Understanding the spatial pattern of urban crime: a developing country's perspective

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Summary

Much of the published spatial analysis research of crime to date has been focused on Euro-American cities. This paper attempts to provide an insight on how we can better understand the spatial pattern of crime in a typical developing country's setting. Data were obtained through extensive field mapping, a block environmental inventory (BEI) and a crime victimization survey to generate a GIS-database of the study area. Grid thematic maps (GTM) for different crime types were produced for visual analysis, which suggests, as observed in many Euro-American studies, crime clusters geographically.

KEYWORDS: *GIS, urban crime, hotspots maps, developing country,*

1. Introduction

Researching the spatial pattern of urban crime is not a recent development (see Zorbaugh, 1929; Shaw and Mckay, 1969; and Burgess and Bogue, 1964) and, for obvious reasons, remains the subject of significant academic attention (Weisburd et al., 2009). Crime clusters spatially (see Shaw and McKay, 1969; Sampson and Groove, 1989; Johnson, 2010) as opportunities for crime are also not evenly distributed across space. The bulk of research to date has pursued a theoretical perspective to better conceptualise and understand crime events alongside the empirical research conducted to test the validity of such theories. However, most research has concerned itself with urban crime in Euro-American cities, largely due to the availability of data in these countries. As data are now gradually becoming available, this paper presents an insight on how we can better understand patterns of crime in the context of developing countries with a particular focus on Kaduna – Nigeria. Research in this context – a typical African setting – is almost non-existent (Igbinovia, 1989; Arthur, 1994; and Mushanga, 2004). To address this we start by asking how does urban crime cluster in a typical developing country's setting? The question is a basic one because it has never been asked of Kaduna and few African cities have been subject to the intensive data collection exercise described here.

2. Background

Urban areas in countries like Nigeria often develop with little or no centralized planning and may have features that are far less prevalent or even non-existent in typical Euro-American cities. These characteristics, combined with extremely sparse spatially referenced crime and population datasets, make for a challenging environment in which to undertake the kinds of research taken for granted in more developed countries. The site of this study, Badarawa-Malali district, is an urban district within Kaduna (see Figure 1), the capital city of Kaduna state which also serves as the regional capital of the

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Northern Nigeria. The city is an important political, transportation and trade hub and houses a diverse population in terms of socio-economic class and racial make-up. The physical setting of the city is mixed – formal settlements with western style physical planning and informal settlements that usually emerged with little or no centralize planning.

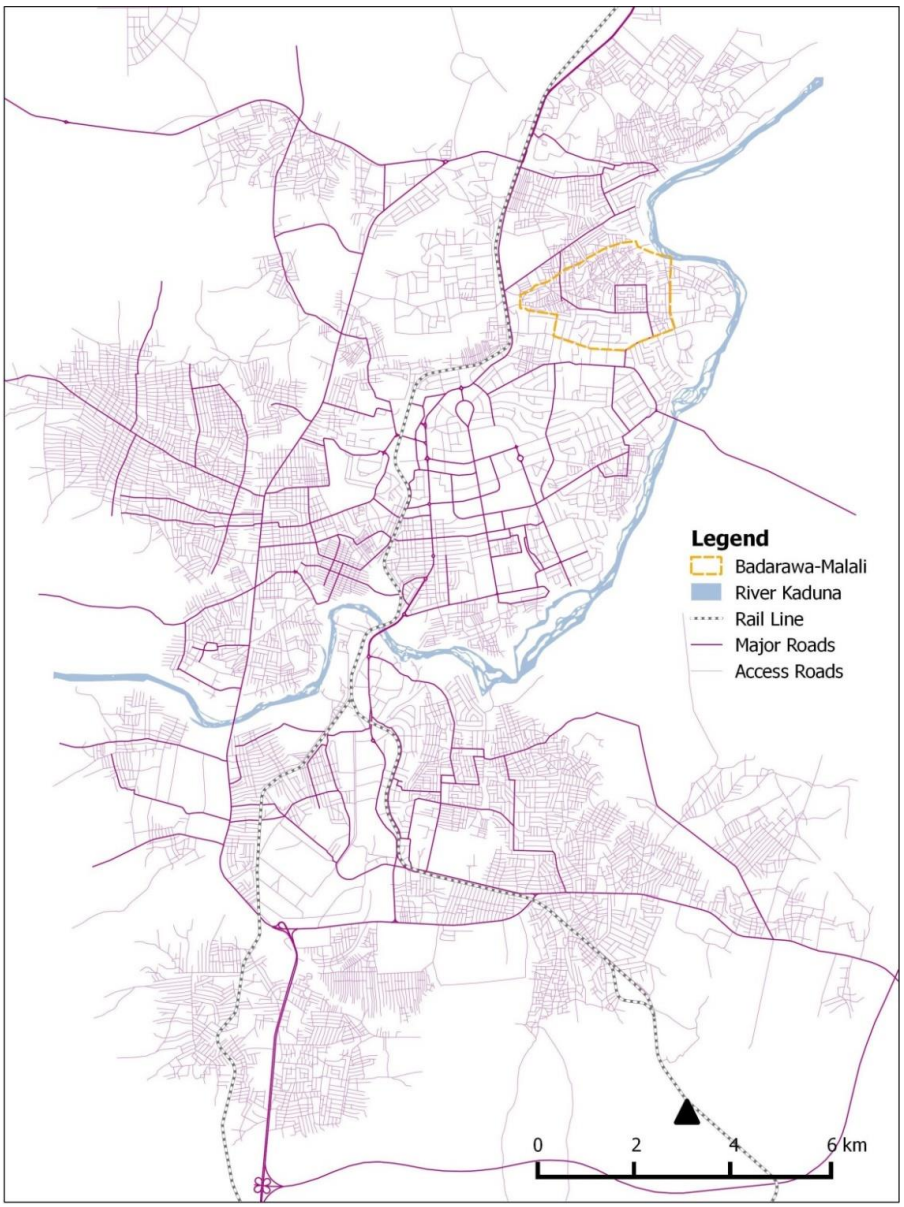


Figure 1: Kaduna Metropolis

Kaduna has an estimated population of 1.14million people and covers a total land area of about 250km^2 making the population density to be around 4,560 Person/km^2 (Max-Lock Consultancy Nigeria (MLCN), 2010).

2.1 Badarawa-Malali Urban District

Badarawa-Malala district (see Figure 2) has a population of 96,540 people (MLCN, 2010), which represents 8.4% of the total population of Kaduna. The average household size in this district is 9.3 persons, which is almost the same as the city's average (9.8 persons). As it could be observed from Figure 2, significant parts of the district appear to be densely populated. These are informal settlements, characterised by irregular plot layouts with narrow streets that are mostly unpaved. The other parts of the district, formal settlements, are the low and medium density areas which streets are wide and mostly paved with regular sized plots aligned and well-arranged on large street blocks.

MLCN (2010) suggests that, the traditional community identity varies between the high, medium and low density areas. These variations in both social and physical settings provide for an interesting study of the spatial distribution of urban crime.

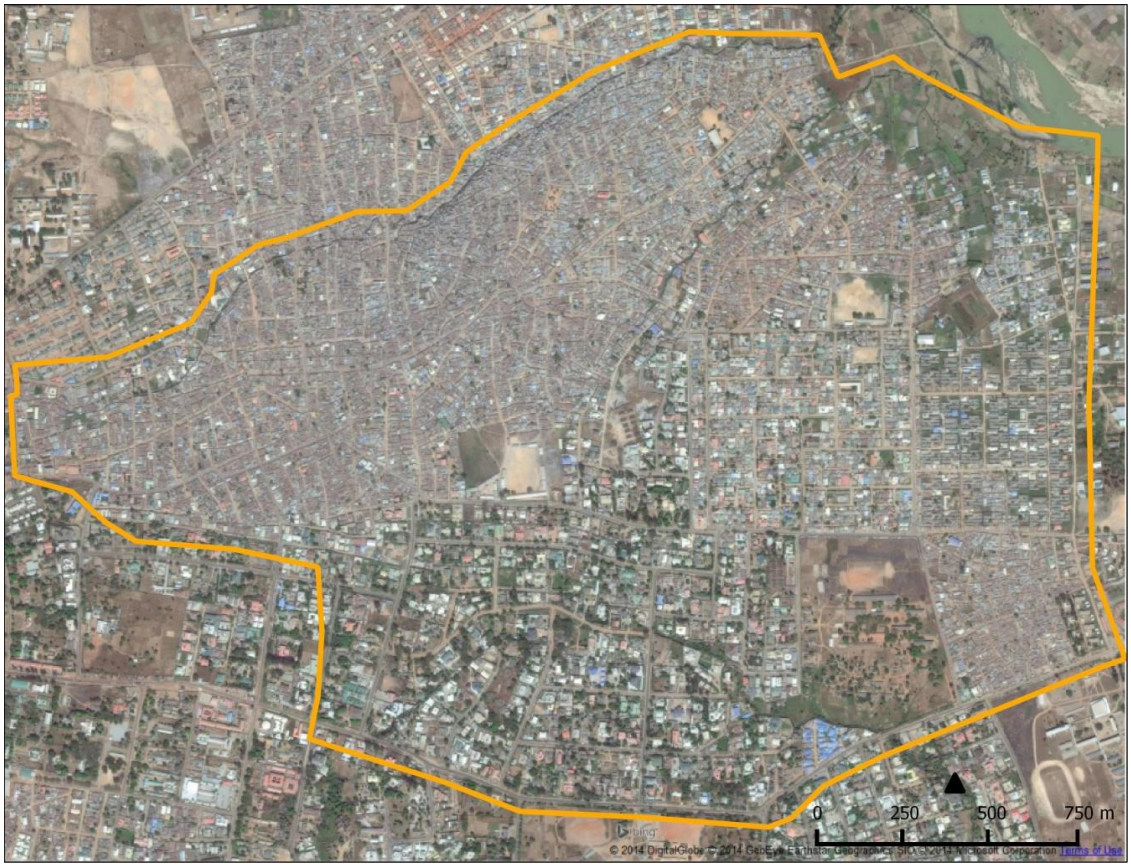


Figure 2: Satellite image with boundaries of Badarawa-Malali. See Figure 1 for district in context.

3. Data and Method

This study obtained primary data using three methods.
(a) Mapping exercise – fieldwork conducted to map the study area using paper maps produced from high-resolution satellite images. During this exercise, the boundaries of every property was marked on the paper maps and a unique reference number (URN) was assigned to each identified property (see Figure 3 for example). The data collected from the fieldwork were digitized using OpenLayers plugin in QGIS 2.0, and all URNs were entered for every property. The URN allowed for the integration of all datasets in a GIS environment at a later stage.

Figure 3: A sample of the paper Map (printed map is A3)

(b) Block Environmental Inventory (BEI) (see Perkins et al., 1990) used to obtain data on the condition of the built environment.
(c) Household and crime victimization survey used to obtain data on crime incidents and a range of other demographic variables. All fieldworks were conducted between March and June 2014.

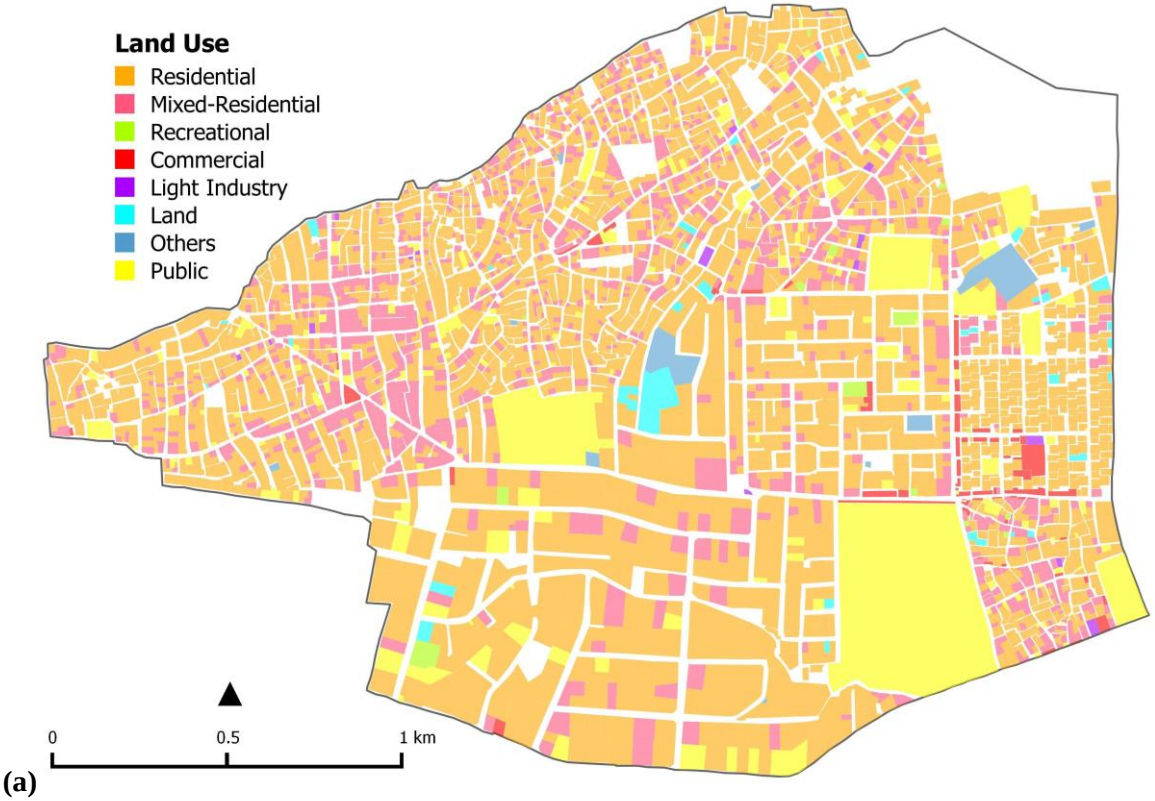
3.1 Block Environmental Inventory (BEI)

Trained enumerators collected data on the physical attributes related to properties using a structured BEI form prepared for this exercise (see Figure 4 for the BEI Form). First, the URN assigned to a property from the mapping exercise was entered as the RefNo and all other items on the BEI form were recorded accordingly. The records were entered into a spreadsheet and later joined to the spatial data generated from the mapping exercise.

BLOCK ENVIRONMENTAL INVENTORY FORM Block Ref:_____

s/n	Ref No	Land use	Plot				Other uses				Building: Type				Building: Material			Access Control & Target Hindering										
			Occupied	vacant	Abandoned	Under construction	Shops	Kiosk	In-house trading	Out-side trading	Flat	Storey	Attached	Detached	Cement	Mud	Temporary	High walls	Burglary-proof bars	Gate	Garage	Outdoor sitting	Security Lights	Guards	Open Access	Warning Signs	CCTV Camera	Dogs
1																												
2																												
3																												
4																												
5																												
6																												
7																												
8																												

Figure 4: The Header of the BEI Form



(a)

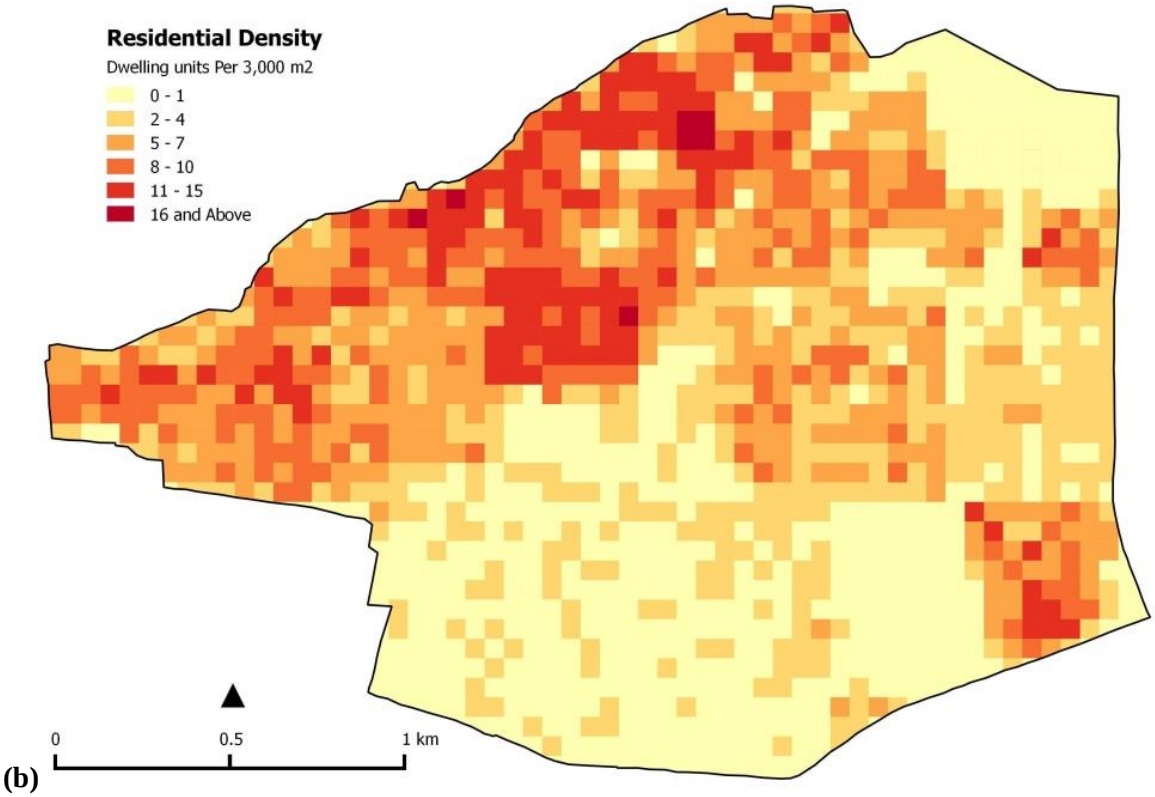


Figure 5: Badarawa-Malali urban district (a) Land Use (b) Density of residential units– all datasets used in producing these maps were collected from the BEI exercises.

3.2 Household and Crime Victimization Survey

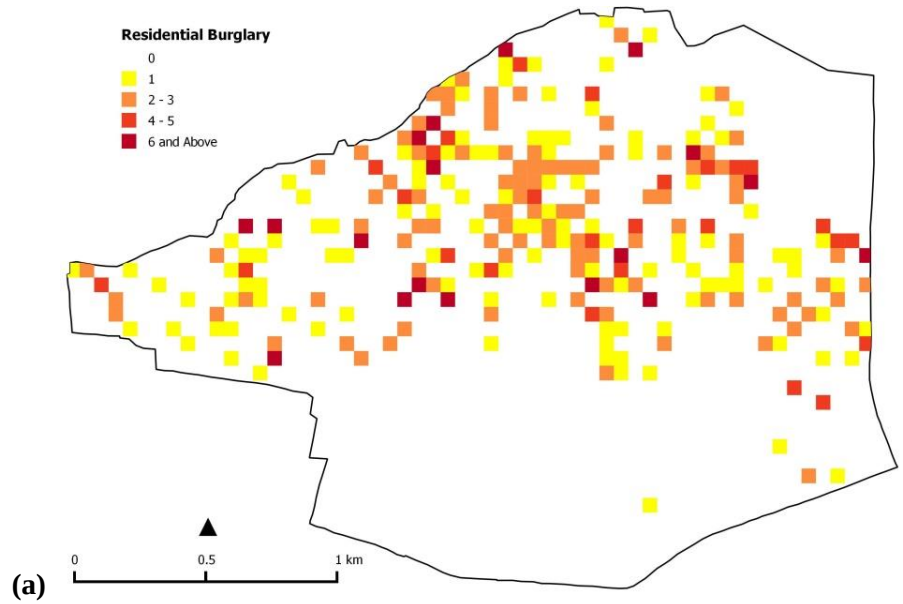
A structured questionnaire interview was designed to collect data on (a) crime incidents, and (b) demographic variables. Each questionnaire has respondent's property URN which corresponds to the one generated during the mapping exercise. This enables the geocoding of the survey data. A total of 2,027 households were interviewed, although, only 1,922 were included in this study. 105 responses were rejected for either lacking or possessing a duplicated URN, or a person at the property declined to respond to most questions. 44 questions were asked – eleven related to demography, such as, ethnicity, household structure and employment status – ten related to collective efficacy – and others related to crime victimisation. Respondents could report: residential burglary; residential stealing; damage to property; theft of automobile; theft from automobile; and damage to automobile.

Table 1: Number of households reporting crime incidents

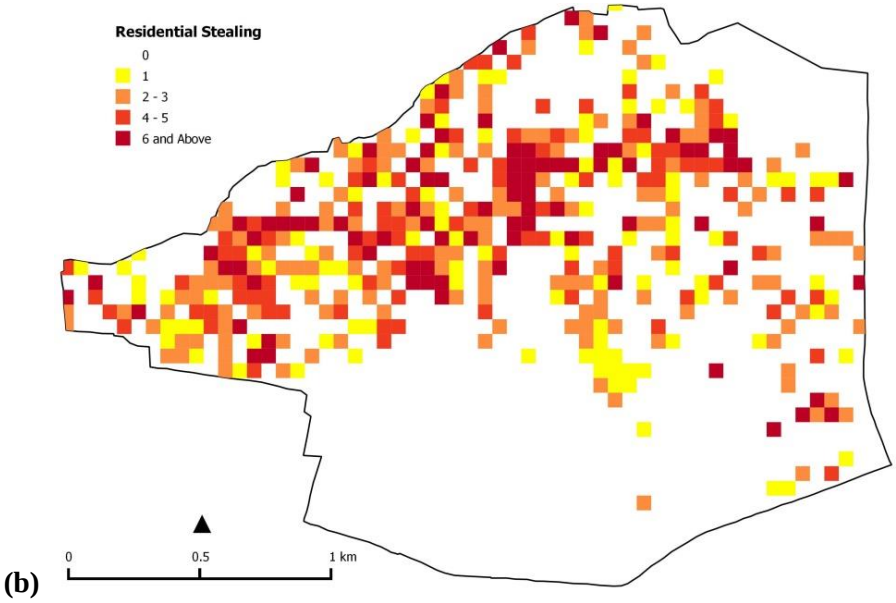
Type of Crime	**No. of households**
Residential Burglary	327
Residential Stealing	664
Damage to Property	278
Theft from Automobile	200
Theft of Automobile	126
Damage to Automobile	290

4. Analysis

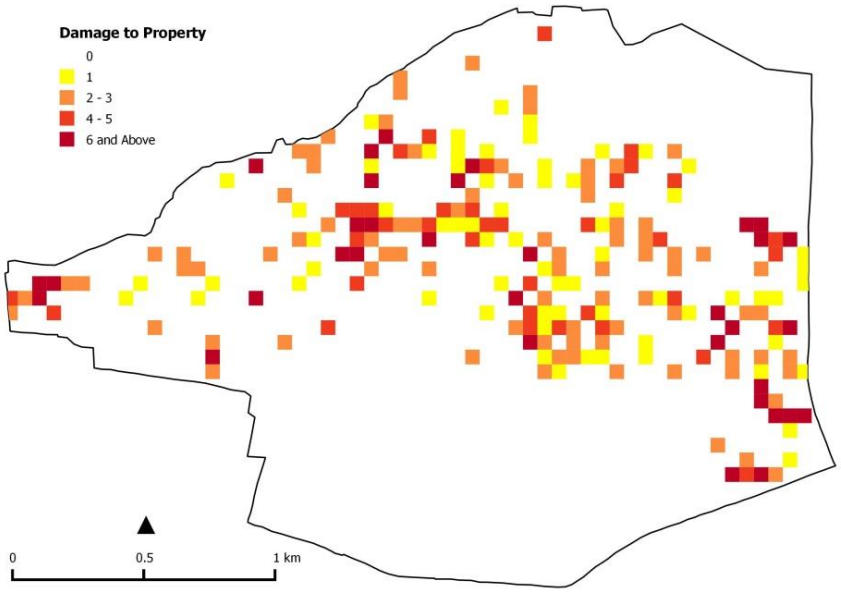
Although there are arguably more precise approaches (see Chainey et al, 2008), for some obvious reasons one of which is the lack of appropriate smaller geographical unit of analysis in the area under study, Grid Thematic Mapping (GTM) technique was considered at this stage in creating crime hotspot maps using a grid-cell size of 55m square. A count of reported incidents within every grid-cell was taken for each of the six crime types and hotspot maps were produced. A visual analysis of these maps (see Figure 6: a – f) suggests that, crime tends to concentrate in particular grid-cells but not in others and different types of crime show different spatial patterns. This concurred with the general existing knowledge about the spatial patterns of urban crime.



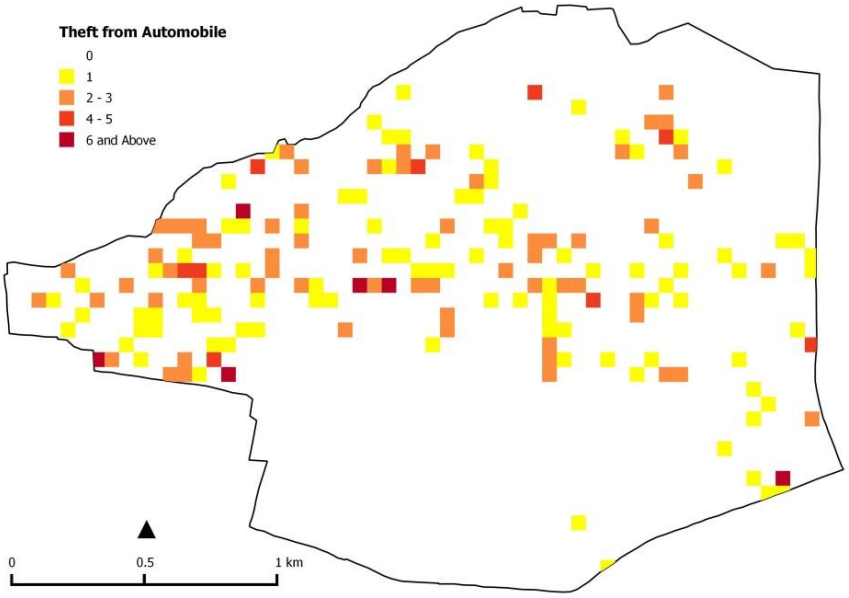
(a)



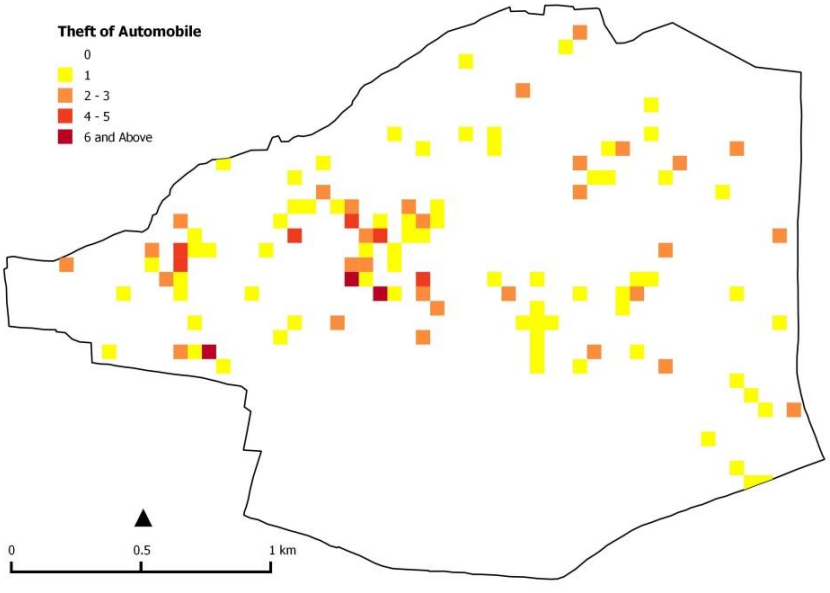
(b)


Damage to Property
0
1
2 - 3
4 - 5
6 and Above
0
0.5
1 km

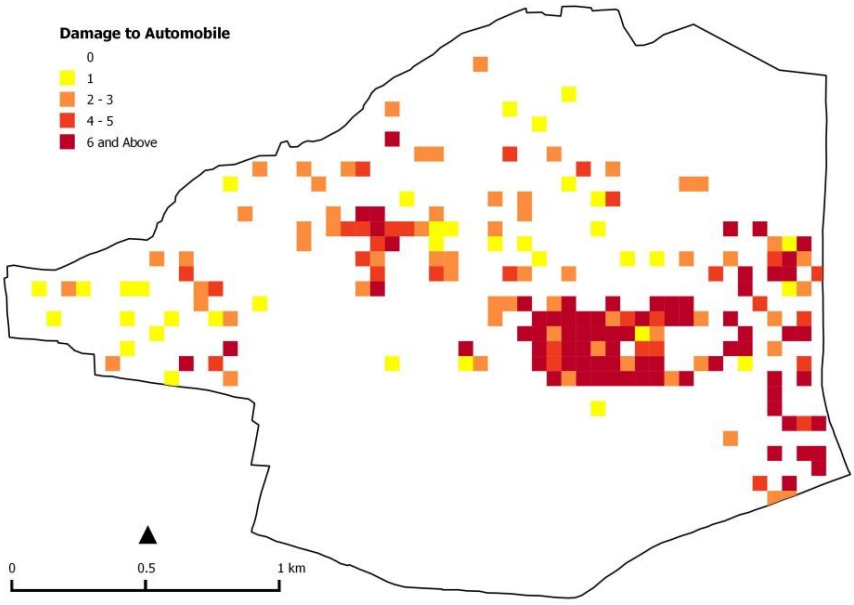
(c)


Theft from Automobile
0
1
2 - 3
4 - 5
6 and Above
0
0.5
1 km

(d)


Theft of Automobile
0
1
2 - 3
4 - 5
6 and Above
0
0.5
1 km

(e)



(f)

Figure 6: Crime hotspot maps of Badarawa-Malali District

5. Discussion and Future work

Knowing the precise location of where crimes occur is the starting point to identifying hotspots. This study does not only obtain the locations of crime incidents; it has generated a GIS-database that links it with the associated attributes of such places. The process was time consuming and required a combination of extensive field work, involving several trained enumerators, and some intensive GIS computations. The volume of data is unprecedented and will form the basis for what we hope will be some of the most detailed study of urban crime in a developing country. From this we will seek explanations on the micro-level relationships between urban crime and the features of both social and physical environment in a typical developing country's setting.

Although, the preliminary visual analysis suggests that some places have high crime incidents while others do not, this paper does not purport to provide the conclusion that crime clusters in space in a typical developing country's setting. More work is still needed to provide a robust spatial and statistical analysis of the datasets generated. If the premise that crime clusters geographically stands, as the preliminary analysis revealed, it will also be interesting to address other issues, such as, at what geographical scale does crime clusters? Pursuing this will mean identifying the most appropriate geographical scale of analysis which could involve further aggregation of datasets. It will also be worthwhile to understand the social and environmental correlates of crime in developing countries. It's still a work in progress and the future work will concentrate in addressing these issues.

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Bibliography

Faisal is a third year PhD student at the UCL department of Geography researching urban crime in developing countries with a particular focus on Kaduna – Nigeria. Research interests are within the broader field of urban planning much of which involves GIS techniques in the analysis and visualization of urban datasets.

James Cheshire is a Lecture in Quantitative Human Geography at UCL Department of Geography with interest in spatial analysis and Geo-visualization. Current research focuses on the use of "big" and open datasets for the study of social science.

Shane Johnson is a Professor and Deputy Head of Department at the UCL Department for Security and Crime Science. Area of particular research interest, among others, is on exploring how methods from other disciplines can inform understanding of crime and security issues.

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