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Geoinformatics-Based Crime Mapping in Okpe Local Government.

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ABSTRACT

This study examines the incidence of crimes in the Okpe Local Government Area of Delta State. Data gathering was conducted through research, involving the issuance of structured questionnaires and interviews with individuals and security outfits in the study Area. The results obtained were collated into a database, and crime analysis was conducted using ArcGIS 10.4 Software accordingly. Crime buffering was carried out in the study Area (Adeje and Orerokpe as focal points) using distances of 400m, 800m, and 1200m from points representing the presence of police, to examine the rate of crime to police presence. The study uncovered several types of crimes occurring in the area, including vandalism, assault, fraud, theft, burglary, sexual assault, domestic violence, homicide, drug trafficking, and kidnapping. Among the locations identified as crime hotspots, Adeje, Mereje, and Orerokpe stood out due to frequent incidents of armed robbery, assault, burglary, fraud, and vandalism. Drug trafficking was particularly common in Mereje, Sapele-Okpe, and Orerokpe. Homicide cases were most reported in Mereje, Okpe Road, Okuokoko, and Orerokpe. As for kidnapping, hotspots included Mereje, Sapele-Okpe, and Orerokpe. Sexual assault cases were most prevalent in Adeje and Orerokpe, while theft was a major concern in Adeje, Egbo-Oloja, Orerokpe, and Mereje. Domestic violence appeared more widespread, with Elume, Ibada-Elume, Amukpe, Okpe Road, Oviri-Okpe, Okuokoko, and Orerokpe all being notable hotspots. Overall, theft emerged as the most common crime in the area, with 143 cases reported. In contrast, sexual assault was the least reported, with just 19 cases. The study observed that the farther the buffering distance (1200m) from the presence of police, the higher the number of crimes recorded. Particularly, at 400m, the total crimes recorded for Adeje and Orerokpe were (31.6%) and (7.8%), while at 800m, the total crimes recorded were (36.8%) and (51%) respectively, which confirms that police presence reduces the rate of crime at a given location.

Keywords*: Crime, Geo informatics, Mapping, Delta state, hotspots, vandalism, kidnapping.*

1 INTRODUCTION

Crime is a human phenomenon; hence, its distribution in space is not random. Crime analyses are important because they help identify the different geographic patterns of criminal behaviour (Daglar & Argun, 2016). The crime scenario in Nigeria ignores class differences in society, as both the rich (haves) and the poor (have-nots) have experienced similar and equal visits from crooks from time to time. The resulting tragedy, suffering, colossal loss, and hardship caused by these hostile visits were ever present and had left an indelible mark on our national psyche and societal tranquility. Worse still is the fact that law enforcement agencies in Nigeria have yet to become computerized to enable effective record keeping, analysis of cases, easy reference and information retrieval and storage to support strategic and appropriate planning for crime response and elimination generally (Taye, 2019).

As a unit, crime has spatial properties, i.e, place, time, and procedure. Mapping is key to understanding where crimes take place in space and time (Kedia, 2016). The fact that criminal activity is not random in time and space raises questions about its location and the reasons for its location. GIS enables the integration and analysis of data to identify, apprehend and prosecute suspects; it supports more proactive behavior through effective resource allocation and better policy making (Liu, et al., 2017) For example, thematic maps could be used to predict likely sensitive points/areas in the hotspot area (Wang, *et al*., 2013). Data on surface communications, telephone communications, and demographic patterns can all be used to predict the sensitivity of a place relative to a given time (Deville *et al*., 2014). Law enforcement needs information management, especially location information. Traditional law enforcement for different types of police applications is really about data collection. However, data collection without data analysis is useless. GIS not only enables the integration and spatial analysis of data to identify, apprehend, and prosecute suspects, but also supports more proactive responses through effective resource allocation and better policy making (Ojiako, *et al*., 2016).

The current investigative strategy of the Police Command in Okpe Local Government Area, Delta State demonstrates that the investigative strategies and techniques employed by the police have not been effective enough to address the challenges faced by the police criminal investigation force. The steady increase in crime and undetected criminal activity continues to leave Nigerians with a general sense of insecurity of life and property in the criminal justice system. This is partly because the Nigerian police are not well equipped with modern trends in criminal investigation, mapping and spatial analysis to carry out their duties effectively. Unfortunately, many law enforcement agencies, most notably the Nigerian Police in Delta State, have yet to leverage GIS for crime mapping and criminal investigation/analysis. Essentially, the availability and ready access to timely and up-to-date spatial information about crime-prone areas for law enforcement agencies will contribute in no small way to effective policing across the state. The geography of crime, which relates to understanding the interactions between crime, space, and society through the analysis of crime, offenders, and the impact of

crime, can usefully be studied using Geographic Information Systems (GIS). Crime maps replace traditional paper pin maps to reveal criminal activity in an area. It involves the manipulation and processing of spatial crime data to display it visually in an output that is informative to the specific user (Ikuesan, *et al*., 2020). Information gleaned from crime mapping includes the location of hotspots or relatively high reported crime rates, which is helpful to patrol officers. With crime mapping, it is also possible to infer the underlying processes that cause a particular crime cluster (Yadav, *et al*., 2019). The types of crimes, spatial patterns in the sequence, and location of a series of related crime events can be examined. This is helpful in a deductive form of investigation that can intelligently support criminal investigations. The graphical displays used to view crime data make the information more understandable and therefore more accessible to decision-makers with less political experience (Naerland & Engebretsen, 2021). Given the prevalence of crime in Okpe Local Government Area of Delta State, it is therefore necessary in this study to produce a crime map that can help to better understand the incidence and location of Crimes in the Area which will in turn foster the planning process on how the crimes can be eradicated.

2. MATERIAL AND METHODS

2.1 Study Area

Okpe is one of Delta State's 25 Local Government Areas. Orereokpe is the headquarters of the Okpe Local Government Area in Delta State, Nigeria, and is within coordinates 5.63776N and 5.88966E. The study area includes districts/settlements in Orereokpe, Osubi and Adeje, which are the heart of Okpe local government. Districts include: Jakpa, Iriama, Okuabude, Ogborode, Osubi Rd, Township Rd, Ufebe Lane, Victory Rd, Oseghale Street, Lucky London Street, Okuomogwa Rd, and Egborode Rd. They lie within the meridians of longitude 5 53 23 E and 5 38 16 N with an elevation of 14 meters and a population of up to 5890 inhabitants. The maps of the study area are shown below.

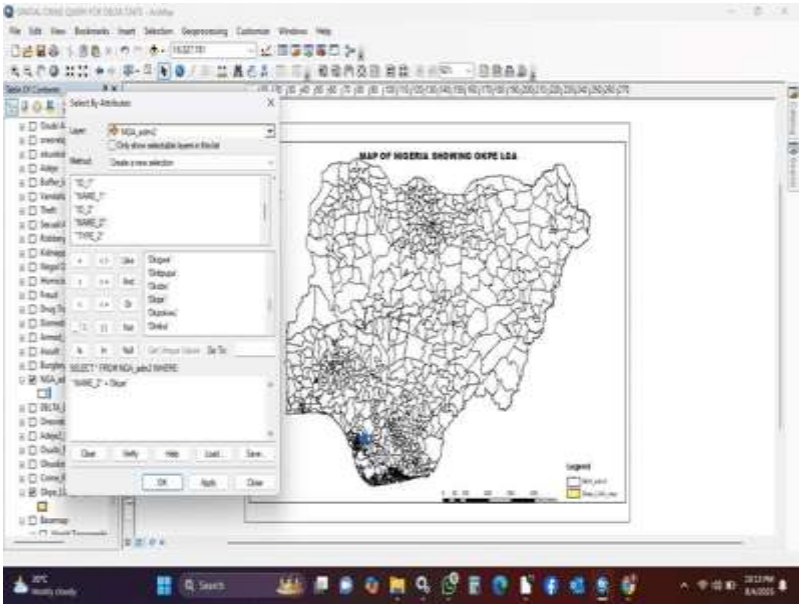

Figure 1: Map of Nigeria showing Okpe LGA.

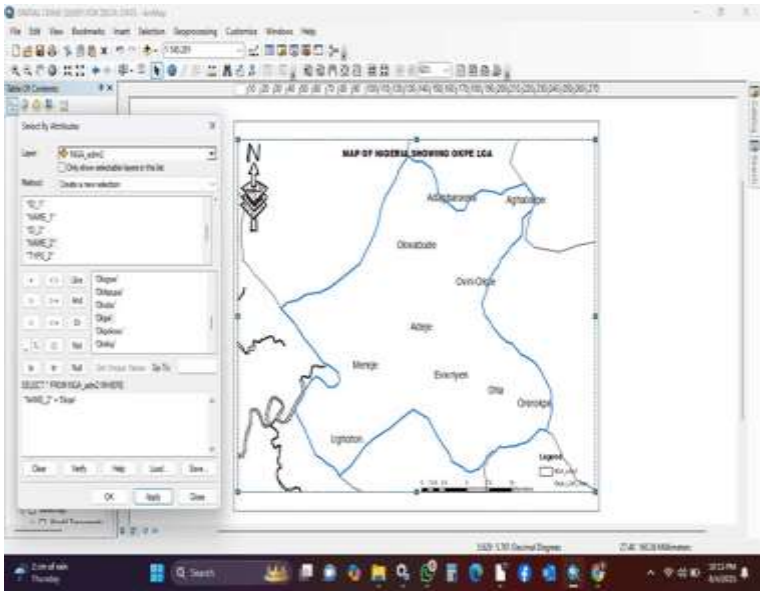

Figure 2: Study Area Map.

2.2 Methods

This section describes the methodology used in conducting this study. It is divided into different steps such as planning, data collection, GIS database design and creation, and GIS analysis.

2.2.1 Planning

This phase of research involved proper planning to ensure effective execution and optimization. In this phase, it needs analysis, and user requirement analysis was carried out. This included conducting a preliminary review of existing crime data collection, analysis, and reporting methods in the Nigerian Police, with a focus on the study area. Key police officers were assessed for their knowledge and need for crime mapping using GIS. This information was obtained through a review of related literature, Nigerian police documentation/press releases, and interviews with relevant personnel at various Division Police Stations in Okpe Local Government Area of Delta State. This phase also included planning the selection of hardware and software to be used in the research.

2.2.2 Data requirements and data collection

To achieve the set research goals, primary and secondary data containing both spatial and non-spatial data were used. They are highlighted in the following subsections (primary and secondary data):

2.2.2.1 Source of primary data

Sources of primary data for this research include:

I. GPS Coordinate Recording: The location/coordinates of the Divisional Police Stations in Okpe and other points of interest were recorded using the Garmin GPSMAP 76 handheld GPS with an accuracy of at least 5 meters.

II. Attribute Data: This was non-spatial descriptive information of points of interest.

III. Where appropriate, digital photographs of points of interest were taken.

IV. Satellite imagery obtained from Google Earth was used to validate the location, coordinates, features, and attributes of various streets, districts, and landmarks such as banks, schools, markets, universities, and others.

2.2.2.2 Source of secondary data

Sources of secondary data for research are:

I. An administrative map of the state of Delta showing local government boundaries was used.

II. A street guidance map and an ArcGIS shapefile were used, showing the street network, counties, and some points of interest.

III. Data on crime and related information were obtained from crime diaries and desk pads in divisional police stations in the study area.

IV. Additional data and general information on crime were obtained from the Police Area Command (HQ) in Delta State.

V. Other relevant information comes from published journals and articles.

2.3 Design and creation of a GIS database

A database is a repository that can store large amounts of data. The processing of geospatial data includes demand and supply processing of a phenomenon (crime) in the world, the application of (GPS) technology to collect survey data, the creation of a (relational) database by selecting a conceptual level model, and the application of technology (software & hardware) and methodology for processing (analysis). A GIS database consists of two parts: (a) the components of the database and (b) the design phases of the database (Balogun *et al*., 2014). The two consist of five basic components consisting of geographic or location entities, non-geographic or attributive entities, topological relationships, business rules, and procedures to be followed. Before designing the geo database for this research, a 10-year-long (2014- 2024) search of crime records from police stations in the study area was conducted to extract relevant and related data on crime cases reported to the police station. Interviews were conducted with the competent authorities of the police departments using a semi-structured questionnaire to identify and validate the serious crimes committed and other characteristics related to the crimes committed.

Criminal records were extracted from the crime diaries of the police station in the study area. The data was compiled and coded using the Microsoft Excel software package and imported into a GIS environment as a shape file layer. The two main parameters used to filter the crime data were the type of crime and the availability of a precise crime scene. Because there were so many crimes recorded in criminal diaries, the records extracted were crimes related to assault, kidnapping, burglary, theft, armed robbery, sexual assault, Drug trafficking, fraud, and vandalism. However, only records with correctly geocodable addresses were included in the final geo database used for crime mapping and multi-criteria analysis. ArcGIS software (ArcGIS 10.4) was used to map crime cases and other associated attributes. A vector representation was used for hotspot generation.

3 RESULTS AND DISCUSSION

3.1 Demography of the population in the study Area

3.1.1 Age distribution

Table 1: Age Distribution.

Status	Frequency	Percentage (%)
18 – 25 years	30	20
26 – 35 years	50	33.3
36 – 46 years	70	46.7
Total	**150**	**100**

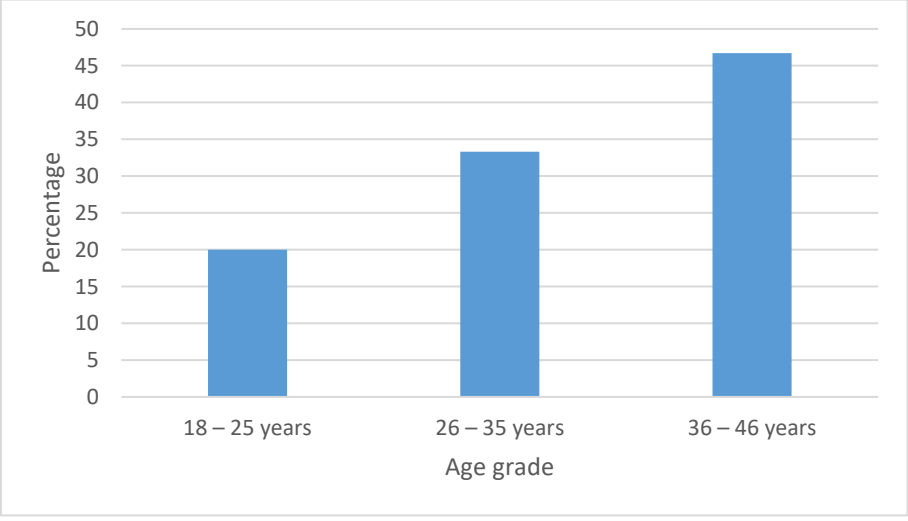

Figure 3: Age distribution of Respondents.

The Age distribution of the Respondents is as shown in figure 3 above. The Result shows that 20% of the population (150) falls within the age range of 18-25years, while 33.6% falls within the range of 26-35years and 46.7% of the population falls within the age range of 36-46years. This shows that the sample population consists of adults that can provide accurate and reliable information that was needed in this study.

3.1.2 Gender distribution

Table 2**:** Gender Distribution.

Status	**Frequency**	**Percentage (%)**
Male	90	60
Female	60	40
Total	**150**	**100**

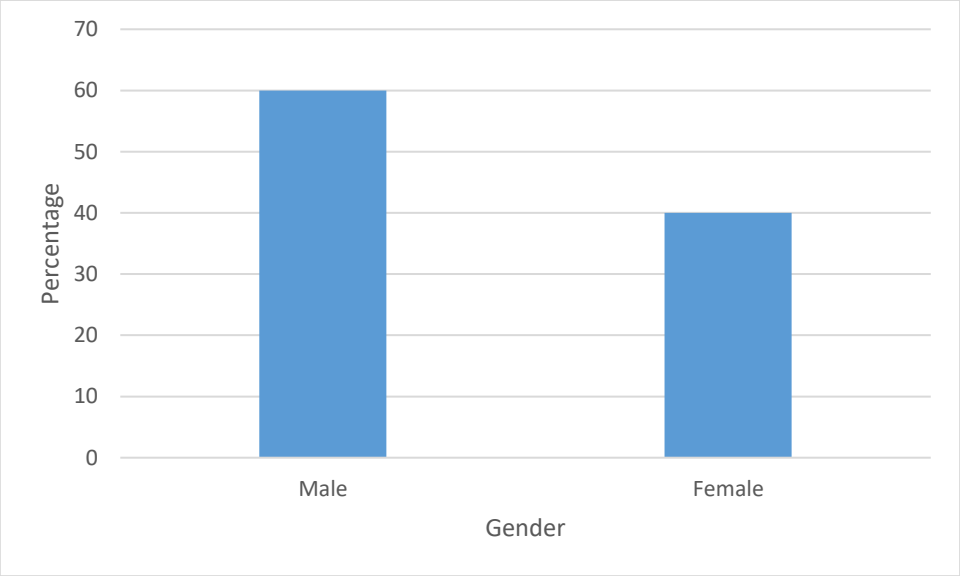

Figure 4: Gender distribution of Respondents

The Gender distribution for this study is shown in figure 4 above. Observation of the Result shows that 60% of the Total population (150) are Male while 40% of the total population are Female. A balance for the male and female population in this study shows that gender inclusivity was adequately adhered to in choosing the population represented in this study.

3.2 Causes of Crime

Table 3: Respondents' findings on the causes of crime

S/N	**Causes of Crime**	**Frequency**	**Percentage**
1	Unemployment	29	19.3
2	Poverty	35	23.3
3	Broken Homes	13	8.7
4	Peer group influence	20	13.3
5	Illiteracy	12	8.0
6	Drug abuse	16	10.7
7	Greed	15	10.0
8	Political influence	10	6.7
	TOTAL	150	100

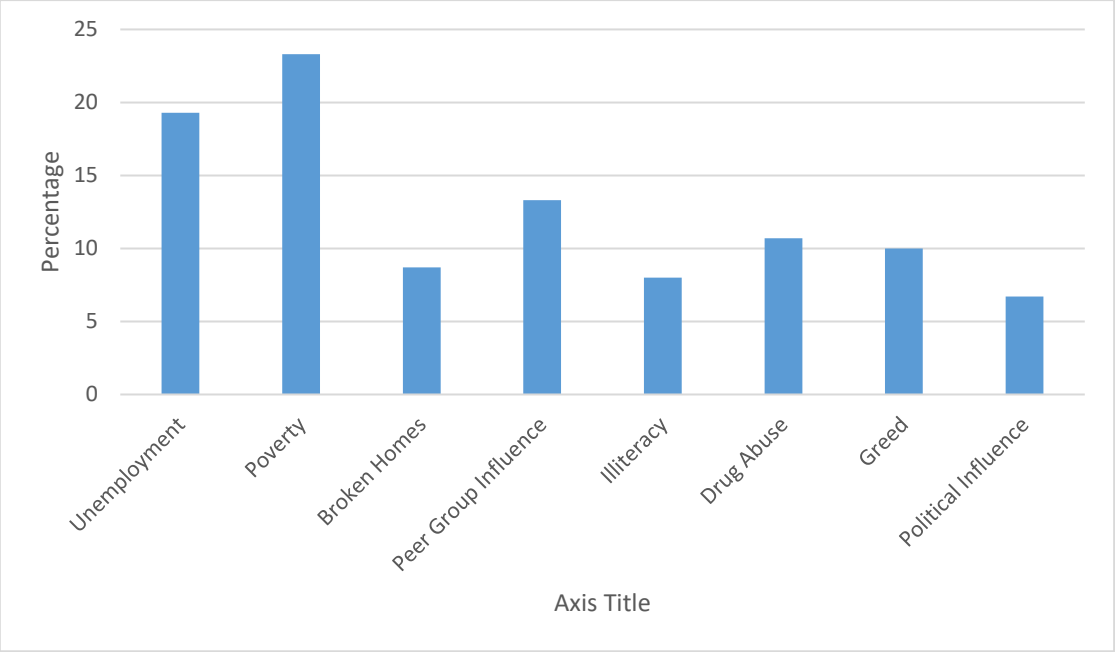

Figure 5: Causes of crime from Respondents

From the distribution of the causes of crime as shown in figure 5, Poverty is the leading cause of crime with a relative percentage of 23.3% which is followed by unemployment, peer group influence, drug abuse, greed, broken homes, Illiteracy and political influence with relative percentages of 19.3%, 13.3%, 10.7%, 10%, 8.7%, 8% and 6.7% respectively.

3.3 Determination of crime types

The various crime types reported in Okpe LGA are shown below.

3.3.1-Armed Robbery Crime.

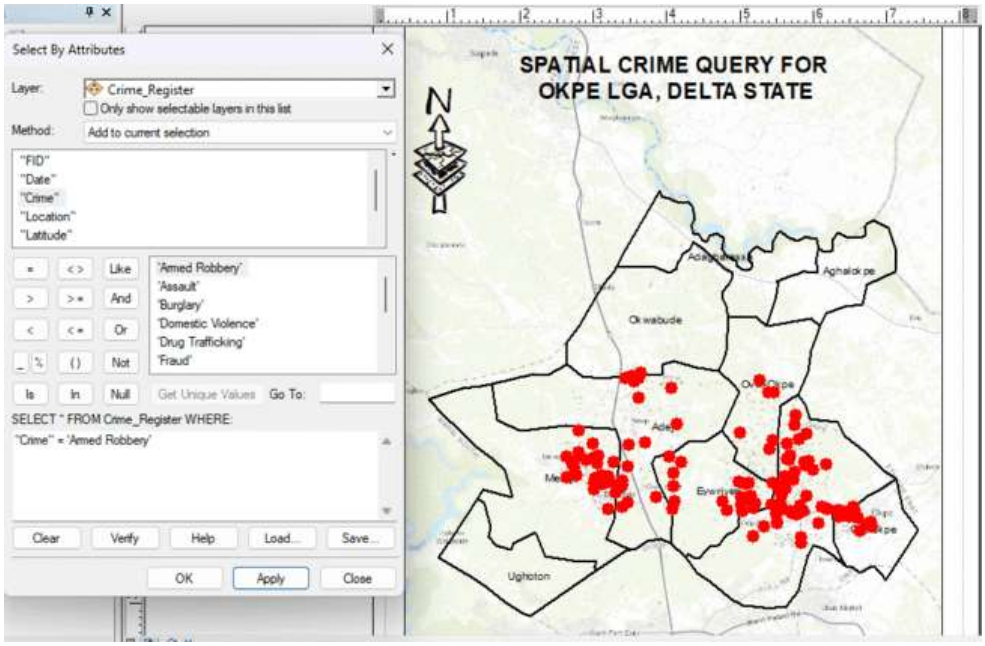

Figure 6: Armed robbery crime committed in Okpe LGA (2014-2024).

The incidence of Armed Robbery committed in Okpe LGA is shown in Figure 6 above. From Figure 6, it was observed that armed robbery was committed across several locations in Okpe LGA. A breakdown of the crime data shows that a total of 107-armed robbery cases were reported. Analysis of the

results shows that 20.6% of the Armed Robbery crimes were committed in Adeje, 4.7% in Amukpe, 7.5% in Egbo-Oloja, 2.8% in Elume, 6.5% in Ibada-Elume, 4.7% in Jakpa, 18.7% in Mereje, 3.7% in Ogiedi, 3.7% in Okpe Road, 1.9% in Okuokoko, 1.9% in Okwidiemo, 15% in Orerokpe, 1.9% in Oviri-Okpe, and 2.8% in Sapele-Okpe and 3.7% in Ugbokodo. According to the results, the crime hotspots are in Adeje, Mereje, and Orerokpe, as these areas show the highest crime rates, as indicated in Figure 6.

3.3.2 Assault Crime

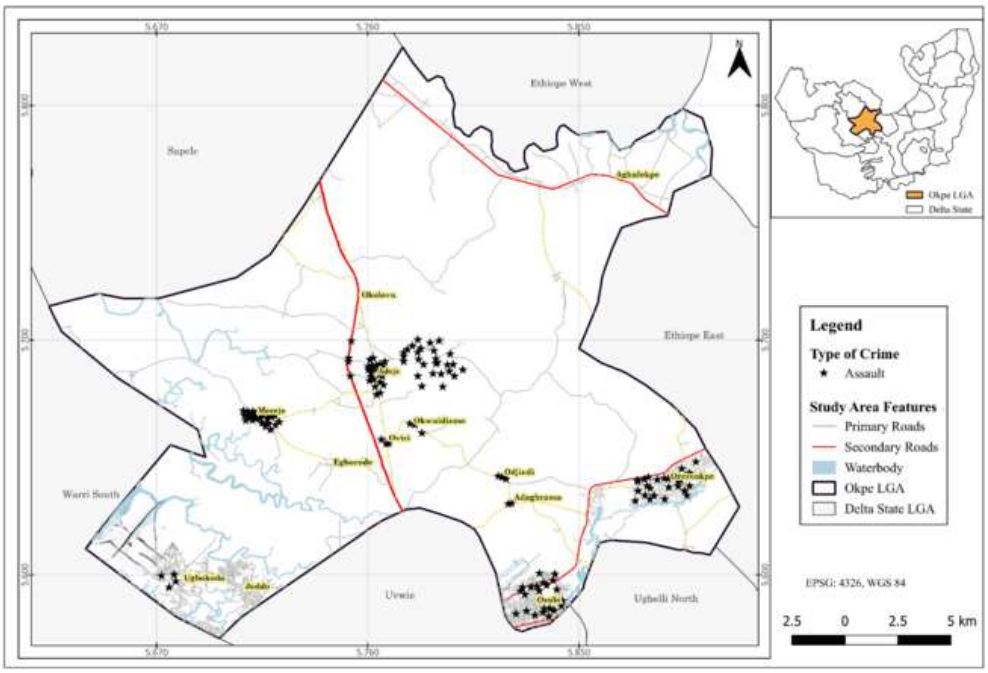

Figure 7: Query showing Assault crimes committed within the study Area (2014-2024).

Figure 7 represents the map showing the incidence of assault crimes committed in Okpe LGA. Observation of the results shows that a total of 102 assault crimes were committed in several districts of Okpe LGA. Analysis of the result indicates that the rate of assault crime committed was 22.5% in Adeje, 3.9% in Amukpe, 8.8% in Egbo-Oloja, 2.0% in Elume, 2.0% in Jakpa, 28.4% in Mereje, 3.9% in Ogiedi, 1.0% in Okpe Road, 1.0% in Okuokoko, 2.9% in Okwidiemo, 14.7% in Orerokpe, 1.0% in Osubi, 2.9% in Oviri-Okpe, 1.0% in Sapele-Okpe and 3.9% in Ugbokodo. The crime hotspots identified in the study are Adeje, Orereokpe, and Mereje.

3.3.3 Burglary crime

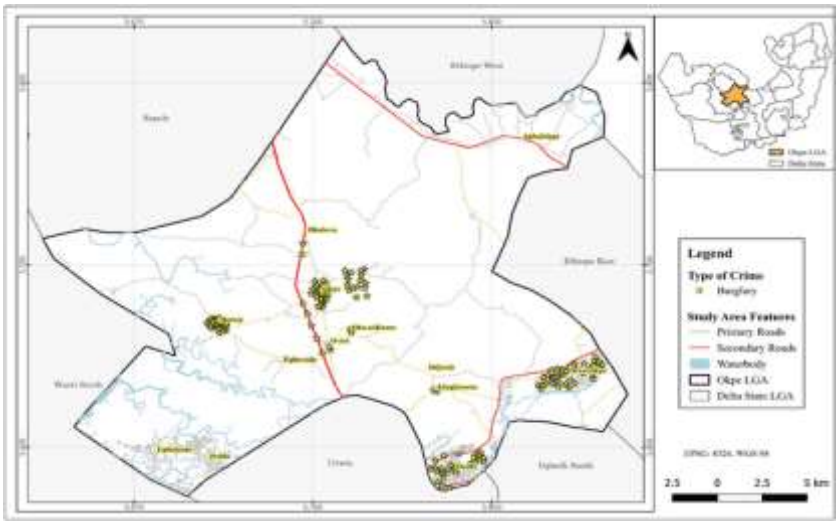

Figure 8: Map showing the incidence of Burglary committed in Okpe LGA (2014-2024).

Figure 8 shows a spatial representation of Burglary crimes committed in Okpe LGA. The result indicated that a total of 108 drug cases were found. From the result, a total of 27.8% burglary crime was reported in Adeje, 2.8% in Amukpe, 2.8% in Egbo-Oloja, 0.9% in Elume, 0.9% in Ibada-Elume, 1.9% in

Jakpa, 25% in Mereje, 5.6% in Okpe Road, 3.7% in Okuokoko, 1.9% in Okwidiemo, 20.3% in Orerokpe, 0.9% in Osubi, 1.9% in Oviri-Okpe, 2.8% in Sapele-Okpe and 0.9% in Ugbokodo. The crime hotspots identified for burglary crime are Adeje, Orerokpe and Mereje.

3.3.4 Drug Trafficking Crime

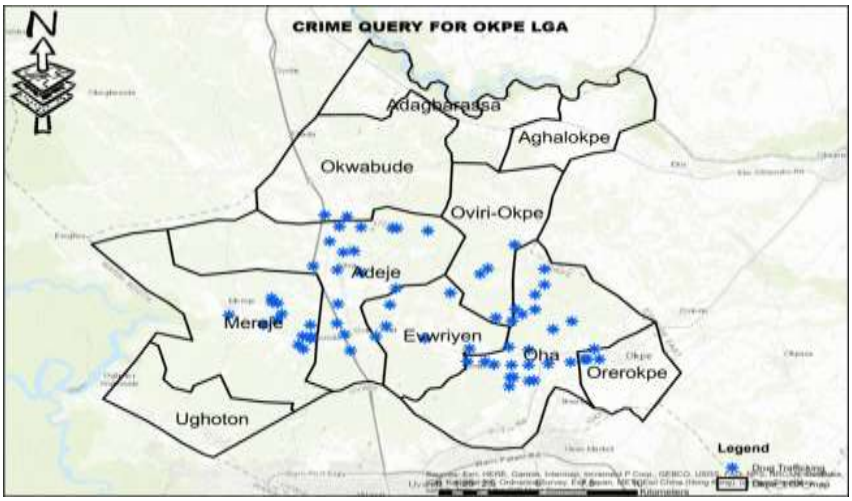

Figure 9: Drug trafficking crime within Okpe LGA (2014-2024)

The map showing the spatial distribution of drug trafficking crimes committed in Okpe LGA is shown in Figure 9 above. The result shows 49 drug cases reported in Okpe LGA. Observation of the results show that the distribution of the crime reported is 10.2% in Adeje, 2.0% in Amukpe, 2.0% in Egbo-Oloja, 2.0% in Elume, 6.1% in Ibada-Elume, 2.0% in Jakpa, 20.4% in Mereje, 6.1% in Ogiedi, 4.1% in Okuokoko, 2.0% in Okwidiemo, 14.3% in Orerokpe, 2.0% in Osubi, 8.2% in Oviri-Okpe, 10.2% in Sapele-Okpe and 8.2% in Ugbokodo. The identified crime hotspots are Mereje, Sapele-Okpe and Orerokpe.

3.3.5 Fraud Crime

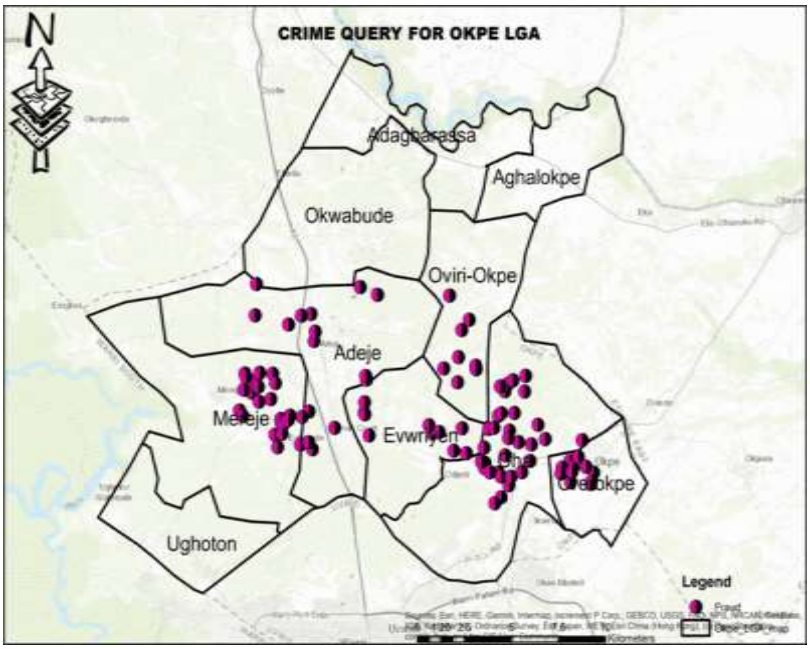

Figure 10: spatial distribution of fraud crimes committed in Okpe LGA (2014-2024).

The result showing the incidence of fraud crimes committed within Okpe LGA is shown in Figure 10 above. Analysis of the result indicates that 91 fraud cases were reported. From the spatial distribution, 15.4% of fraud crimes were reported in Adeje, 3.3% in Amukpe, 4.4% in Egbo-Oloja, 4.4% in Elume, 1.1% in Ibada-Elume, 6.6% in Jakpa, 25.3% in Mereje, 3.3% in Okpe Road, 1.1% in Okwidiemo, 24.2% in Orerokpe, 3.3% in Oviri-Okpe, 1.1% in Sapele-Okpe, and 6.6% in Ugbokodo. The identified crime hotspots are Mereje, Adeje, and Orerokpe.

3.3.6 Homicide Crime.

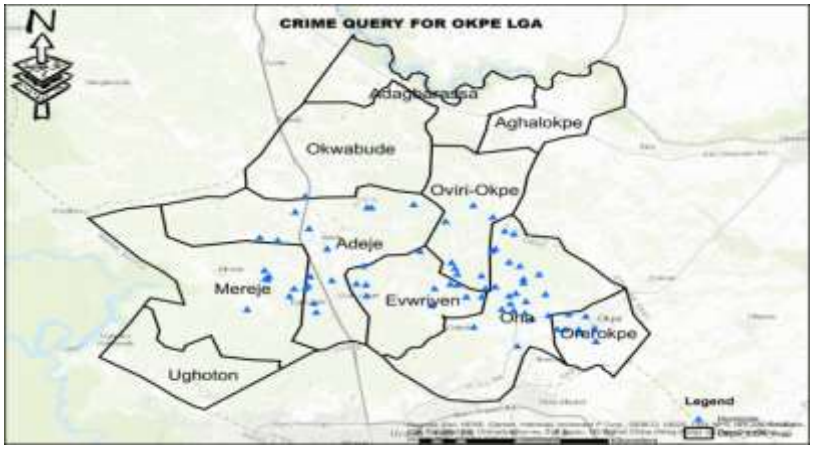

Figure 11: Homicide crime committed within Okpe LGA (2014-2024).

The incidence of homicide crime within Okpe LGA is presented in Figure 11. A total of 56 homicide cases were reported. Analysis of the result from the spatial distribution shows that 8.9% cases were found in Adeje, 7.1% in Egbo-Oloja, 1.8% in Elume, 3.6% in Ibada-Elume, 5.4% in Jakpa, 14.3% in Mereje, 3.6% in Ogiedi, 12.5% in Okpe Road, 12.5% in Okuokoko, 3.6% in Okwidiemo, 19.6% in Orerokpe, 3.6% in Osubi, and 3.6% in Ugbokodo. The identified crime hotspots are Mereje, Okpe Road, Okuokoko, and Orerokpe.

3.3.7 Kidnapping Crime

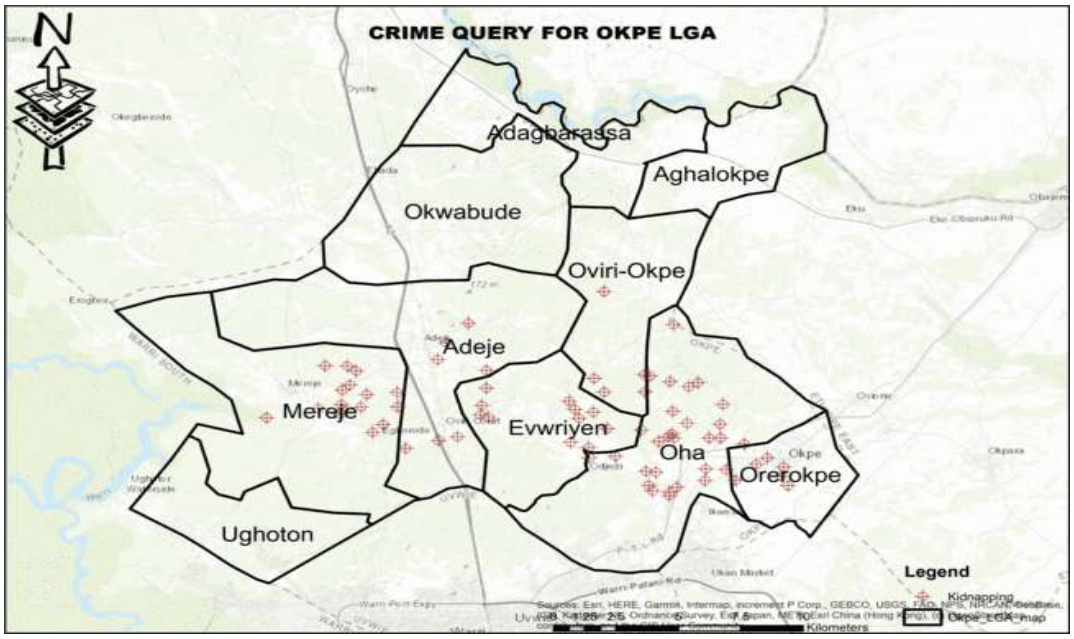

Figure 12: Kidnapping crime in Okpe LGA (2014-2024)

Figure 12 represents the map showing the spatial distribution of kidnapping incidence in Okpe LGA. A total of 56 cases of kidnapping were recorded. Observation of the result indicates that 8.9% cases were reported in Adeje, 1.8% in Amukpe, 8.9% in Egbo-Oloja, 3.6% in Ibada-Elume, 1.8% in Jakpa, 19.6% in Mereje, 1.8% in Ogiedi, 1.8% in Okpe Road, 7.1% in Okuokoko, 5.4% in Okwidiemo, 21.4% in Orerokpe, 3.6% in Oviri-Okpe, 10.7% in Sapele-Okpe, and 3.6% in Ugbokodo. The identified crime hotspots are Mereje, Sapele-Okpe, and Orerokpe.

3.3.8 Sexual Assault Crime.

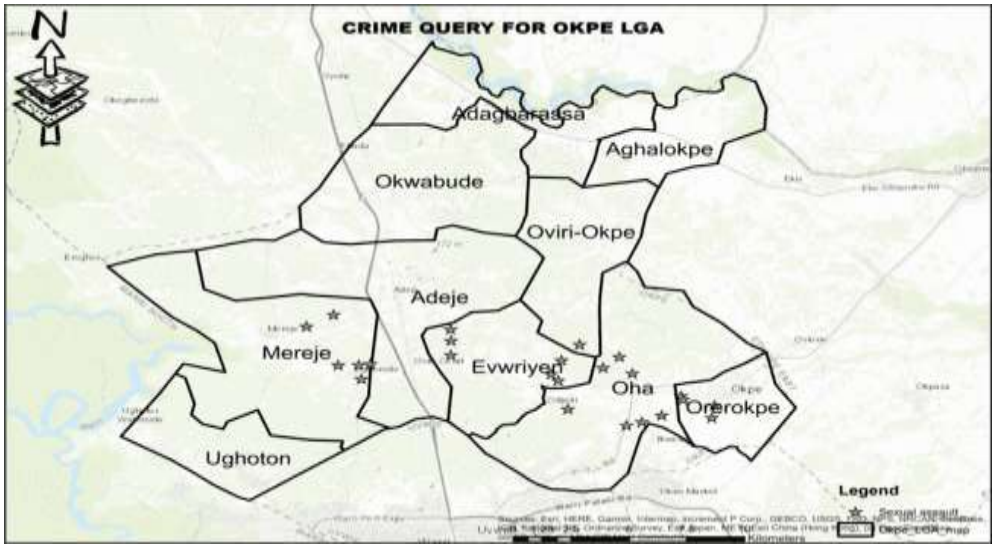

Figure 13: Sexual assault crime committed in the Okpe LGA (2014-2024).

The spatial representation showing the sexual assault crime committed within Okpe LGA is shown in Figure 13. A breakdown of the crime record shows that of the 19 sexual assault crimes recorded in Okpe LGA, 31.6% of the incidents were recorded in Adeje, 21.1% in Egbo-Oloja, 21.1% in Mereje, and 26.3% in Orerokpe. The study indicates that Adeje and Orerokpe are the major sexual assault crime hot spots.

3.2.9 Theft crime

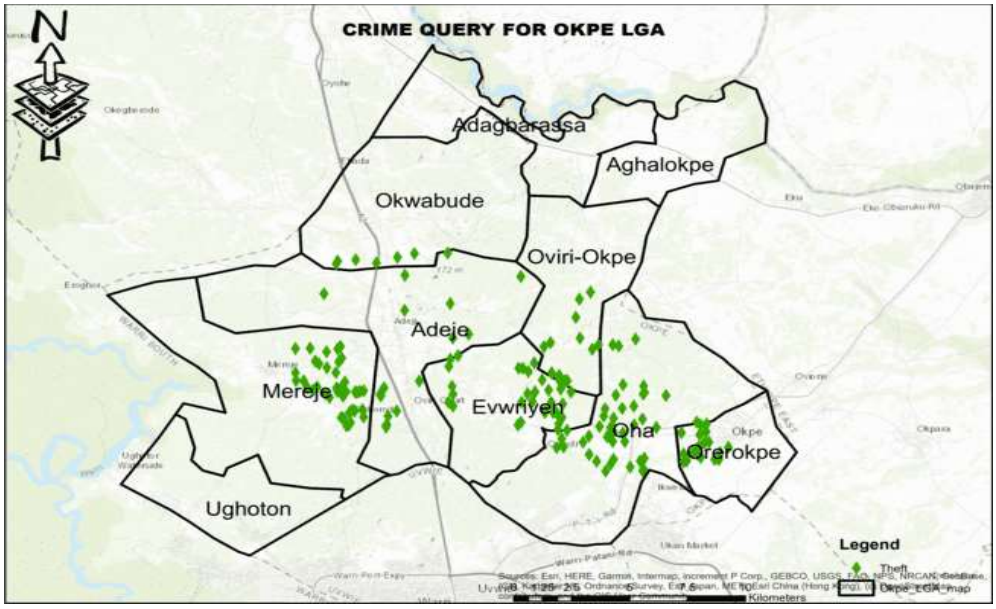

Figure 14: Theft crime distribution in Okpe LGA (2014-2024)

The spatial distribution of theft crimes committed in Okpe LGA is shown in Figure 14 above. Observation of the result shows that out of a total of 143 of theft crimes reported in the study Area, 18.2% of these crimes was recorded in Adeje, 1.4% in Amukpe, 18.2% in Egbo-Oloja, 1.4% in Elume, 2.8% in Ibada-Elume, 3.5% in Jakpa, 16.8% in Mereje, 2.8% in Ogiedi, 1.4% in Okpe Road, 2.1% in Okuokoko, 0.7% in Okwidiemo, 21% in Orerokpe, 1.4% in Osubi, 2.8% in Oviri-Okpe, 1.4% in Sapele-Okpe and 4.2% in Ugbokodo. The crime hotspots identified for theft crime are Adeje, Egbo-Oloja, Orerokpe and Mereje.

3.3.10 Vandalism crime.

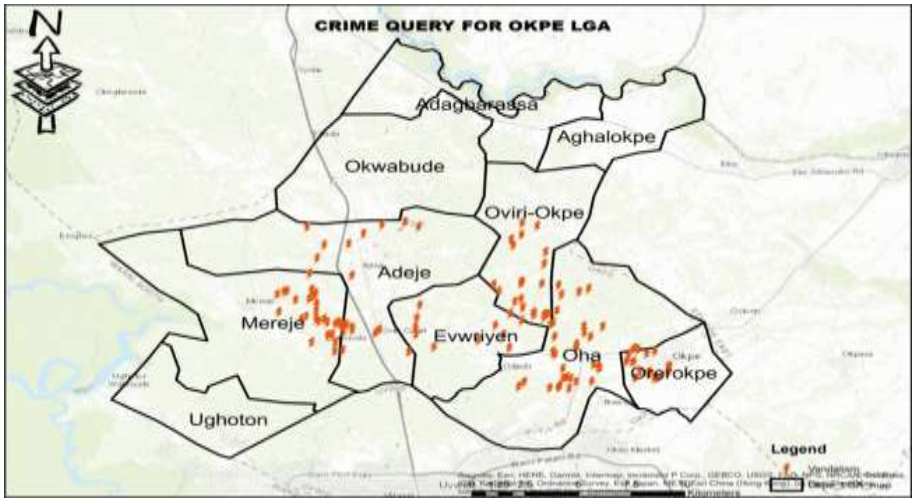

Figure 15: spatial distribution of vandalism crime in Okpe LGA (2014-2024).

The map showing the distribution of vandalism crime in Okpe LGA is shown in Figure 15 above. The total number of vandalism crimes reported was 103. The distribution of this crime among the districts in Okpe LGA is as follows: 20.4% in Adeje, 2.9% in Amukpe, 8.7% in Egbo-Oloja, 2.9% in Elume, 2.9% in Ibada-Elume, 1.0% in Jakpa, 16.5% in Mereje, 4.9% in Ogiedi, 1.0% in Okpe Road, 1.9% in Okuokoko, 1.9% in Okwidiemo, 25.2% in Orerokpe, 4.9% in Sapele-Okpe, and 4.9% in Ugbokodo. The crime hotspots identified for theft crime are Adeje, Orerokpe, and Mereje.

3.3.11 Domestic violence

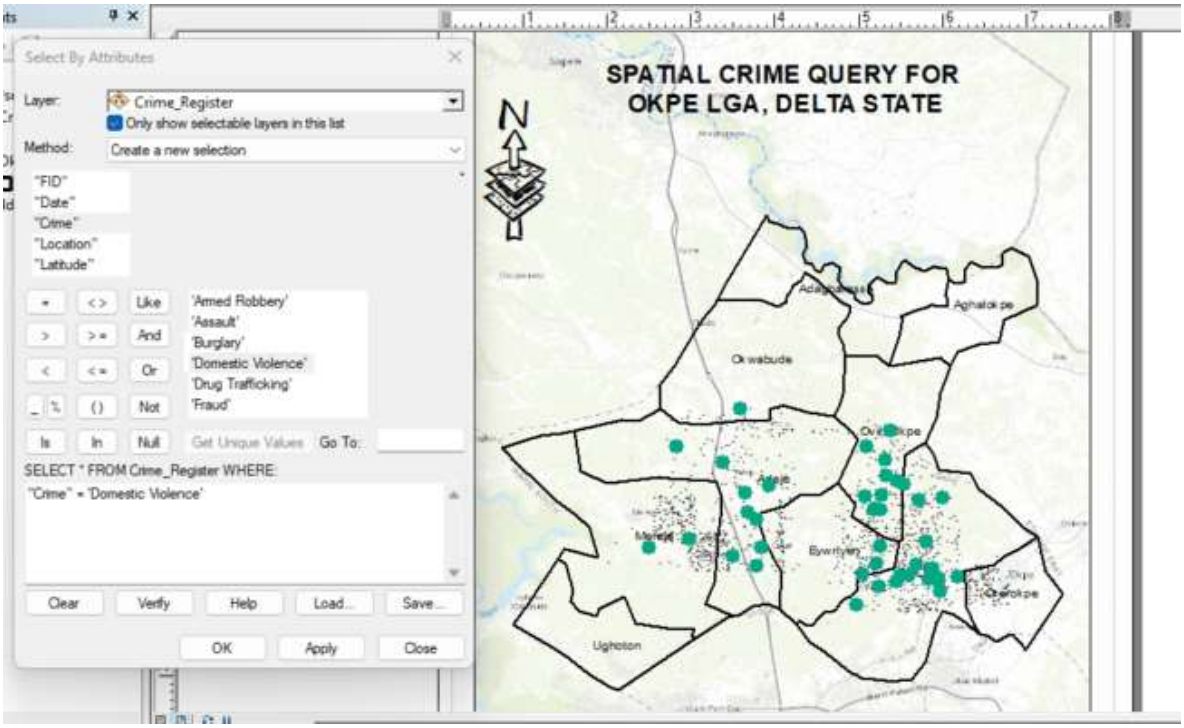

Figure 16: SQL to show domestic violence committed in Okpe L.G.A between 2014-2024.

Figure 16 shows the spatial distribution of domestic violence crimes committed within the Okpe Local Government. Area. A breakdown of the crime report shows that a total of 39 domestic violence crimes were identified, with 10.3% reported in Amukpe, 10.3% in Elume, 12.8% in Ibada-Elume, 2.6% in Jakpa, 5.1% in Mereje, 5.1% in Ogiedi, 10.3% in Okpe Road, 10.3% in Okuokoko, 2.6% in Okwidiemo, 10.3% in Orerokpe, 10.3% in Oviri-Okpe, 2.6% in Sapele-Okpe, and 7.7% in Ugbokodo. The identified crime hotspots are Ibada-Elume, Elume, Amukpe, Okpe Road, Okuokoko, Orerokpe, and Oviri-Okpe.

3.4 Determination of crime incidence

Regarding the study's objective, queries were conducted on the incidence of crime committed in the Okpe Local Government Area of Delta State. The incidence of crimes mapped within the district of Okpe LGA includes Burglary, Armed Robbery, Homicide, Assault, Vandalism, Theft, Fraud, Drug trafficking, and Sexual assault. From Table 4 Theft crime is the predominant in Okpe LGA in comparison with the other crime types with a frequency of occurrence of 16.4%

Table 4: Analysis of crime data.

S/N	Type of Crime	Total No Crimes	Frequency of occurrence (%)
1	Vandalism	103	11.8
2	Theft	143	16.4
3	Sexual Assault	19	2.2
4	Kidnapping	56	6.4
5	Homicide	56	6.4
6	Fraud	91	10.4
7	Drug trafficking	49	5.6
8	Domestic violence	39	4.5
9	Armed robbery	107	12.2
10.	Assault	102	11.7
11.	Burglary	109	12.5

3.5 Determination of Area of Crime Dominance

The Area of crime dominance is shown using Table 5 below. Observation of the result shows that Mereje is the Area of crime dominance, which is closely followed by Orerokpe and Adeje Mereje with total crime of 175, 170, and 157 out of a total crime of 873 reported, with a relative percentage of 20.1%, 19.5% and 18% respectively.

Table 5: Area of Crime Dominance in Okpe LGA.

Locations	Total Crimes	Crime percentage (%)
Adeje	157	18
Amukpe	26	3
Egbo-Oloja	73	8.4
Elume	21	2.5
Ibada-Elume	28	3.3
Jakpa	27	3.1
Mereje	175	20.1
Ogiedi	25	2.9
Okpe Road	28	3.3
Okpe Town	1	0.2
Okuokoko	29	3.4
Okwidiemo	18	2.1
Orerokpe	170	19.5

Locations	Total Crimes	Crime percentage (%)
Osubi	7	0.9
Oviri-Okpe	24	2.8
Sapele-Okpe	27	3.1
Ugbokodo	37	4.3
TOTAL	873	100

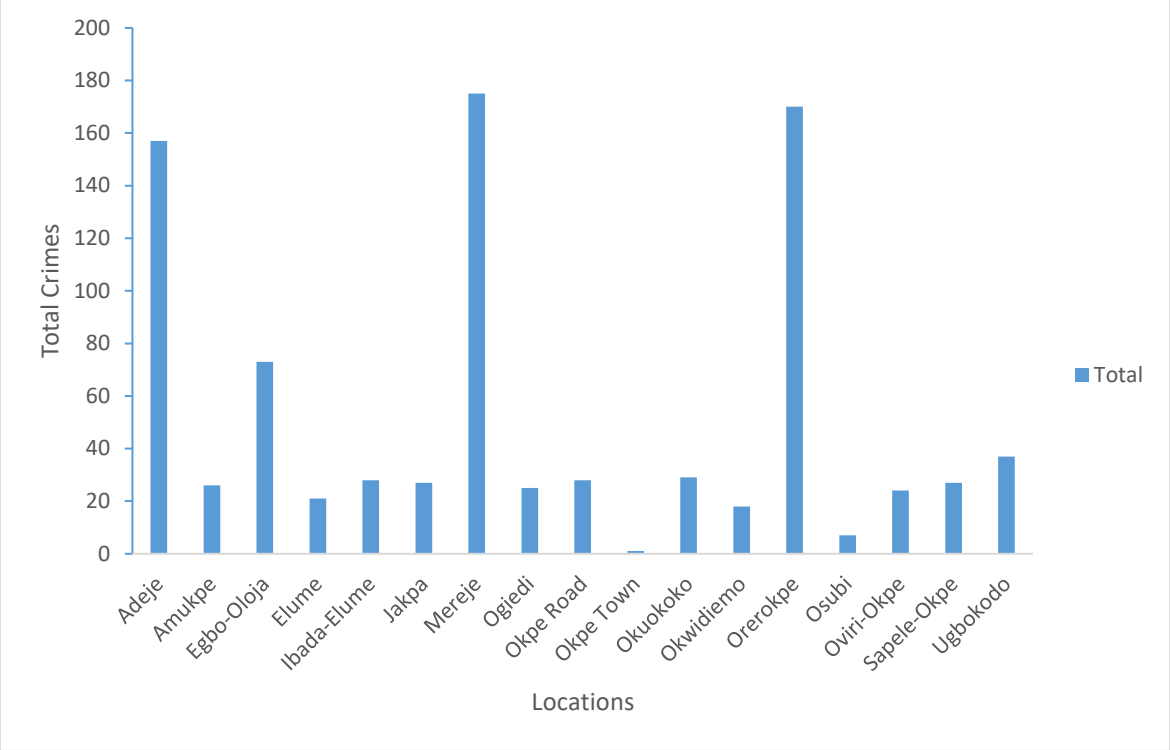

Figure 17 Area of crime dominance in Okpe LGA.

Figure 17 represents the Area of crime dominance in Okpe Local Government Area of Delta State. Observation of the result shows that Mereje is the Area of crime dominance in Okpe LGA, followed by Ororokpe and Adeje, respectively.

3.6 Crime buffer analysis

Crime buffering analysis was conducted to determine the incidence of crime at distances of 400m, 800m, and 1200m, respectively, from a chosen point. The criteria used in selecting the fact is that there is the presence of security outfits (Police Station, Checkpoints, and Patrols, etc.). This will help us determine the crime rate in Okpe LGA from these selected points. An overview of the buffer analysis is shown in Figure 4.16 below.

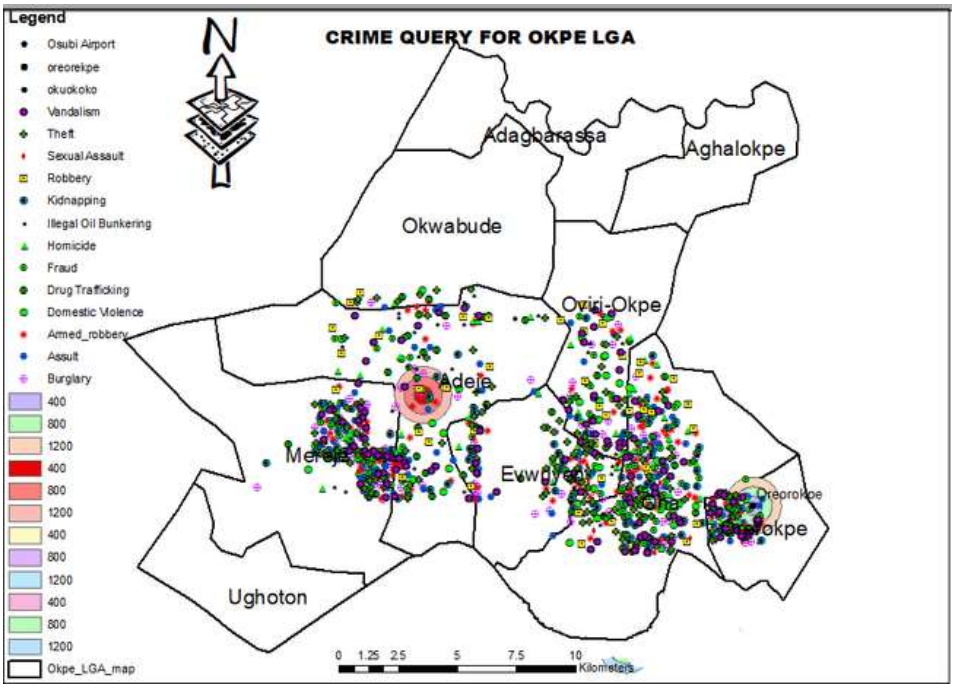

Figure 18: Overview of the Buffer analysis showing all crime types

3.6.1 Multiple Ring Buffer in Orerokpe

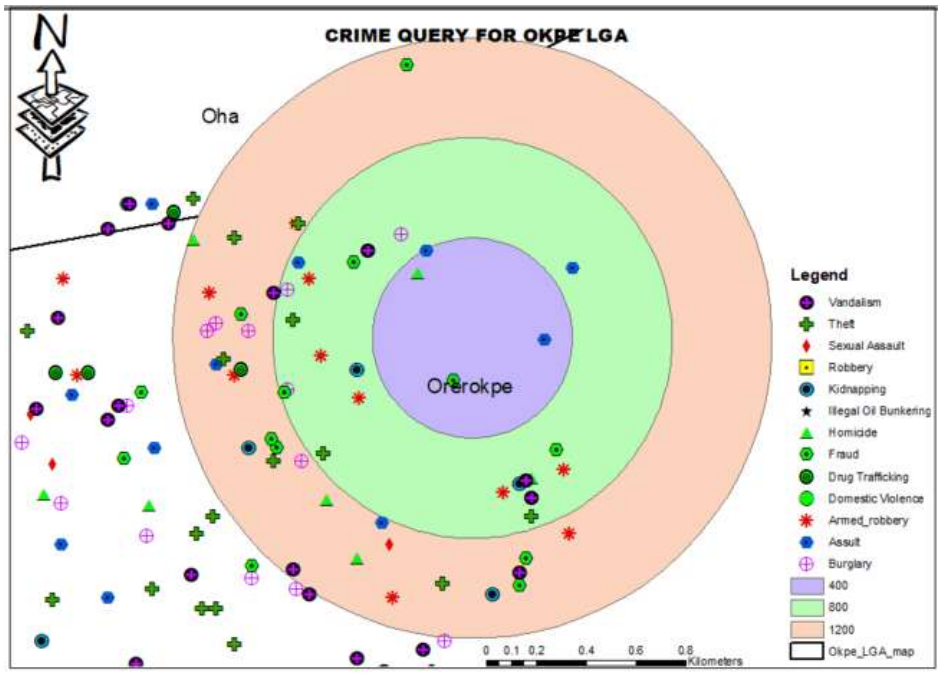

Figure 19: Multiple ring buffer for 400m, 800m, and 1200m from Oroerokpe,

Figure 19 illustrates the multiple-ring buffer implemented in Orerokpe. This was carried out from the point where there is police presence to ascertain the level of crimes observed in those Areas from the presence of Police. The total number of crimes reported within the buffering zones, according to the results, was 51. The result shows that burglary (14%), assault (12%), sexual assault (2%), armed robbery (20%), kidnapping (8%), fraud (20%), drug trafficking (2%), homicide (10%) and vandalism (14%) as predominant in Oreorokpe. Analysis of the result shows that a total of 51 crimes were committed from the buffering point in Orerokpe. According to the study, 7.8% of the crimes occurred within 400m of the Police presence, 41.2% were observed at 800m, and 51% occurred at 1200m from the police presence. Observation of the results shows that as the distances (400m, 800m, and 1200m) from the police presence increase, the crime rates (7.8%, 41.2%, and 51%) also increase. This shows that the presence of police has a significant impact in curtailing the number of crimes that can happen in Orerokpe, as it can be inferred from Figure 19 that People are unwilling to commit crimes in Areas that are close to a police station or police presence because of fear of being arrested or apprehended by the Police. A breakdown of the total crimes

observed is shown in Table 6 below. Observation of the results indicates that armed robbery and fraud are the most frequent crimes committed in Orerokpe, with a percentage of 20% and 10%, respectively.

Table 6: Analysis of crime dominance within 400m, 800m, and 1200m from the Buffer point in Orerokpe.

Location	**Oroerokpe**	
Crime	**Frequency**	**% Of total**
Burglary	7	14%
sexual assault	1	2%
Assault	6	12%
armed robbery	10	20%
drug trafficking	1	2%
Homicide	5	10%
Fraud	10	20%
Kidnapping	4	8%
Vandalism	7	14%
TOTAL	51	

3.6.2 Multiple ring buffer in Adeje.

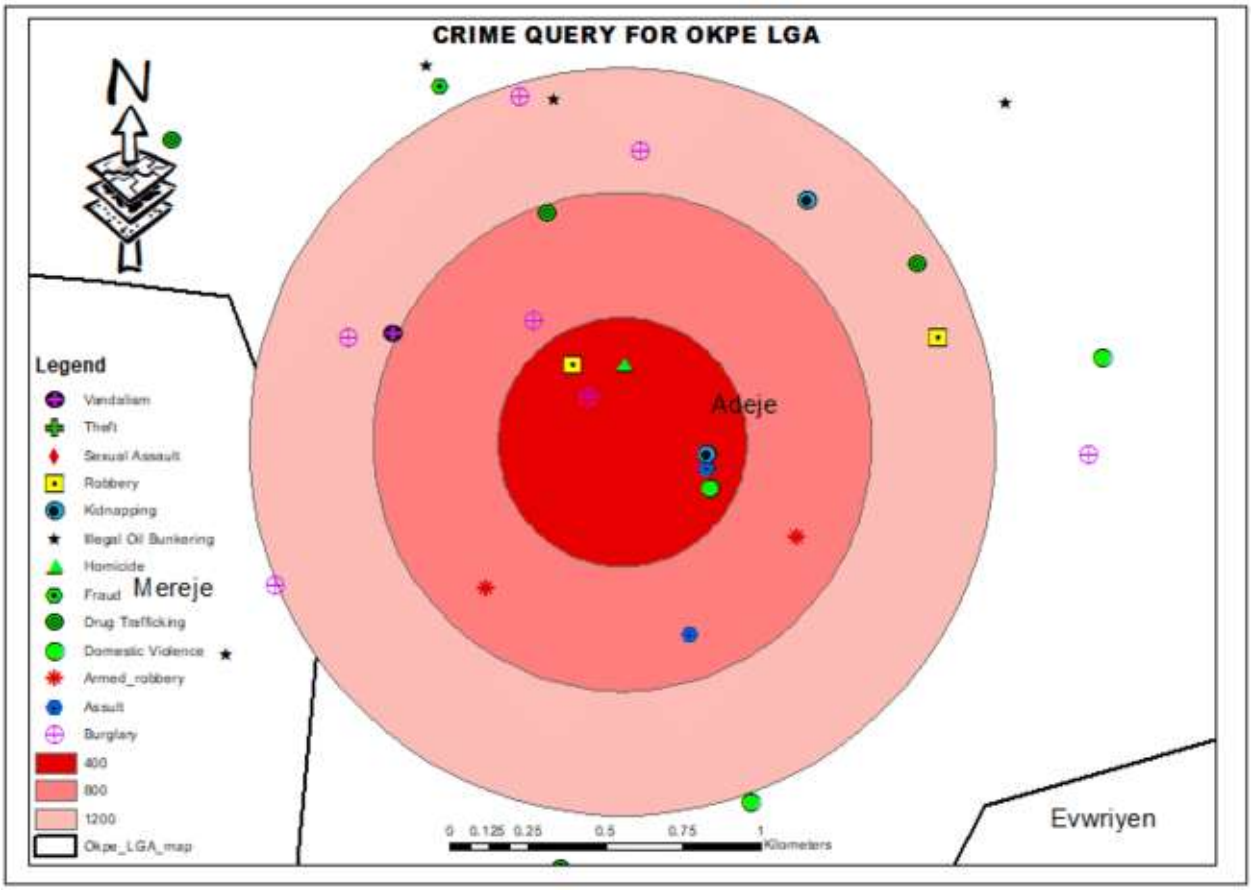

Figure 20: Multiple ring buffer for 400m, 800m, and 1200m from Adeje.

The multiple ring buffer carried out from 400m, 800m, and 1200m from the presence of Police in Adeje is shown in Figure 20 above. According to the results, a total of 19 crimes were reported. The result indicates that burglary (32%), robbery (11%), assault (11%), armed robbery (11%), drug trafficking

(11%), homicide (5%), illegal oil bunkering (5%), kidnapping (11%) and vandalism (5%) as predominant in Adeje. Observation of Figure 20 shows that at a point 400m away, 31.6% of crimes in the area were reported, while at a point 800m away, 31.6% of crimes were reported, and at a point 1200m away, 36.8% of crimes were reported. The result shows that the furthest distance of 1200m is where most crimes (36.8%) occur, which may be attributed to the presence of Police from the buffering point. A breakdown of the crimes is presented in Table 7. According to Table 7, burglary is the most committed crime in Adeje with a percentage of 32%.

Table 7: Analysis of crime dominance at 400m, 800m, and 1200m in Adeje.

Location	**Adeje**	
Crime	Frequency	% Of total
Burglary	6	32%
Robbery	2	11%
Assault	2	11%
armed robbery	2	11%
drug trafficking	2	11%
Homicide	1	5%
illegal oil bunkering	1	5%
Kidnapping	2	11%
Vandalism	1	5%
TOTAL	19	

3.7 Discussion of Results

The crime types of results shows that theft crime was the prevalent crime in Okpe Local govt with a relative percentage of 16.4% in comparison with Armed Robbery, Assault, Sexual assault, Vandalism, burglary, domestic violence, homicide, fraud, kidnapping, and Drug trafficking whose relative percentages are 12.2%, 11.7%, 2.2%, 11.8%, 12.5%, 4.5%, 6.4%, 10.4%, 6.4% and 5.6% respectively. This finding is in line with the report of Ojeh et al. (2024) whose study on crime mapping analysis was carried out in Northern Taraba State.

The Report also shows that theft crime was the prevalent in his study, with a total percentage of occurrence reported as 20.9%. It was also observed that the report by Guma et al., 2023 on the geospatial approach to crime mapping and analysis in Lokoja Metropolis presents similar findings to the results obtained in this study. It was shown that theft crime was the prevalent in their study with a relative percentage of 32.11%. Report by Balogun *et al*., 2014 on crime mapping in Benin City reported Armed Robbery as the predominant crime with a percentage of 29% occurrence, and this is different from the results obtained in this study. The reason for this deviation may be due to the presence of more commercial activities in Benin City in comparison with Orerokpe.

The buffering result obtained in this study is similar to those reported by Anumba et al., 2018. In this study the result shows that as the distances (400m, 800m, and 1200m) from the police presence increase in Orerokpe, the crime rates (7.8%, 41.2%, and 51%) also increases respectively. Similarly, Anumba et al., 2018 reported that as the distances (500m, 1000m and 1500m) from the police presence in Enugu Urban increases, the crime rate (9.9%, 34.9% and 81.8%) also increases. This shows that the presence of Police in Nigeria at a particular location has a profound effect on the rate of crimes committed. In Nigeria, these findings corroborate Olaogbebikan & Ayinde (2016), who reported robbery clustering in underserved parts of Lagos, and Adzandeh & Olayinka (2021), who identified kidnapping hotspots in remote Taraba communities. However, this study extends the literature by providing systematic evidence of buffering effects of police presence in a semi-urban Nigerian LGA.

4. CONCLUSION

A crime mapping study was successfully carried out in the Okpe Local Government Area of Delta State, Nigeria. Respondents within the community and security Agents were interviewed for data gathering to identify the prevalent crimes in the study area. The crimes identified from the study are Vandalism, Assault, Fraud, Theft, Burglary, Sexual assault, Domestic violence, Homicide, Drug trafficking, and Kidnapping. The crime hotspots identified in the study are Adeje, Mereje, and Orerokpe, which are associated with crimes such as armed robbery, assault, burglary, fraud, and vandalism. While Mereje, Sapele-Okpe, and Orerokpe are hotspots for drug trafficking crime. For homicide crimes, the identified hotspots are Mereje, Okpe Road, Okuokoko, and Orerokpe. For the kidnapping crime, the hotspot areas are Mereje, Sapele-Okpe, and Orerokpe. Furthermore, Adeje and Orerokpe are the hotspots for sexual assault crime. For theft crime, Adeje, Egbo-Oloja, Orerokpe, and Mereje were found to be hotspot Areas. Lastly, for domestic violence crimes,

several locations, including Elume, Ibada-Elume, Amukpe, Okpe Road, Oviri-Okpe, Okuokoko, and Orerokpe, were identified as hotspot areas. The study shows that theft crime was the most committed crime in the study area with a total of 143 reported cases, while sexual assault crime was the least committed in the study Area with a total of 19 reported cases. A robust database of crime was successfully created for the study Area, detailing all crime types, their locations of occurrence, and coordinates. A GIS analysis was also conducted using ArcGIS 10.4 to map the crime data.

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