

SPATIAL DISTRIBUTION OF CRIME INCIDENCE AND PREVALENCE WITHIN STUDENTS' RESIDENTIAL AREAS; A HOTSPOT ANALYSIS

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Abstract

This study investigated the types and spatial distribution of crime incidences in the residential areas occupied by students of the University of Jos. The study identified geospatial crime patterns to better understand how criminal activities manifest across space and time within the selected locations. The study used a descriptive survey design, integrating both primary data (questionnaires and GPS coordinates) and secondary data (crime reports and satellite imagery) within a GIS framework. A multi-stage sampling method identified 180 hostels from a total of 540, and spatial analysis using ArcGIS allowed for the visualization of crime patterns and hotspots. Findings revealed four major crime types: theft, assault, burglary, and rape. Theft was found to be the most prevalent, accounting for 44% of reported cases, followed by assault (32%), burglary (20%), and rape (4%). Spatial analysis revealed that Ring Road, Rutsau, and Naraguta Village/Gidan-Mai were the most affected areas, with Ring Road having the highest concentration of theft and burglary incidents. The accessibility of these areas and their proximity to main roads, coupled with poor urban planning and limited security presence, were major contributing factors to the high crime rates. In contrast, Fillin Sukwa, which is closer to a police station and has stronger community cohesion, recorded fewer crime cases. The findings confirmed the dominance of property crimes and personal assaults in university environments. The study concluded that the spatial characteristics of neighbourhoods and the availability of security infrastructure significantly influenced crime patterns. The study recommends keeping up-to-date records of crime detection points, as well as their geographic coordinates, in order to track crimes at the spot level rather than at the neighborhood level, this will help in solving the problem of crime at the grassroot level. Furthermore, strategic urban planning and increased security presence in off-campus student residential areas is encouraged to mitigate crime and enhance student safety.

Key Words; Crime mapping, student residence, urban security, crime hotspots, off-campus crime

INTRODUCTION

The prevalence of crime within universities and other educational institutions in Nigeria is increasingly alarming. In recent years, university students have become frequent victims of various crimes, significantly affecting their academic performance and overall well-being. Crime, a persistent threat to human society, remains deeply rooted in the Nigerian context as it is globally. Ackerman and Murray (2004) observe that crime is a major issue that accompanies societal development, while Danbazau (1999) notes that it undermines the social fabric by eroding public safety and trust.

Despite their role in nurturing morally upright individuals, Nigerian tertiary institutions are not

exempt from high crime rates. University environments, once considered safe havens, have become increasingly insecure. Benjamin and Fashola (2012) assert that traumatic events and place of residence are key factors influencing students' fear of crime. While students residing on campus are assumed to enjoy better security, the reality is complicated by the chronic shortage of on-campus accommodation. Most federal and state universities lack the capacity to house their growing student populations, leading many students to seek accommodation off-campus where they are more vulnerable to crime.

The establishment of private hostels off-campus was initially perceived as a solution (Harasta, 2008). This is a result of the poor funding of universities.

Consequently, a great number of students who do not get accommodation on campus are forced to reside off-campus in the surrounding localities close to the universities. Such students are on their own with little or no university inspection hence a high level of insecurity, albeit the off-campus residences are close to the university.

Various studies on the university and its surrounding regions have shown the economic impact of universities in their surrounding regions. Abiodun (1981) stated that the establishment of Obafemi Awolowo university in 1967 at Ile-Ife expanded and turned Ile-Ife and Madoka an area close to it into an urban unit. The expansion gave rise to land speculation in the neighboring town as a result of both students and staff population who needed accommodation off-campus (Oyenike et al., 2016).

Crime on university campuses has become increasingly widespread, with rising cases of rape, theft, assault, burglary, and other offenses affecting students' safety and well-being. Two broad categories of crime are evident in tertiary institutions. The first involves rare but catastrophic events referred to as "low-probability, multiple-death incidents" that have long-lasting consequences. The second, more frequent type includes crimes such as robbery, sexual assault, theft, fraud, and physical assault. Both categories have infiltrated campuses, exposing students to significant risk.

Although crime is predominantly an urban issue, Baldwin and Bottoms (1976) argue that the urban social dynamics contributing to crime have been underemphasized in criminological research. Crime in urban areas is multifaceted, influenced by behavioural, managerial, physiological, and spatial factors. According to Sutherland et al. (1992), crime rates are closely tied to socio-demographic characteristics such as income level, ethnic composition, education, and youth concentration regardless of race. Since the mid-20th century, it has been acknowledged that crime is not uniformly distributed across urban areas but tends to concentrate in specific locations, prompting the emergence of environmental criminology (Davies, 2020).

Environmental factors including land use play a significant role in crime occurrence. Certain facilities, such as schools, bars, and abandoned buildings, tend to attract more crime (Block & Block, 1995). Formosa (2015) emphasizes that both the physical and social characteristics of neighbourhoods contribute to variations in crime patterns. When repeated incidents

share similar features such as crime type or method, patterns can be detected, potentially forming crime "hot spots" in localized areas (Philip, 2011; Oyenike et al., 2016).

As societies evolve, crime adapts and spreads across various settings, including schools. Once considered safe havens for learning and personal development, educational institutions are increasingly compromised. Noonan and Vaura (2007) regard schools as foundational to national development, while Henry (2000) describes them as sanctuaries of education, free from violence. Unfortunately, this ideal no longer holds. The growing incidence of school-related crimes has become a major concern, disrupting not only the learning environment but also broader societal stability (Wosu & Ukulor, 2014; Oyenike et al., 2016).

Tracking and understanding school-based crimes is essential for effective response strategies. Hanke (1996) notes that without adequate insight into the nature of school crime, efforts to document and address it will be ineffective. According to Wali (2007), school crimes range from threats to life and violent attacks to theft, all of which undermine institutional communication and public confidence. Okechukwu (2012) adds that school-based crimes can involve both internal and external actors—students may be victims or perpetrators, and outsiders can also be involved.

One contributing factor to campus crime is the youthful demographic of the student population. While youth are often full of creativity and energy—attributes beneficial to national development—if misdirected, this energy can lead to social unrest and criminal behavior (Okechukwu, 2012). The consequences of school crime extend beyond the immediate victims, affecting institutions and society as a whole. These effects pose significant challenges to achieving development goals, including the Millennium Development Goals (MDGs) in Nigeria (Amaele, 2006). The investigation of geographic patterns of crime serves as a cornerstone for deciphering the dynamics of spatial phenomena under scrutiny across temporal scales. The integration of spatial feature patterns alongside their corresponding values, achieved through mapping techniques, underpins the application of geographic analysis to the study of crime (He et al., 2020). This approach involves the utilization of point and polygon overlay analysis to map crime incidence at specific

locations, complemented by the employment of the Global Positioning System to capture spatial reference points for each crime incident (Cohen & Felson, 1979). It is within this context that the present study assesses the spatial distribution of crime with the aim of identifying and analyzing the types, distribution and hotspots of crimes occurring in students' residential areas.

MATERIALS AND METHOD

The Study Area

Plateau state is located in the middle belt zone of Nigeria and lies between latitude 8° 30' and 10°30N and longitude 7° 30 and 8° 37E of the equator. It shares a boundary with Bauchi state in the North, Nasarawa state in the south western part, Kaduna state by the west, and Taraba by the east. The state has a land mass covering 26,899 km² (Dung-Gwom, Baklit, Gontul, Galadima and Gyang 2009). The research was carried out in Jos North local government area which is located between Longitude 8° 52' 30" and 8° 53' 30" East and Latitude 9° 57' 30" and 9° 58' 30" North. it has a land area of 291-kilometer square and a population of 429,300 at the 2006 census (Figure 1).

Methods

This study employed a descriptive survey research design, which is appropriate for understanding existing conditions, attitudes, and perceptions within a population. The research utilized both primary and secondary data, integrated through Geographic Information System (GIS) tools to enable spatial analysis. Primary data were collected through the administration of structured questionnaires and the use of GPS devices. The questionnaire was designed to obtain information on the types and frequency of crimes, causes of criminal activities, the occurrence of crime events, and their effects on the student population. Additionally, GPS was used to capture the precise geographical coordinates of each residential hostel, allowing for spatial referencing of data.

Secondary data were sourced from police stations, crime reports, academic journals, libraries, archives, and institutional records. These included crime statistics for the region and other relevant documents. Remote sensing data from Google Earth and the United States Geological Survey (USGS) were also used to support the spatial analysis. The information gathered helped in the creation of base maps and layers within ArcGIS 10.8 for further geospatial processing and interpretation.

The study population comprised all students of the university, but the sampling frame focused specifically on those residing in off-campus hostels. A preliminary reconnaissance survey identified 540 student hostels within four key locations: Ring Road, Rutsau Community, Filin-Sukwa, and Naraguta Village/Gidan Mai. These locations were purposively selected due to their proximity to the university and concentration of student residences. A multi-stage sampling technique was adopted. Firstly, purposive sampling was used to determine the major zones of coverage. Subsequently, systematic random sampling was employed to select 180 hostels, using an interval of three. One student from each selected hostel was administered a questionnaire, and an additional three questionnaires were given to Police Public Relations Officers (PPROs) to provide institutional perspectives on crime in the area.

The data collected were first entered into Microsoft Excel 2021 to build a spatial database. The dataset was then exported to the Statistical Package for Social Sciences (SPSS) version 21 for analysis. Descriptive statistics, such as frequency tables, were used to summarize the responses. For spatial analysis, ArcGIS 13 was employed. Techniques such as point and polygon overlay analysis were used to map crime incidences, identify hotspots, and visualize the geographic spread of criminal activities. The analysis identified areas with crime incidence through average returns method. The GPS data provided the spatial reference points necessary for accurate mapping and display of crime locations.

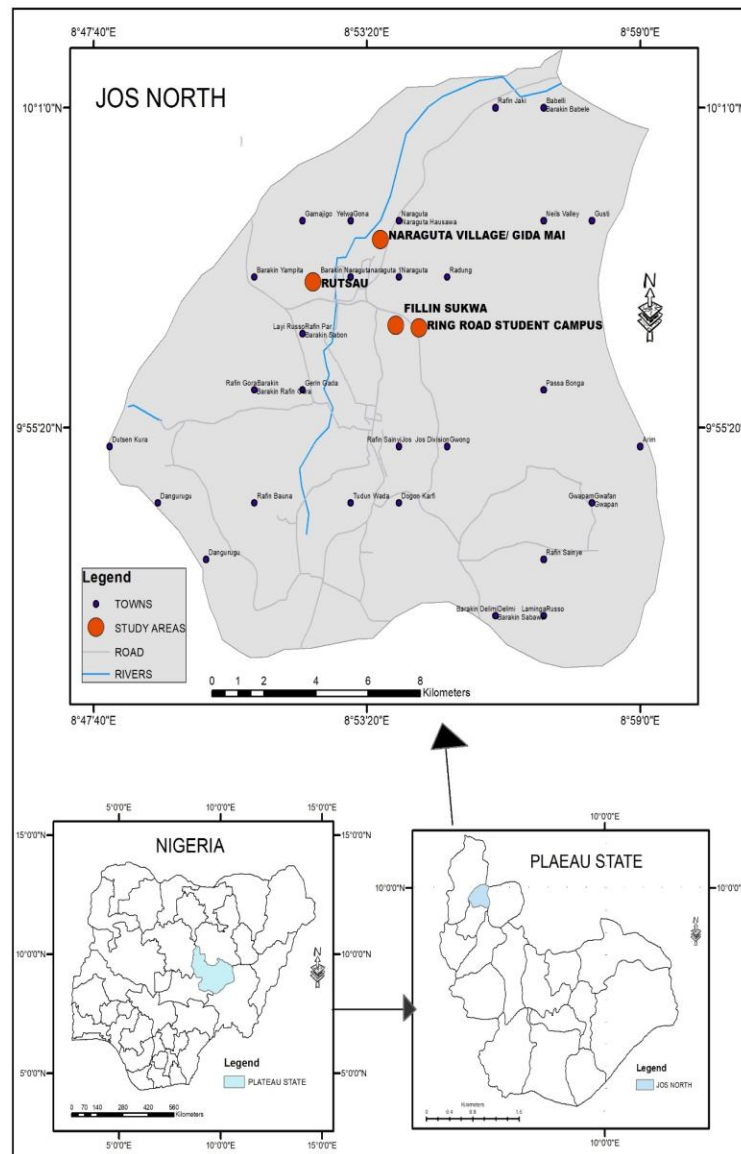


Figure 1: Jos North showing selected off campus hostels; Jos North in Plateau State, and Plateau State in Nigeria

Source; GIS Lab, University of Jos).

RESULTS AND DISCUSSION

Findings showed four predominant types of crime within the University of Jos student residential areas: theft, assault, burglary, and rape. These findings align with prior research conducted in Nigerian educational contexts, which similarly documented these crime categories as common (Oyenike, et al., 2016; 2016; Umar et al., 2020). Additionally, assaults, particularly sexual assaults, have been noted

as prevalent victimization forms on college campuses internationally (Adejimi et al., 2016).

The data collected revealed that theft was the most frequently reported crime (Figure 2), accounting for 44% of incidents, followed by assault (32%), burglary (20%), and rape (4%). The disproportionate rates of these crimes may be linked to socioeconomic challenges, infrastructural deficits, and notably, inadequate security measures in these residential areas (Aluko, 2011; Uche & Uche, 2023).

The unplanned and poorly regulated nature of these neighbourhoods facilitates criminal activity by providing offenders opportunities to evade detection (Anyaka et al., 2020). Furthermore, al., 2024).

rape cases are often underreported due to social stigma, fear of reprisal, and mistrust in law enforcement (Azuka, 2014; Peng et

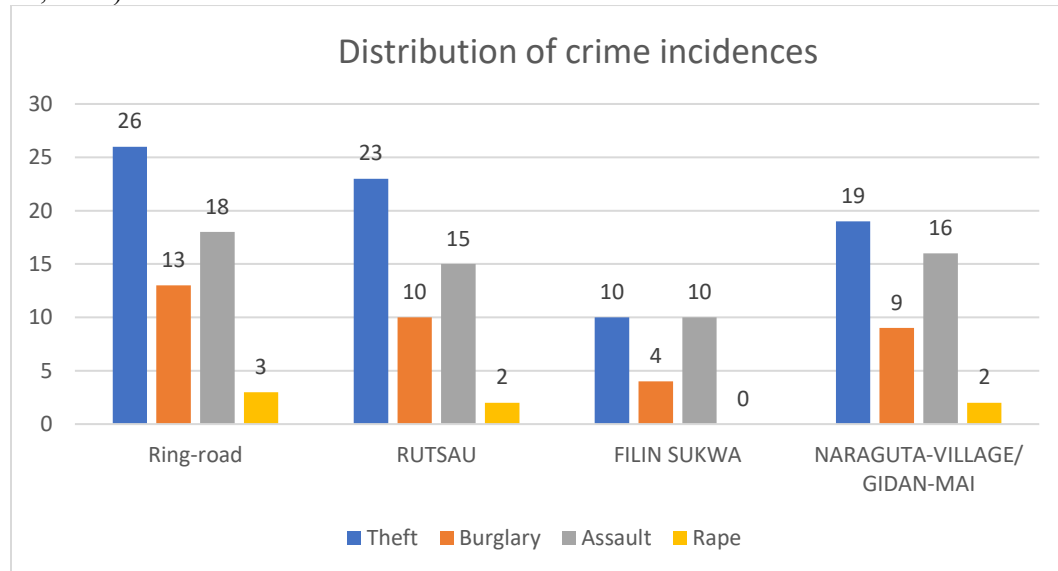


Figure 2. Distribution of crime incidences
Source; Author's analysis, 2023

The spatial analysis highlighted distinct clusters of criminal activity (Figure 3). Theft incidents were widespread (Figure 3), with the highest concentrations reported in Ring Road (15%), Rutsau (12.8%), Naraguta Village/Gidan-Mai (10.6%), and Fillin Sukwa (5.6%). Most thefts occurred at night, targeting valuables such as mobile phones, money, and laptops. Burglary rates were similarly concentrated, with Ring Road accounting for 36% of incidents, followed by Rutsau and Naraguta Village (Figure 3). These burglaries typically occurred during residents' absence and involved forced entry techniques like lock-breaking and window-jumping (Aluko, 2011). Assaults were also prominent across the study area, while rape, although less frequent, remains a significant concern. The higher crime rates in Ring Road, Naraguta Village/Gidan-Mai, and Rutsau can be attributed to the absence of nearby police posts, poor urban planning, and the ease of access these locations provide offenders (Umar et al., 2020; Anyaka et al., 2020). In contrast, Fillin Sukwa, benefiting from closer proximity to a police station (Figure 2) and stronger community cohesion, exhibited lower crime rates (Uche & Uche, 2023). Religious homogeneity in this area may also contribute to its reduced crime prevalence (Corradi et

al., 2020). The roadside location of Ring Road further exacerbates crime rates by facilitating offenders' quick escape and creating a hotspot for armed robberies and burglaries targeting facilities along this corridor (Peng et al., 2024; Bala et al., 2015).

Crime Hot Spot Within Students' Residential Areas

According to Brower and Carroll (2007), crimes were not evenly distributed throughout the university environment. In other words, crime rates were unevenly distributed in a non-random manner across the study area. Consequently, this study conducted a hotspot analysis to identify locations with a consistently high incidence of criminal activity. To achieve this, both hot and cold spots in the study area were identified and mapped. The average returns method was employed to pinpoint areas with elevated crime rates. Specifically, "hot" spots referred to locations with a positive average return, while "cool" spots referred to areas with fewer crime cases than the average. It was important to note, however, that the intensity of these hot and cool spots varied—some were hotter or cooler than others.

The analysis revealed crime-prone areas using the average returns method. Based on the calculated differences between the average and the number of

crime cases, certain locations—Ring Road, Rutsau, and Naraguta Village/Gidan-Mai—exhibited high crime rates (Table 1). These areas were therefore identified as crime hotspots and were represented in

deep red in Figure 4. Medium cool spots were illustrated in light red and light blue, while low cool spots appeared in deep blue. Fillin Sukwa was identified as one of the medium cool spots.

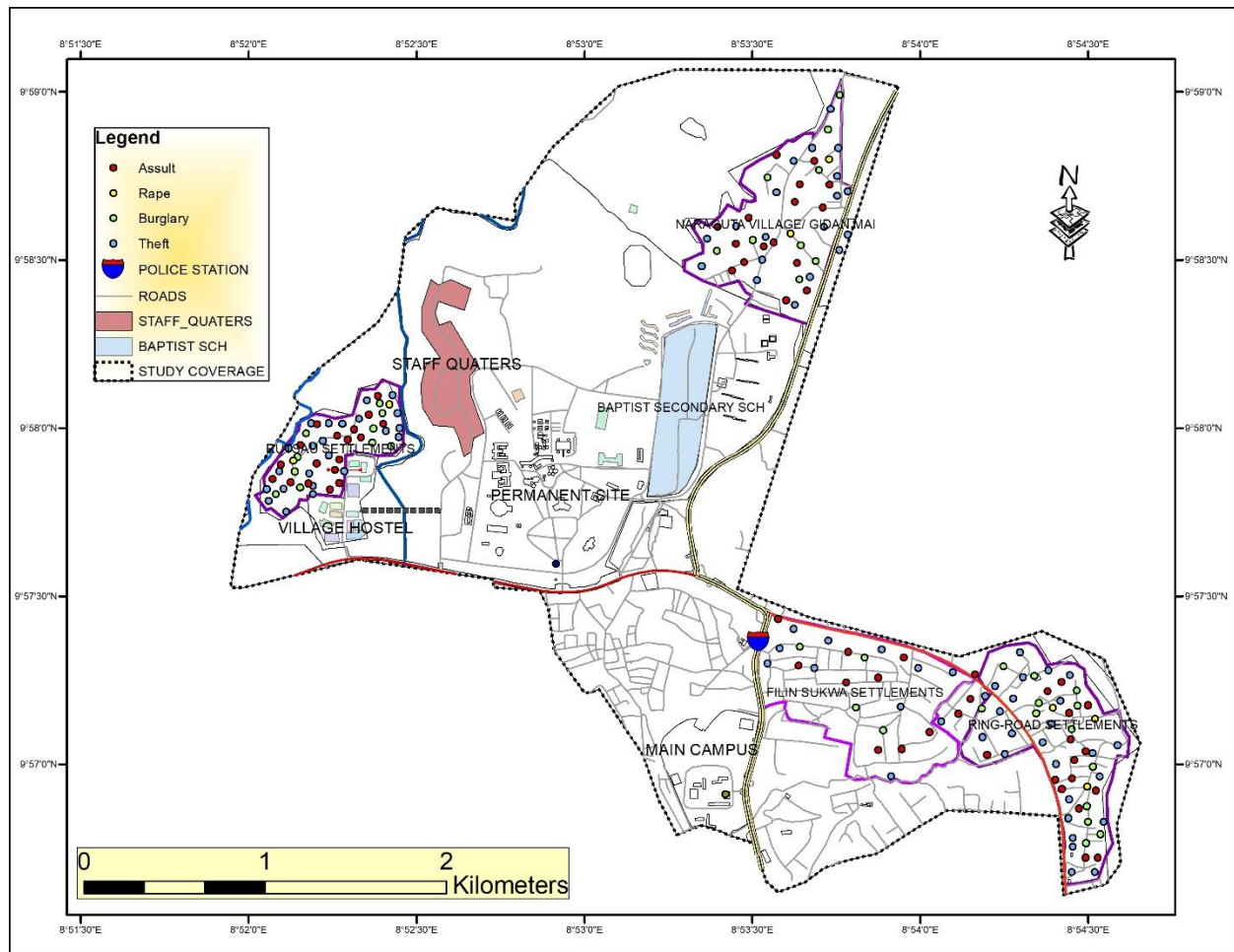


Figure 3: Location and spatial distribution of crime incidence.
Source; Author's analysis, 2023

It was also noted that Ring Road, Rutsau, and Naraguta Village/Gidan-Mai had positive average returns, classifying them as hotspots. These locations experienced a regular influx of students due to their proximity to the campus, vibrant social life, and religious tolerance—factors that attracted many student residents. Additionally, many hostels in these areas were situated in relatively remote locations, potentially providing concealment for criminal perpetrators.

The study demonstrated that geospatial analysis was an effective tool for identifying crime hotspots. Owing to its usefulness in crime prevention, Weisburd and McEwen (2004) observed that crime mapping had fostered a more comprehensive approach to addressing crime issues and had received considerable institutional support.

Table 1 The average returns data of crime

LOCATION	Number of CASES	DIFF. btw Avs no. of crime cases	Remarks
Ring-Road	60	15	Hotspot
Rutsau	50	5	Hotspots
Filin Sukwa	24	-21	Not hotspot
Naraguta-Village/ Gidan-Mai	46	1	Hotspot

Source: Field survey, 2021

Crime Hot Spot Analysis using IDW

Inverse Distance Weighting (IDW) is a deterministic method used for multivariate interpolation based on a known set of scattered points. The IDW interpolator assumes that each input point exerts a local influence that diminishes with distance. From the IDW analysis results (Figures 4 and 5), the Ring Road area exhibited the highest concentration of deep red coloration, indicating a significantly high crime rate. This was followed by Rutsau and Naraguta Village.

In contrast, the results showed that Fillin Sukwa functioned more as a cool spot, with a relatively lower crime rate. This may be attributed to the proximity of a police station and the area's religious homogeneity. Additionally, Fillin Sukwa had a lower concentration of students compared to the other study locations, which could have contributed to its lower crime incidence. It was also observed that most of the crimes occurred along the sides of major roads, particularly in the Ring Road area and Gidan Mai.

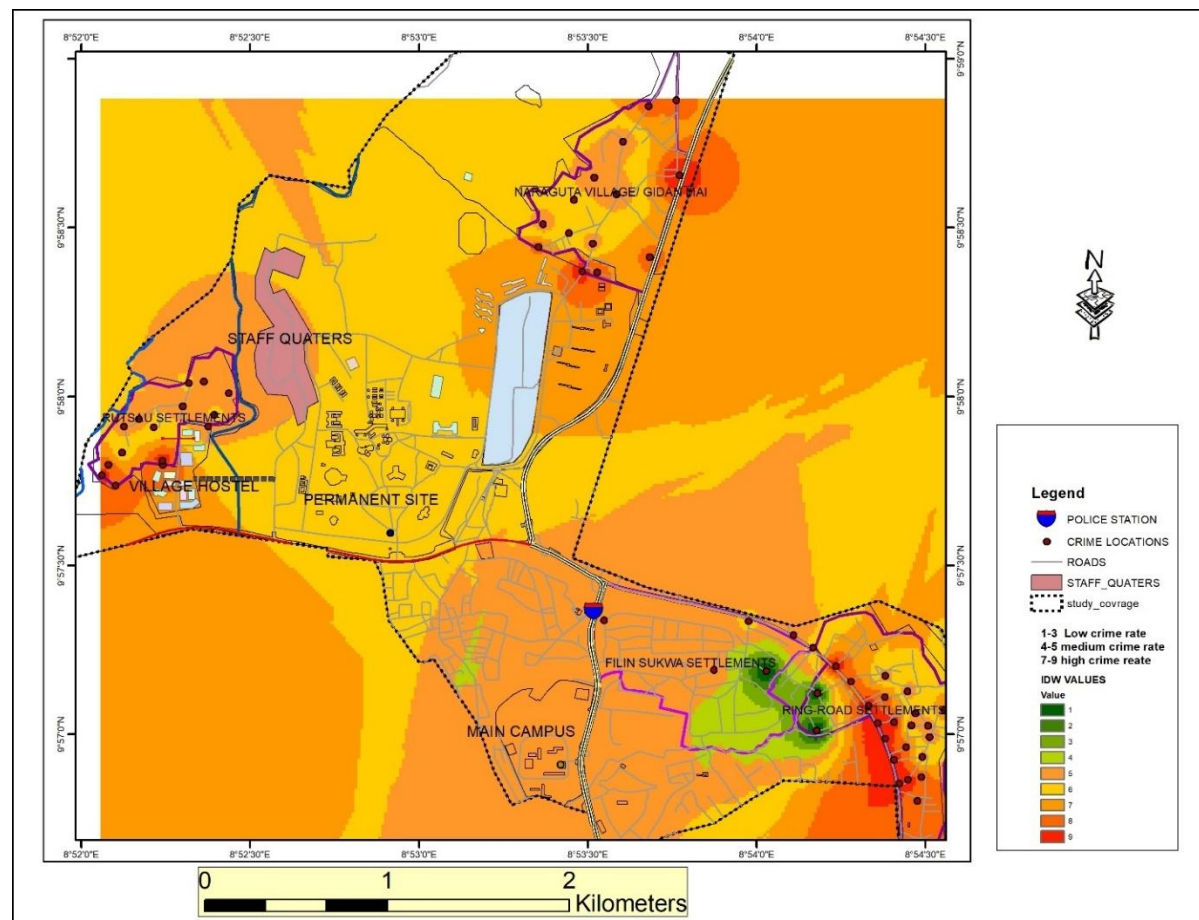


Figure 4 Crime Hot Spots IDW Analysis

Source (Authors' fieldwork, 2023)

Due to the high concentration of crime within Ring Road, Rutsau, and Naraguta Village/Gidan Mai, it was reasonably predictable that criminal activities

would continue to occur in these areas unless preventive measures—such as the establishment of police or other security posts—were implemented.

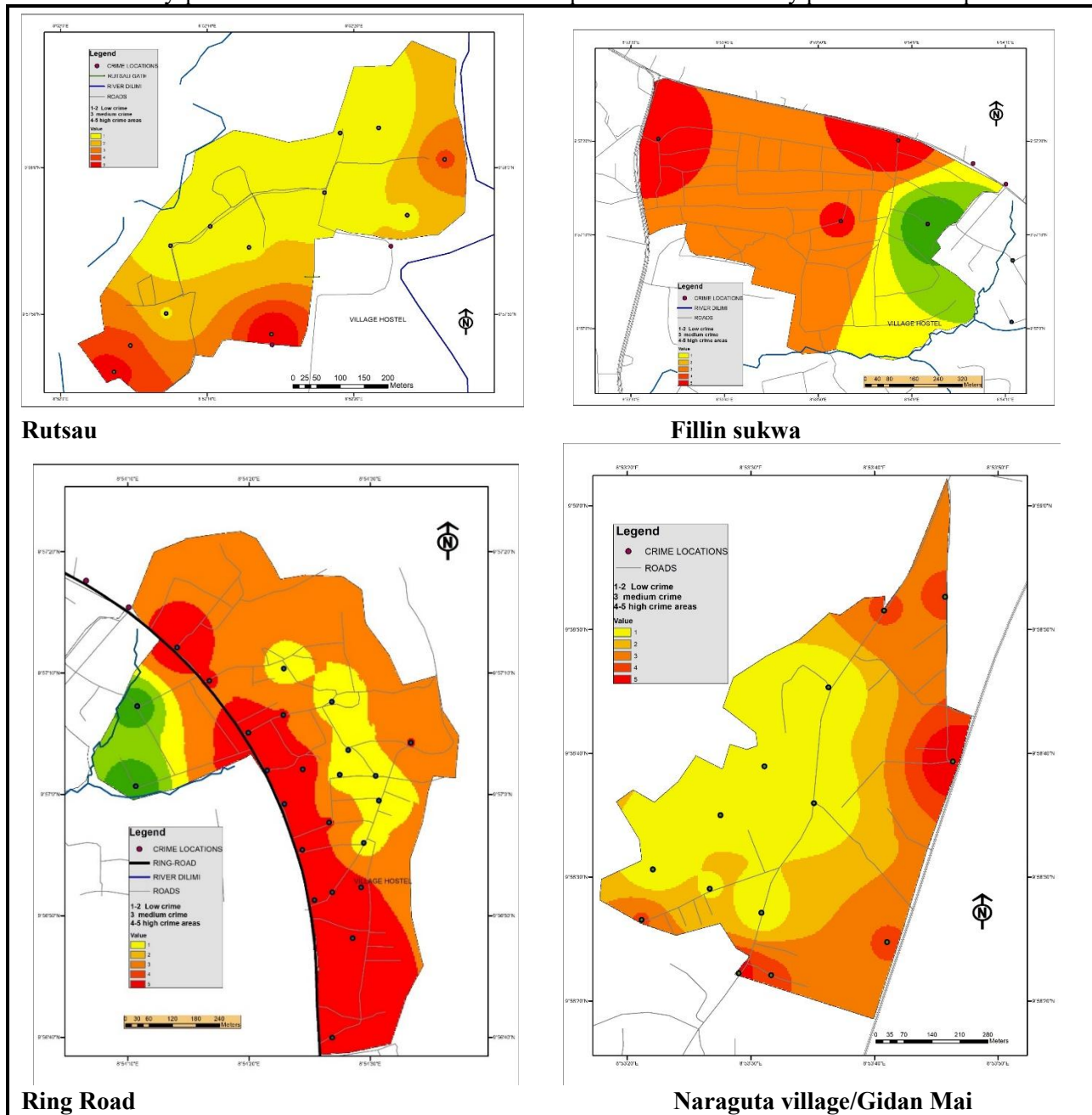


Figure 5; Crime Hot Spots by Study Locations
Source; Author's analysis, 2023

Proximity Analysis of the Relationship Between Study Locations and Police Stations

A 1-kilometre buffer analysis was conducted to assess the distance between the available police station and the various study locations. As shown in

Figure 6, the 1,000-metre (1 km) buffer was used to determine the proximity of the police station to surrounding residential areas. The study revealed that the only police station located within 3 km of most residential areas was the one situated along Bauchi Road, near the university's main campus.

On average, the distance between the police station and the different study locations was approximately 2 km.

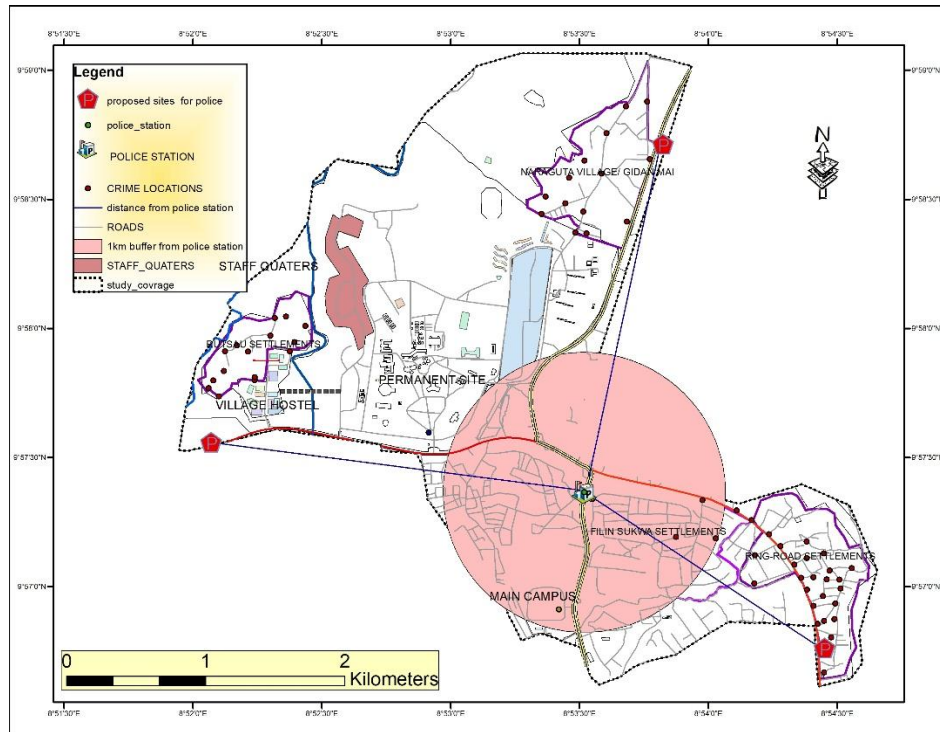


Fig 6: A 1km buffer analysis from the available police post
Source; Author's analysis, 2023

Findings from the study indicated that the number of police posts within the residential areas was insufficient, making it easier for crime perpetrators to operate. As part of the research, a locational analysis was conducted to determine suitable sites for the establishment of new police outposts. Identifying an appropriate location for a police station is influenced by several parameters, including proximity to crime-prone areas, distance from major roads, and distance from existing police

stations, each of which carries a different weight in the decision-making process. This strategic process is referred to as positioning (Karimi, 2016).

A fitness model (Figure 7) was employed to identify optimal locations for the siting of additional police posts. The purpose of this model was to determine the most suitable areas based on predefined criteria. By analyzing spatial data, the fitness model was able to highlight locations that met the necessary conditions for establishing new police stations.

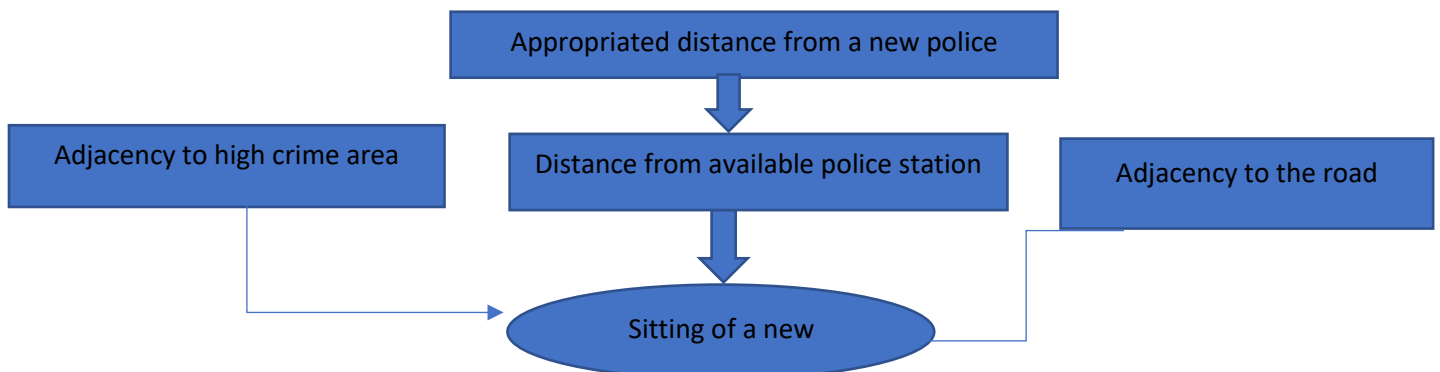


Figure 7: Fitness model for appropriate places for a police station
Source; Author's analysis, 2023

Consequently, appropriate sites for police posts were identified and are presented in Figure 8. In addition, a fitness map (Figure 7) was generated to identify proposed sites for new police stations. The factors considered in the analysis included proximity to crime-prone areas, distance from major roads, and distance from existing police stations. An average distance of 2.3 km was calculated from the existing police station at Bauchi

Road to the three crime-prone study locations. Furthermore, a 2-kilometre buffer analysis was conducted to assess the spatial relationship between the police station and the surrounding residential areas. Based on these findings, three new proposed sites for additional police posts were identified (Figure 8) to enhance security coverage in the study area.

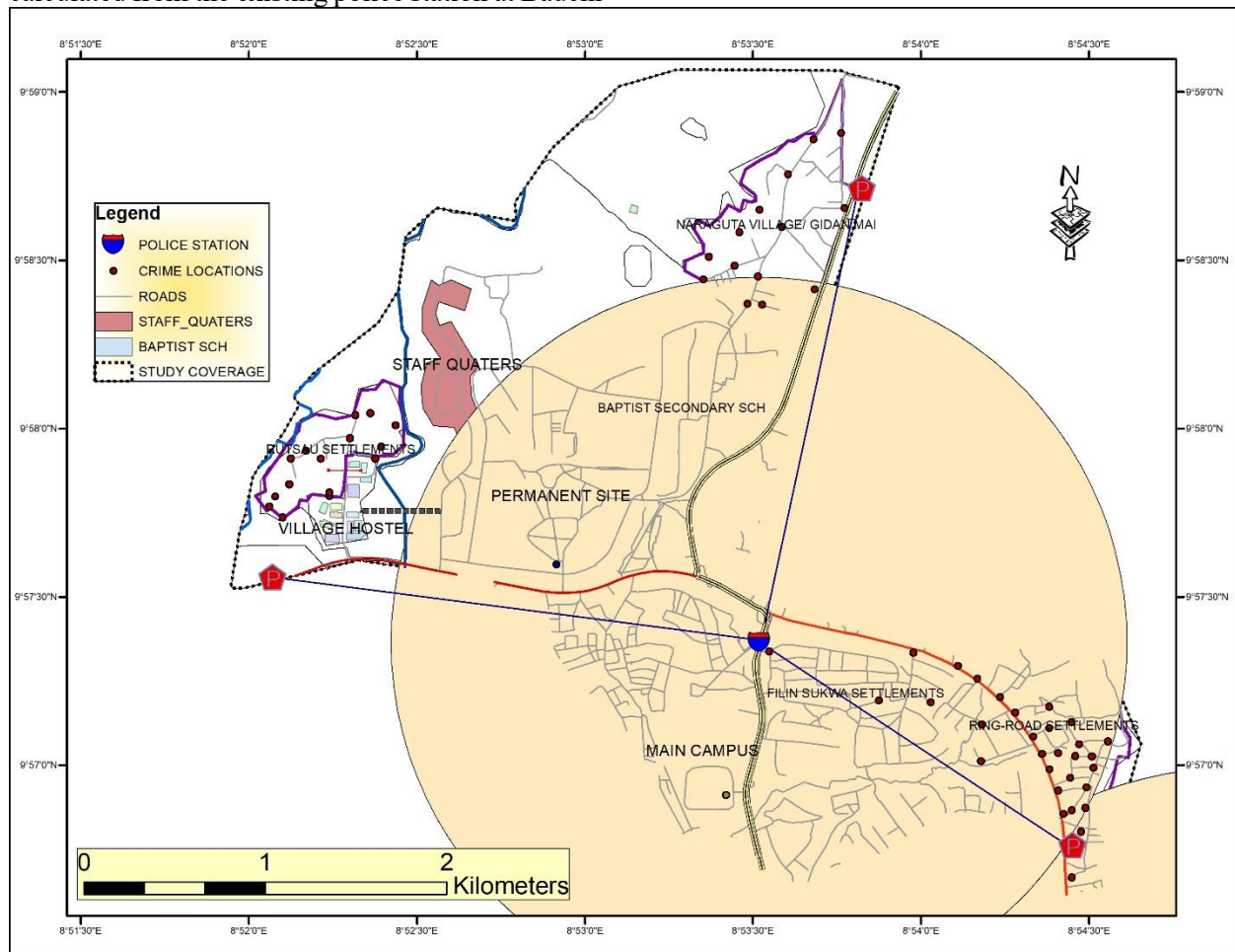


Figure 8: Proposed sites for sitting of new police posts
Source; Author's analysis, 2023

According to the Routine Activity Theory proposed by Cohen and Felson (1979), the convergence of a motivated offender, a suitable target, and the absence of a capable guardian in the same space and time are the primary conditions necessary for a crime to occur. Establishing a new police post near crime-prone areas would address the issue of the "lack of a capable guardian," thereby contributing to a reduction in crime rates in these locations.

Furthermore, the presence of a police post in closer proximity to the identified hotspots would help mitigate the challenges associated with delayed police response, particularly those caused by frequent traffic congestion around Bauchi Junction and along Farin-Gada Road. These traffic-related delays often hinder rapid response to incidents in areas such as Rutsau and Naraguta Village/Gidan Mai.

CONCLUSION

Crime patterns in student residential areas are heavily influenced by the physical and social environment, with security deficits playing a critical role in facilitating criminal behaviour (Arney, 2019; Aluko, 2011). To enhance student safety, it is essential to improve security infrastructure and adopt strategic urban planning focused on crime prevention (Umar et al., 2020). Proactive measures informed by spatial crime analysis can enable law enforcement and university authorities to allocate resources more effectively and reduce crime incidence in vulnerable off-campus communities (Anyaka et al., 2020; Uche & Uche, 2023).

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