



## ABSTRACT

Crime is a common phenomenon in all urban cities around the world. This study applied geospatial techniques in analyzing crime in Jalingo Metropolis, Taraba State, Nigeria. The data on crime were obtained from the Taraba State Police Command. ArcGIS version 10.8 and SPSS software were used to analyze the data using Nonlinear Principal Component

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## EOSPATIAL ANALYSIS OF CRIME INCIDENCE IN JALINGO METROPOLIS, TARABA STATE, NIGERIA

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## Introduction

Urbanization has created numerous social problems, among which is crime that is a common phenomenon to all urban areas in both developed and developing nations (Ghani, 2017). Crimes are a common social problem that affects the quality of life and the economy of a society. Crime is an act, default or conduct, prejudicial to the community or the commission which by law renders the person responsible to punishment by a fine, imprisonment or other penalty (Alison, 2015). Crime is considered one of the major forces shaping society and individuals at the cost of substantial public and private resources (Albanese, 2005).

The occurrence of criminal activities in the form of housebreaking, arson/mischief, forgery, armed robbery, rape, fraud, kidnapping, illegal



*Analysis, Kernel Density Estimation (KDE) and Questionnaire survey to show the spatio-temporal analysis of crime and critical factors contributing to crime in the study area. The findings of the study revealed the general crime incidence within the study area with the highest crime incidence occurring in Kona ward with 15.14% while the figure in Turaki-A ward shows low crime incidence rate with 3.57%. The temporal analysis of crime shows that the months August and September witness a very low crime rate, while those with high and very high are April, May and December. The year 2019 recorded the highest crimes with 983 representing about 20.13% of the total crimes recorded as against year 2016 with the lowest with 290 incidences representing 5.93% of the total crimes recorded. The hotspots result shows that Stadium is the most dangerous location in the study area with 17.73% of the crime cases. The study also revealed the major factors contributing to crime rates, with unemployment having the highest coefficient of 0.987 and the lowest is inflation with the coefficient of 0.277. The study, therefore recommends that government and non-governmental organization should create job opportunity for the masses, community policing should be established, more security personnel should be deployed to such areas with high crime incidence and tackle the menace of illicit drug abuse among the teeming youth in the study area.*

**Keywords:** Co-efficient, Crime, Geospatial, Incidence, Spatio-temporal

possession of arms, breach of peace, theft, assaults, homicide, and terrorism/insurgency takes place every time in almost all parts of the globe (Olomo, Ojeh, and Orakwe, 2012). That is, high crime rates are not unique characteristics of developing countries only, but an ordinary characteristic of life all over the globe. There are certain environmental factors that are also contributing to the increased number of crime such as the physical characteristics, proximity to various services and land uses are most likely to influence criminal behaviour and are fundamental to the explanation of criminal activities in a spatial context. The issue of access, exposure, opportunity and the availability of targets are



also important elements in helping to explain crime from an environmental perspective (Ayuba, 2015).

Criminal activity continues to be a major concern in contemporary society. Most nations in the world are faced with unacceptable levels of criminality. In many of the world's most developed countries crime rates recorded by the police are on the increase as against 30 years ago (Fajemirokun, Adewale, Idowu, Oyewusi and Maiyegun, 2006). The International Crime Victim Survey (ICVS) has collected data on 150 countries, spread over the six continents. The findings showed that more than half of urban respondents reported being victimized at least once, regardless of what part of the world they inhabit (Zhuo, Messner, and Zhang, 2008). The social structure influenced by techno-industrial-urban complexes offers a setting conducive to crime so much such that a number of scholars, consider crime largely as an urban phenomenon. However, it does not mean that rural areas are free from crime; it only indicates that urban community is more prone to crime (Galvin, 2002).

Over the years the rate of crime in Nigeria has been on the increase and these crimes are being carried out with more perfection and sophistication. According to Nigeria Police Watch, crimes reported in 2011 and 2015 across major urban cities in Nigeria have shown a significant increase, where property crime accounted for the highest, followed by crime against local acts, persons and lawful authority respectively (Ukwayi, Ojong and Anam, 2017). The resultant tragedy, suffering, colossal loss and distress, occasioned by those inimical visits, have been pervasive and had left an indelible mark on our national psyche and societal tranquility. Crimes weaken the defense of any city. Security is the support that makes all other socio-economic activities attract investors both locally and internationally (Usman, 2009). Certainly, a city with high occurrence of crime cannot advance or develop. Generally, crime is the direct opposite of development and it leaves a negative social and economic consequences (Sylvester, 2001).

In Nigeria, the rate of crime is attributed to the unacceptable high rate of drug abuse, unemployment, poverty, political thuggery and lack of manpower of the various security agencies (Adibe, 2009). Nigeria is



currently caught in the web of insecurity. But the most alarming and terrifying is the present escalation of violent crimes and the trauma the perpetrators unleash on the innocent citizens across the country. Notable in this regard are the rising incidents of insurgency, armed robbery, herdsmen killing, religious crisis, communal clashes, assassination and kidnapping, which are now ravaging the country like a wildfire and spreading fears and anxieties among the general populace (Uche, 2008).

Jalingo has witness its own escalating rate of crime due to increase in population, economic hardships, unemployment, and socio-political condition among others (Oruonye and Basher, 2010). This has made the police authority, to describe the insecurity in Jalingo and some part of Taraba State as deteriorating situation and a threat to the peaceful co-existence enjoyed by the inhabitants of the state (Adaji, 2018).

The applications of Geographic Information System (GIS) in crime mapping and analysis has been successful in many developed countries. Most developed nations have migrated from the “pin on maps” to the use of GIS. Unfortunately, most of the developing nations, including Nigeria, still utilize analogue and outdated file systems. In most cases, police operations are carried out based on intuition, tip-off information and also “trial-and-error” method. However, Ayuba (2015) was of the view that crime is spatially distributed in nature hence the need to use Geographic Information System (GIS) which provides the capability to store, update, retrieve, compare and spatially display data in crime mapping. This necessitated the need to apply GIS in analyzing crime incidence in Jalingo metropolis.

### **THE STUDY AREA**

Jalingo is located from Latitudes  $08^{\circ} 20' 00''$  N to  $08^{\circ} 50' 00''$  N of the Equator and Longitudes  $11^{\circ} 10' 00''$  E to  $11^{\circ} 43' 00''$  E of the Greenwich meridian. It is bounded to the north by Lau L.G.A, Yarro L.G.A to the north-west and east, and Arda-Kola L.G.A to the south as shown in (Figure 1). The location of Jalingo makes it strategic for commercial and agricultural activities of diverse dimensions due to the abundant resources in the area (Taraba State Government, 2014).



The Local Government Area is one of the fastest growing L.G.A in the North East. The concentration of government employment opportunities and infrastructures in the town attracted a lot of people (movement of young and strong labourers in large numbers from rural agricultural villages to the state capital during dry season) from other part of the state to Jalingo. That is, the transfer of rural poverty to urban areas eventually contributes to the emergence of increasing crimes in the city (TRSG, 2014).

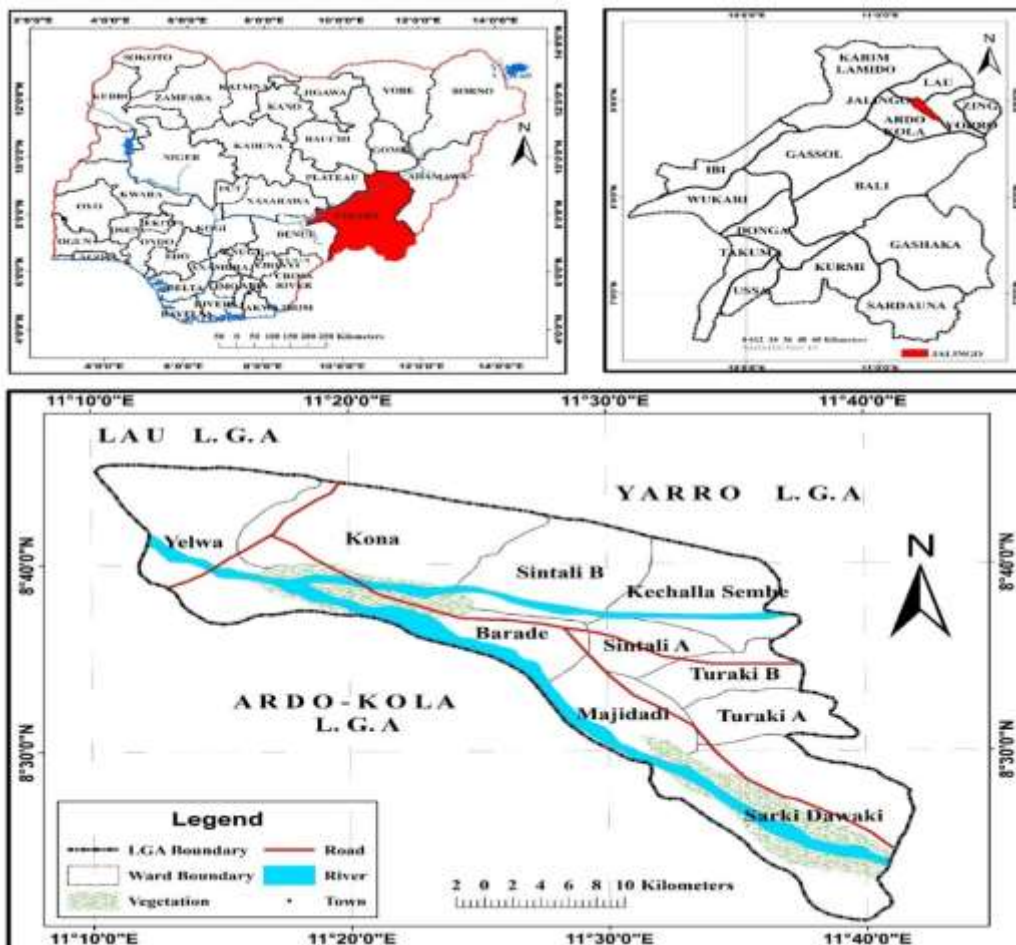


Figure 1: Jalingo Local Government Area  
Source: Adapted from Administrative Map of Taraba State (2021)

## METHODOLOGY

For the conduct of this paper, the following types and sources of data were used as shown on Table 1. The data used for this study originates from various sources. Topographic and Administrative map were gotten



from the Ministry of Land and Urban Planning Taraba State. The geographic coordinates of crime scene were collected from the field using Promark 3 Global Positioning System (GPS) Receiver for mapping of crime scene. Crime statistics from Taraba State Police Command for spatio-temporal analysis and crime hotspots using Nonlinear Principal Component Analysis method called Rotated Complex Kernel Principal Component Analysis (ROCK-PCA) in Statistical Package for Social Sciences (SPSS) and Kernel Density Estimation tool in ArcGIS 10.8. Questionnaire survey was used to identified the critical factors contributing to crime using factor analysis in SPSS.

Table 1: Types and Sources of Data Used

Data Used	Source	Purpose
<b>Administrative Map of Jalingo (Scale:-1:400,000)</b>	Ministry of Land and Urban Planining, Taraba State	Base map for overlay operations
<b>Coordinates of crime Scene/ Crime Records (2011-2020)</b>	Promark 3 GPS Receiver/ Divisional Police stations	Mapping of various crime
<b>Coordinates of Crime Scene</b>	Taraba State Police Command and Divisional Police stations	Spatio-temporal variation of crime and crime hotspots
<b>Socio-economic data and crime characteristics</b>	Questionnaire Survey	Examine the factors that contribute to crime occurrences
<b>Literature materials</b>	Published Journals and Articles.	Literature Review

Source: Author's Compilation, 2021

## RESULTS PRESENTATION AND DISCUSSIONS

This section presents the results of crime data obtained in Jalingo between January 2011 to December 2020. The results were presented using relevant map, chart and table which were analysed and discussed thereafter with a view to satisfy the purposes of the research.

### General Crime Incidence in Jalingo Metropolis

The general crime incidence in Jalingo metropolis shows the total crime incidence in each ward that comprises the metropolis. Table 2 shows the general crime incidence within Jalingo metropolis. A close look at the figure revealed that crime incidence is highest in Kona ward with 15.14%, then followed by Sarki Dawaki and Barade wards with 14.43% and 14.17% respectively.



Table 2: General Crime Incidence in Jalingo Metropolis

S/N	Name of Wards	No. of Cases	%
1	Barade	594	14.17
2	Mayo Gwoi	380	9.06
3	Sintali	250	5.96
4	Turaki A	150	3.57
5	Turaki B	225	5.36
6	Maji Dadi	352	8.44
7	Kachella Sembe	450	10.73
8	Sarkin Dawaki	605	14.43
9	Yelwa	550	13.14
10	Kona	634	15.14
	<b>Total 10</b>	<b>4190</b>	<b>100</b>

Source: Author's Field Work, 2021

The high crime incidence in Kona, Sarkin Dawaki and Barade ward is as result of presence of commercial activities around these areas as well as pocket of alcoholic drink joints such as bars and hotels. While the figure in Turaki A and Turaki B ward shows low crime incidence rate with a percentage of 3.57% and 5.36% respectively. Figure 2 shows the general crime types and incidence in Jalingo metropolis.

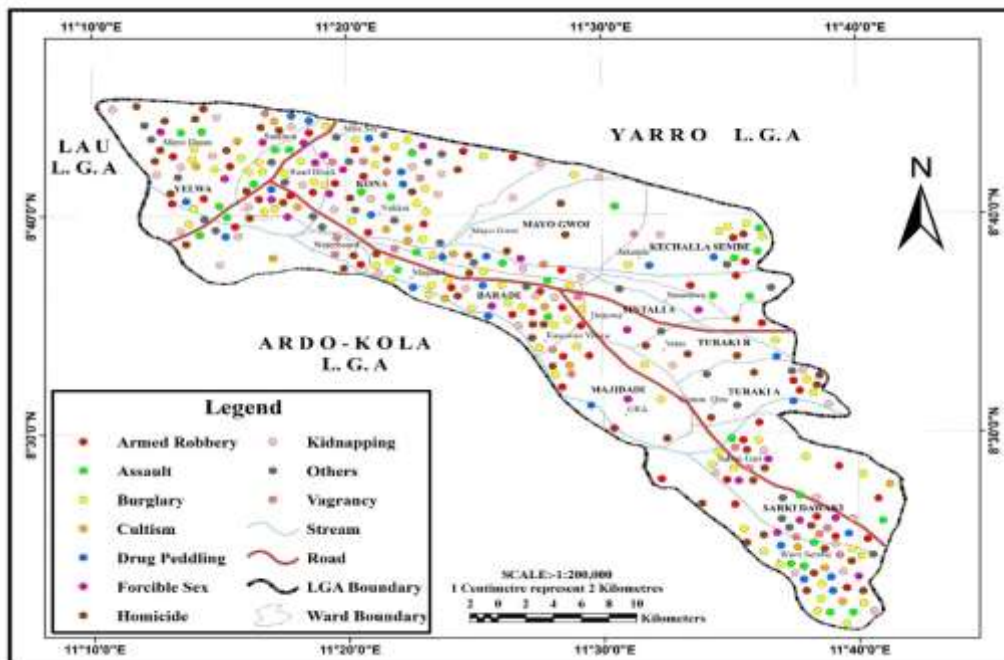


Figure 2: General Crime Incidence in Jalingo metropolis.

Source: Author's Field Work, 2021



### Temporal Variation of Crime in Jalingo Metropolis

The data on crime rates in Jalingo metropolis was used to further examine the temporal pattern of crime using Nonlinear Principal Component Analysis method called Rotated Complex Kernel Principal Component Analysis (ROCK-PCA) which is used for both space and time features. This was done to know the number of principal components to be retained on the twelve (12) variables representing monthly crime records. To this end, five (5) principal components have been retained and the variables for each component were identified based on which component they have the highest loading. The five (5) components 1 – 5 were labelled ‘Very low’, ‘Low’, ‘Moderate’, ‘High’ and Very high’ respectively as shown in Table 3. It should be noted that the months of the year that were grouped under very low crime rates are August and September, while those of high and very high are April, May and December. This is a confirmation of earlier assertion by Ayuba (2015) that crimes are more perpetrated mostly during months that are associated with festivities.

Table 3: Monthly Rating of Crime in Jalingo Metropolis

<b>Rotated Complex Kernel Principal Component Analysis<sup>a</sup></b>				
Components				
1	2	3	4	5
<b>Very Low</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Very High</b>
August	January	March	April	December
September	February	November	May	
	June			
	July			
	October			
Extraction Method: Rotated Complex Kernel Principal Component Analysis				

Source: Author’s Field Work, 2021

The distribution of crime occurrences in Jalingo metropolis over a period of 10 years was also analysed and the result presents a trend indicating a general direction to which the rate of crime tends to move. The year 2019





recorded the highest crimes with 983 representing about 20.13% of the total crimes recorded as against year 2016 with the lowest that had 290 incidences representing 5.93% of the total crimes recorded. Generally, there had been steady rise and fall in crime occurrences from 2011 to 2020 with spikes in some years as shown on Figure 3. The spikes occurred in the following years: 2011, 2015 and 2019. There was a regular interval of four years between these periods which also correspond with the election year. This corroborates the finding of Shittu (2017) which state that election year always witnessed an increase in crime occurrences.

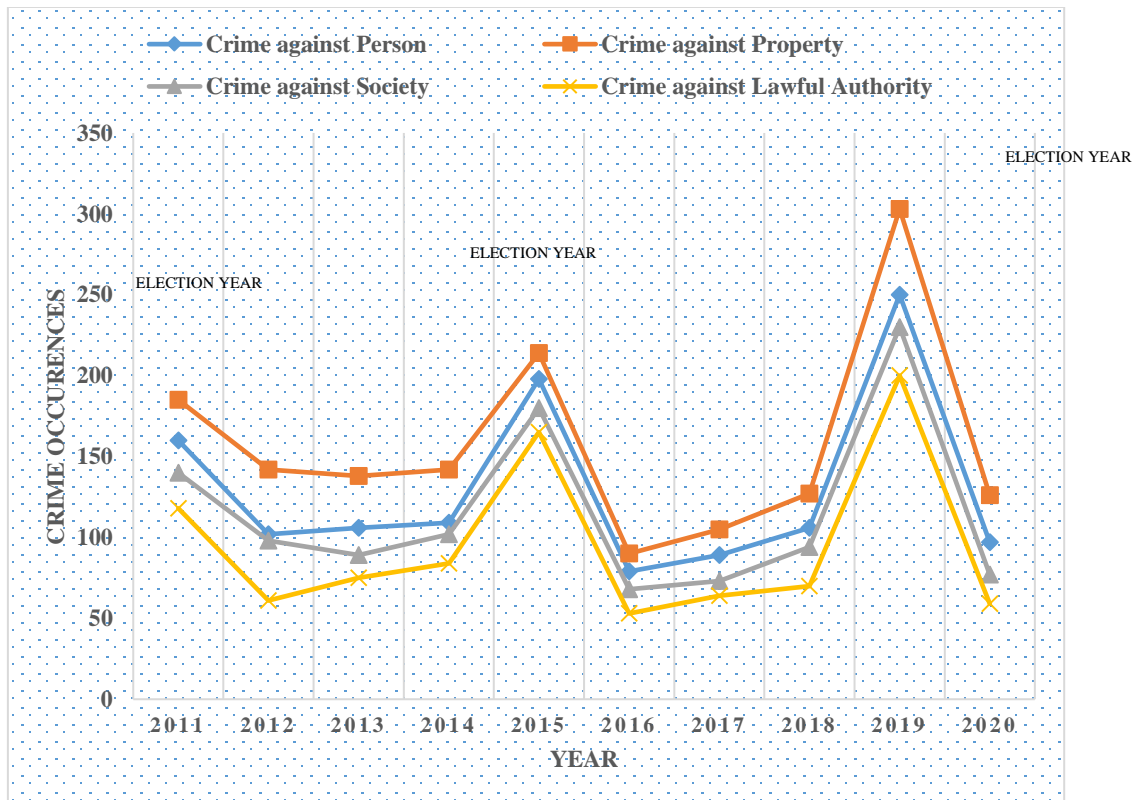


Figure 3: Temporal Variation of Crime in Jalingo Metropolis

Source: Author's Field Work, 2021

### Crime Hotspots in Jalingo Metropolis

The hotspots analysis was carried out for the study to show the sections of the area or location where there is concentration of crime in the study area. Kernel Density Estimation method in ArcGIS 10.8 was used to calculate the density of crime hotspots in Jalingo metropolis as presented in Table 4 and Figure 4.



Table 4: Crime Hotspots in Jalingo Metropolis

S/n	Area	No. of Cases	%	Remarks
1	Mayo Dassa	170	4.06	Moderate
2	Nukkai	229	5.47	Moderate
3	Water Board	610	14.56	Very High
4	G.R.A	177	4.22	Moderate
5	Dorowa	163	3.89	Low
6	Stadium	743	17.73	Very High
7	Magami	222	5.29	Moderate
8	Mile Six	632	15.08	Very High
9	Comm. Qtrs	224	5.34	Moderate
10	Wuro Sembe	378	9.02	High
11	Nassarawo	98	2.33	Low
12	Jakanda	75	1.79	Very Low
13	Mayo Gwoi	53	1.28	Very Low
14	Vetto	83	1.98	Very Low
15	Sabon Gari	95	2.28	Low
16	Kasuwan Yelwa	238	5.68	Moderate
	<b>Total</b>	<b>4190</b>	<b>100</b>	

Source: Author's Field Work, 2021

The result shows that Stadium is the most dangerous location in the study area with 17.73% of the crime cases followed by Mile six with 15.08% and Water Board with 14.56% respectively which is as a result of high number of exist routes (minimal chances of being caught) and easy accessed to their victims due to high level of economic activities around the area. Figure 4.4 shows four (4) locations (Mile Six, Stadium, Waterboard and Wuro Sembe) with more crime occurrences, which is an indication of high prevalence of crime and can be regarded as hotspots. The four (4) locations are indicated with red colour and are covering the three major wards (Kona, Barade and Wuro Sembe) with high crime rate. The finding of this study contradict with the findings of Daukere, Yelwa, Akpu and Ajani (2020) in Bayelsa West Senatorial District, Bayelsa State, Nigeria where it was stated that crime is mostly concentrated in poor and unplanned neighbourhoods.

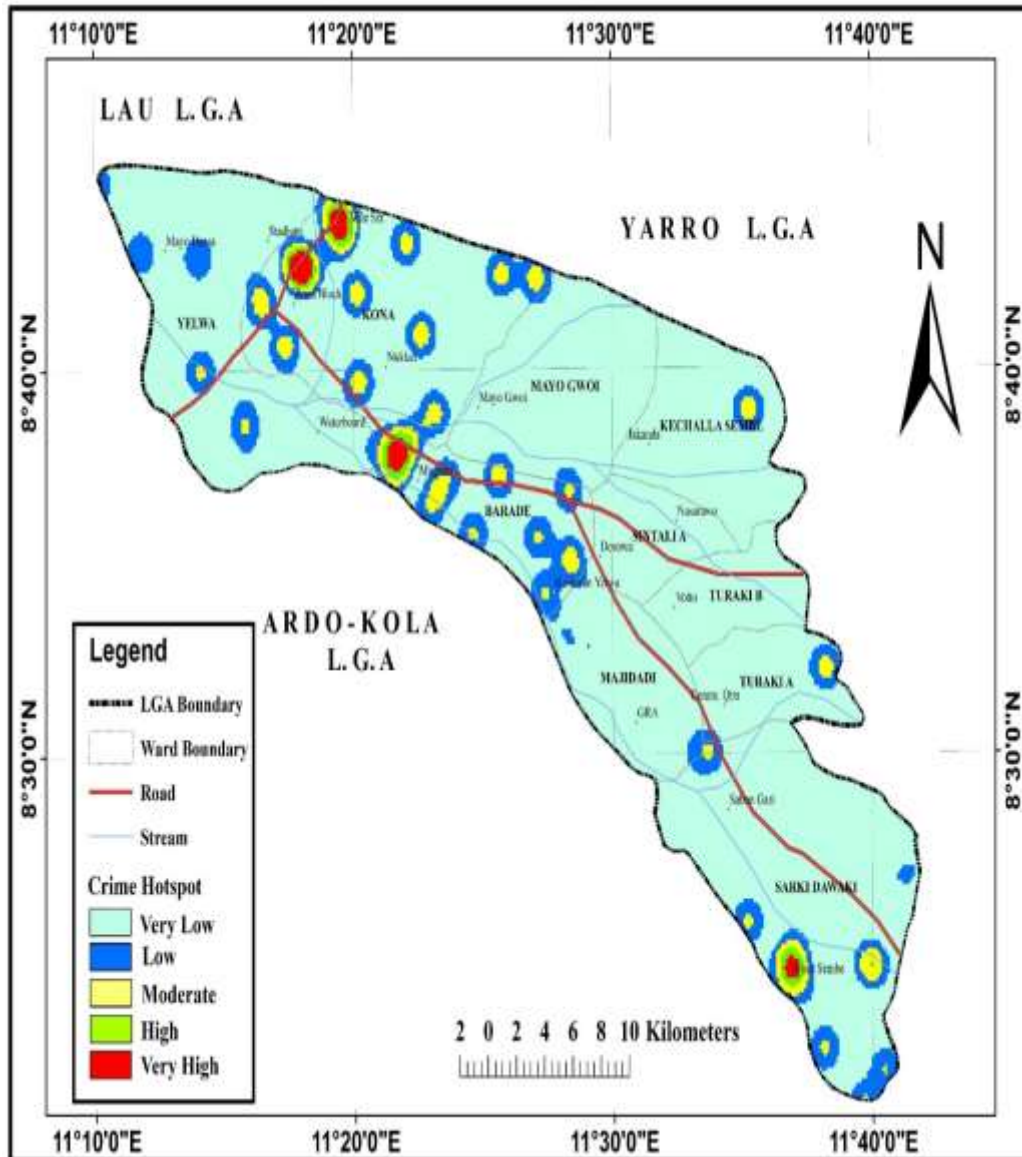


Figure 4: Crime Hotspots in Jalingo Metropolis  
Source: Author's Field Work, 2021

### Factors Contributing to Crimes in Jalingo Metropolis

In view of this situation, it is appropriate to identify the major causes of crimes in Jalingo metropolis, particularly those that border around the locations of crimes. To do this, the result obtained were based on respondents' view regarding causes of crimes in their own locality. Their responses are as varied as shown in Figure 5. The figure displays eight (8) different factors that can individually or collectively be responsible for crime occurrence in the study area.

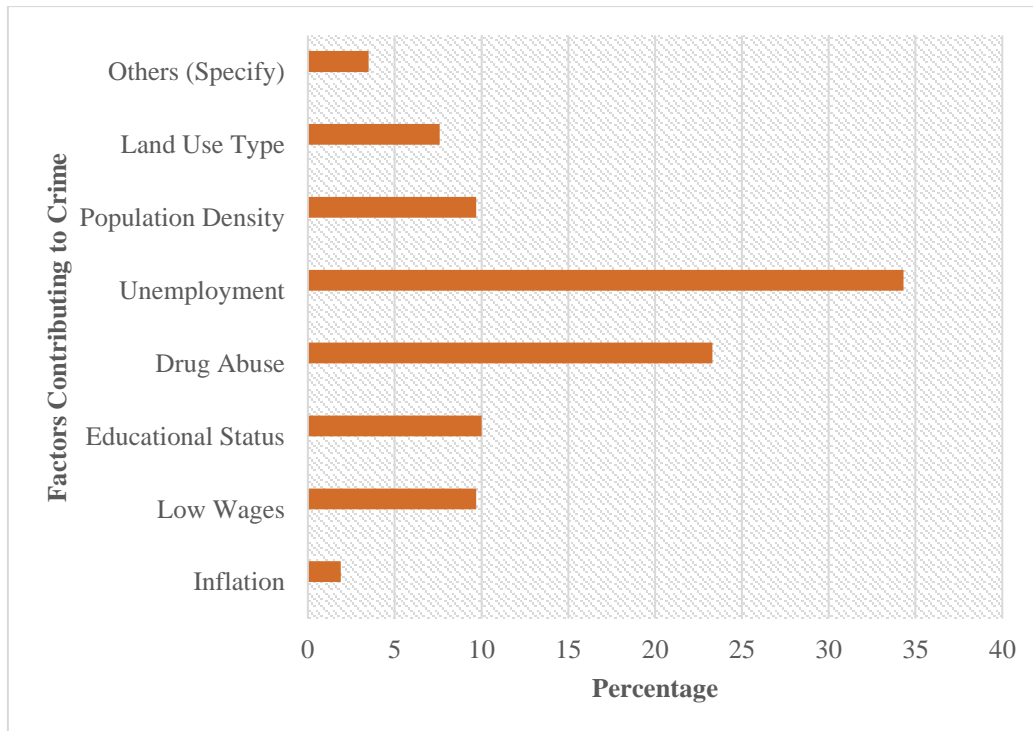


Figure 5: Factors contributing to crime occurrences in Jalingo metropolis  
Source: Author's Field Work, 2021

Out of these factors, 34.3% of the respondents agreed that unemployment, is one of the major factor responsible for crime occurrences in the study area follow by drug abuse with 23.3% of the respondents who opined that drug abuse by the teeming youth is responsible for crimes in their areas. educational status, land use type, population density and low wages account for 10.0%, 7.6%, 9.7% and 9.7% respectively are also attested to as responsible for crimes in Jalingo metropolis. While inflation and others (specify) account for 1.9% and 3.5% respectively. In all of these, unemployment and drug abuse have been identified by residents as the major factors responsible for crime occurrences in the study area. This position is further strengthened by the factor analysis (principal axis factoring) conducted using Statistical Package for Social Sciences (SPSS) on factors responsible for crime occurrences in Jalingo metropolis. In the factor matrix, the first principal axis factors associating and contributing to crime in the study area are Unemployment (0.987), Drug Abuse (0.938) and Educational Status (0.881) which makes them statistically significant. While the second and



third principal axis factors correspond strongly with Low wages (0.860), Population density (0.808), Landuse type (0.840), 'Others' (0.417) and Inflation (0.277) respectively.

However, in identifying the major factors contributing to crime rates from the individual factor, while holding all other variables constant, "Unemployment" with the highest coefficient of 0.987 is contributing to increase in crime rate in the study area. While the least identified factor is "Inflation" with the coefficient of (0.277), which is statistically insignificant based on its contributory co-efficient value to crime as shown in Table 5.

Table 5: Factors Contributing to Crime in Jalingo Metropolis

Factor Matrix <sup>a</sup>	Factor		
	1	2	3
Others (Specify)	.211	-.137	.417
Land Use Type	-.238	.840	.077
Population Density	-.301	.808	-.255
Unemployment	.987	.153	.067
Drug Abuse	.938	.321	.156
Educational Status	.881	-.370	-.094
Low Wages	-.420	.860	.233
Inflation	.139	.066	.277
Extraction Method: Principal Axis Factoring.			
a. Attempted to extract 3 factors. More than 25 iterations required. (Convergence=.003). Extraction was terminated.			

Source: Author's Field Work, 2021

## CONCLUSION AND RECOMMENDATIONS

Crime is not spread evenly across the landscape. It clumps in some areas and is almost absent in others. People use this knowledge in their daily activities. They avoid some places and seek out others. Their choices of neighbourhoods, schools, stores, streets, and recreation are governed partially by the understanding that their chances of being victims are greater in some of these places than in others (Ayuba,



2015). The study has shown how GIS as a tool can be used effectively to analyze crime over space and time for adequate planning in terms of resources and personnel deployment towards combating crime in the study area. The following recommendations were made based on the findings:

1. Government and non-governmental organization should create job opportunity for the masses in order to reduce the level of hardship and poverty in the society.
2. Community policing should be established in the study area in order to improve on intelligence gathering.
3. More security personnel should be deployed to such areas with high crime incidence and high risk areas of crime hotspots should be specially treated.
4. The Government need to tackled the menace of illicit drug abuse among the teeming youth in the study area.
- 5. Crime cases should be recorded alongside geographical coordinate of crime incidence location by the Nigerian police.**
- 6. More security formations should be established within the study area as this will help reduce crime.**

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