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JOURNAL OF ENVIRONMENTAL PLANNING AND SUSTAINABILITY (JOEPS-NSUK)

Aims and Scope

The aim of the Journal is to advance understanding of the concept of environmental planning in relation to sustainable development and also to serve as a bridge between academic and practitioner communities and guide policy and management practice to achieve environmental sustainability. Environmental planning is the process of facilitating decision making to carry out land development with the consideration given to the natural environmental, social, political, economic and governance factors and provides a holistic framework to achieve sustainable outcomes. Sustainability is the capacity to endure socio-ecological process characterized by the pursuit of a common ideal economic development, social development and environmental protection. Environmental sustainability is the rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued indefinitely. If they cannot be continued indefinitely then they are not sustainable. The scope of the journal include, but are not limited to, the following fields namely: environmental policy and legislation, sustainable development, environmental planning, urban planning, regional planning, town planning, rural planning, urban management, biodiversity and conservation management, disaster management, natural resource planning and management, environmental and strategic impact assessment, environmental management, environmental economics, valuation and natural resource accounting, regulatory and market-based instruments for environmental management, sustainable agriculture, waste management, global climate change studies and applications of remote sensing and GIS.

About the journal

Journal of Environmental Planning and Sustainability is published in the Faculty of Environment Science in conjunction with Institute for the Built Environment of Nasarawa State University, Keffi (NSUK). The Journal provides an academic platform for professionals and researchers to contribute innovative work in the field. All articles must relate to the concept of environmental planning and sustainability and must encompass applied research, the application of new approaches and techniques, and the evaluation of policy and practice. The Editor also welcome critical 'state-of-the-art' reviews papers. Contributions from integrated and cross-disciplinary research teams and from policy makers and practitioners are welcome. This edition Vol. 8, No. 1, 2023 will consist at least 250 pages featuring In-depth peer-reviewed papers; Shorter "articles from the field"; "Crossfire"-a debate on topical issue argued out between experts/specialists; Book reviews-views on which books are really worth reading; "From our correspondent"-a regular letter from environmental professional dealing, in a balanced, objective and evidence-based manner, with contemporary "controversial issues"; and Webwatch-theme-relevant websites to visit.

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Professor of Environmental Planning and Management
Faculty of Environmental Science,
Nasarawa State University, Keffi (NSUK)
Tel: 08023570800; Email: nasiru@nsuk.edu.ng

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Nasarawa State University, Keffi, Nigeria
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WELCOME MESSAGE FROM THE EDITOR-IN-CHIEF

It is with profound pleasure, humility and honor that I welcome you, the reader, to this issue of the *Journal of Environmental Planning and Sustainability (JOEPS)* – an official peer-reviewed research journal published in the Faculty of Environmental Science, Nasarawa State University Keffi.

I wish to draw your attention to the fact that, articles presented herein were mostly invited articles, solicited from researchers during the call for paper submission for this edition.

As you read the articles in this journal issue, you will appreciate that there is cogent evidence of huge gaps in research today. These important gaps require immediate and adequate redress from the scientific research community. In subsequent *JOEPS* issues, we will strive to publish research papers that address some of these gaps. A search in some of the most esteemed research databases reveals the existence of a dire need to conduct and publish research from other disciplines and other equally important topics that have not yet been accorded significant attention. Additionally, there seem to be impediments that need remedial measures and harmonization to facilitate smooth, efficient, and effective conduct and publication of research studies.

Once more, on behalf of the editorial board, I welcome you to this journal – your journal! We look forward to your submissions and to publishing your research work. Together, we will indisputably move sustainability research to the next level. Ultimately, we will improve more lives and, consequently, our environment.

Thank you.

NASIRU M. IDRIS, PhD
Editor-in-Chief

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Analysis of Spatial Crimes in the University of Ilorin, Ilorin, Nigeria.

*Babalola A.¹, Solalu H.A¹, Babalola S.O², and Ogunkunle B. T¹

¹Department of Surveying and Geoinformatics, University of Ilorin, Ilorin, Nigeria.

²Department of Surveying and Geoinformatics, Federal University of Technology Akure, Nigeria

KEYWORDS

**Crime, GIS,
Misdemeanor,
ANOVA, Spatial
analysis**

ABSTRACT

Most recently spatial crime analysis has become increasingly popular as a practical tool for effective planning of emergency response to crime, crime prediction, law enforcement and as a research and teaching tool in geography, criminal justice, and other related issues. The purpose of this paper is to discuss the procedure used in modeling crimes within the University of Ilorin, Nigeria, using Geographic information Systems (GIS) and statistics to display crime hotspots in low, high and very high scales and a 200m buffering analysis of security beats in relation to crime spots within the University campus. This paper also examined the pattern in the spatial distribution of crime. We analyzed data from the university security records and crime spots containing three years spatially referenced crimes particularly misdemeanor crime. The results showed that crime densities concentrated in the computer-based test (CBT) center, senior and junior staff quarters, faculty of arts, agricultural sciences and communication and information sciences. The findings also indicate that these techniques can be used by policy makers and managers as decision support tools for effective management. It also shows the relationship between spatial location and crime within the institution.

*Corresponding author's Telephone:
Email addresses: babalola.ayo@unilorin.edu.ng

1. Introduction

Law enforcement and crime prevention has attracted increasing attention in recent years as a result of the rapid deterioration of moral values and decline in the respect for the rule of law. Crime prevention and enforcement of the law can help to mitigate the consequence of crime.

Crime occurring on and around university campuses concerns many individuals, including students, faculty members, parents, and administrators. With the application of GIS, University campus crime activities can be modeled by overlaying other datasets such as University population, locations of shops, facilities, faculties, etc., to better understand the underlying causes of crime and help law enforcement administrators to devise strategies to deal with the problem, easing allocation of security officers and dispatching them to emergencies. Crime mapping is used to map, visualize, and analyze crime incident patterns. It is a key component of crime analysis. Mapping crime, using Geographic Information Systems (GIS) helps to identify crime hot spots, along with other trends and patterns. It also assists in crime mapping and analysis. Crime mapping and spatial analysis of crime are recognized as powerful tools for the study and control of crime, because crime maps help police identify problems at the block. Using GIS, one can create a map that will identify where the crimes are occurring and clarify what crimes are or are not related based on one's research. This allows investigators to target their efforts and line officers to patrol and respond to locations while being more fully aware (Boba, 2001).

The development in the University of Ilorin and the unprecedented rise in students' population has led to tremendous increase in crime rate. Crime mapping models are needed to help planners and decision makers to generate, evaluate and visualize different crime scenarios in the planning of crime prevention strategies.

The ultimate aim of any crime mapping is to understand the pattern and related factors attached to crimes scene, such activities are geospatial phenomena, they must be interpreted and analyzed in relation to situational factors. Crime is usually concentrated around crime opportunities and other environmental features that facilitate criminal activity. The purpose of crime analysis is to identify and describe these crime patterns. Thus, environmental criminology is a branch of criminological theory that can guide crime analysis and crime prevention efforts (Ibrahim and Kuta, 2015). Digital maps will serve as the fastest way of visualizing crime pattern and scenario. Recent studies have indicated that GIS is a useful tool for crime mapping (Chris et al. 2008, Ferreira et al. 2012). It has also been used for predictive crime mapping (Elizabeth and Nancy 2002, Wang, et al. 2010, Gerber, 2010). GIS models can be integrated with statistics to produce accurate and more realistic outcomes. Some of the

early GIS models were mostly concerned with investigating, experimenting ideas and assumptions related to crimes. However, recent researches indicate that GIS models can be used for crime modeling and prevention (Chainey and Ratcliffe, 2005, Lisa, 2007).

This paper presents the application of Geographic Information System (GIS) and modeling crime spots in University of Ilorin for year 2014 and 2015 and analyzing its spatial pattern with the view of making appropriate recommendations for effective crime management.

2.0 Study Area

The study area is University of Ilorin (Unilorin) main campus, Ilorin Kwara state. The university has a population of over 30,000 (University of Ilorin website). The geographic extent of the study area lies between the coordinates of latitude $8^{\circ} 32' 52''$ N and longitude $4^{\circ} 37' 49''$ E, latitude $8^{\circ} 32' 38''$ N and longitude $4^{\circ} 37' 43''$ E World Geodetic System 84 (WGS 1984).

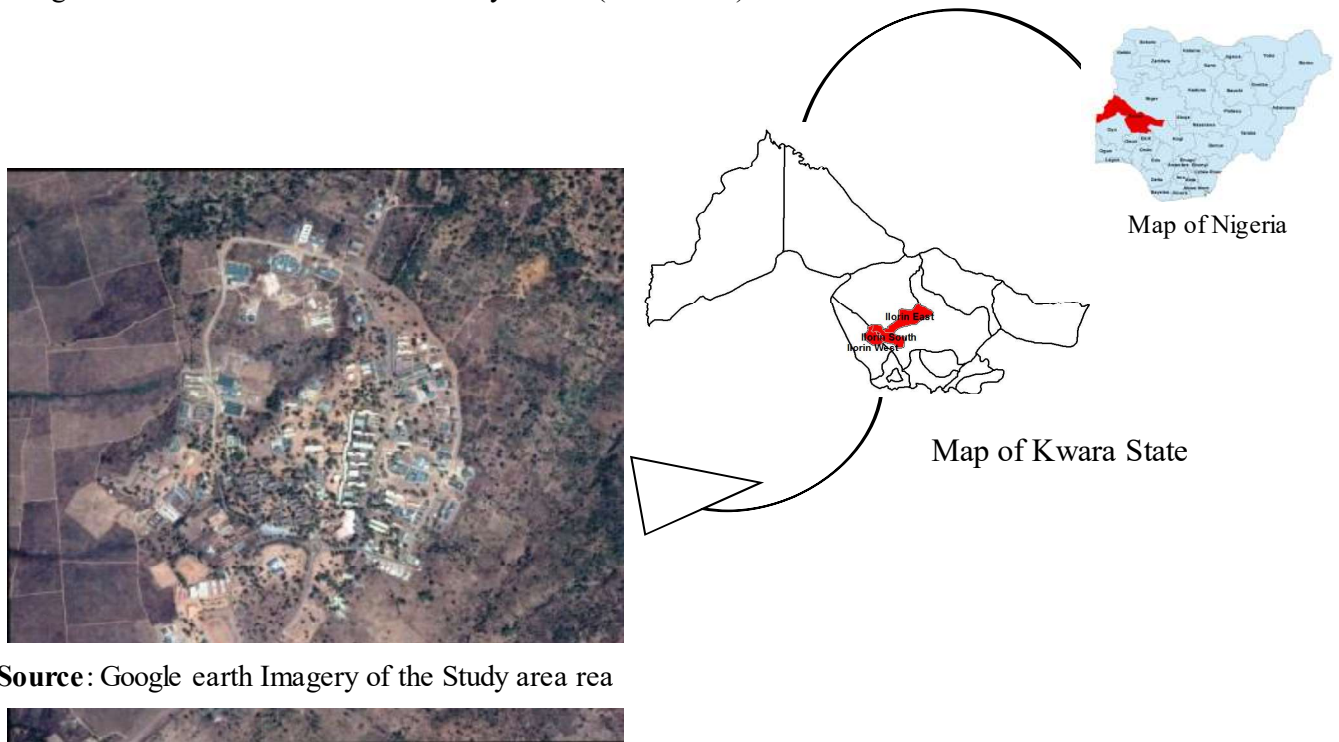


Figure: 1. Map of the Study area.

3.0 Materials and Methods

The satellite imagery covering the study area was downloaded and the feature was extracted to give the base map. Point data representing crime locations were collected using a handheld global positioning system (GPS). The point data was saved as attribute data in the MS Excel spreadsheet format and exported into GIS as point layer. The University wide crime data were collected from the security unit. Based on the data collected, we created crime map indicating crime density in the study area. The data

analysis was carried out in the Arc Map 10.3.1 software, while the spatial analyst extension was used to present the hot spot distribution of crime. Questionnaires were administered to collect information on reported cases of crimes. The data involves the reported cases of crime such as burglary, theft, impersonation, exam malpractices, extortion, trespassing, cultism, rape, drug abuse, wandering, assault, robbery, threat to life, fraud and others. Areas with crime occurrence of three times and above were selected to validate the actual records given by the University of Ilorin security unit. The online source (Survey Monkey) specified 395 questionnaires for a population of 30,000, in this study, 450 questionnaires were administered to persons residing or working in the University of Ilorin for the period of 2years but only 426 were received. Table 1. Shows the number of areas observed in each premise of University of Ilorin campus. The number of locations selected for observation per Areas was based on high rate of recorded crime incidence in the area reported by the University Security Unit.

Table 1: Areas observed using the in-built crime questionnaire

AREAS	No of Location Observed under Crime Offences
Abuja Female Hostel	150
Lagos Female Hostel	120
Lagos Male Hostel	100
Senior Staff Quarters	80
Total	450

Source: Field Survey, 2018

Acquiring non-spatial data through secondary means entailed rigorous research on various relevant materials relating to the topic under discussion. Thus, to gather key data relating to crime occurrence in the University of Ilorin main campus involved paying frequent visits to the Security unit. Some of the data gathered were crime occurrence records from 2014 and 2015. These records were hard copies of reported crime statements forms submitted by security beats within the university security division unit. Records for each year under review were carefully sorted out according to various crimes.

The data gathered from the questionnaire and security report were subjected to statistical analysis of variance (ANOVA) at a $P \leq 0.05$ in SPSS 20.0 edition. The analysis was carried out in ArcMap GIS software resulting in the production of the crime map. The temporal crime variation as well as the university wide percentage of crime were presented.

3.1 Hotspot Crime Distribution using GIS

The Geographic Information Systems (GIS) was used to recognize and analyze the spatial relationships/distributions that existed within the stored digital crime datasets. The GIS crime

analysis and processing consisted of both qualitative and quantitative techniques. Qualitative data and analytical techniques consisted of non-numerical data as well as the examination and interpretation of observations for the purpose of discovering underlying meanings and patterns of occurrence relationships. As a result, the non-spatial database was structured in such a way that each area can be queried to see total level of crime occurred for year 2014 and 2015.

The quantitative data procedure adopted were crime data primarily in a numerical format. Quantitative GIS analysis consists of manipulations of observations for the purpose of describing and explaining the phenomena that the observations represent. The Spatial Analyst extension in ArcMap 10.3.1 was carefully used to statistically show the hotspot distribution of crime occurrence patterns in 2014 and 2015.

3.2 Data analysis

Multiple regression model was used to present the relationship between crime and beat points, persons with the view on crime occurrence, the mean reported crime cases and time of crime. The regression model is of the form:

$$\text{Cubic equation: } Y = a + bx_1 + bx_2 + bx_3 + \dots + bx_n$$

Where:

Y = dependent variables (Number. of reported crimes)

X = independent variables (Number. of beat points and no. of persons with the view on crime occurrence)

In Table 2. Independent variable represents the number of police beats and no. of persons with the view on crime occurrence data captured within the period while the dependent variable was the mean reported cases of crimes within the study area.

Table 2: Crime occurrence data

	Crime	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Burglary	10	5.6	5.6	5.6
	Theft	70	39.3	39.3	44.9
	Impersonation	9	5.1	5.1	50.0
	Exam malpractices	7	3.9	3.9	53.9
	Extortion	1	.6	.6	54.5
	Trespassing	14	7.9	7.9	62.4
	Cultism	7	3.9	3.9	66.3
	Rape	4	2.2	2.2	68.5
	Drug abuse	3	1.7	1.7	70.2
	Wandering	3	1.7	1.7	71.9
	Assault	8	4.5	4.5	76.4
	Robbery	9	5.1	5.1	81.5
	Threat of life	2	1.1	1.1	82.6
	Fraud	6	3.4	3.4	86.0
	Others	25	14.0	14.0	100.0
	Total	178	100.0	100.0	

Source: University security division beat posting roster.

4.0 Results and Discussion

The results of the analysis are presented in the section below as follows:

4.1 Kernel Density Analysis for Crime Hotspots in University of Ilorin Campus

Figure 2 presents the map showing the crime hotspot in the study area. These are areas with low, high and very high crime concentrations (hotspots). For instance, areas coloured red are regions of very high crime concentration (hotspots). The blue-coloured portions of the map are areas with high concentration of crimes while the white-coloured portions are low

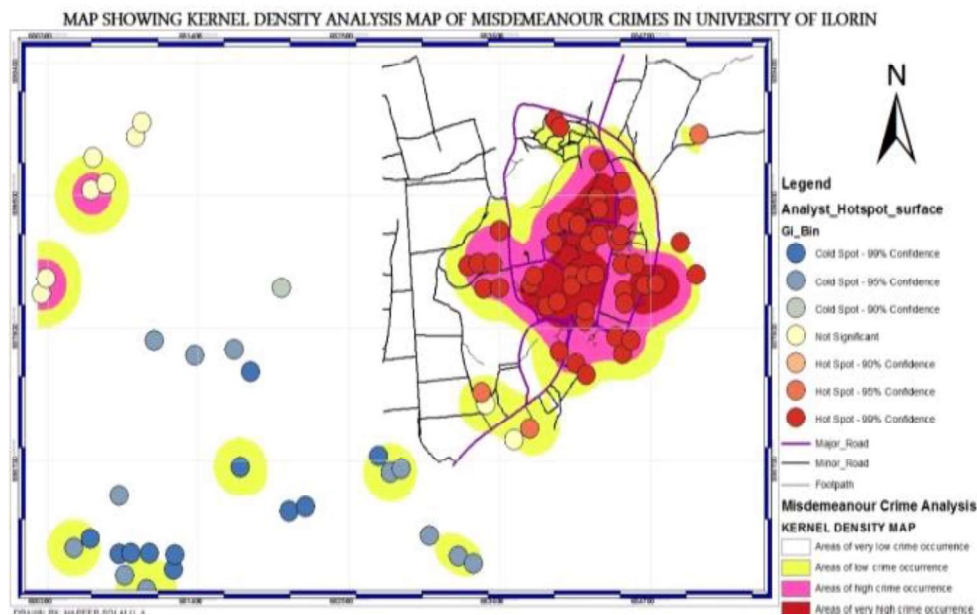


Figure: 2 Crime Hotspots in the University of Ilorin

crime areas. The main crime hotspots areas are C.B.T (Computer based test) center, L.T.1 (Lecture Theater 1), Senior Staff Quarters, Jalala Quarters, Faculty of Art, Agric. Science and CIS areas. Other areas like Senate building, Abuja hostel, Clinic, S.L.T (Science Lecture Theater), Home-Economics, Chapel and Mosque are areas which also have a considerably high concentration of crimes.

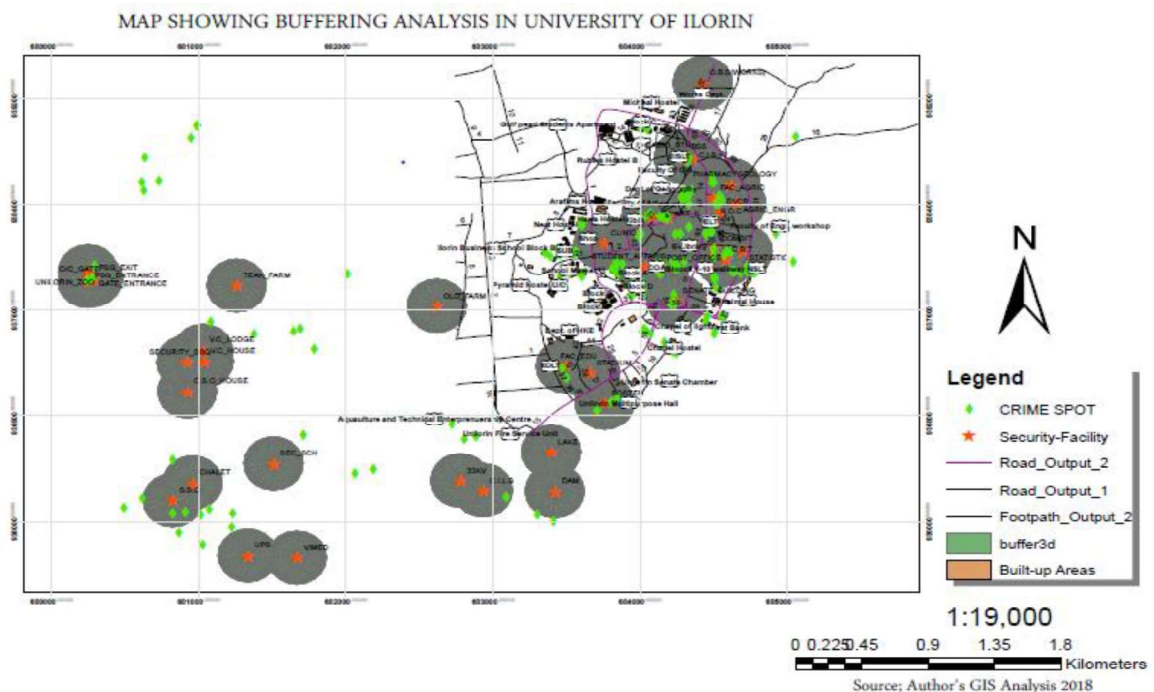


Figure 3: Buffer Analysis

Buffering of Security facilities

Buffer analysis (Figure 3) of Security facilities in relation to crime spots in Unilorin Campus was performed in accordance to international standards (200 m radius), to allow decision makers to collaborate with security department in the University of Ilorin to site security beat(s) or assign security operatives to these locations to enhance crime management. International standard stipulates that, residents should not travel longer than 200m to access security facilities. From the 200m radius buffer analysis shown in figure 4, it can be observed that some areas are out of coverage. This means that these areas do not have access to the available security facilities meaning that security beats/post should be located in these disadvantaged areas to reduce criminal activities in the areas.

Crimes are rampant in areas like C.B.T center, L.T1, senior staff quarters, Jalala quarters, and faculty of art, agric. science and CIS environment within the University campus. Other areas like senate building, Abuja hostel, Clinic, SLT, home-economics, chapel and mosque are other crime prone areas with considerable number of cases reported. The buffer analysis reveals that areas like School farm, senior staff quarters, Unilorin business school amongst others are out of coverage to accessing security facilities. The GIS query operation reveal that in general, 92 crimes from a total of 178 crimes occur during the day, while 78 crimes were committed at night and 8 crimes occur at random. 51.7% of the crimes happen during the day, 43.87% of the crimes happen at night while 4.5% occur at random. Day crimes are more prominent in neighborhoods like C.B.T center, L.T1, senior staff quarters, Jalala quarters, and faculty of art, agric. science and CIS. The query operation also reveals that C.B.T center has the highest number of day crimes with a total of 13 counts followed by senior staff quarters, faculty of art and faculty of CIS areas with 10, 6, 5 and 5 counts

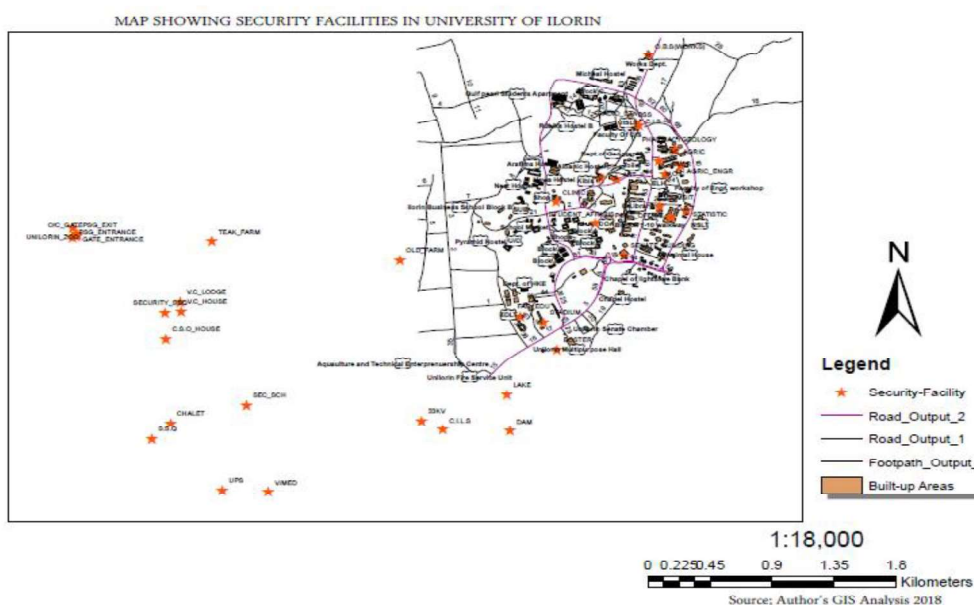


Figure 4: Buffering of Security Facilities

respectively. Zamfara hostel, COMSIT, dam site and others have the lowest day crime with a count of 1 recorded case. As regard crimes committed during the night, Lagos male hostel, Jalala quarters,

management and social Sciences and LT.1 has 6, 5, 5 and 5 counts respectively. Environmental Science, Sky way has the least number of night crimes with 1 count each.

4.4 Factors Responsible for Crime in Unilorin Campus

In an attempt to identify factors causing crime in the study area, Unilorin security division on campus, residence of senior staff quarters, faculty of management/social sciences, residence students in male and female hostel and student from faculty of art on campus were interviewed. Similarly, in our quest to actualize these, two hundred and fifty (250) persons were interviewed and are drawn from the areas with high population. Equal numbers of respondents (50) were drawn from each area for fair representation. However, the following variables were investigated; Home life, parental neglect, peer influence, youthful exuberant, poor academic performance and others etc. (see interview guide in appendix A). Various reasons were given for occurrence of crimes in Unilorin, primarily related to the following; The frequency at which students commit crime is presented in table 4, out of the 100-questionnaire distributed, 34.4% of the respondents rated peer influence as the highest driver of crime, and 2.4% rated poor academic performance. This indicates that peer influence is the reason why most students are involved in crime. A post-hoc tests (Table 5) conducted on the data yielded a p-value of 0.000 which is below 0.05, thus indicating a 95% confidence. Hence the mean of crime type (theft) differs significantly among other crime type in three locations earlier mentioned. Thus, the model statistically significantly predicts the outcome. From table 6, a multiple regression analysis carried out to investigate the relationship between crime location, beat points and whether time has any relationship with crime location. The result of the regression analysis of crime and the aforementioned elements shows the R^2 is 1.273. This suggests that 1.27 of variance in crime is been explained by crime location, beat points and time of crime occurrence. Y is predicted to increase by 0.253, and 0.387 when the beat points and time changes positively and decrease by 0.122 with decline in crime location. The result indicates that the regression model statistically determined the outcome variable. Again, the method was applied to determine the level of contribution of each element. This result is in agreement with that reported by Firoz, et al. (2017) that crime rate and its nature vary from place to place.

Table 4: Why people commit crime (questionnaire)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Home life	40	16.0	16.0	16.0
	Parental neglect	56	22.4	22.4	38.4
	Peer influence	86	34.4	34.4	72.8
	youthful exuberant	60	24.0	24.0	96.8
	Poor academic performance	6	2.4	2.4	99.2
	Others	2	0.8	0.8	100.0
	Total	250	100.0	100.0	

Table 5: Post Hoc Test on Crime type using Fisher's Least Significant Difference

Beta	Mean Difference	Standard Error	P-VALUE
Burglary	3.0760*	.69922	.000

Impersonation	3.2728*	.69922	.000
Exam malpractices	3.5774*	.69922	.000
Extortion	4.4880*	.69922	.000
Trespassing	2.7999*	.69922	.000
Cultism	3.5774*	.69922	.000
Rape	3.9107*	.69922	.000
Drug abuse	4.0166*	.69922	.000
Wandering	4.2440*	.69922	.000

Source: The Author, 2018

Since the P-value=0.000 is less than $\alpha=0.05$, we reject H_0 and conclude that the mean of crime type (theft) differ significantly among other crime type in the three locations.

Table 6: Location where crimes are committed

Coefficients Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	(Constant)
0.755	0.273	2.764	0.008	
Crime location	-0.122	0.156	-0.112	-0.784 0.437
Beats point	0.253	0.221	0.163	1.143 0.259
Time occurred	0.387	0.213	0.252	1.823 0.074

Source: The Author, 2018

The regression equation $Y = 0.755 - 0.122_{\text{crime location}} + 0.253_{\text{beatpoints}} + 0.387_{\text{time occurred}}$

Table 7: Analysis of Variance (ANOVA) for crime and crime location

Model	Sum of squares	Diff	Mean Square	F	Sig.
Regression	2.851	3	0.950	1.647	0.191
Residual	28.270	49	0.577		
Total	31.121	52			

Source: The Author, 2018

Table 8: Temporal Variation of Crimes

Time of occurrence	Frequency	Percentage (%)
Day	92	51.7
Night	78	43.8
Nil	8	4.5
Total	178	100

Source: The Author, 2018

Table 9: Frequency of Areas of Daytime Crimes

Areas	Frequency	percentage
C.B.T	13	14.1
Lagos male hostel	5	5.4
Faculty of Art	5	5.4

Faculty of C.I.S	5	5.4
Senior staff quarters	6	6.5
Others	58	63.2
Total	92	100

Source: The Author, 2018

Table 10: Frequency of Areas of Night-time Crimes

Areas	Frequency	percentage
Lagos male hostel	6	7.7
Jalala quarters	5	6.4
LT.1	5	6.4
Social Sciences	5	6.4
Others	57	73.1
Total	78	100

Source: The Author, 2018

Table 11: Frequency of Crime Types

Crime Recorded in main campus	No. of cases recorded	Percentage
Theft	71	39.8
Assault	8	4.5
Burglary	12	6.7
Examination malpractice	4	2.3
Impersonation and Trespass	26	14.6
Robbery	12	6.7
Rape	4	2.3
Narcotic offence	3	1.7
Other Offences (Pornography, Forgery, Fraud ETC).	38	21.4
Total	178	100

Source: The Author, 2018

From table 4 above, out of the 100-questionnaire distributed, 34.4% of the respondents rated peer influence as the highest driver of crime, and 2.4% respondents rated poor academic performance. This indicates that peer influence is the major reason why many students indulged in crime. In table 5 above, a little over 35% of respondents appears to be unsatisfied with the attitudes of the security personnel towards crime occurrence in the study area.

Conclusion

Majority of the residents in Unilorin Campus are unsatisfied with the way the security personnel handle crime related issues. About 35.2% of the respondents are not satisfied with the frequency of security patrol in their respective areas especially those prone to crime or where crimes are highly committed and reasons were attributed to irregular security patrol and lack of total coverage of all parts of the neighborhood especially crime hotspot zones. The response towards security personnel, 18.4% of the respondents acknowledged that they didn't think the campus security division would help crime scenes. About 39.8% of crimes in the study area were attributed

to theft, 34.4% was due to peer influence, youthful exuberant accounts for 24.0%, parental neglect accounts for 22.40%, home life with 16% and poor academic performance also takes a share of 2.4%. family structure, high population turnover, corruption in the law enforcement agencies and parenting accounts for each of the crimes committed in the study area. Based on the findings of this research, it was concluded that, virtually almost all types of crime occurred in university and most of the crimes are committed during the day. C.B.T center, L.T1, senior staff quarters, Jalala quarters, faculty of art, agricultural science department and CIS are hotspots, consequently, school farm, Jalala quarters, and Unilorin business school area are located far away from security beats and hence needs one each. The research findings also revealed that; theft, burglary, impersonation, trespass and robbery are the major crimes committed in the university of Ilorin main campus.

Recommendation

Arising from the findings, the following recommendations will be adduced; strategies for securing the area from crime must be improved. Closed-circuit television cameras (CCTV), security lights should be installed at strategic locations to improve safety and security. Again, students caught in crime must be punished according to the dictates of the university rules to serve as deterrent to others. Finally, given the findings outcome, further research is needed to unearth ways in which security managers, and decision makers will ameliorate crime occurrence in the university.

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