

## Mapping the Prevalence and Distribution of Crime within University of Lagos Using Geographic Information System

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### Abstract

*This study examined the prevalence and distribution of crime in the University of Lagos (Akoka campus) between 2012-2015 using Geographic Information System. Specifically, it mapped and classified the security posts, examined the spatial and temporal pattern of crime as well as the factors responsible for the observed pattern. The data utilized for the study entails spatial and non-spatial data acquired through surveys conducted to identify the location of security post and crime incidents and existing University of Lagos map and database of the Security department of the University. The study revealed that there are 81 security posts and 6 security zones within the University. Depicting a clustered distribution pattern, 66 of these security posts were classified as functional while 15 were classified as non-functional. The study also revealed that a total of 2,012 crime incidents which were categorized into 18 groups were reported to have occurred between 2012-2015 in the University. While Larceny (1,025) was discovered to be the most prevalent crime, Zone B (601) was discovered to be the zone with the highest crime rate and 2015 (700) the year with highest crime incidents. The factors responsible for the observed crime pattern include high student population, proximity and easy access to neighbouring communities, and remoteness and low human traffic. With the identification of crime susceptible zones using GIS as demonstrated in this study, it is recommended that the University of Lagos security department adopt the use of GIS especially for the siting of security posts and allocation of personnel to aid crime management.*

**Keywords:** Crime, Mapping, GIS, UNILAG

### Introduction

Crime is an intentional act in violation of the criminal law committed without defence or excuse, and penalized by the state as a felony or misdemeanour (Lanier and Henry, 2001). It can also be defined as an offence which goes beyond the personal and into the public sphere, breaking prohibitor rules or laws, to which legitimate punishment or sanctions is attached, and requires the intervention of a public authority (Marshall, 1998). It is a huge threat to public safety as it causes great personal suffering, vast material damage, and place enormous burden on

social networks (Adebayo, 2013). Since crime is a human phenomenon, its distribution is therefore not random in space (Anumba et al, 2018). It has been the problem of the past transcending into the modern age while it exists in various countries across the globe in varying degrees affecting policies and development (Fajemirokun et al, 2006). It therefore applies that any community striving towards development must reduce the rate of recurrence of crime to the barest minimum.

A major challenge however is the failure of the traditional and age-old system of crime management living up to the requirements of the contemporary crime scenario. This is more so as this system which is manually operated neither provide accurate, reliable and comprehensive data round the clock nor help in trend prediction and decision support (Johnson, 2000; Balogun et al, 2014). The foregoing particularly applies to Nigeria due to the increasing trends of crimes and criminal activities (Alemika & Chukwuma, 2005; Adebayo, 2013; Balogun et al, 2014). For instance, murder in Nigeria steadily increased from 1,629 in 1994 to 2,120 in 2001 and climbed to a record high of 2,136 in 2003 (Alemika & Chukwuma, 2007). Such a phenomenal increase of over 75 percent between 1994 and 2003 is worrisome. Armed robbery equally rose from 2,044 in 1994 to 3,889 in 2002 amounting to over a 52 percent increase in less than a decade. In addition, in 2007, the Nigeria Police Force (NPF) recorded 34,738 incidences as crimes against persons and this figure escalated to 35,108 incidences in 2008 (NPF, 2008). Since the Nigerian Police is not well equipped in modern trends of criminal investigation, mapping and analysis to effectively discharge her responsibilities, there is a serious setback in the criminal justice system in the country (Anumba, 2018).

Even though crime increase is prevalent across Nigeria, every community across the country has its peculiar problem and challenge. This national upsurge in the frequency of criminal activities is however applicable to the University of Lagos, Akoka with most national dailies devoting a significant proportion of their issues to reporting of crime incidence in the institution. Significant among these are cultism (Agha, 2015; Egbe, 2016), rape (Afinsulu, 2013; Ezeamalu, 2015), suicide (Nwosu, 2016) among others. Although, some crime mitigation efforts have been adopted by the institution's management among which are the establishment of patrol teams of UNILAG security and police personnel, the use of technology enabled device such as toll free emergency telephone numbers, crowd control gadget and close circuit television among others, the crime rate still seems to be high.

The need to improve the crime management system in the University therefore arises especially through Crime mapping and analysis with the effective use of Information Technology and Geographic Information System (GIS) (Ferreira et al, 2012). As opined by Ejemeyovwi, (2015) crime mapping and analysis can support all levels of combating crime; strategic operation and tactic. Specifically, while crime mapping entails the manipulation and processing of spatially referenced crime data in order to display them visually in an output that is informative to the particular user, crime analysis is a set of processes applied on relevant information about crime patterns to prevent and suppress criminal activities (Ahmadi, 2003).

GIS on its part does not only allow the integration and spatial analysis of data to identify, apprehend, and prosecute suspects, it also aids more proactive measures through effective allocation of resources and better policy setting(Lew, 1999). Specifically, it uses geography and computer-generated maps as an interface for integrating and accessing massive amounts of location-based information. This allows police and other personnel to plan effectively for emergency response, determine mitigation priorities, analyse historical events, and predict future events (Johnson, 2000). It helps crime officers determine potential crime sites by examining complex seemingly unrelated criteria and displaying them all in a graphical, layered, spatial interface or map.

This study is thus designed to examine the prevalence/distribution of crime in the University of Lagos (Akoka campus) using Geographic Information System (GIS). Explicitly, it is meant to map and classify the security posts in the University of Lagos (Akoka); examine the spatial and temporal pattern of crime within the University of Lagos (Akoka); and examine the factors responsible for the observed pattern of crime within the University of Lagos.

### **Study Area**

The study area is University of Lagos (main campus) Akoka-Yaba, Lagos state, Nigeria. It is a Federal Government owned institution having residential districts within and around it. The University with an estimated area of about 250 hectares was established on 22 October, 1962 by Act of the Parliament popularly called University of Lagos Act of 1962. The University is geographically located between Latitudes 6° 30' 15" and 6° 31' 20" North of the equator and Longitude 3° 23' 05" and 3° 24' 20" East of the Greenwich Meridian. It shares boundary with the Akoka and Ilaje communities to the North, Abule-Oja/Abule-Ijesha

communities to the West, Onike and Iwaya communities to the South and the Lagos lagoon to the East (Figure 1).

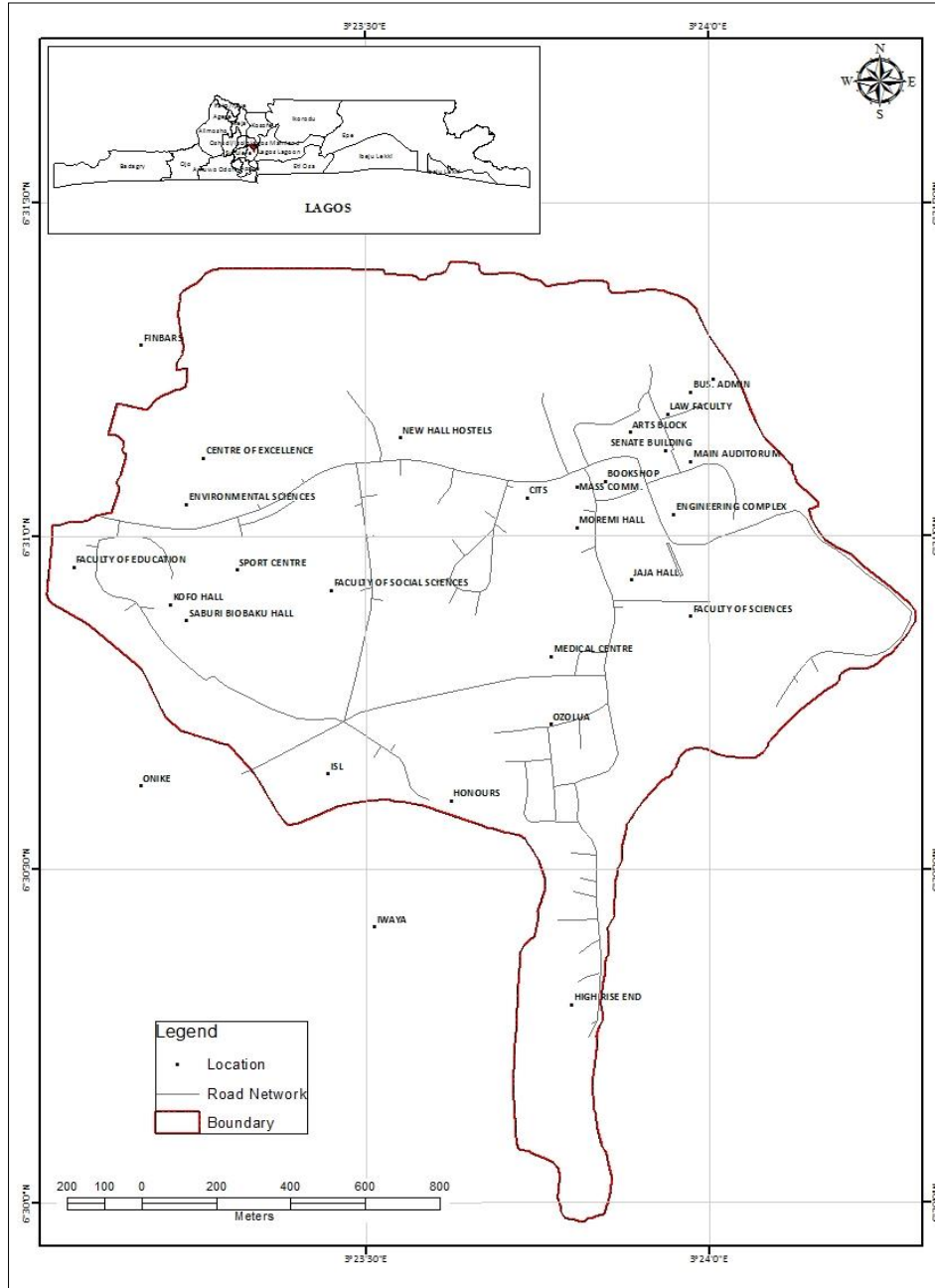
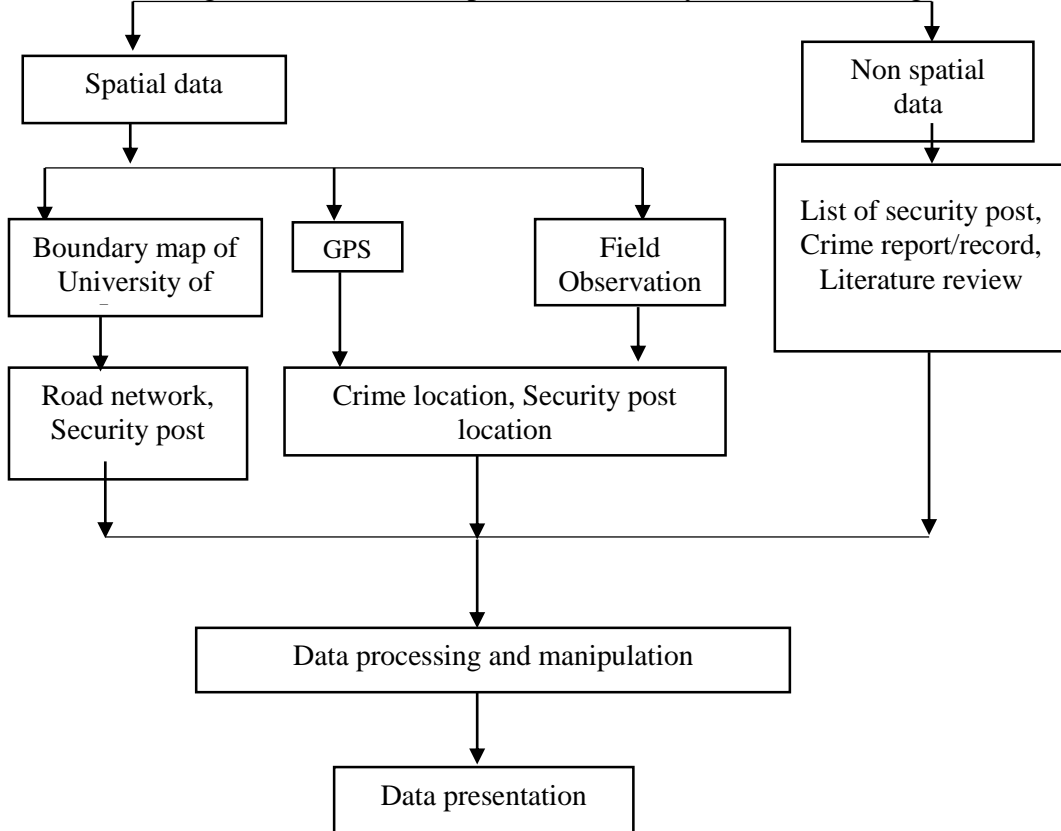


Figure 1: University of Lagos

### Materials and Method

The methodological framework adopted for this study is outlined in Figure 2.



**Figure 2: Methodology framework**

### Data Sources and Characteristics

This study relied essentially on data obtained from the crime records of the University of Lagos Security Unit (Table 1). The other non-spatial data were also collected and collated from existing statistics/report/database of the Security Unit of the University of Lagos. For the spatial data acquisition, a field survey was conducted in order to identify the location of security posts and crime incidents using Global Positioning System (GPS).

**Table 1: Data Type and Source**

S/N	Data Type	Source	Year	Scale
1	Administrative map of UNILAG	LABCARS, Dept of Geography, UNILAG	2016	1:25,000
2	Crime data and related information	UNILAG Security Unit, Fieldwork	2012-2015	N/A
3	GPS coordinates	Fieldwork	2016	0.5m accuracy
4	Digital photographs of points of interests	Fieldwork	2016	N/A

### Data Processing, Analysis and Presentation

The specific technique used for data processing and analysis are outlined in Table 2. The analysis of spatial data was carried out in ARCGIS 10.3. The contents of the database are shown in form of images, maps and tables which gives the visual impression of research findings and also the results of the aim and objectives.

**Table 2: Data Analysis Procedure**

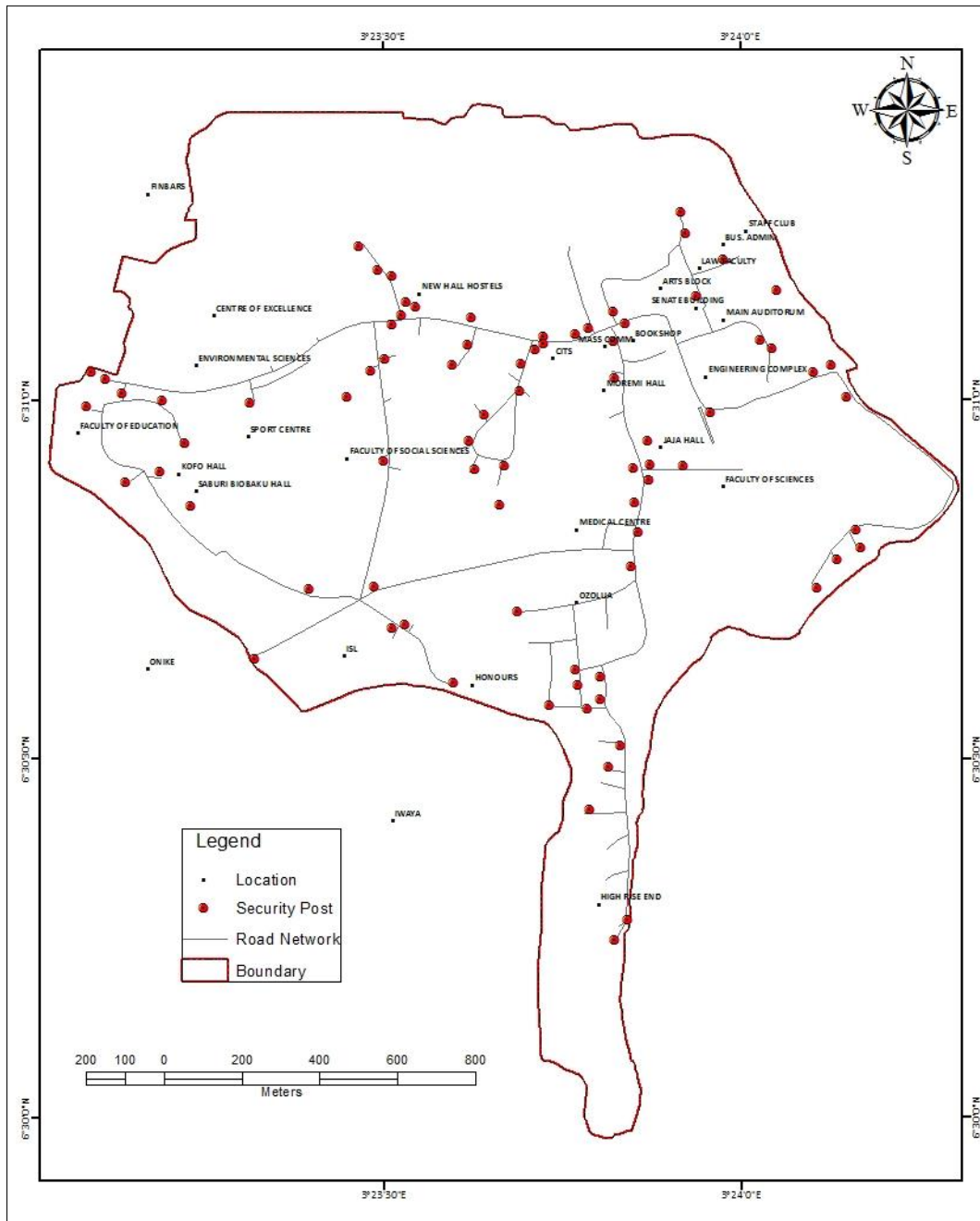
S/N	Parameters	Technique
1	Crime density	Point Density Analysis
2	Security post and Crime distribution	Nearest Neighbour Analysis (NNA)
3	Functionality of Security Posts	Checklist

As shown in Table 2, the point density spatial analyst tools in the GIS environment were used to assess the coverage of security posts and density of crime in the study area (the number of crimes per unit area). The point density tool also calculates the magnitude per unit area from point features that falls within a neighbourhood around each cell. The crime hotspots map was generated using the crime point data. The hotspot analysis used the Geostatistical Analyst which include Inverse Distance Weight analysis. The NNA was used to analyse the spatial pattern of crime and security post to depict the areas with agglomeration of crime and security posts.

### Result and Discussion

#### Mapping and Classification of Security Posts in the University of Lagos

This study discovered that there are eighty-one (81) security posts in the University of Lagos, Akoka campus. These security posts are located in different parts of the campus as shown in Figure 3. A typical security post in the study area is shown in Plate 1.



**Figure 3: Location of Security Posts in the University of Lagos**



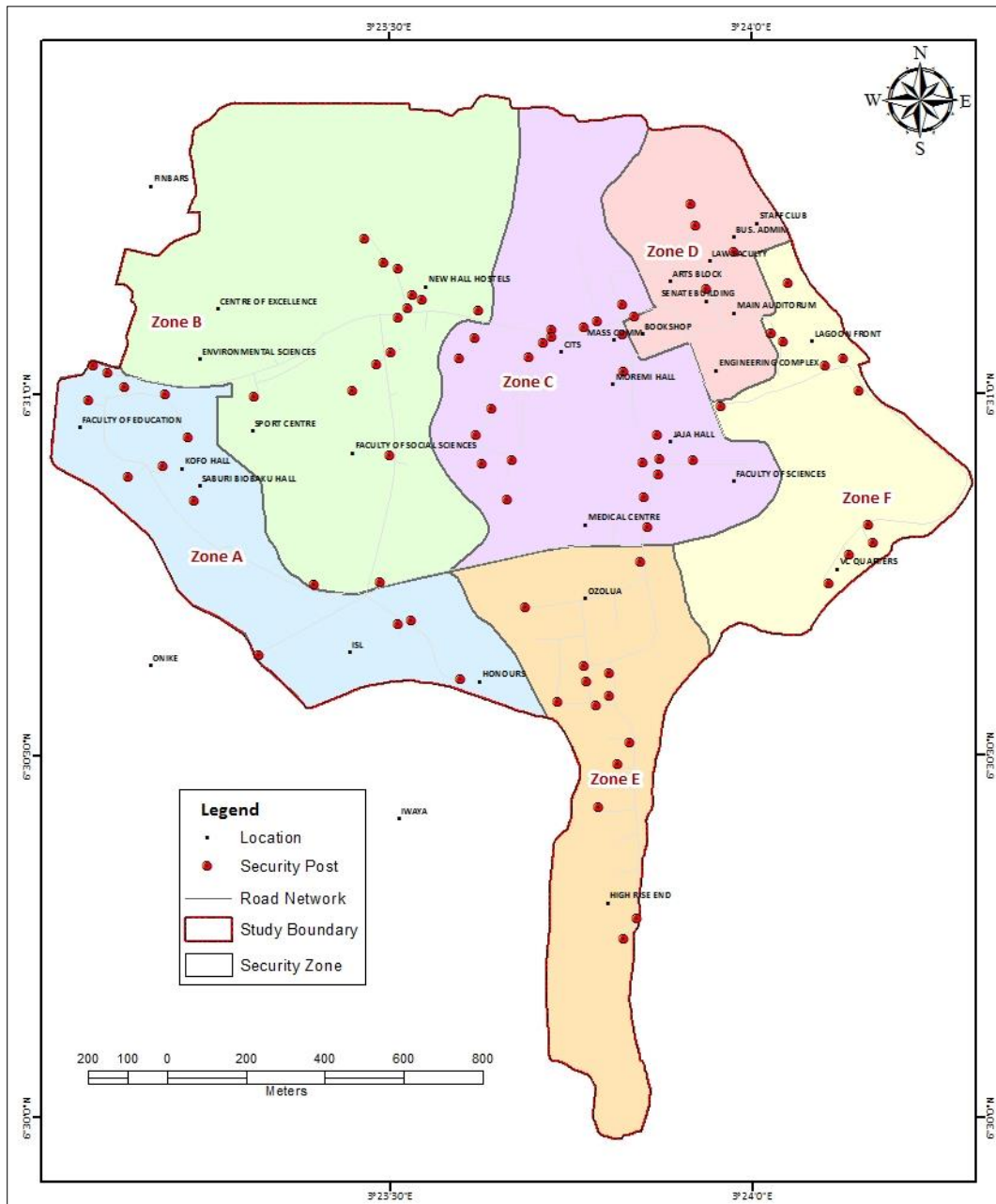
***Plate 1: A Typical Security Post in the University of Lagos***  
***Source: Fieldwork, 2016***

The study also discovered that security posts in the University of Lagos are classified into six zones (A-F) for effective monitoring of the campus (UNILAG Security Unit, 2016). These security zones are defined based on their contiguity rather than on natural boundaries or land uses. The security zones therefore cover varying land uses and areas as shown in Table 3 and Figure 4.



**Table 3: Security Posts and Zones in the University of Lagos**

S/N	Zones	No. of Security Post	Coverage
1	A	14	Main and Second Gate, Faculty of Education, Biobaku Hall (male undergraduate hostel), Queen Amina Hall (female undergraduate hostel), School of Postgraduate Studies, Academy of Science Institute, Kofoworola Hall (female undergraduate hostel), International School, UNILAG Consult, Distant Learning Institute, Honours' Hall (Female undergraduate hostel), Multi-Purpose Hall
2	B	26	Faculty of Environmental Science, Sport Centre, Works and Physical Planning Unit, Ikoli close, New Hall (Male and Female Undergraduate hostels), UNILAG chapel, UNILAG Mosque, Faculty of Social Science, ETC building, Creative Arts building and UNILAG water complex, UBA Garden
3	C	12	Service area, CITS, UNILAG Pharmacy, Eni Njoku close, Moremi hall (Female Undergraduate hostel), Jaja hall (Male Undergraduate hostel), Mariere hall (Male Undergraduate hostel), Faculty of Science complex, UNILAG staff school, Women Society Nursery and Primary School, Medical Centre, UNILAG Laundry Unit, Nana close, Idris Aloma close, Emotan close, Masaba close, Hydraulic Research unit and Jumbo close.
4	D	5	Senate Building, Faculty of Arts, Faculty of Engineering, Faculty of Business Administration, UNILAG Guest House, Main Library, Faculty of Law, HRDC, Cash Office, Students' Affairs Unit, Bookshop, Student Records, Examination Office, Admission Office, UNILAG Radio and Information Unit.
5	E	14	Ozolua road, AlvanIkoku road, Jibowu Close, Oritshejolomi Thomas crescent, High rise, College of Medicine quarters, Registrar's lodge, DVC (m/s) residence and Librarian lodge.
6	F	10	Oduduwa lodge, UNILAG lagoon front, Julius Berger hall, Art gallery, Botanical garden, Pie base and Energy center



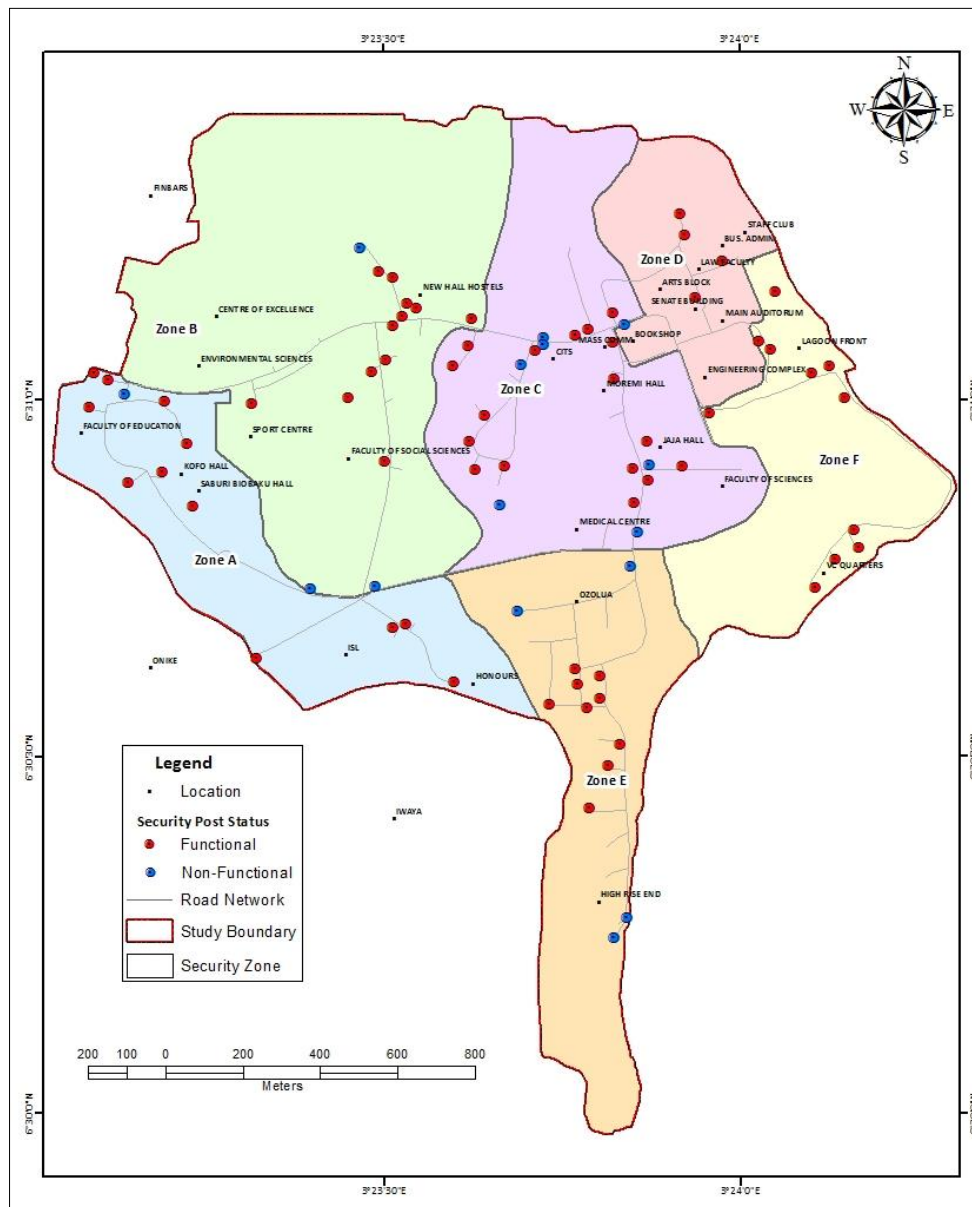
**Figure 4: Zonal distribution of security posts in the University of Lagos**

The security posts in the University of Lagos were further classified based on their functionality where it was revealed that out of the eighty-one security posts, sixty-six (66) security posts are functional while fifteen (15) security posts are non-functional (Table 4 and Figure 5).

**Table 4: The Functionality of Security Posts Per Zone in the University of Lagos**

S/N	Security Post	Functional	Non-functional	Total
1	Zone A	12	2	14
2	Zone B	11	1	12
3	Zone C	19	7	26
4	Zone D	5	0	5
5	Zone E	9	5	14
6	Zone F	10	0	10
	TOTAL	66	15	81

**Source: Fieldwork, 2016**



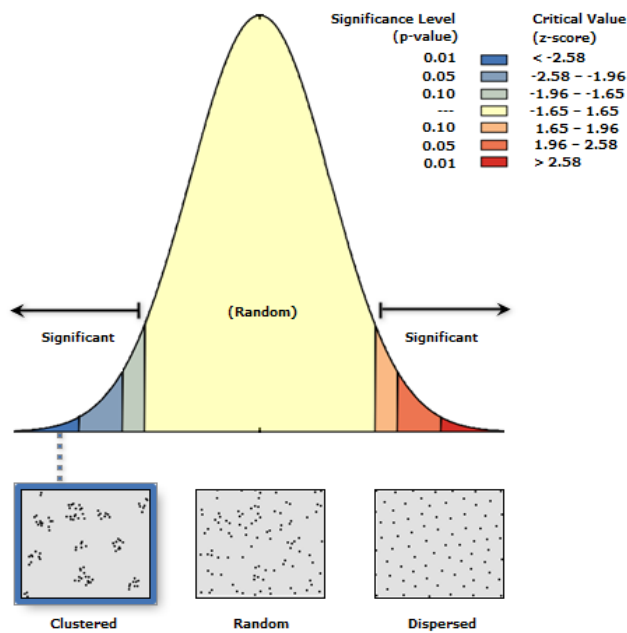
**Figure 5: Functionality of Security Posts in the University of Lagos**

The result of the Nearest Neighbour Analysis revealed that the distribution of security posts within the campus are tending towards clustering (0.757070) as shown in Table 5 and Figure 6. This indicates that most of the security posts are close to the same point.

**Table 5: Distribution Pattern of security posts**

Observed Mean Distance:	87.5987 Meters
Expected Mean Distance:	115.7074 Meters
Nearest Neighbour Ratio:	0.757070
z-score:	-4.182674
p-value:	0.000029

Given the z-score of -4.18267424537, there is less than 1% likelihood that this clustered pattern could be the result of random chance.



**Figure 6: Distribution Pattern of security posts using nearest neighbour analysis**

**Spatial and Temporal Patterns of Crime within the University of Lagos**

In terms of the spatial patterns of crime within the University of Lagos, the study revealed that a total of 2,012 crimes were reported to have occurred from year 2012-2015 (Table 6). These crimes which were categorized into eighteen (18) groups are scattered across the campus over the 4-year period (Fig 7). As shown in the Table, Zone B (which covers Faculty of Environmental Science, Sports Centre, New Hall, Faculty of Social Science, ETC building, Creative Arts

building among others) has the highest number of reported crime (601). This is followed by Zone A (which covers Main and Second Gate, Faculty of Education, Biobaku Hall, Queen Amina Hall, School of Postgraduate Studies, Kofoworola Hall and International School among others) with 468 reported crimes. However, Zone F (which covers Oduduwa Lodge, UNILAG lagoon front, Julius Berger Hall, Art gallery and Botanical garden among others) has the lowest number of reported crime (47).

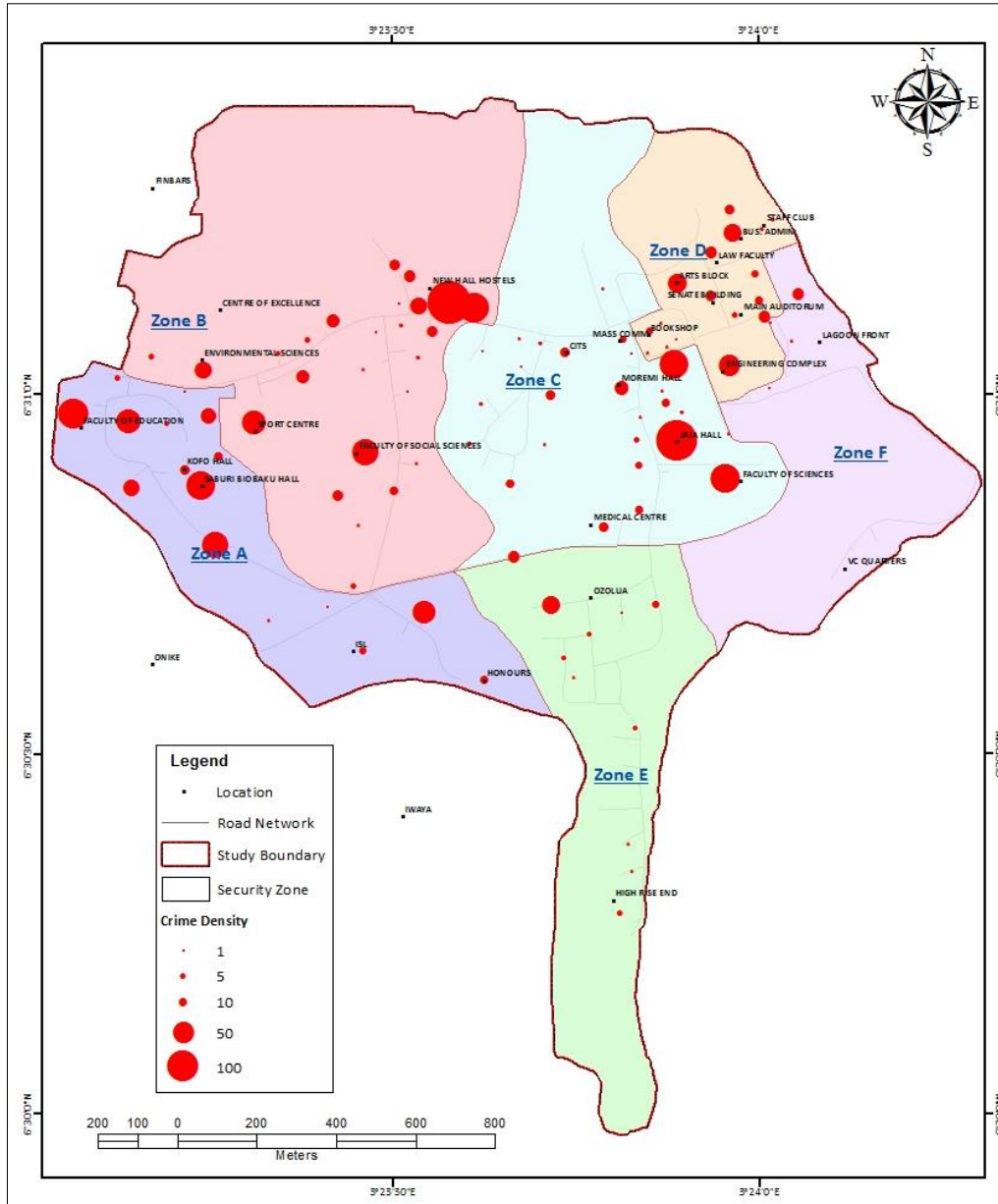
**Table 6: The Spatial Pattern of Crime within the University of Lagos from 2012-2015**

S/N	Crime	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Total
1	Abduction	1	0	0	1	0	0	2
2	Affray	3	5	6	1	0	0	15
3	Armed Robbery	4	4	0	0	0	0	8
4	Assault	68	63	43	29	42	3	248
5	Attempted Murder	2	4	3	0	0	1	10
6	Attempted Rape	1	1	1	2	1	0	6
7	Battery	7	2	6	5	1	0	21
8	Breach of Peace	39	41	25	14	22	1	142
9	Burglary	35	64	52	27	26	1	205
10	Car Theft	7	7	9	2	4	0	29
11	Forgery	0	0	1	0	0	0	1
12	Fraud	18	7	13	8	5	0	51
13	Impersonation/ Examination Malpractice	24	23	37	29	0	0	113
14	Larceny	231	343	219	133	79	20	1025
15	Murder	4	3	1	0	0	0	8
16	Possession of Weed	15	16	14	8	13	17	83
17	Rape	2	3	0	0	5	0	10
18	Robbery	7	15	3	2	4	4	35
	Total	468	601	433	261	202	47	2012

**Source: UNILAG Security Unit; Fieldwork, 2016**

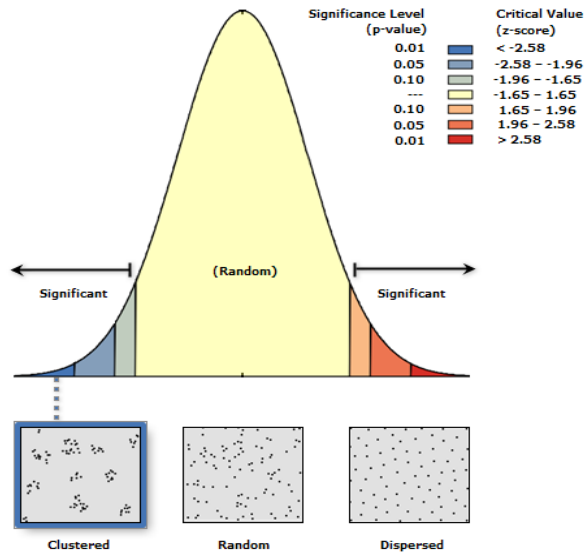
It was also revealed that while larceny (1,025) is the highest reported crime type in all the security zones of the University, forgery (1) and abduction (2) are the lowest.

Figure 7 shows the spatial distribution and density of crime across the University. As shown, Zone B has the highest crime density followed by Zone A and C respectively.



**Figure 7: Crime Density in the University of Lagos from 2012-2015**

The spatial pattern of crime within the University of Lagos was also analysed using the Nearest Neighbour Analysis as shown Figure 8 and Table 7.



**Figure 8: Spatial Pattern of Crime using Nearest Neighbour Analysis**

**Table 7: Spatial Pattern of Crime in the University of Lagos**

Observed Mean Distance:	71.7253 Meters
Expected Mean Distance:	85.9029 Meters
Nearest Neighbor Ratio:	0.834958
z-score:	-3.641256
p-value:	0.000271

Given the z-score of -3.64125643921, there is less than 1% likelihood that this clustered pattern could be the result of random chance.

The result in Figure 8 shows that the crime pattern in the University of Lagos is tending towards clustering. Using the classification of the University of Lagos into security zones, it was discovered that most of the zones had a clustered crime pattern (Zone A, Zone B, Zone C and Zone D are shown to have a clustered crime pattern) while Zone E and zone F have a random crime pattern. This means that the distribution of crime within the University gather around the same point.



With regards to the temporal pattern of crime within the University, the study revealed that 2015 has the highest number of reported crime (700) while 2013 has the lowest (358). This is shown in Table 8.

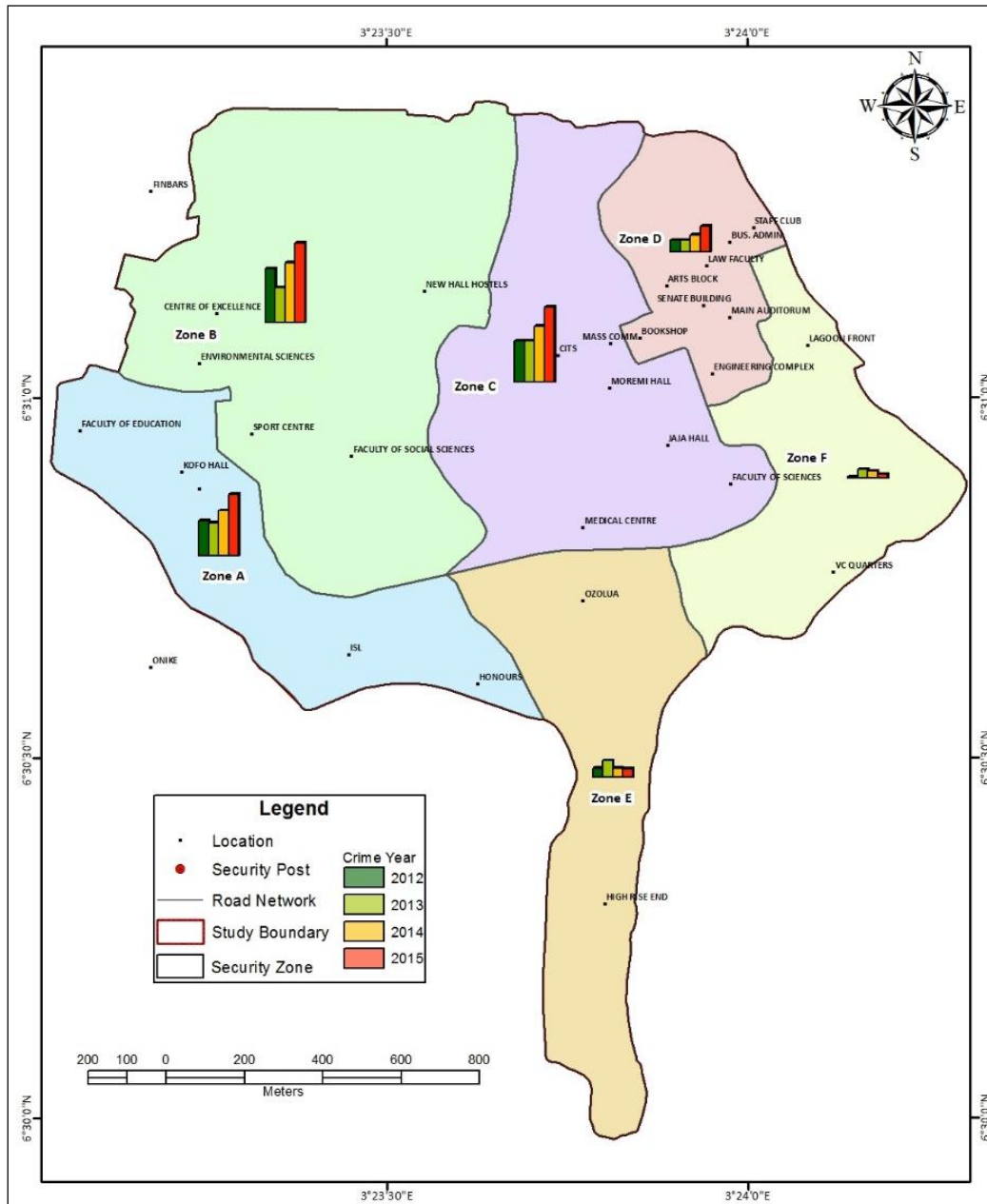
**Table 8: Temporal Pattern of Crime within the University of Lagos**

S/N	Crime	2012	2013	2014	2015	TOTAL
1	Abduction	1	1	0	0	2
2	Affray	6	2	5	2	15
3	Armed Robbery	0	7	0	1	8
4	Assault	45	43	66	94	248
5	Attempted Murder	3	1	3	3	10
6	Attempted Rape	1	2	0	3	6
7	Battery	4	9	8	0	21
8	Breach of Peace	11	19	32	80	142
9	Burglary	48	20	48	89	205
10	Car Theft	16	4	1	8	29
11	Forgery	1	0	0	0	1
12	Fraud	9	17	17	8	51
13	Impersonation/Examination Malpractice	30	19	27	37	113
14	Larceny	220	183	283	339	1025
15	Murder	3	2	2	1	8
16	Possession of Weed	4	17	32	30	83
17	Rape	4	2	2	2	10
18	Robbery	15	10	7	3	35
	Total	421	358	533	700	2,012

**Source: UNILAG Security Unit; Fieldwork, 2016**

The temporal pattern as revealed depicts an annual increase (apart from the decline in 2013) in the number of reported crimes in the University. The temporal pattern of the reported crimes in the six (6) security zones of the University is shown in Figure 9.

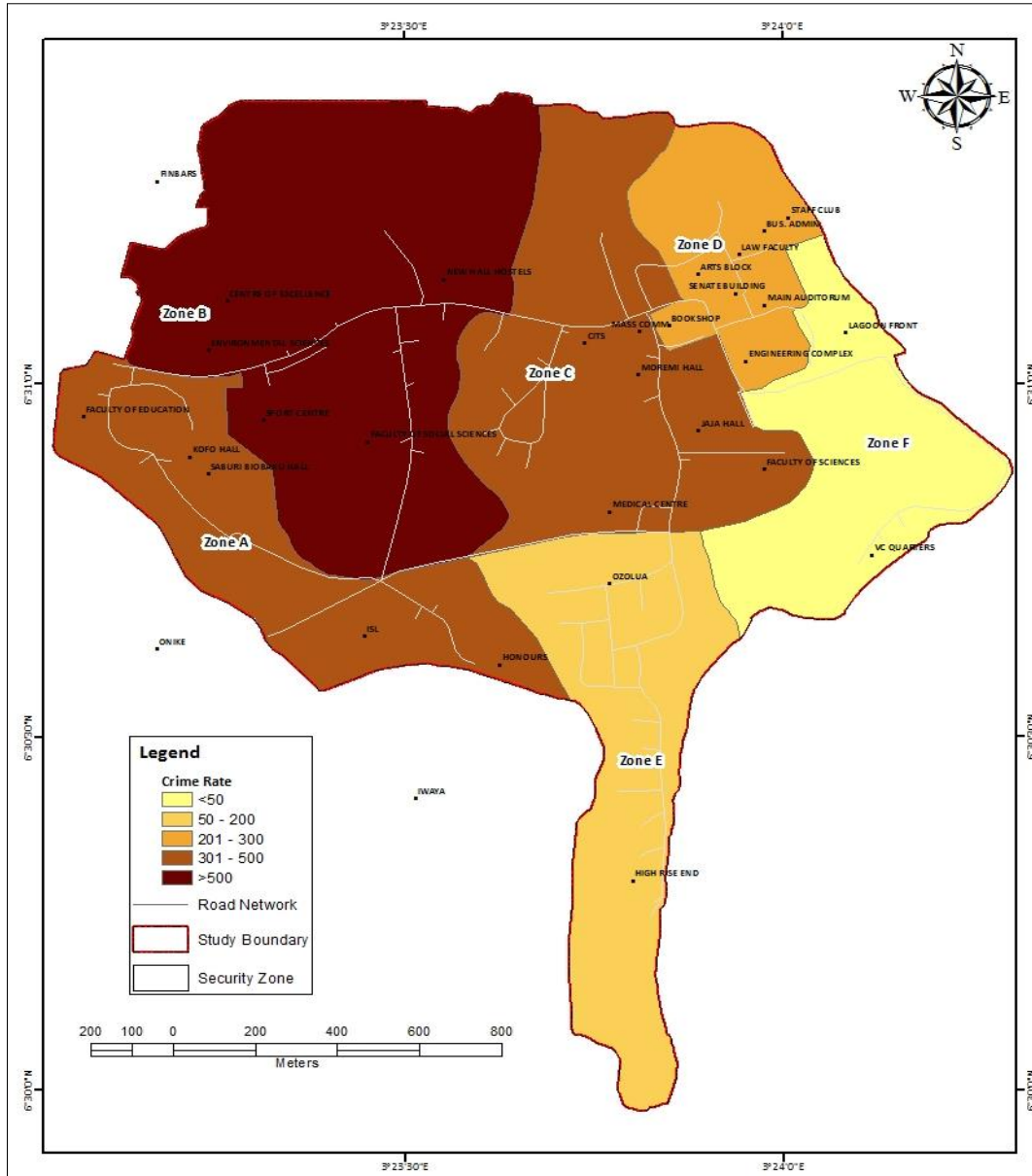
As shown in Figure 9, year 2015 has the highest number of reported crimes in Zones A, B, C and D while 2013 is the year with the highest number of reported crimes in Zone E and F.



**Figure 9: Temporal Pattern of crime in the University of Lagos 2012-2015**

The classification of the six (6) security zones of the University based on crime rates revealed that Zone B (with crime rate of >500 annually) has the highest

crime rate in the University and can be regarded as a crime hotspot. This zone is followed by zones A and C (with crime rate of 300-500 annually). Zone F with crime rate of <50 has the lowest annual crime rate in the University (Figure 10).



**Figure 10: Crime Rate for each zone in the University of Lagos from 2012-2015**

**Factors Responsible for the Observed Pattern of Crime within the University of Lagos**

Investigation of the factors responsible for the observed pattern are discussed based on the geographic characteristics of the security zones and the numbers of crime reported in each (Table 9).

**Table 9: Functionality of security posts and the numbers of reported crime from 2012-2015**

S/N	Zones	Coverage	Functional Security Post	Non-functional Security Post	Total Crime Reported
1	Zone A	Main and Second Gate, Faculty of Education, Biobaku Hall, Queen Amina Hall and Kofoworola Hall among others	12	2	468
2	Zone B	Faculty of Environmental Science, Sport Centre, Works and Physical Planning Unit, New Hall, Faculty of Social Science, Creative Arts building and UBA Garden among others	11	1	601
3	Zone C	CITS, UNILAG Pharmacy, Eni Njoku close, Moremi hall, Jaja hall, Mariere hall, Faculty of Science complex, UNILAG staff school, Women Society Nursery and Primary School, Medical Centre, Masaba close, Hydraulic Research unit among others	19	7	433
4	Zone D	Senate Building, Faculty of Arts, Faculty of Engineering, Faculty of Business Administration, UNILAG Guest House, Main Library, and Faculty of Law among others.	5	0	261
5	Zone E	Ozolua road, Alvanlloku road, Jibowu Close, High rise, Registrar's lodge, DVC residence and Librarian lodge among others	9	5	202
6	Zone F	Oduduwa lodge, UNILAG lagoon front, Julius Berger hall, Art gallery, Botanical garden and Energy center among others	10	0	47
	Total		66	15	2012

**Source: UNILAG Security Unit; Fieldwork, 2016**

As shown in Table 9, geography has a major influence on crime in the study area. Specifically, the characteristics of the zones make it easier or more difficult for crime to occur. In zone A where four hundred and sixty-eight (468) crime cases were reported between 2012-2015, the observed crime pattern may be attributed to fact that this zone is close to the first and second gate of the University which makes it susceptible to criminals from the adjoining communities. This zones also have four (4) undergraduate hostels with high student population. The observed crime pattern can thus be likened to the zone's proximity to adjoining community and its high human population.

Zone B with the highest number of reported crimes (601) in the University covers the most populous and busiest part of the University (New hall) with five (5) undergraduate hostels. Although there are twelve (12) security posts out of which one (1) is non-functional, the pattern of crime in this zone can be attributed to the fact that there are few security posts compared to the land area and peculiar population it accommodates.

Although Zone C has more security zones than any other zone in the University, the four hundred and thirty-three (433) crimes reported can be attributed to the fact that it has three (3) Undergraduate hostels and the highest number of non-functional security posts. Specifically, it has twenty-six (26) security posts out of which seven (7) are non-functional. Most of the security posts in this zone cover both staff and student residential area not considering the roads.

The two hundred and sixty-one (261) crimes reported to have occurred in Zone D can be attributed to the fact that it is bounded by the lagoon and wetland which provides access to criminals from the adjoining communities. In addition, there are few security posts compared to the land area in which this zone covers even though the five (5) security posts in the zone are all functional.

The two hundred and two (202) crime cases reported in Zone E can be attributed to the fact that the security posts are clustered and also because it is bounded by the lagoon which creates entry and escape routes for criminals. The crime rate in this zone can also be attributed to the inadequate number of security posts (fourteen (14) Security posts of which five (5) are non-functional).

Zone F has the lowest number of crimes recorded in the University. The low number of reported crimes in zone F can be attributed to the fact that it is isolated with minimal human traffic.

### **Conclusion and Recommendation**

The study has revealed that crimes are committed at particular locations on the earth surface with every location on the earth surface having characteristics which may or may not provide opportunities and favourable setting for criminal activities. It has diagrammatically shown that there are six security zones and 81 security posts in the University of Lagos with their spatial distribution tending towards clustering. It has also revealed that a total of 2,012 crimes were reported with larceny being the most common; and Zone B with highest number of reported crimes. In addition, it revealed 2015 as the year with the highest number of reported crimes.

Based on the findings of the study, it is recommended that more security posts should be established across the University to improve crime management. It is also recommended that the number of security detail posted to crime hotspots like Zone B and the boundaries of the University (Gate and Lagoon) should be increased.

The study has demonstrated the capability of Geographic Information System (GIS) for crime analysis and management. It has also shown that while criminality is very complex, with its remarkable dynamic nature difficult to model with a simple multivariate statistic method, geography explains its spatial coherence and GIS explores the true possibilities of its spatial analysis. In essence, the use of Geographic Information System (GIS) by security officers in the University of Lagos will aid them in the identification and effective management of crime susceptible zones. It is thus recommended that Geographic Information system (GIS) should be introduced into crime management processes in the institution to checkmate the rising trend of crime.

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