

# Spatial Pattern and Distribution of Crime in Suleja Lga, Niger State, Nigeria

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## Abstract

The study examines the Spatial Pattern and Distribution of Crime in Suleja LGA, Niger State, Nigeria. The study used GIS and statistical methods to analyse the pattern and distribution of crime incidence in the study area. The records of each crime incidence were geocoded. Microsoft Excel was used to collate and organise the crime entries before they were imported into the ArcGIS Pro 2.0 environment. A geodatabase was created where the spatial and aspatial data were encoded and geospatial analysis was performed. The study reveals that the crime distribution pattern is generally clustered with a Global Moran's I index of 0.097, a Z-score of 1.87, and a P-value < 0.06. Furthermore, the study reveals that armed robbery (61), kidnapping (40), car theft (33), culpable homicide (31), rape (29), and robbery (13) cases rank the highest in crime rate. Equally, findings of the study show that Chaza, Kwamba, Madalla, Suleja central, and Gaboda are the major crime hotspot zones at 90% confidence, as analysed using the Getis-Ord  $G_i^*$  (Hot spot analysis) spatial statistics tool in ArcGIS Pro 2.0. The research therefore recommends that more effort be put into fighting crime, especially in areas where there are low-security formations, as they mostly have the highest record of crimes committed. Also, the patrol units should be equipped with GPS for better surveillance and real-time tracking of criminal activities.

## Keywords

Urban Security, Spatial Pattern, Crime, GIS, Hotspot, Insecurity

## 1. Introduction

Urban security has dominated recent discourse among Geographers and related disciplines. This is because urban security is being threatened by increased criminal activities taking place. In fact, urban areas are no longer safe as a result of the continuous activities of criminals. Essentially, the rate of urban crime is due to

the degree of urbanization and population density, increase rate of migration and population growth as well as differences in demographic structures between urban areas and rural areas.

Consequently, urban crimes are the different types of crimes that are committed in urban areas. Indeed, crime is responsible for the high rate of insecurity. According [1], as cited in [2], insecurity compromises the safety of lives and property, desecrates human rights, destabilises the economic and social milieu and hampers sustainable development and reduction in the quality of life. [3] identified some of the negative effects of crime on the societies to include loss of life and property, unemployment, victimization, evictions and displacement, diversion of investment and a drop in income among several others.

There has been an increase in crime in urban centres. According to [4], crime-problem in Makurdi Metropolis of Benue State includes frequency of armed robbery, kidnapping burglary and kidnapping.

Several studies on crime have been undertaken over the years. [5] examined the social and physical correlates of crime in Makurdi town with a view to predicting their influence on the emerging crime pattern, especially in a rapidly developing city in the global south. The study looked at the determinants of the distribution of opportunities for crime within built environment. [4] looked at the occurrence and distribution of crime in Makurdi Metropolis. The study applies the use of Geographic Information Systems (GIS) in crime analysis. [6] examined the Geo-spatial Analysis of Crime in Kaduna Metropolis, Nigeria. The study employs geospatial techniques and secondary records. A result of the study shows that theft/stealing ranks the highest among recorded crimes with 19.29%. Also, the major crime hotspots in the metropolis were discovered to be Sabon Tasha, Rigachikun, Rigasa and Sabon Tasha.

[7] studied mapping the incidences of crime in Makurdi Metropolis, Benue State, North-Central, Nigeria. The study used GIS applications in identification, mapping and presentation of crime patterns and trends in Makurdi. Findings of the study using the one-way ANOVA indicate a statistically significant difference in the distribution of crime incidents among the 5 Police jurisdictions ( $F(4, 100) = 3.767, p < 0.05$ ). The study recommended that for proper crime analysis, GIS units should be established in all police stations.

Furthermore, [3] studied spatial analysis of factors responsible for the spread of crime activities in Akure, Nigeria, using GIS Techniques. The study found that the main road network that traverses Akure Metropolis, provides easy access and exit to criminals, and constitutes a dominant axis of crime events as facilities located along the road usually experience armed robbery attacks or burglary. Generally, transport route is known to be prone to crime incidences. [8] posits that transport route passing through Akure metropolis is subject to crime activity.

[9] studied locational analysis of Police stations and Crime Spots in Ikeja Lagos Nigeria. Geographic Information Systems were employed to collect coordinates of locations of police stations and crime spots. Nearest Neighbour Analysis

was employed to determine the spatial pattern of police stations and crime spots. Furthermore, [10], studied the analysis of the spatial distribution of crimes in urban public spaces in Tehran parks. The study applies a geostatistical approach to study and analyse the distribution of criminal activities in urban parks with respect to their proximity to city centres. The investigation found out that the lack of adequate security and surveillance services during the night is responsible for the illicit and criminal activities that go on in the parks. Equally, [11] investigated the spatial distribution of crime in Akure, Nigeria: The GIS Perspectives. This study utilized GIS technology to access the spatial distribution of crime in selected communities in Akure. The findings of the study using GIS analysis shows that theft and battery are the dominant crimes committed in the study areas and poor building conditions are responsible for it. Apparently, [12], asserted that crime mapping and spatial analysis is a critical tool in the study and control of crime. However, none of these studies looked at the spatial pattern and distribution of crime in Suleja LGA, Niger State. It is against this premise that this study was undertaken.

## 2. Material and Methods

### Study Area

Suleja lies within latitude  $9^{\circ}17'48''\text{N}$  and  $9^{\circ}06'07''$  and longitude  $7^{\circ}08'27''\text{E}$  and  $7^{\circ}14'08''\text{E}$ . The town is situated on the Iku River a minor tributary of the Niger river at the foot of Abuchi Hill and lies at the intersection of several roads. Suleja local government is bounded by the Federal Capital Territory to the South, Gurara LGA to the West & North and Tafa LGA of Niger State to the East (**Figure 1**). Suleja covers a total land mass area of 118,910 Sq.km with 2142 Density/Square kilometre [13] with about ten (10) political wards within the Local Government Area namely; Bagama A, Bagama B, Magajiya, Iku South I, Iku South II, Hashimi A, Hashimi B, Maje, Kurmin Sarki and Wambai. The area is covered by two major rock formations; the sedimentary and basement complex rocks. The sedimentary rocks (Bida basin) to the south are characterized by sandstones and alluvial deposits, particularly along the Niger valley and in most parts of Niger state while the Basement Complex comprises of migmatites, gneisses, schists, migmatite-gneiss and granite [14] of the Birnin-Gwari Schist and Kuschaka Formation. The existing land use of the study area includes residential, commercial, recreational, Industrial, Agricultural and educational land uses. These land use types create spatial imbalance due to human needs. The relocation of the seat of Government from Lagos to Abuja in 1991, has also led to the emergence of satellite towns such as Karu Urban Area, Suleja, Gwagwalada, Lugbe, Kuje and other smaller settlements. The influx of people from these towns to Suleja has led to rapid construction of houses to accommodate people who commute to work in Abuja on daily basis. Suleja Local Government has a population of 216,578 according to the 2006 census and Socio-economic activities in the area include export of pottery, farming, cotton weaving, dyeing with locally grown indigo and mat making are the traditional primary activities.

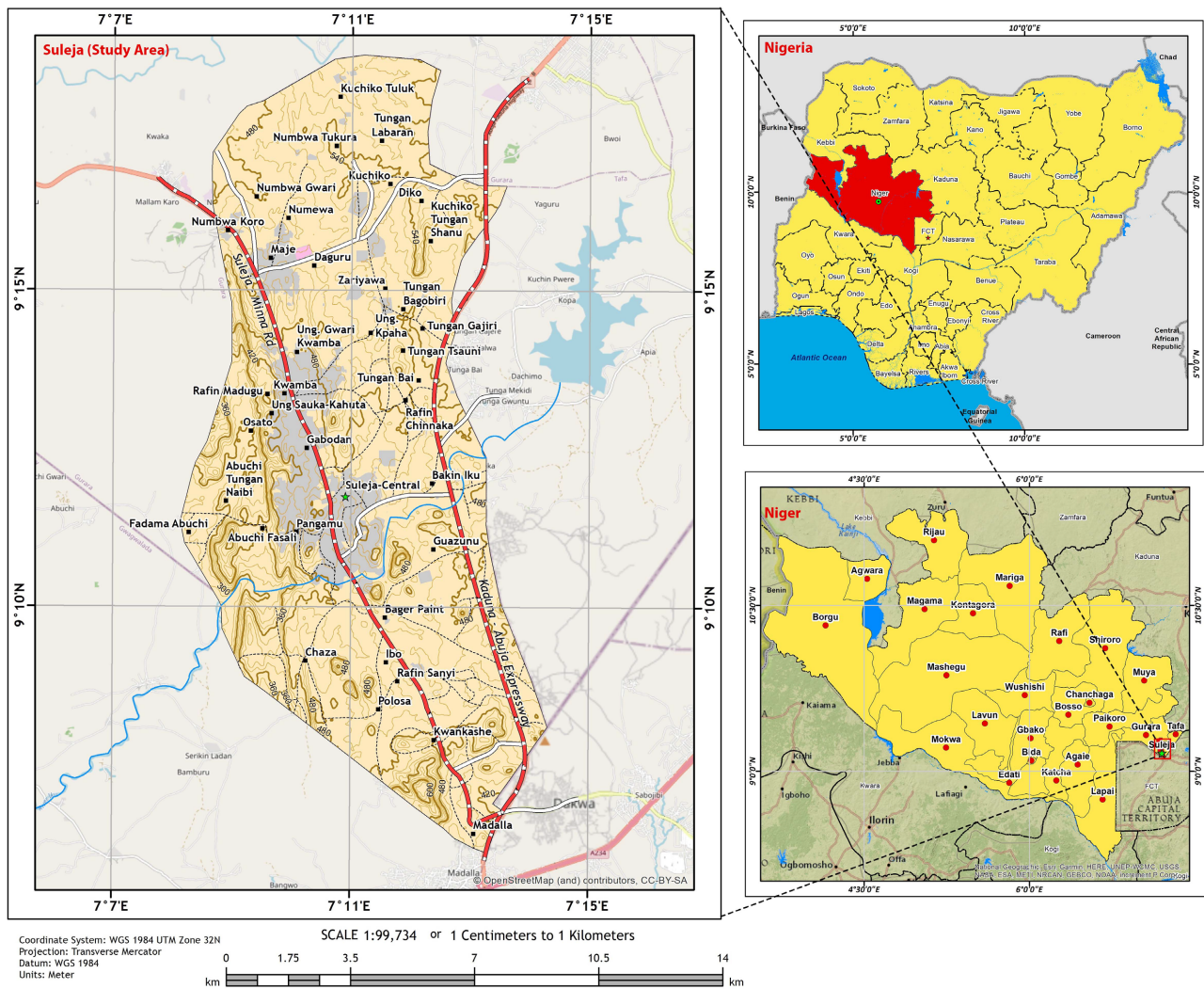


Figure 1. Map of Study Area. Source: Author’s lab work (2022).

### 3. Methodology

#### 3.1. Data Collection

Aspatial and spatial statistical techniques along with GIS were used for this research. Secondary data which includes crime rate, address of incidence, time, date and type of offence according to the Nigerian Police Abstract of Statistics (NPACS) as outline by [15] were collected from the crime records of the Nigerian Police Force (NPF) Divisional Headquarters, Suleja, Niger State Police Command. Data on the absolute location of the Police stations were obtained using a hand-held GPS (76CSx Garmin) set to an accuracy of  $\pm 3$  m. The documented crime addresses collected from the Police alongside the postal code (due to the primitive addressing system) of the area were used to geocode the crime locations which aided in the crime mapping. The crime incident data collected showed crime occurrences in the 3 Police Jurisdictions (A, B and C) from 2017 to 2021, this restriction was placed due to the availability of data within the period under study.

### 3.2. Data Analysis

Data were analysed using descriptive, inferential and spatial statistics techniques. Tables, graphs and maps were used to display and symbolize outputs of the analyses. The spatial distribution pattern of crime incidence was investigated by the Spatial autocorrelation (Global Moran's I) which was set to aggregate features within 300 meters and a conceptualization of fixed distance band. After obtaining the spatial pattern, the spots with the highest incidence called hot spots, were analysed using the Hot Spot Analysis (Getis-Ord  $G_i^*$ ) spatial statistics tool in ArcGIS Pro software. Finally, the Inverse Distance weighted (IDW) analysis was performed for better visualization of the crime hot spot zones.

## 4. Result and Discussion

### 4.1. Spatial Pattern and Distribution of Crime

Research findings on the types of crime committed from June, 2017-October, 2021 shows a wide variety of offences (**Table 1**) which are categorized into three broad classes. These are crime against persons (kidnapping, rape, culpable homicide, armed robbery etc.), property crime (robbery, store breaking, theft.) and crime against public order (act of gross indecency, exam malpractice, joint act, etc.). It was observed that incidence of very serious crime such as armed robbery (61), kidnapping (40), car theft (33), culpable homicide (31), rape (29), and robbery (13) amongst others, were found to be the relatively high and common crime committed in the study area, indicating an average level of urban insecurity (**Table 1**).

**Table 1.** Types and categories of crimes reported in Suleja (2017-2021).

| Crime Against Person  | 129 | 47% |
|-----------------------|-----|-----|
| Abduction             | 6   | 2%  |
| Accidental discharge  | 2   | 1%  |
| Allegation            | 1   | 0%  |
| Causing grievous harm | 6   | 2%  |
| Cheating              | 1   | 0%  |
| Cruelty to children   | 1   | 0%  |
| Culpable homicide     | 31  | 11% |
| Defilement            | 6   | 2%  |
| Foil kidnapping       | 2   | 1%  |
| Kidnapping            | 40  | 15% |
| Person miscarriage    | 1   | 0%  |
| Rape                  | 29  | 11% |
| Sexual abuse          | 1   | 0%  |
| Suicide               | 2   | 1%  |

## Continued

|                                   |            |            |
|-----------------------------------|------------|------------|
| <b>Crime Against Property</b>     | <b>125</b> | <b>46%</b> |
| Armed robbery                     | 61         | 22%        |
| Arson                             | 1          | 0%         |
| Breaking & entry                  | 5          | 2%         |
| Car theft                         | 33         | 12%        |
| Extortion                         | 4          | 1%         |
| Robbery                           | 13         | 5%         |
| Theft                             | 4          | 1%         |
| Unlawful possession               | 4          | 1%         |
| <b>Crime Against Public Order</b> | <b>11</b>  | <b>4%</b>  |
| Act of gross indecency            | 1          | 0%         |
| Exam malpractice                  | 1          | 0%         |
| Joint act                         | 8          | 3%         |
| Looting                           | 1          | 0%         |
| <b>Other offence</b>              | <b>7</b>   | <b>3%</b>  |
| Sudden & unnatural death          | 5          | 2%         |
| Unnatural offence                 | 2          | 1%         |
| <b>Total</b>                      | <b>272</b> | <b>100</b> |

Source: Author, 2021.

Crime distribution among the Police Divisions as presented in **Table 2** depicts that B Division (99) recorded the highest incidents of crime in the area, followed by C Division (90) and A Division (83) respectively. Crime against persons and property crimes were prevalent, constituting 93% of the total crime committed in the study area. The most common crimes in these two categories are armed robbery, kidnapping, Car theft and culpable homicide.

#### 4.2. Spatial Pattern of Crime

In spatial modeling, the spatial autocorrelation play an important role. A wide variety of methods for testing and measuring spatial autocorrelation have been improved over time. However, many geographers are keen on utilizing the Moran's I which is one of the well-known spatial autocorrelations [16].

The result of the spatial autocorrelation (global Moran's I) analysis as depicted in **Figure 2** shows that the crime incidence rate in the study area have a clustering pattern, with a Moran's index of 0.097 and a p-value of 0.06. With a corresponding Z-score of 1.87 the result implies a more than 90% confidence that the likelihood of the observed clustering pattern could not have been the result of a random happenstance.

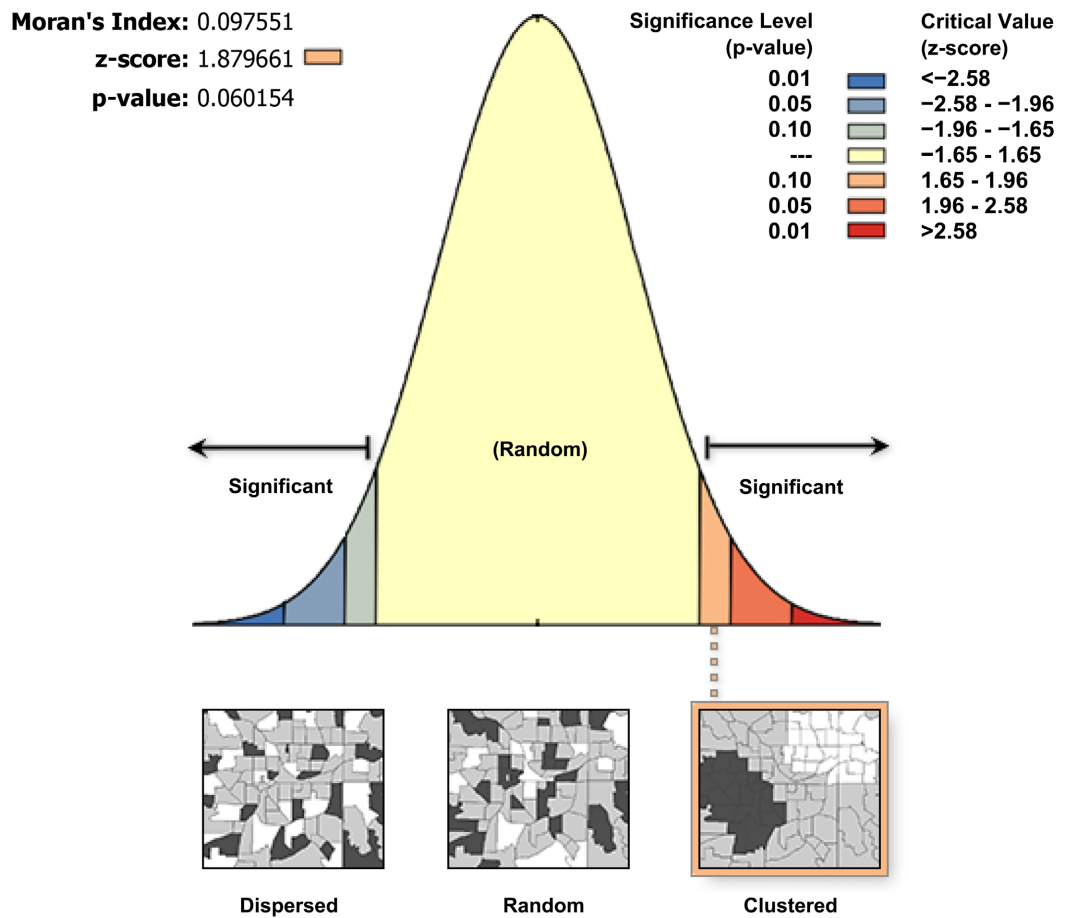
The Getis-Ord  $G_i^*$  statistic was applied to identify crime hot-spots as illustrated in **Figure 3**, there are three major hot spots areas (Suleja-central, Chaza

**Table 2.** Crimes by police division.

| Type of Offence          | A Division | B Division | C Division |
|--------------------------|------------|------------|------------|
| Abduction                | -          | 1          | 5          |
| Accidental discharge     | 2          | -          | -          |
| Act of gross indecency   | -          | -          | 1          |
| Allegation               | 1          | -          | -          |
| Armed robbery            | 17         | 20         | 24         |
| Arson                    | -          | 1          | -          |
| Breaking & entry         | 1          | 4          | -          |
| Car theft                | 16         | 7          | 10         |
| Causing grievous harm    | 2          | -          | 4          |
| Cheating                 | -          | 1          | -          |
| Cruelty to children      | 1          | -          | -          |
| Culpable homicide        | 11         | 10         | 10         |
| Defilement               | -          | -          | 6          |
| Exam malpractice         | 1          | -          | -          |
| Extortion                | -          | 2          | 2          |
| Foil kidnapping          | -          | 2          | -          |
| Joint act                | 4          | -          | 4          |
| Kidnapping               | 1          | 36         | 3          |
| Looting                  | -          | 1          | -          |
| Person miscarriage       | -          | -          | 1          |
| Rape                     | 12         | 3          | 14         |
| Robbery                  | 7          | 6          | -          |
| Sexual abuse             | -          | -          | 1          |
| Sudden & unnatural death | 1          | 2          | 2          |
| Suicide                  | -          | 1          | 1          |
| Theft                    | 4          | -          | -          |
| Unnatural offence        | -          | 2          | -          |
| Unlawful possession      | 2          |            | 2          |
| <b>Σ</b>                 | <b>83</b>  | <b>99</b>  | <b>90</b>  |

Source: Author, 2021.

and Madalla) with 90% confidence and only one cold spot (Anguwan Gwari, Kwamba), which was at 90% confidence. The prediction model has a high Z-value of 1.045 concentrated in the central and down south of the study area and a low Z-value of -1.63 mostly located in the northern and southeastern part of the study area. Some community noted for regular incidence of crime such as Kidnapping, Armed robbery and culpable homicide are Chaza, Berger paint, Polosa,



Given the z-score of 1.879661, there is a less than 10% likelihood that this clustered pattern could be the result of random chance.

**Figure 2.** Spatial autocorrelation of crime incidence rate.

APC and PDP quarters all in B division's jurisdiction. Occurrence of serious crime in these areas can be attributed to low or few security formation as in the case of Chaza on the other hand PDP and APC quarters are more developed and urbanize such an area can serve as crime attractors and can create criminal opportunities according to the Crime Pattern Theory (CPT) by [17]. Offences such as Rape, Defilement, as well as culpable homicide, Armed robbery and kidnapping among other items were mostly carried out around Kwankwashe, Madala, New kwata, Alhaji borehole and Rafin sanyi (C division's jurisdiction). As shown in **Table 2** armed robbery and rape are the most frequent reported crimes amongst residents of Madalla, the proliferation crimes in this area can be attributed its close promixty with the Federal Capital Territory, Abuja and also presence of market. A division has also recorded high cases of robbery, rape, culpable homicide, car theft and armed robbery cases repeatedly occurring in Suleja-central, Kwamba, Maje, Kaduna road, and second gate as shown in **Table 2** and **Figure 3**.



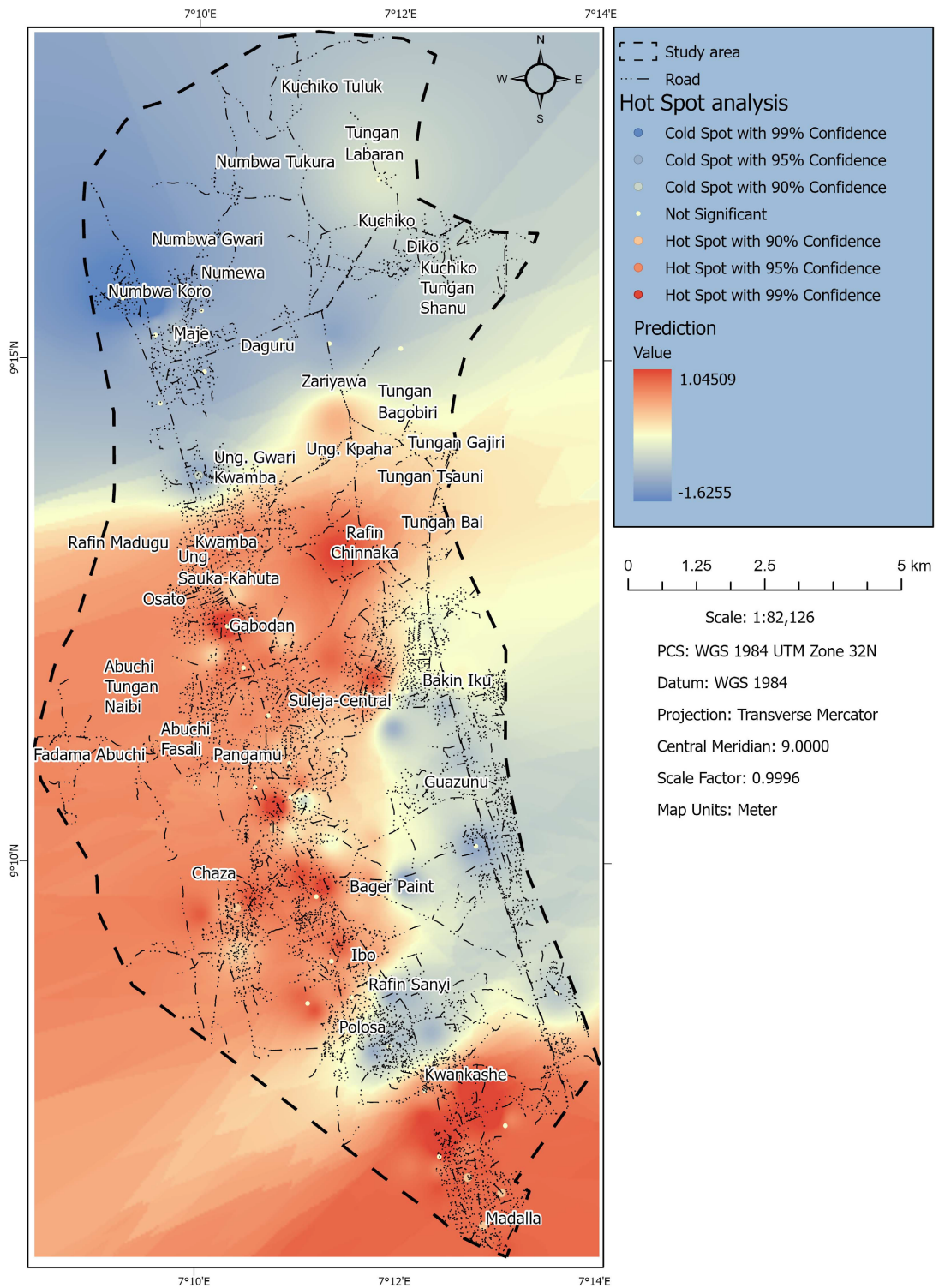


Figure 3. Crime hot spot map of the study area. Source: Author, 2021.

The crime hotspot map as depicted in Figure 3 shows areas with cluster of criminal activities. Inadequate Security formation has been noted for and the lapses identified for effective prevention and control of crime in these crime hotspots and in Suleja Local government at large. These hotspots as shown in

**Figure 3** require efficient and effective security intervention, intensive patrol and the application of improved strategies in prevention crime.

## 5. Conclusions and Recommendation

The research work was based on data collated from the records of the Suleja Police Divisions (A, B, C) for the period of January 2017 to October 2021, 272 officially reported capital offences were collected and used in the analysis. However, due to the unwillingness of residents to report crime, particularly in developing countries such as Nigeria, the data presented in this study may not represent accurately the volume of crime committed in the study area during the period under study. Nonetheless, it remains the official data for researchers, criminologists, policy makers and others to work with. Thus, the most widely available data source right now on investigating the spatial pattern and distribution of crime in the study area comes from the available police data as at the time of writing.

Crime rate is not uniformly spread across the landscape. In some places, crime rate is high. And in other places, crime rate is almost absent. This study has shown how GIS analytical techniques as a tool can be used effectively to analyse crime and display crime maps for adequate planning in terms of resources and personnel deployment towards combating crime in the study area.

Crime of different types and magnitudes are common features of human settlement that threaten the security of our towns and cities. In fact, in developing countries inadequate infrastructural facilities in the rural and some urban areas encourage migrant to cities and town with the expectation for better standard of living. Surprisingly, that hope is being eluded leading to increase in urban poverty.

The study of types and pattern of crime in Suleja reveals that the town recorded varying degrees of crime across its neighbourhoods between year 2017 and 2021. Although the study observed that the incidences of serious crimes like armed robbery, Kidnapping, car theft, culpable homicide and rape are high, the predominance of other forms of personal and property crimes in neighbourhoods classified as hot spots and high crime areas are enough threat to urban security. The following recommendations are therefore put forth based on the findings of this study;

- 1) There is the need for the Nigerian Police and other law enforcement agencies to focus and devote more policing activities to crime against persons and property which are the predominant in Suleja.
- 2) The crime hot spots areas require close monitoring and devotion of more resources in terms of establishment of police stations\post, deployment of more personnel and logistics, etc.
- 3) The police authorities in Suleja and Niger State at large should set up Geospatial science departments in all police stations to provide Geospatial analysis so as to aid crime prevention and appropriate policing.

4) The patrol units should be equipped with GPS for better surveillance and real time tracking of criminal activities.

5) The community, vigilantes and private security outfit as stakeholders should be encouraged and enlightened on the strategies and vital role they can play and, in an attempt, to curb crime in the area.

The recommendations made should be considered and implemented by concerned authorities to promote the security of lives and properties in Suleja.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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