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Research Article

Spatial Assessment of Crime Vulnerability Using AHP and GIS in Kano Metropolis

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ABSTRACT

Crime remains a significant urban challenge in Kano Metropolis, requiring data-driven approaches to understand its spatial patterns and support effective interventions. This study applies geospatial techniques to model crime vulnerability using an integrated Analytical Hierarchy Process (AHP) and Geographic Information Systems (GIS) framework. Factors considered include distance to police stations, population density, land use/land cover, poverty index, road network density, education level, and the children exclusion index. These variables were standardized, reclassified into vulnerability classes, and weighted according to their influence on crime occurrence. A weighted overlay analysis was conducted to produce a composite Crime Vulnerability Index (CVI) map, categorizing the metropolis into low, moderate, and high-risk zones. The results reveal clear spatial variations in crime vulnerability. Low vulnerability areas cover 340.8 km² (68.3%) of the study area, moderate vulnerability zones account for 107.8 km² (21.6%), while high vulnerability areas occupy 50.4 km² (10.1%). High-risk zones are concentrated in densely populated areas with intense commercial activities, poor socio-economic conditions, and limited access to police services. Conversely, low-risk areas are associated with planned residential neighborhoods, lower population density, and stronger security presence. The study demonstrates the effectiveness of integrating GIS and multi-criteria decision-making techniques in identifying crime hotspots and recommends enhanced policing, surveillance systems, and GIS-based monitoring to support proactive crime prevention and efficient resource allocation.

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1 Introduction

Urban crime has emerged as one of the most persistent challenges confronting cities across the globe, particularly in rapidly growing urban centers in developing countries. In Nigeria, the rise in urban population, socio-economic disparities, and infrastructural deficits has contributed to increasing crime rates, especially in major metropolitan areas such as Kano. As a commercial and administrative hub in northern Nigeria, Kano Metropolis has experienced varied forms of criminal activities, including theft, assault, burglary, and violent crimes, which pose significant threats to public safety, economic stability, and urban development (Ahmed, 2011).

Poverty and inequality have become critical factors influencing crime rates in Kano. Empirical studies indicate that individuals living in poverty are more likely to engage in criminal activity as a coping mechanism or as a result of limited access to education and formal employment (Alemika & Chukwuma, 2005; UNODC, 2019). Common crimes in the city include theft, burglary, robbery, and drug-related offenses, often concentrated in densely populated and economically deprived neighborhoods. These challenges are compounded by weak institutional responses, limited law enforcement capacity, and inadequate urban governance structures (Ojo & Ojewale, 2018). Crime analysis, therefore, plays a role in understanding and addressing these dynamics. Through tools such as Geographic Information Systems (GIS), spatial statistics, and socio-economic data analysis, researchers and policymakers can identify crime hotspots, examine root causes, and implement targeted interventions (Odufuwa et al., 2015). Analyzing the relationship between population pressure, poverty, and crime is essential for designing effective crime prevention strategies and promoting safer, more inclusive urban development in Kano Metropolis (Ahmed & Maikano, 2012).

In Kano State, one of Nigeria's most populous and economically vital states, with its metropolis being the largest city in Northern Nigeria, the crime situation has grown increasingly complex and spatially dynamic due to rapid urban expansion, high population growth, rural-urban migration, and its role as a major commercial and administrative center (Pilling, 2025). Kano Metropolis experiences a unique blend of urban crime typologies, including theft, assault, drug-related offenses, political thuggery, and inter-group clashes (Ahmed & Salihu, 2013; Okeshola & Mudiare, 2013; Jibril et al., 2017). These criminal activities are often concentrated in dense, low-income neighborhoods and informal settlements such as Kurna, Yankaba, Dorayi, and parts of Sabon Gari, where social amenities are lacking, and street crimes and youth

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gang activities are recurrent (Adebayo, 2013; Ahmed et al., 2019).

The rise in drug abuse, particularly among youths, has been a major security concern, with the National Drug Law Enforcement Agency regularly reporting high rates of drug-related arrests in the metropolis, viewing drug use as both a driver and consequence of criminal behavior (NDLEA, 2020; Abdullahi & Abdullahi, 2019). Despite several policy interventions, the absence of real-time, spatially explicit crime data and the lack of integration between crime data and spatial analysis tools have hindered proactive crime prevention and effective deployment of law enforcement resources, making it difficult to understand where and why crimes are occurring. The socio-economic consequences are severe: this rising insecurity undermines quality of life and public trust in law enforcement, deters investment, hampers tourism, and limits the effective functioning of the justice system, particularly as rapid population growth, poverty, and youth unemployment continue to create conducive conditions for criminal activities in urban centers.

Recent literature underscores the value of GIS in crime analysis. For example, Adepoju and Aloba (2020) demonstrated how spatial analysis using GIS could effectively map and identify armed robbery hotspots in Ibadan, enabling targeted policing interventions. Similarly, Oshan and Wolf (2020) employed spatio-temporal modeling to analyze urban crime dynamics in the United States, highlighting the importance of integrating temporal trends in crime mapping. In the Nigerian context, Eze and Uzochukwu (2019) applied GIS to map crime patterns in Enugu metropolis, revealing spatial clustering of crimes around transport terminals and market areas. These studies illustrated the growing role of GIS in enhancing crime data interpretation, resource allocation, and proactive policing.

Existing studies in Kano Metropolis and similar Nigerian urban areas have made important contributions to understanding crime patterns, yet several critical gaps remain. For instance, Ahmed et al. (2013) and Ahmed and Salihu (2013) highlight the usefulness of GIS in mapping crime distribution in Dala LGA and show hotspots in some strategic locations. Similarly, Ibrahim et al. (2018) identified crime hotspots in Minna and emphasized the role of spatial planning, while Abubakar (2023) extended the analysis to institutional environments by linking crime patterns to youth demographics. Beyond spatial factors, Umar and Ahmed (2021) revealed the importance of media in crime prevention, and Ahmed (2011) pointed out persistent challenges related to crime data availability and accessibility in Nigeria.

However, these studies are largely descriptive and focus on mapping crime patterns rather than modeling using different factors. Furthermore, there is limited application of advanced geospatial modeling and machine learning techniques that can capture complex, non-linear relationships between crime and its determinants. Therefore, the key gap lies in the lack of an integrated and predictive modeling approach to crime analysis in Kano Metropolis.

Therefore, the main objective is to develop a geospatial model that combines environmental, socio-economic, and infrastructural factors to predict crime occurrence using the Analytical Hierarchy Process.

2 Materials and Methods

2.1 Study Area

Kano Metropolis is located in the northwestern part of Nigeria and serves as the capital of Kano State (Figure 1). It lies between Latitudes 11°50′N and 12°05′N and Longitudes 8°30′E and 8°50′E (Akinyemi, 2012). Kano is one of the oldest and most prominent commercial centers in West Africa, with a long-standing history of trade, agriculture, and craftsmanship. The metropolis is made up of eight Local Government Areas (LGAs): Dala, Fagge, Gwale, Kano Municipal, Nassarawa, Tarauni, Kumbotso, and Ungogo (Abubakar, 2014).

The 2006 NPC has shown the area with over 4 million people and projected to be over 4.648 million in 2022. Indicating to be one of the most densely populated urban areas in Nigeria resulted in various forms of crime, including theft, burglary, assault, drug abuse, and political thuggery, which have been linked to factors such as poverty, unemployment, youth restiveness, rapid population growth, and inadequate policing (Yahaya, 2025).

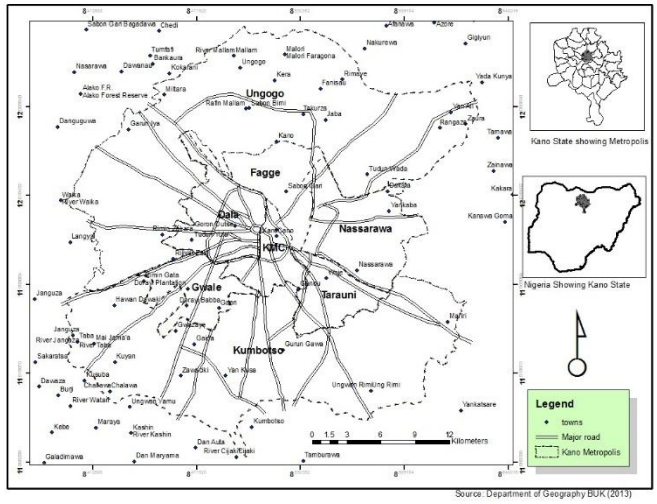

Figure 1. Kano Metropolis

2.2 Type and Sources of Data

The study utilizes multiple datasets from diverse sources to support spatial analysis and validation (as summarized

in Table 1). Sentinel imagery with a spatial resolution of 10 meters, obtained from the USGS data pool (http://lpdaac.usgs.gov/datapool/datapool.asp), is used as raster data for land use analysis. Population data from 2006, available in shapefile format, is sourced from GRID3 (https://grid3.gov.ng/), the National Population Commission (NPC), and WorldPop (https://www.worldpop.org), and is used for population projection. Data on police stations and other security agencies, collected through fieldwork, provide records on the distribution of security infrastructure. Socioeconomic variables such as income level, education level, and household characteristics are derived from NPC records, GRID3, and WorldPop, and are used for spatial analysis across the study area.

Table 1: Type and Source of Datasets

Datasets	Resolution (m)	Data type	Purpose	Source(s)
Sentinel	10	Raster (2025)	Land use	http://lpdaac.usgs.gov/datapool/datapool.asp
Population (2006)		Shapefile	Population projection	https://grid3.gov.ng/ NPC https://www.worldpop.org
Police stations and other security stations		Record	Distribution of security agencies	Field data
Income level		NPC records	Spatial analysis	NPC https://grid3.gov.ng/ https://www.worldpop.org
Education level		NPC records	Spatial analysis	NPC https://grid3.gov.ng/
Household level		NPC records	Spatial analysis	NPC https://grid3.gov.ng/

2.3 Data Analysis

2.3.1 AHP Comparison Matrix for Crime Modeling

Based on empirical crime research in Nigerian urban contexts, the following matrix reflects the relative importance of each factor. Values >1 indicate the row factor is more important than the column factor (Table 2).

Table 2: Pairwise Comparison Matrix for Crime Modeling

Factors	Education Exclusion (Child)	General Exclusion (Child)	Population	Poverty	Land Use	Road Network	Distance to Police
Education Exclusion (Child)	1	1/2	1/3	1/3	2	2	1/3
General Exclusion (Child)	2	1	1/2	1/2	3	3	1/2
Population	3	2	1	1	4	4	1
Poverty	3	2	1	1	4	4	1
Land Use	1/2	1/3	1/4	1/4	1	1	1/4
Road Network	1/2	1/3	1/4	1/4	1	1	1/4
Distance to Police	3	2	1	1	4	4	1

2.3.2 Normalized Matrix and Priority Weights

Normalize each value (value ÷ column sum) and average across rows is presented in Table 3. The weights were used in the GIS environment during the integration of the modeling.

Table 3: Factors Normalization

Factor	Priority Weight	Percentage
Distance to Police	0.231	23.1%
Poverty	0.231	23.1%
Population	0.231	23.1%
General Exclusion (Child)	0.115	11.5%
Education Exclusion (Child)	0.077	7.7%
Road Network	0.058	5.8%
Land Use	0.058	5.8%
TOTAL	1.000	100%

2.3.3 Consistency Ratio (CR) Calculation

The Consistency Ratio (CR) serves as a critical validation metric in the Analytic Hierarchy Process (AHP), ensuring that the pairwise comparisons among the seven crime factors are logically coherent rather than random or contradictory. A CR value of 0.019 (or 1.9%) was obtained from the pairwise comparison matrix, which is well below the acceptable threshold of 0.10 (10%). Consequently, the derived priority weights, where distance to police, poverty, and population each received 23.1% influence, can be confidently applied in the weighted overlay analysis to generate a valid crime susceptibility map for Kano Metropolis. CI = (λmax - n) / (n - 1)

CI = (7.15 - 7) / (7 - 1)
CI = 0.15 / 6
CI = 0.025
CR = CI / RI

For n = 7, the Random Index (RI) = 1.32

CR = 0.025 / 1.32
CR = 0.019 (or 1.9%) (within the acceptable unit)

3 Results

3.1 Analyse the factors of crime modeling

The spatial distribution of crime-related factors across the metropolitan area reveals a strong relationship between urban structure, socioeconomic conditions, and vulnerability patterns (Figure 2).

The road network distribution (Figure 2A) shows a clear concentration within the core urban LGAs, particularly in Nasarawa, Tarauni, Gwale, Dala, and Municipal. These areas exhibit high connectivity and accessibility, which tend to support intense economic and social interactions. While such connectivity promotes development, it also increases opportunities for crime due to higher movement of people, goods, and potential offenders. In contrast, the peripheral LGAs of Ungogo and Kumbotso show lower road density, reflecting reduced accessibility and potentially lower crime opportunities, but also limited surveillance and emergency response coverage.

Proximity to law enforcement, as indicated by the police buffer zones (Figure 2B), further reinforces this spatial pattern. Areas within a 1–2 km radius of police stations, especially around Nasarawa, benefit from higher security presence and faster response times, which can act as a deterrent to criminal activities. However, the outskirts of Ungogo and Kumbotso fall outside these effective coverage zones, potentially increasing vulnerability due to delayed intervention and reduced deterrence.

The education exclusion index (Figure 2C) presents a critical social dimension of crime vulnerability. High levels of educational exclusion are concentrated in the northeastern parts of the metropolis, particularly in Ungogo, and in the southern sections of Kumbotso. Additional hotspots are observed in eastern areas such as Nasarawa and Municipal. These patterns suggest that limited access to education may contribute to higher susceptibility to crime, either through increased likelihood of youth involvement in criminal activities or reduced socioeconomic opportunities.

The general exclusion index (Figure 2D) shows a similar spatial pattern, further emphasizing the role of social deprivation in shaping crime risk, especially in central and eastern neighborhoods such as Dakata and Yankaba. High levels are also observed around Dorayi Babba, as well as in the northwestern areas around Kokarani and in the southwestern parts, including Zawaciki and Unguwan Yantu. In contrast, areas such as Goron Dutse, Kofar Kudu, and parts of Nasarawa exhibit relatively lower levels, while moderate levels are observed in Rimin Zakara and Rijiyar Zaki.

The poverty index (Figure 2E) provides a strong socioeconomic explanation for crime patterns. Higher poverty levels are observed in the eastern parts of the metropolis, with index values reaching up to 2.99, while lower levels (around 0.64) are found in northern areas. Moderate poverty levels are present in the southwestern region. Areas with higher poverty are often linked to increased crime vulnerability due to economic hardship, unemployment, and social inequality. When combined with other factors such as educational exclusion and limited access to law enforcement, these areas become

critical hotspots for crime risk.

Land use distribution (Figure 2F) highlights the influence of urban form on crime dynamics. The core metropolitan LGAs, Gwale, Nasarawa, Municipal, Fagge, and Dala, are characterized by mixed land use, combining commercial, residential, and institutional functions. Such complexity often leads to increased human activity and interaction, which can elevate crime risk, particularly in densely populated commercial hubs. Conversely, the outskirts of Kumbotso and Ungogo are dominated by agricultural land use with limited urban development, resulting in lower activity levels but also reduced natural surveillance.

Population distribution (Figure 2G) further intensifies these spatial dynamics. High population densities are concentrated in Dala and Fagge, with additional clusters in Gwale and parts of Nasarawa and Municipal. High population density is often associated with increased crime risk due to overcrowding, competition for resources, and anonymity within large populations. In contrast, the more sparsely populated LGAs of Kumbotso and Ungogo exhibit lower population pressure but may face challenges related to service accessibility and infrastructure.

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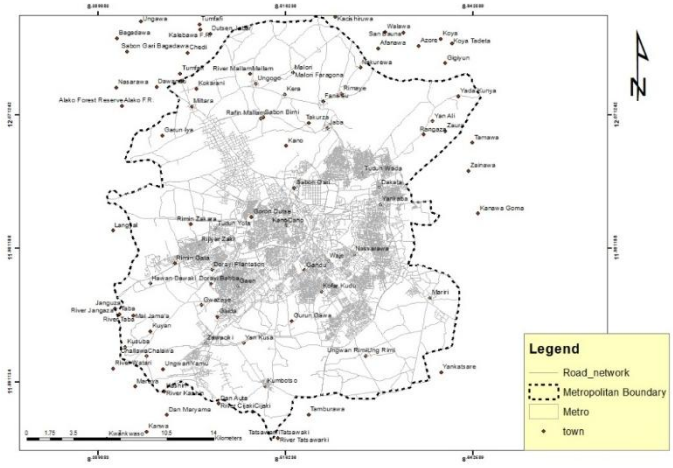

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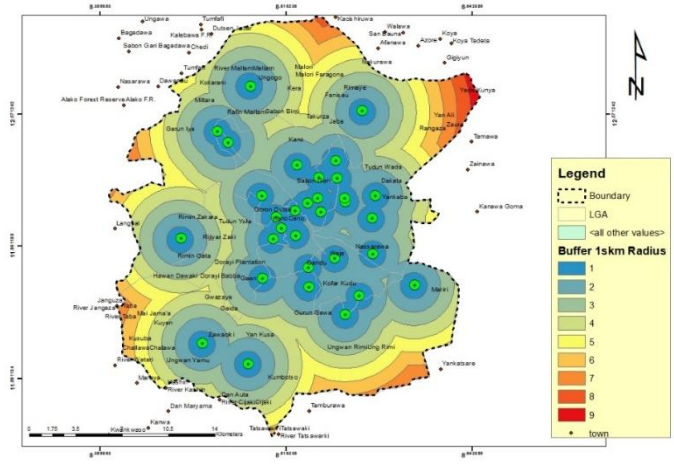

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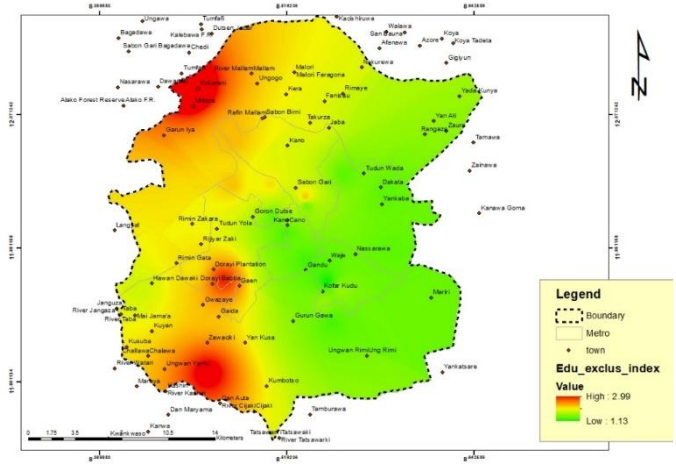

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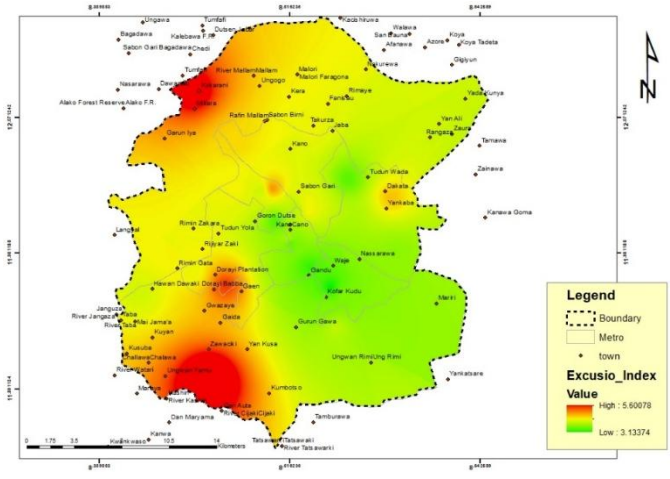

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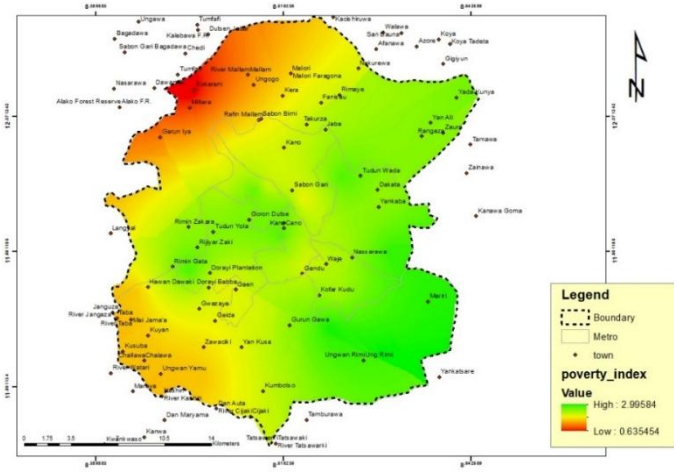

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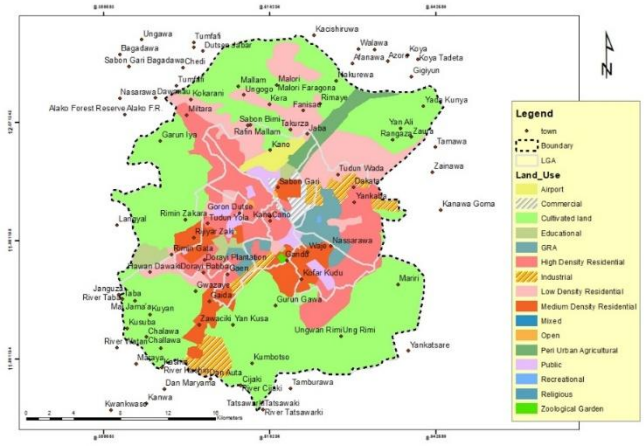

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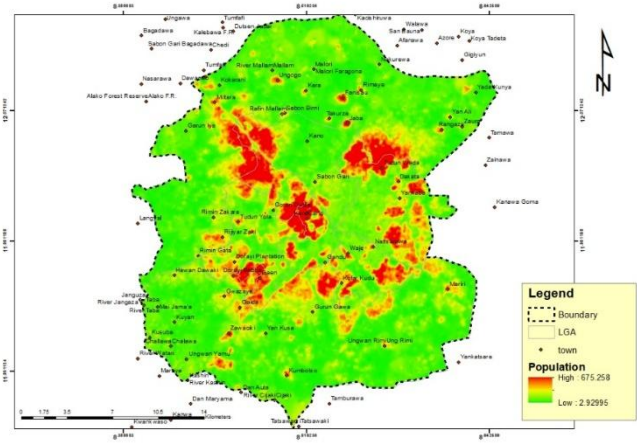

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Figure 2: Distributions of Crime Factors

3.2 Distribution of Classified Crime Factors

Population distribution (Figure 3A) also contributes to variations in crime patterns. High-density areas (9.7%) experience higher crime rates due to overcrowding, competition for resources, and increased anonymity. These findings align with Crime Pattern Theory, which explains how crime is influenced by human movement and interaction in space (Brantingham & Brantingham, 1993). Moderate population areas (19.8%) show balanced crime levels, while low-density areas (70.5%) generally experience lower levels of street crime but remain vulnerable to isolated incidents such as burglary due to limited surveillance.

Poverty (Figure 3B) emerges as a major underlying factor influencing crime distribution. A substantial portion of the study area (43.6%) falls within high poverty zones, and these areas are strongly associated with property-related crimes such as theft and burglary. This supports the argument of Strain Theory, which posits that individuals experiencing economic hardship may resort to crime as a means of coping with limited legitimate opportunities (Merton, 1938). Areas with moderate poverty levels (34.7%) display mixed crime patterns, while low poverty areas (21.7%) tend to experience fewer economically motivated crimes but may attract targeted offenses due to the presence of valuable assets. Empirical studies consistently show a strong relationship between poverty and increased crime rates, particularly in urban settings (World Bank, 2022; UNODC, 2023).

The results reveal that road density (Figure 3C) plays a significant role in shaping the spatial pattern of crime across the study area. Areas with high road density, although relatively small in size (12.5%), tend to experience higher levels of street-related crimes such as phone snatching, pickpocketing, and vehicle theft. This can be attributed to the high level of connectivity in these areas, which provides multiple access and escape routes for offenders. The constant movement of people and vehicles also creates anonymity, making it easier for crimes to occur without immediate detection. This finding is consistent with the principles of Routine Activity Theory, which explains that crime occurs where opportunities, motivated offenders, and a lack of guardianship intersect (Cohen & Felson, 1979). In contrast, areas with moderate road density (18.8%) show transitional crime patterns, while low road density areas

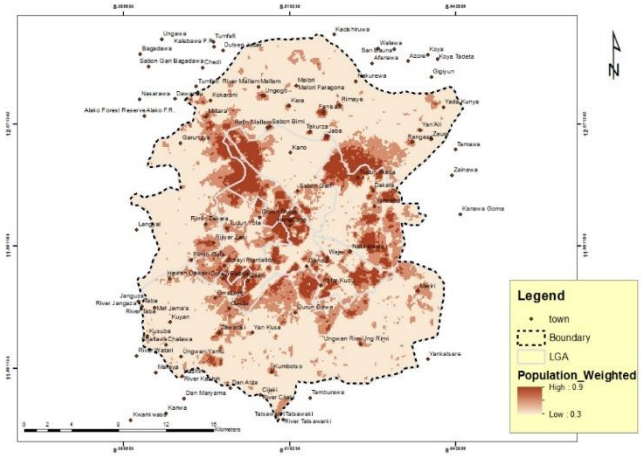
(68.7%) generally record fewer street crimes due to reduced accessibility. However, their isolation makes them more vulnerable to crimes such as burglary, where offenders can operate with minimal surveillance.

Child exclusion (Figure 3D) further highlights the social dimensions of crime. Areas with high levels of child exclusion (8.8%) tend to experience increased juvenile delinquency, including petty theft and antisocial behavior. This is often linked to a lack of access to education, social services, and family support systems. The large proportion of moderate exclusion areas (50.9%) is particularly concerning, as these areas may develop into future crime hotspots if preventive measures are not implemented. In contrast, areas with low child exclusion (40.3%) generally show stronger social cohesion and lower levels of youth-related crime. Research indicates that early childhood support and inclusion significantly reduce long-term involvement in crime (UNICEF, 2022).

Education exclusion (Figure 3E) also plays an important role, particularly in influencing youth involvement in crime. Areas with high levels of educational exclusion (9.6%) are more prone to crimes such as street violence, drug-related activities, and gang formation due to limited access to formal opportunities. This finding aligns with Social Disorganization Theory, which emphasizes that weak social institutions, including education systems, contribute to higher crime rates (Shaw & McKay, 1942). Moderate exclusion areas (44.8%) represent zones of emerging risk, while areas with low education exclusion (45.6%) tend to exhibit greater social stability and lower crime involvement. Recent studies also confirm that increased educational access significantly reduces youth crime and delinquency (UNESCO, 2023).

Access to police services, as shown by the police buffer zones (Figure 3F), significantly affects crime occurrence and distribution. A large proportion of the study area (63.0%) has low police coverage, and these areas tend to experience higher levels of crime due to weak deterrence and delayed response times. This observation supports Deterrence Theory, which suggests that the likelihood of punishment reduces criminal behavior (Becker, 1968). Areas with moderate police accessibility (33.7%) show partial control, while areas with high police presence (3.4%) generally report lower levels of visible crime. However, some crimes may persist in less visible forms, indicating that policing alone cannot eliminate criminal activity. Studies by the United Nations Office on Drugs and Crime highlight that effective policing combined with community engagement is more successful in reducing crime (UNODC, 2023).

Land use patterns (Figure 3G) provide important insight into the spatial dynamics of crime. Areas with high land use intensity (68.1%), particularly those characterized by mixed residential and commercial activities, tend to experience higher crime rates. The concentration of people and economic activities in these areas creates more opportunities for crimes such as shoplifting and street theft. Moderate land use areas (10.3%) show relatively stable crime patterns, while low land use areas (21.6%) generally experience lower crime levels but may still face occasional incidents such as trespassing and theft. Studies in urban criminology confirm that mixed land use areas often serve as crime hotspots due to increased interaction between potential offenders and targets (Jacobs, 1961; UN-Habitat, 2022).



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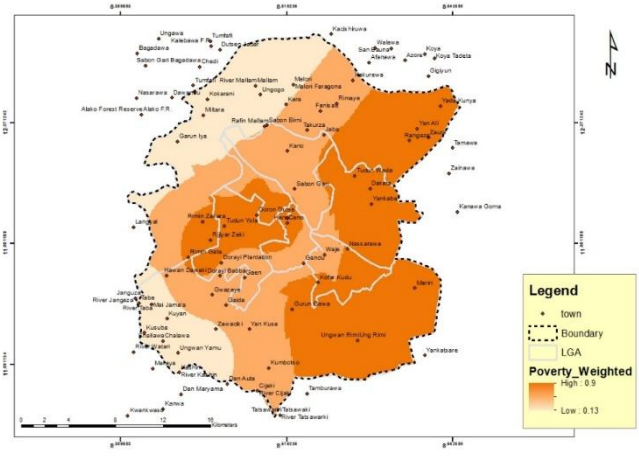

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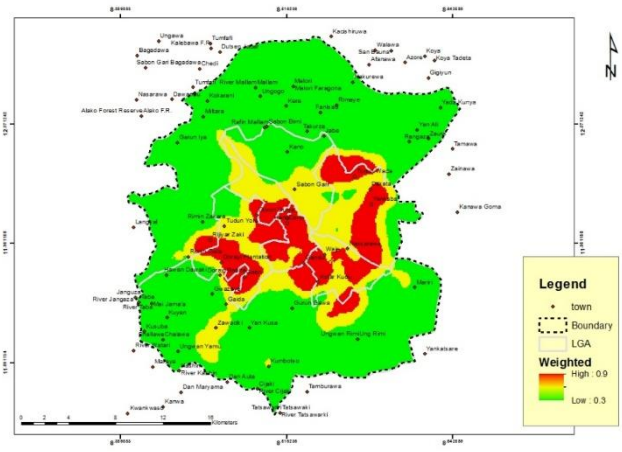

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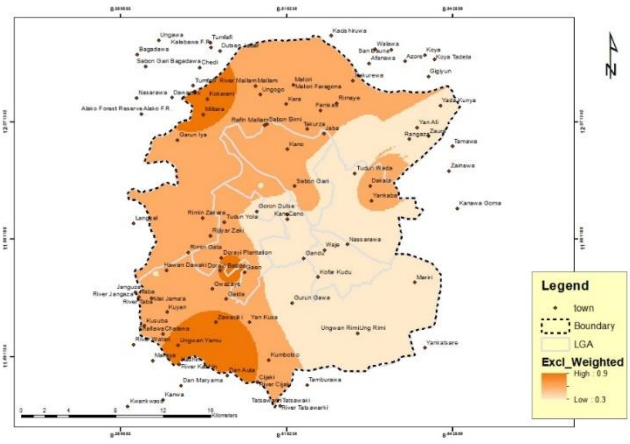

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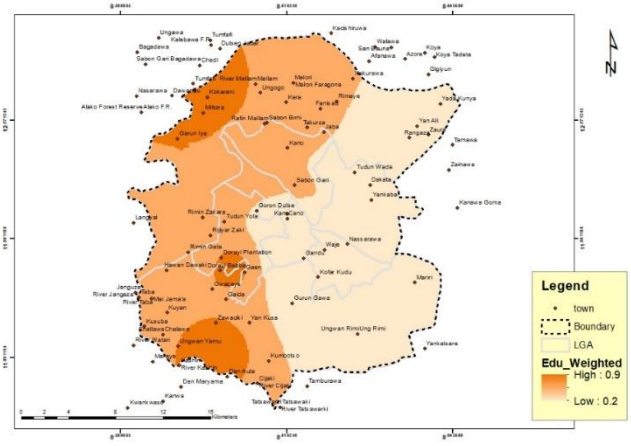

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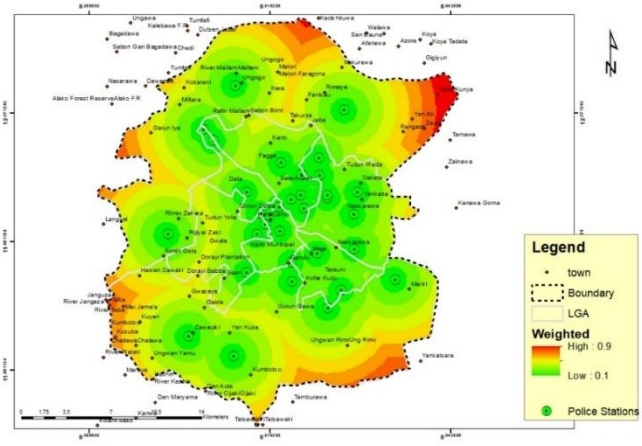

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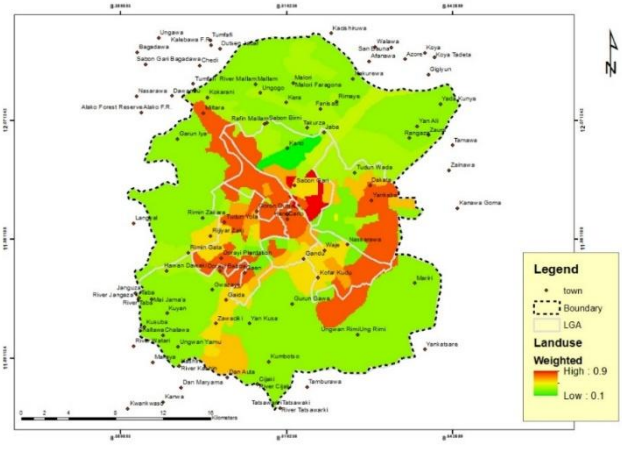

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Figure 3: Distribution of Classified Crime Factors (A=Population, B=Poverty, C= Road network density, D=Exclusion, E=Education exclusion, F=Police Buffer zones, G=Landuse)

Table 4: Classified Crime Risk Factors

	Road density		Poverty Level		Education Exclusion Level		Police	
Class	**%**	**Km²**	**%**	**km²**	**%**	**km²**	**%**	**km²**
Low	68.70%	342.7	21.70%	108.3	45.60%	227.7	63.00%	314.4
Moderate	18.80%	93.8	34.70%	173.2	44.80%	223.6	33.70%	168.2
High	12.50%	62.5	43.60%	217.5	9.60%	47.9	3.40%	16.4
Total	100	499	100	499	100	499	100	499

	Child Exclusion Level		Population		Land Use	
Class	**%**	**km²**	**%**	**km²**	**%**	**km²**
Low	40.30%	201	70.50%	351.7	21.60%	107.8
Moderate	50.90%	254	19.80%	98.8	10.30%	51.4
High	8.80%	43.5	9.70%	48.5	68.10%	339.8
Total	100	499	100	499	100	499

3.3 Crime Vulnerability Modelling

The spatial distribution of crime vulnerability across the study area reveals a clear core–periphery pattern, indicating that crime is unevenly distributed and strongly influenced by urban structure and human activity (Figure 4). This aligns with recent GIS-based studies in Nigeria, which confirm that crime hotspots are typically concentrated in densely populated urban cores where accessibility, commercial activity, and population pressure are high (Idhoko et al., 2025; Umar et al., 2023). The high crime index areas (≈0.7), though occupying only 10.1% (50.4 km²) of the study area, represent the most critical hotspots located in central urban districts such as Dala, Fagge, Gwale, and Nasarawa (Table 5). Similar findings in Nigerian cities show that central business districts and high-density neighborhoods consistently record higher crime incidence due to increased human interaction and land-use complexity (Balogun et al., 2014).

The moderate vulnerability zones, covering 21.6% (107.8 km²), form transitional belts surrounding the urban core. These areas are characterized by expanding road networks, increasing population density, and mixed residential–commercial land use. Recent studies in Nigeria have shown that such peri-urban zones often experience shifting and emerging crime patterns due to rapid urban expansion and weak planning control (Umar et al., 2023; Idhoko et al., 2025). If unmanaged, these zones may evolve into future high-risk crime hotspots as urbanization intensifies.

In contrast, low vulnerability areas dominate the landscape, covering 68.3% (340.8 km²), and are mainly located in peripheral settlements such as Ungogo and Kumbotso. These areas are associated with low population density, limited road connectivity, and predominantly agricultural land use, which reduces opportunities for criminal activities. This supports recent Nigerian spatial crime studies, which found that crime intensity is significantly lower in sparsely populated and less accessible rural–urban fringe areas due to reduced offender–target interaction (Nkwunonwo et al., 2020).

This finding is consistent with recent GIS-based crime research in Nigeria, which shows that crime is highly clustered in limited urban hotspots rather than evenly distributed across space (Ahmed et al., 2013). The results highlight that crime vulnerability is more intense than extensive, meaning that a small number of highly active urban locations account for most crime occurrences. This underscores the need for targeted policing, improved urban planning, and spatially informed crime prevention strategies in Nigerian cities.

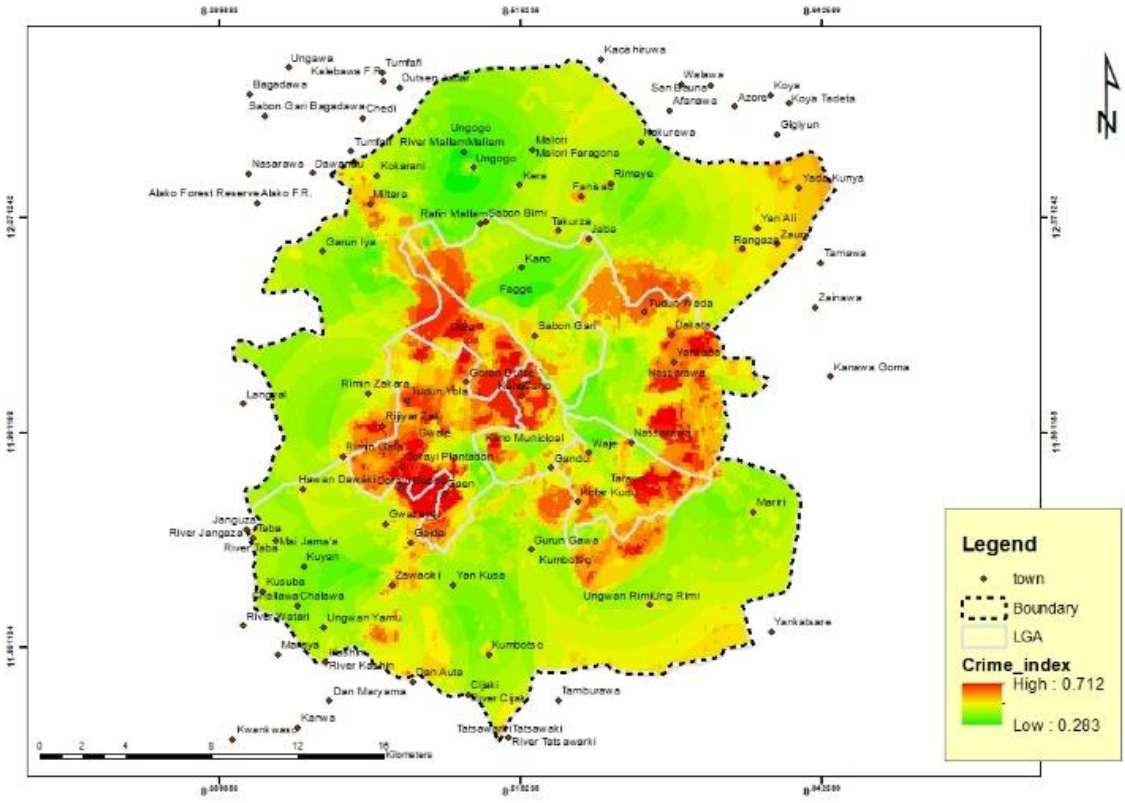

Figure 4: Crime Vulnerability Classes

Table 5: Crime Vulnerability Classes

Vulnerability Class	(%)	km²
Low	68.30%	340.8
Moderate	21.60%	107.8
High	10.10%	50.4
Total	**100**	**499**

4 Conclusion

This study has demonstrated that crime vulnerability within the metropolitan area is strongly influenced by the spatial interaction of physical, socioeconomic, and infrastructural factors. By integrating variables such as road density, population distribution, land use, poverty levels, education exclusion, and accessibility to police services, the analysis reveals that crime risk is not randomly distributed, but rather spatially structured and clustered.

The findings show that the high vulnerability zones, though covering a relatively small proportion of the study area, represent the most critical crime hotspots. These areas are concentrated within the urban core, particularly in Dala, Fagge, Gwale, Nasarawa, and Municipal, where there is a high concentration of population, dense road networks, and complex land use activities. These conditions create an enabling environment for crimes such as phone snatching, pickpocketing, robbery, and other urban-related offenses. The intensity of human interaction and mobility in these areas significantly increases both the opportunity and frequency of criminal activities.

In contrast, the low vulnerability areas, which dominate the study area, are largely located in the peripheral regions such as Ungogo and Kumbotso. These areas are characterized by lower population density, limited road connectivity, and less intensive land use, often dominated by agricultural and low-density residential activities. While these conditions reduce the likelihood of frequent crime, they may still be susceptible to isolated incidents due to limited surveillance and reduced access to law enforcement services.

The paper recommended for;

i. Law enforcement agencies should adopt a geographically focused crime prevention strategy that prioritizes the high-vulnerability zones identified in Dala, Fagge, Gwale, Nasarawa, and Municipal. Given that these areas cover a relatively small proportion of the metropolis but harbor the most critical crime hotspots, deploying additional police patrols, establishing mobile police posts, and increasing surveillance in these specific locations

would yield the highest crime reduction returns per resource invested.

ii. The Kano State Government should implement targeted poverty alleviation programs, youth skills acquisition schemes, and child education enrollment campaigns, particularly in high-vulnerability urban core areas where these factors are most concentrated.

iii. The finding that high-density population, complex land use, and dense road networks correlate strongly with crime vulnerability suggests that urban planning interventions can reduce crime opportunities. These interventions should include improving street lighting in high-density residential and commercial zones and regulating land use mixing to reduce unsupervised blind spots.

iv. The Kano State Police Command should collaborate with relevant stakeholders such as KANGIS to establish a Geographic Information System (GIS)-based crime dashboard that maps incidents in real time, enabling dynamic resource deployment and early warning systems for emerging hotspots.

v. The state government should promote community engagement. In areas with access problems, both in the urban core and peripheral zones with limited road connectivity and reduced police access, community-based surveillance mechanisms should be established.

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