IJSRM
INTERNATIONAL JOURNAL OF SCIENCE AND RESEARCH METHODOLOGY
An Official Publication of Human Journals

Human Journals
**Research Article**
November 2016 Vol.:5, Issue:1


# Land-Use and Crime Relationships in Sub-Sahara Africa: A Spatio-Temporal Assessment Using GIS in Apapa Council Area, Nigeria

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**Submission:** 29 October 2016
**Accepted:** 7 November 2016
**Published:** 25 November 2016



**Keywords:** Land-use, crimes, GIS, Sub-Sahara Africa, Nigeria

**ABSTRACT**

Different land uses are to a large extent associated with different crimes, and some criminal acts tend to be predominant in specific land-sue types than other. This study aimed at evaluating the relationship between land-use and crime rates in Apapa Local Government Area (LGA) in Lagos State, South-Western Nigeria. We hypothesized that crime rates and types differ based on specific land-use types and that the residential areas are more likely prone to crimes compared to other land-use types monitored in the area. Data covering the land-uses, the ten wards of Apapa LGA, crimes and security/police posts were collected for the six years' study. GIS and statistical operations such as GPS, digitizing, image processing, and correlations were used to analyze and present the data. The results revealed that crimes were higher in the residential and commercial centers and these were mainly found in the Northern parts. Stealing, robbery and gambling were found as the most common crime types. Increase in population led to rising in crime, and 2003 recorded the highest occurrence of criminal acts. In as much as well-developed security maps are needed, the police should be equipped with basic kits and information for effective delivery.

## INTRODUCTION

Land-use is referred to the manner in which a specific piece of land, property or district input to use, and it is characterized by the arrangement, activities, and certain land cover which produce or maintain change (FAO/UNEP, 1999). Land can be used for agricultural, industrial, commercial, residential, recreational and other purposes. The features of the physical environment to a high degree either encourage or discourage crimes (Brantingham and Brantingham 2001). In order to ameliorate the crime incidences, the concept termed Crime Prevention Through Environmental Design (CPTED) was established in the early 1970s (Cozens, 2008). Which mandate is to comprehend the relationships between land-use and criminal activities in order to minimize crime (Sohn 2016a; Armitage 2013). Land-use-crime correlations have been of recent concern by researchers in the fields of environment, Land-use planning and design and criminology. Sequel to these broad views and interdisciplinary interests, three theories have been developed namely; the routine activity, the crime pattern theory and the territoriality theory (Sohn, 2016a). The routine activity theory is based on the daily activities including shopping, working, feeding, recreation/sporting by which people involve see offenders and targets in close nearness separately thus, making the crime victimization level differ by activities (Cohen and Felson, 1979). The crime pattern or trend looks at the location in which the offenders often engage in common activities such as sporting, working, shopping, eating and drinking (Brantingham and Brantingham, 1995). This theory postulates that the offenders' migration from place to place develops an awareness space within which the crime acts prevail. According to the view of the crime pattern theory, various land-uses in dissimilar juxtapositions and arrays generate differences in crime spots by differently interfering offenders' choice of crime targets (Kinney *et al*. 2008). On the contrary, the territoriality theory is concerned with residents' boundary of their duty within their premises and the effectiveness of neighborhood socialization (Taylor *et al*. 1984). It is therefore reported by Browning *et al.* (2010) that street activity grows as neighborhoods have more residential and commercial density. Thus, from the opinion of territoriality theory, the combination of commercial and residential land-use types creates gaps in the territoriality rules which consequently heightened the rational for hatred and crime elevation risks.

However, several studies have revealed that land-uses integration can increase crimes and have adverse effect on the people and their neighborhood safety (Wilcox *et al*. 2004; Bowers and Hirschfield, 1999; Taylor and Harrell, 1996). The importance of different or specific land-use types in relation to criminal activities has also been revealed (Cahil and Mulligan, 2003). Most of these studies which focused on the association between land-use and crime are conducted in the developed countries, and there is crucial need to perform such studies in the developing countries where recently there has been proliferation of crimes. In this note, we aimed at evaluating the relationship between land-use and crime rates in Apapa Local Government Area (LGA) in Lagos State, South-Western Nigeria. It is hypothesized that crime rates and types differ based on specific land-use types and that the residential areas are more likely prone to crimes compared to other land-use types monitored in the area. Within this context, we attempt to answer the following questions:

(i) Do crime rates and types differ in relation to different land-use types?
(ii) Which land-use types recorded higher crimes?
(iii) Is there any other socio-economic factor which could be responsible for differences in criminal activities?
(iv) Can a re-adjustment in land-use type influence crime occurrences?

## MATERIALS AND METHODS

### *Study area*

Apapa LGA is one of the newly created LGA in Nigeria with a population of 217,362 persons (NPC, 2006) and with a projected population of 449,702 (RCDL, 2004).Apapa is between latitude $6^0$ 41'N and $6^0$ 48'N and longitude $3^0$ 33'E and $3^0$ 40'E. Apapa LGA is bounded by five LGAs namely: Lagos Island, Lagos (West), Mainland (North West), Surulere (North-East), Ajeromi-Ifelodun (North East) and Amuwo-Odofin (South East). It is made up of ten wards: Alasin/Afolabi ward, Creek/Tin Can Island, Gaskiya, Iganmu, Ijora-Oloye, Liverpool, Marine Beach, Pelewura, Marine, and Sari/Badia ward. The climate of Apapa LGA is similar to that of Lagos and the rest of Southern Nigeria. There are two climatic seasons with heaviest rains falling from April to July and a weaker rainy season in October and November. A brief dry spell in August and September and a longer dry season from December to March. The dry season brings

'hamattan' winds from the Sahara Desert. Mean annual rainfall ranges from 1500mm to 2500mm while the mean annual temperature ranges from $24^0$ C to $28^0$ C with March as the hottest and July coolest months. Apapa-Lagos is Nigeria's leading port. The port of Lagos is divided into three main sections: Lagos port, Apapa port and Tin-Can port, all are located within the Gulf of Guinea. The land-use types included; Commercial area, industrial, Islands, Lagoon, residential, Sandfill, Swamp, and Wharf.

***Data sampling and analysis***

Spatial data which involved the geographical coordinates of the sampling locations and the police security posts (Table 1) were collected using GPS, Aerial photo, topo maps and satellite imageries of the area. The maps were scanned and digitized while the information from the satellite imageries and reconnaissance survey were used to identify and classify the land-use types and crime hotspots (Fig. 1). The data on the land-use were collected from the Lagos State Government Physical Planning Development Authority (LASPPDA), while the land-use map of Apapa and Lagos State map were obtained from the Town Planning Unit in Apapa LGA. The GPS device was issued by the Department of Geography, University of Lagos. The non-spatial data such as population and crime data were collected from the Center for Rural Development, Lagos State Apapa LGA and Nigerian Police Force, Area B Command in Lagos State.

The population and crime data were summed based on wards and year and presented in tables 2 and 3 respectively. The data on the location of the police stations and their 1km buffer distance covering their main functional areas were shown in Table 1 and Fig. 2 respectively. The Spearman rank correlation coefficient was used to determine the association between crime and population and crime and land-use. Furthermore, 300 residents and workers were interviewed on the land-use types, crime rates and types using structured questionnaire. Their responses were analyzed using correlation analysis (Table 4).

**Table 1**: Geo-coordinate locations of police stations in Apapa LGA

| Police station | Latitude | Longitude |
|---|---|---|
| Area B Apapa | $54^0$ 09' 13" | $71^0$ 29' 62" |
| Sari/Badia Headquarters | $55^0$ 19' 66'' | $71^0$ 73' 94" |
| Iganmu Headquarters | $55^0$ 08' 61'' | $71^0$ 73' 93" |

**Table 2:** Population of Apapa LGA and wards 2001-2006

| | Wards | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Alasin/Afolabi | Creek/Tin Can Is. | Gaskiya | Iganmu | Ijora/Oloye | Liverpool | Marine Beach | Pelewura | Marine | Sari/Badia | TOTAL |
| 2001 | 38911 | 35949 | 45217 | 48516 | 43458 | 31085 | 41498 | 34593 | 32839 | 46783 | 398849 |
| 2002 | 40499 | 37416 | 47062 | 50496 | 45232 | 32353 | 43192 | 36005 | 34179 | 48693 | 415127 |
| 2003 | 42152 | 38943 | 48982 | 52558 | 47978 | 33674 | 44955 | 37475 | 35575 | 50680 | 432073 |
| 2004 | 43872 | 40532 | 50982 | 54702 | 48999 | 35048 | 46789 | 39004 | 37026 | 52748 | 449702 |
| 2005 | 45665 | 42186 | 52063 | 56934 | 50999 | 36478 | 48698 | 40596 | 38537 | 54938 | 468091 |
| 2006 | 47526 | 43908 | 55228 | 59258 | 53080 | 37967 | 50686 | 42253 | 40109 | 57141 | 487156 |
| TOTAL | 602915 | 4441622 | 582063 | 1240776 | 1642207 | 1590128 | 11104718 | 111423 | 1541341 | 602538 | 14459731 |

**Table 3**: Crime rates in Apapa wards 2001-2006

| | Wards | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Alasin/Afolabi | Creek/Tin Can Is. | Gaskiya | Iganmu | Ijora-Oloye | Liverpool | Marine Beach | Pelewura | Marine | Sari/Badia | TOTAL |
| 2001 | 7 | 5 | 11 | 14 | 14 | 5 | 7 | 6 | 7 | 16 | 92 |
| 2002 | 9 | 7 | 11 | 15 | 8 | 6 | 9 | 8 | 6 | 8 | 87 |
| 2003 | 7 | 6 | 12 | 17 | 15 | 4 | 8 | 7 | 3 | 25 | 104 |
| 2004 | 8 | 5 | 11 | 16 | 13 | 8 | 10 | 6 | 2 | 9 | 88 |
| 2005 | 6 | 6 | 6 | 15 | 8 | 8 | 10 | 7 | 3 | 12 | 81 |
| 2006 | 4 | 5 | 8 | 9 | 5 | 7 | 7 | 5 | 4 | 12 | 66 |
| TOTAL | 41 | 34 | 59 | 86 | 63 | 38 | 51 | 39 | 25 | 82 | 518 |

## RESULTS AND DISCUSSION

### *Land-use types, wards and crimes*

The number of crime incidences differs based on the land-use and wards. For example, Iganmu ward (86) recorded the highest crime rate followed by Sari/Badia (82) (Table 3).

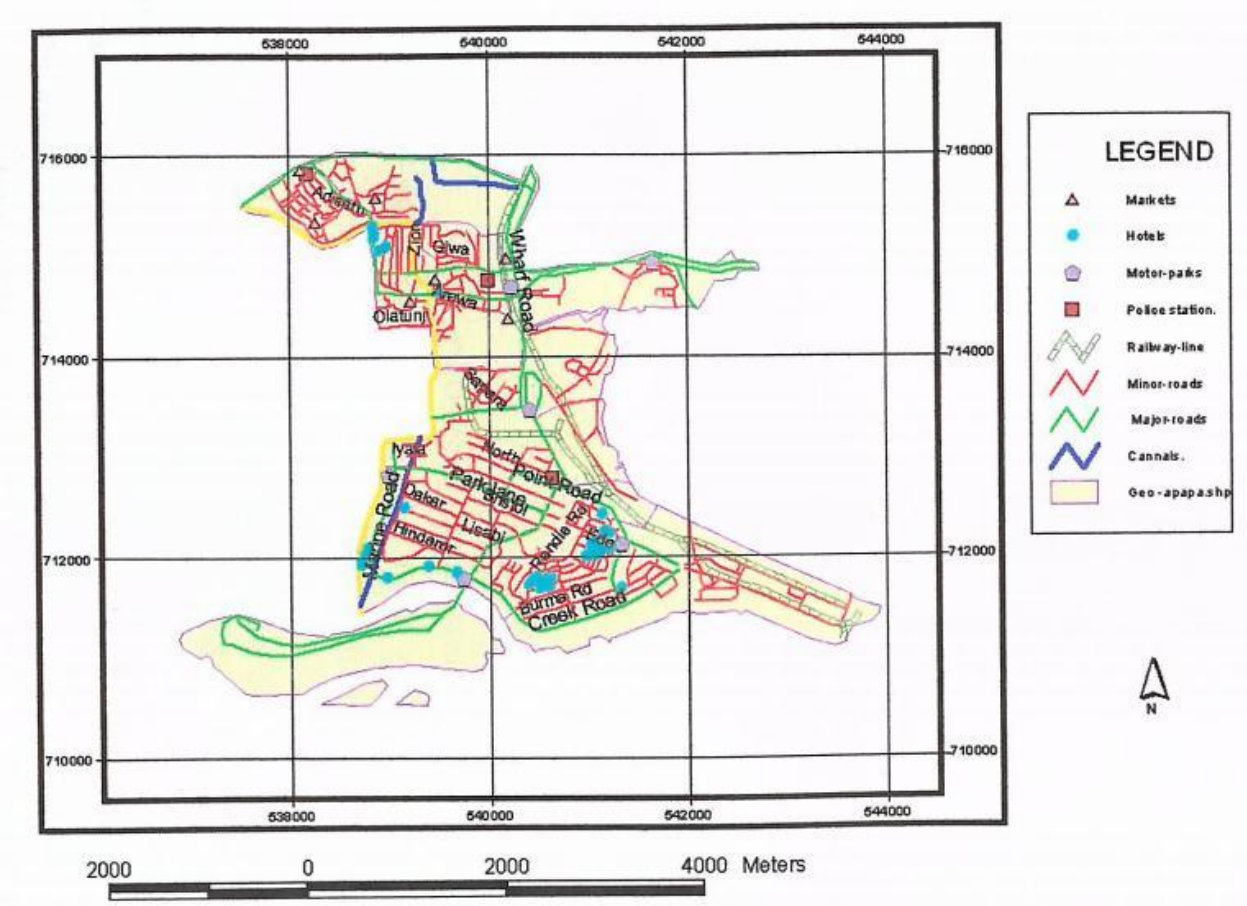


**Fig. 1**: Crime activities hot-spots

Others were Ijora-Oloye (63), Gaskiya (59), Marine Beach (51), Alasin/Afolabi (41), Pelewura (39), Liverpool (38), Creek Tin-Can Island (34) and the lowest was Marine ward (25). The results of the correlation analyses performed between the wards and crime rates based on the residents' opinion and available data revealed that positively significant relationship in all the wards except Pelewura and Marine wards (Table 4). On the other hand, the result further showed that not all the land-use types (Fig. 3) have significant correlation with crimes. For example, Residential ($p < 0.001$; r = 0.93) and commercial centers ($p = 0.002$; r = 0.87) showed relatively high significant (Table 5). Others which were significant were industrial areas, islands and wharf, while sandfill, lagoon, and swamp land-use types were not significant. The higher number of crimes recorded in Iganmu and Sari wards can be explained by the prevailing land-use type which is primarily the integration of residential and commercial centers. Our result was consistent with the findings of previous research which reported that combination of commercial

centers with residential areas can increase the risk of crimes (Wolfe and Pyrooz, 2014; Sohn e*t al.* 2016b).

**Table 4**: Correlation between ward and crimes based on the peoples' view and available data

| Ward | Corr. (r) |
|---|---|
| Alasin/Afolabi | 0.49* |
| Creek/Tin Can Island | 0.84* |
| Gaskiya | 0.65** |
| Iganmu | 0.89*** |
| Ijora-Oloye | 0.7** |
| Liverpool | 0.44* |
| Marine Beach | -0.52* |
| Pelewura | 0.63 |
| Marine | 0.76 |
| Sari/Badia | 0.81*** |

Significant at $p< 0.05$*, $p< 0.01$** and $p< 0.001$***

The negative effects of shopping areas on neighborhood residents' safety have been severally documented (Brantingham and Brantingham, 1995; Wolfe and Pyrooz, 2014) as the influx of people to the shops creates the favorable atmosphere for the offenders to perpetuate their criminal activities (Wilcox *et al.* 2004). In contrast, some other literatures have stated that integrating commercial centers with residential areas helps to reduce the victimization of the neighborhoods (Chang, 2011; Shu, 2009). According to Nee (2015), the offenders need to be hidden places, therefore shopping centers with neighborhoods tend to increase surveillance and decrease residential property burglary. Our result further revealed hoteling as one of the top land-use that increased crime rates. This finding was in line with the study by Shannon *et al.* (2006) who reported that high crimes were documented in holes, especially with single room occupancy.

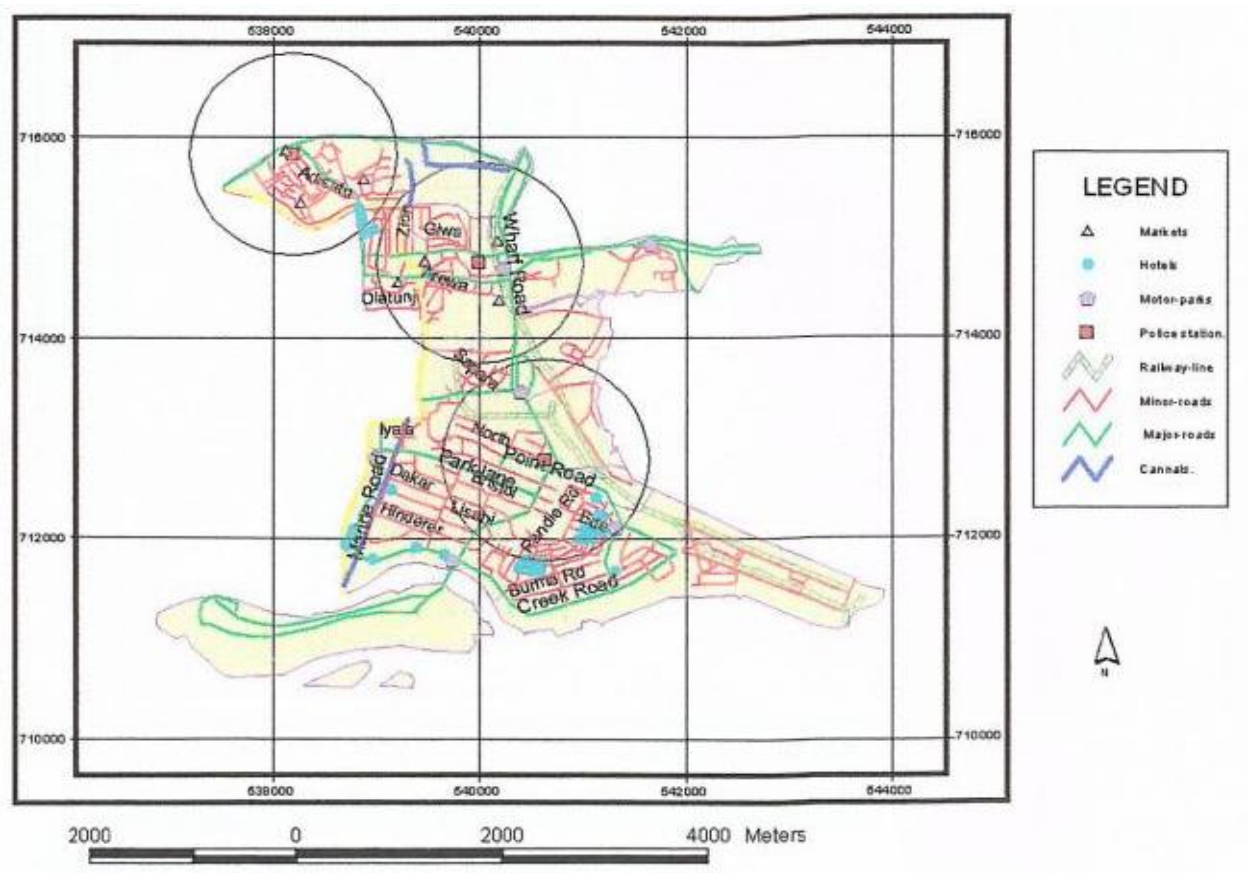


**Fig. 2**: One km buffer of police security stations over crime activities hot-spots

***Motor-parks and crimes***

The public vehicle parks showed high rates of crimes because the activities of the touts who dominated the area were not checked. Besides, there were many hide-outs for the offenders to inhale/consume illegal drugs which aggravate their urge for crimes. According to the British Crime Survey, the highest crime rates in 1991 was at the motor parks. For instance, 22% of the stolen cars and 20% of the thefts from England and Wales and 40% and 39% in Nottinghamshire and Derbyshire respectively occur in public or private car parks (Webb *et al.* 1992). In another study which focused on the touting activities in selected urban motor parks in Ibadan Metropolis, Offiong *et al.* (2015) revealed that touts in the motor-parks involve in several criminal activities such as stealing, raping, robbery, gambling and killing. Several studies have reported the significant relationships between motor-parks and crimes (Aremu, 2010; Ikuoruola *et al.* 2011; Okpara, 2007).

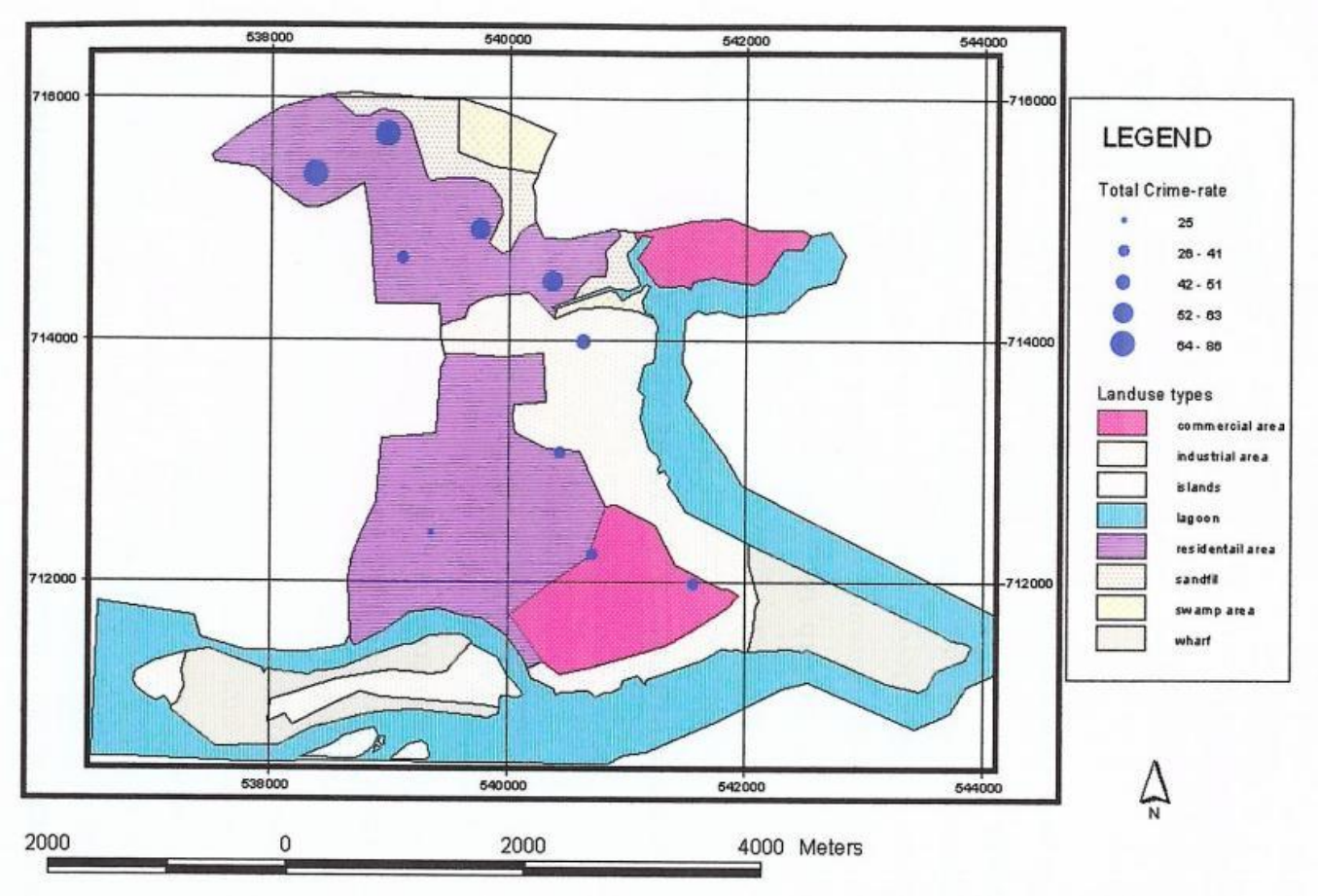


**Fig. 3**: Land-use and total crime rates from 2001-2006

**Table 5**: Relationships between land-use types and crimes

| Land-use type | Corr. (r) |
|---|---|
| Commercial | 0.87** |
| Industrial | 0.71* |
| Islands | 0.06* |
| Lagoon | -0.77 |
| Residential | 0.93*** |
| Sandfill | 0.14 |
| Swamp | -0.58 |
| Wharf | 0.55* |

Significant at $p< 0.05$*, $p< 0.01$** and $p< 0.001$***

### 3.2 *Time, events and crimes*

Annual differences were recorded in the rates of crimes. Year 2003 had the highest crime rate of 104 while year 2006 had the lowest with 66 crimes (Table 4). Others were 2001 (92), 2004 (88), 2002 (87), and 2005 (81). The heightened cases of crimes in 2003 as compared to other periods was probably because of the election period when the political thuggery activities became pronounced (Bauonanno *et al.* 2016). The author revealed the relationship between politics, mafia and crimes in the Italian region of Sicily between 1994-2013. It was stated that crimes were created by the politicians and their agents as to alter the peoples' choices for their own favor (Bauonanno *et al.* 2016).

### *Policing crimes*

The role of the law enforcement agencies such as police in the control of crimes in Apapa is crucial because the area is dominated by high residential and commercial activities. However, there are police stations located in the area but the number seemed to be inadequate to combat the offenders (Torti, 2005). Fighting crime should not be left in the hands of police alone; the people must support the security agents by being vigilant and disseminate vital information if violent is to be minimized (Braga *et al*. 1999). Under equipping has been observed as one of the major challenges of the Nigerian police which militates against full combat of criminals and their acts (Owen, 2014), unlike in the developed countries where police are well supplied with medical kits and insurance as well as provision of arms and detective tools including body cameras.

## CONCLUSION

The residential and commercial land-use has been discovered as the land-use types with the highest crime rates in the study area. Stealing, robbery, and gambling were found as the most common crime types. The higher the number of the people, the more crimes are committed. The use of touts and youths during elections seemed to have increased the rates of crime in 2003 compared to the other years investigated. GIS needs to be given more attention for the production of better maps to enhance crime hot spots identification and reduce crimes. We also

recommend that security maps be improved and released to the police while more police posts are established with better detective gadgets.

## ACKNOWLEDGEMENT

We acknowledged the help of the Nigerian Police-Division B Lagos, The NURTW and The Department of Geography, University of Lagos. The effort of the LASPPDA and the respondents who supplied us with vital information were also appreciated.

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