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Identifying High Crime Areas Using Spatial Analysis

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Abstract

Crime incident locations and trends are examined spatially using GIS to produce maps that pinpoint high crime areas or “hot spots.” Crime mapping aids police departments by identifying areas to allocate limited resources where and when they are most needed. This project introduces the availability of GIS technology to smaller police departments as a tool to assist in the development of crime prevention strategies. In this model crime incident reports for Windham, Maine are geocoded to identify clusters of hot spots. The Police Zones were recreated with ArcMap with the Police Zones overlayed on the town Street Map for ease of reference (Figure 2).

Introduction

A study published by the U.S. Department of Justice suggests a principal theme wherein crime hot spots can provide guided police action when the maps are guided by theory. “The Neighborhood Theory” discussed in the study is applicable to this project as the subject community’s number one crime is home burglary. This theory links crime to underlying neighborhood social conditions. Some neighborhood characteristics may be made up of residents who work during the day and no one is in the area to report suspicious activity or it may be an economically depressed neighborhood of many multifamily homes that lacks a sense of community involvement. “...depending on neighborhood characteristics, relevant action might include efforts to engage residents in collective action against crime and disorder.” J.E. Eck et al. (2005). Advances in computer and information systems now make it possible for smaller police departments to geographically identify clusters of high crime areas. The Town of Windham’s burglary problem may be reduced by using GIS, spatial analysis and theory to influence decision making policies that implement targeted police patrols.

Methods

The Town of Windham, Maine has a population 17,001, covers 50 sq. miles, and has 190 full and part-time municipal employees including a 23 member police department. The police department currently uses a hand drawn representation of the town’s police zones made by Ronald Ramsdell (Windham Police Department, Retired) (Figure 1). The Police Zones were originally established using road lines as zone separators and designed as a way to section off the town for call assignments but are not determined by frequency of crime, travel time or patrol patterns. The Police Zone Map was recreated with ArcMap with the Police Zones overlayed on the town Street Map previously shown in Figure 4.

Several methods were explored to analyze crime distribution. Analytical tools used for this project include ArcGIS Desktop 10.1 with Spatial Analyst. Using the Point Density method and the geocoded burglary point locations a Hot Spot Map was produced as a raster data set to identify and highlight problem areas in red (Figure 4). The data results from this map were used to produce the project results shown in Figure 6. Other analysis methods used include: Getis-Ord Gi*, Kriging; and Anselin Local Moran’s I. These methods also produced a picture of the primary trouble spots, however, the point density method provides the most effective visual communication tool for municipal officials unfamiliar with the advantages of using GIS (Figure 4). The northern most hot spots are located in a highly populated area of suburban homes and could fall into the “Neighborhood Theory.” In addition to increased policing, these areas may benefit from community outreach programs like Crime Watch.

Results

The choropleth map in Figure 5 shows the burglary counts by police zone for January 2007 through October 2013 with the highest number of burglaries occurring in Zones 1 and 2.

Future Development

Future development of this data will include a recommendation to the Windham Police Department to increase patrols in the areas categorized as high or medium. Periodic analysis of the results of implementation of the increased patrol areas; Repeat Address Mapping (RAM); analysis of assessing neighborhoods vs. crime activity and seasonal properties vs. crime activity; and analysis of crime in areas with and without street lights.

References


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