were made available to property owners at no cost, through selected commercial pest control companies, with the understanding that property owners fixed any conducive conditions, such as leaking roofs, at their expense. The pest control companies had to follow established guidelines and make available data on infestations and treatments. Representa-

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tives from the Louisiana State University Agricultural Center inspected all treatments to insure guideline compliance.

C. formosanus alate monitoring was carried out from 8 May through 14 July 1998. This was accomplished by using white sticky traps (Bell Laboratories, Inc., Madison Wisconsin, USA) measuring 10.5 cm by 20.5 cm attached to streetlights approximately 3 m above the ground. Traps were placed in a 4 x 6 regular grid pattern at distances of = 120 m apart (Fig. 1). Traps were changed 2-3 times weekly and the number of alates were counted and combined into a weekly trap count. Location of each sample point was determined using a differential global positioning system (Trimble Model Pro XR, Trimble Navigation Ltd., Sunnyvale CA, USA) to obtain latitude and longitude values.

Data analysis

These geographic locations were converted to metric coordinates (± 1.5 m) referenced to the latitude and longitude of the southwest corner of the management area. The spatial structure of *C. formosanus* alates were characterized within the management area by inverse distance weighting interpolation using ArcViews' Spatial Analyst module. The coefficient of dispersion (CD), or variance to mean ratio (Taylor 1984) was used to infer the spatial distribution (aggregated, random or uniform) of the alates.

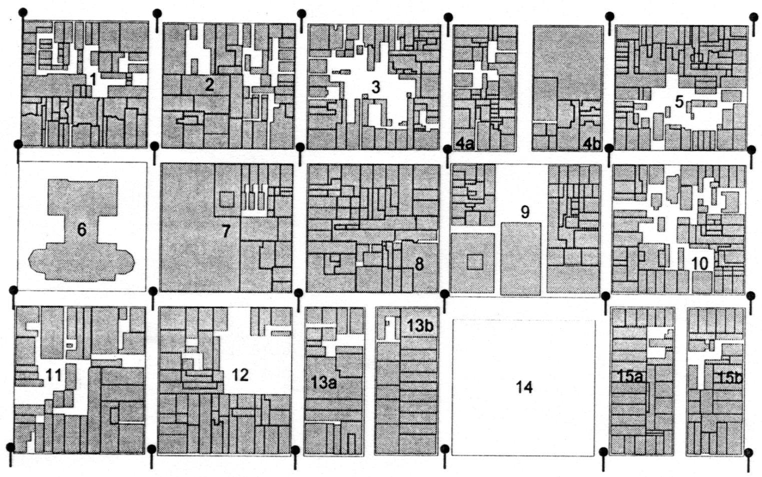

Figure 1. Map of the management area in the French Quarter of New Orleans, Louisiana, USA.

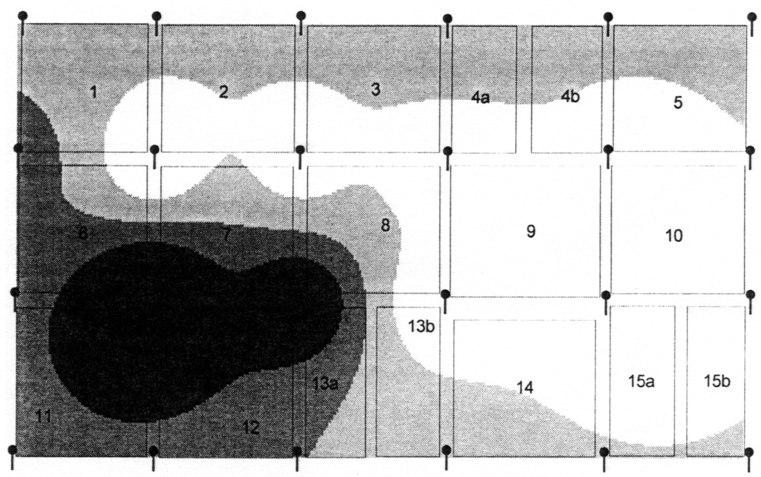

Figure 2. Interpolated surface of *C. formosanus* alates captured during the summer of 1998.

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RESULTS AND DISCUSSION

A total of 13,760 *C. formosanus* termite alates were collected from the 24 sticky trap stations during the study. Alate numbers peaked with a mean of 189.38 per trap during the second week of the study and continued to decline until monitoring was terminated in July when less than 1 one trap were captured (Table 1). The CD indicated that the counts had an aggregated distribution (CD>1) over the entire trapping period (Table 1). The CD, like the mean peaked in week 2 and generally declined with time however, even when alate numbers were low they were not randomly distributed.

The distribution of *C. formosanus* alates across the management area was greatest around blocks 6, 7, 11 and 12 (Fig. 2). While this area is predominately a business area, block 6 is occupied by one large building (see Fig. 1) that is currently being renovated and the grounds surrounding it have several southern magnolias (*Magnolia grandiflora* L.), live oaks (*Quercus virginiana* Mill), crepe-myrtles (*Lagerstroemia indica* L.) and low shrubs. In the past, this building has been heavily infested with *C. formosanus* to the extent that during renovations cypress window frames through the third story were destroyed or damaged beyond repair.

Table 1. Summary statistics for *C. formosanus* alates captured on sticky traps in French Quarter of New Orleans, Louisiana, USA from 8 May through 14 July 1998.

Week	Total	Mean	Variance	CD[1]
Week 1	2806	116.92	17910.95	153.19
Week 2	4545	189.38	32910.85	173.79
Week 3	1220	50.83	5131.19	100.94
Week 4	2550	106.25	13054.11	122.86
Week 5	928	38.67	2811.88	72.72
Week 6	268	11.17	242.58	21.72
Week 7	1154	48.08	2088.69	43.44
Week 8	209	8.71	667.69	76.67
Week 9	65	2.71	31.35	11.57
Week 10	15	0.63	2.68	4.29

[1]CD is the coefficient of dispersion, or variance to mean ratio (Taylor 1984).

The area covered by blocks 9, 10, 15a and b consistently had the lowest numbers of alates caught on sticky traps over the trapping period. This is due in large part to the extensive baiting program that has been taking place in the historical buildings in blocks 9, 13b, 15a since 1996 by the New Orleans Mosquito and Termite Control Board. Block 14 and the open area in block 9 are parks with vegetation consisting of southern magnolias (*M. grandiflora*), live oaks (*Q. virginiana*), crepe-myrtles (*L. indica*) and low shrubs and has been part of the bait treatment program conducted by the New Orleans Mosquito and Termite Control Board.

New Orleans has a history of *C. formosanus* infestation going back over 30 years. The purpose of the 1998 alate trapping was to provide baseline data for evaluating control measures implemented within the management area in November 1998 over the next two years. In addition to the alate trapping, ground-monitoring stations with temperature, sensors have been placed approximately every 25-m in the sidewalks in the management area to assess foraging. These data will be incorporated into the GIS and will add another component to evaluating areas at risk. Future development of a hazard rating system, based on preferred environmental factors, will be used to predict areas at risk for *C. formosanus* infestation.

REFERENCES CITED

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