

A SPATIO-TEMPORAL STUDY OF ACCESSIBILITY TO POLICE SERVICES AND FACILITIES IN SAGBAMA LOCAL GOVERNMENT AREA, BAYELSA STATE, NIGERIA

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Abstract

This study applied geospatial techniques in examining the spatial distribution of police services and facilities in Sagbama Local Government Area (LGA) of Bayelsa State, Nigeria. Data on the geographical coordinates of the police facilities were acquired through Global Positioning System (GPS). The location of a police station at an appropriate place is influenced by different parameters, such as crime-prone areas, distance from major rivers/roads, and the presence of influential people and politicians, political influence and industrial development. Data pertaining to the strength of the LGA police were obtained from the Sagbama Police Division through the approval of the Bayelsa State Police Commissioner. An administrative map of the study area was obtained from the Ministry of Land and Survey, Bayelsa State, which was used as a base map. The data were analyzed using descriptive (frequency tables, simple ratio) statistics. Nearest Neighbour Analysis (NNA) was used to derive the pattern of distribution of the police facilities. The buffer operation was used to examine the area of coverage of police facilities. Findings of the study revealed the existence of 6 police divisions/stations. The findings revealed that the police - population ratio continue to drop from 2014 to 2018. The NNA result of the spatial pattern of police divisions/stations produced a dispersed point pattern at 0.01% significance level with the Nearest Neighbour Ratio (NNR) of 1.59. Furthermore the analysis showed that 5 administrative wards were well served while 9 others were underserved, most of them situated in the extreme northern and southern part of the study area. The study therefore recommends that the number of staff attached to political officials should be decreased by the police authority, while those attached to individuals who are not entitled to personal police security should be removed and attempts should be made to recruit more individuals into the police force to be deployed to the region.

Keywords: Police Facility, Crime, Spatio-Temporal Analysis, Sagbama, Bayelsa

Introduction

One of the major concerns of Government globally is the provision of security for citizens and properties. A secured settlement or environment enhances socio-economic development of people and businesses in addition to attracting investors. Globally police force are saddled with responsibility of ensuring law and order by fighting crimes and insecurity in towns, cities and rural setting. Without police presence most settlements will know no peace due to the activities of

criminals and hoodlums. One key challenge confronting policing in Nigeria is the inadequacy of police personnel and facilities to adequately protect the teeming population of over 200 million. Most settlements are underserved by the police services making them vulnerable and insecure. It is on record that the total police force in Nigeria has a staff strength of 371,800 (Ahmed et. al, 2013). This figure is grossly inadequate when compared with the total population and cannot serve all the nooks and crannies of the Nigerian nation. In Nigeria, the position of geography and population size are underestimated by the police (Ahmed, et. al., 2013). To a large degree, they could be responsible for the failure of the police force in most parts of the country to deter and monitor the unprecedented rise in illegal activity. These issues are also due to so many other factors, including: insufficient personnel, inadequate and outdated equipment and lack of sufficient means of transport, including helicopters, inadequate accommodation and inadequate funding, and lack of expertise in specialized fields (Abdulkadir, 2005). Increasing the number of police facilities and officers is one common tactic to minimize crime globally (Stucky, 2005). For example, the Minister of Police Affairs, Muhammad Dingyadi, said President Buhari provided for the recruitment of 400,000 community police officers over a period of four years against the context of the expected implementation of the federal government's community policing (Adepegba, 2019).

The number of police officers serving in Nigeria increased by 19.12 per cent from 2004 to 2017, but this has not been felt equally across the country. A brief survey in the state of Bayelsa, Nigeria, showed that the increase was concentrated in the capital city of Yenagoa, while the majority of rural communities experienced a steady decrease in police staff or the closure of police stations in the state's rural areas. In Sagbama Local Government Area (LGA), the rate of crime is on the rise. A total of 1,541 cases of crime were recorded in Bayelsa State in 2016, with offence against property being the most common type of crime reported (National Bureau of Statistics, 2017). The reasons for this high crime rate have been attributed to population growth, unemployment and increased economic activities in the area. Related to the increased in criminal incidents is the inaccessibility of police services and facilities by residents. To date, it is unclear how this process has affected the accessibility of police services, particularly in the most remote and sparsely populated areas of Bayelsa State, Nigeria.

The state of rural policing in Nigeria is relatively unknown. Most studies concentrate on public (rational) preference, conflict, and organizational viewpoints (Kasali and Odetola, 2016; Ikuteyijo, 2008; Ackerman and Murray, 2004), others looked at the existence of police stations in an urbanized region (Ikharo and Ikharo, 2019; Ahmed and Salihu, 2013), although few other studies consider the local political background, which is somewhat surprising given the political determination of most police budgets (Chinwokwu, 2016). Using Sagbama LGA as a case study, by presenting a regional account of police service accessibility and the spatiotemporal ratio of police staff to the population, this paper seeks to make a direct contribution to this neglected field of research.

Literature Review

Several studies have examine the role of police in safeguarding the lives of people and property and majority of the studies stressed the inadequacy of police personnel and facilities in Nigeria. There were several outcry from so many quarters for employment of more police personnel in the polity particularly with the increasing spate of crime and insecurity in the country. Despite divergent opinions on whether adding more police facilities or officers decreases crime, the variation in police strength and efficiency has been measured by various studies worldwide (Koper, et. al. 2001; Ajala and Owabumoye, 2018; Chinwokwu, 2016). In Akure, Nigeria, Ajala and

Owabumoye (2018) used geospatial approaches to study the effect of police stations on crime incidence. The analysis indicates that the rate of crime continued to increase as distances from police stations rose. The results of the study showed that the central section of the study area where the police stations are situated was concentrated with crimes. The research concluded that the pattern of crime occurrence in cities could be influenced by the spatial distribution of police stations.

Using simple ratio and buffer operation, Ikharo and Ikharo (2019) used spatial and attribute data to analyze the spatial location of Bauchi Metropolis police stations. The study's results showed that the ratio of population to police in the region was 898:1. The study further revealed that while the western and southern sections were underserved, the old city of Bauchi and the eastern portion of the metropolis were completely served. Their study failed to analyze the temporal difference in the proportion of police men to the population. The spatial distribution of police stations in Kano metropolis using buffer operation had also been investigated by Ahmed and Salihu (2013). The geographical coordinates of the police stations were obtained with the use of GPS while the data relating to the number of police workers in each station were obtained from interview and the headquarters of the police divisions of the area. This study failed to explain explicitly how the inferential statistics (chi square test) arrived at the inferential relationship between the police station and the distribution of the population as inferred.

In another report, Chinwokwu (2016) studied the ways in which police authorities in Nigeria manage their workers for successful crime control and prevention. The study used data collected in southeast, southwest and north central Nigeria through questionnaires and in-depth interviews (IDI) to define the criteria used in the posting of police officers. The results of the study showed that the crime rate, population size, economic growth and land mass or political intervention are variables, although the parameters used in staff posting are not well defined. In addition, the study found that corruption, political intervention, ethno-religious consideration, lack of funds and lack of facilities are the key factors that combat the efficient use and management of police officers. It also found that the majority of states are under-policed and under-staffed.

Study Area

The study area is Sagbama LGA of Bayelsa State, Nigeria. Its headquarters is in the town of Sagbama and it has an area of 945 km² and based on a projection of 2006 population census to 2018, the area had a population of 274,772 people (National Population Commission (NPC) [Nigeria] 2009). The study area is located between Latitudes 4°48'N and 5°24'N of the Equator and Longitudes 5°57'E to 6°34'E of the Greenwich Meridian (see Figure 1). It is bounded by Patani and Ndokwa East LGAs of Delta State to the North and Ekeremor, Southern Ijaw, Kolokuma/Opukuma and Yenagoa LGAs of Bayelsa State on the South. The localities and communities that make up the study area include: Ofoni, Aduku, Sagbama, Ossiamia, Adagbariri, Adoni, Agbere, Asamabiri, Angalabiri, Ebedebiri, Osekwenike, Agoro, Toru-Ebeni and Trofani. The LGA is under Bayelsa West Senatorial District. Sagbama LGA's climate is a tropical monsoon climate with temperatures rising up to 31°C with a high relative humidity of around 78-82%. Generally, rainfall occurs throughout the year in the study region, but over 80% of it occurs in the months of May to September. The region is a freshwater swamp and lowland rain forest in terms of vegetation. The study area lies on the young, low-lying geological formation of the Quaternary and the recent alluvium underlain by cretaceous sediment. The area is blessed with oil minerals, while farming and fishing are the main occupation.

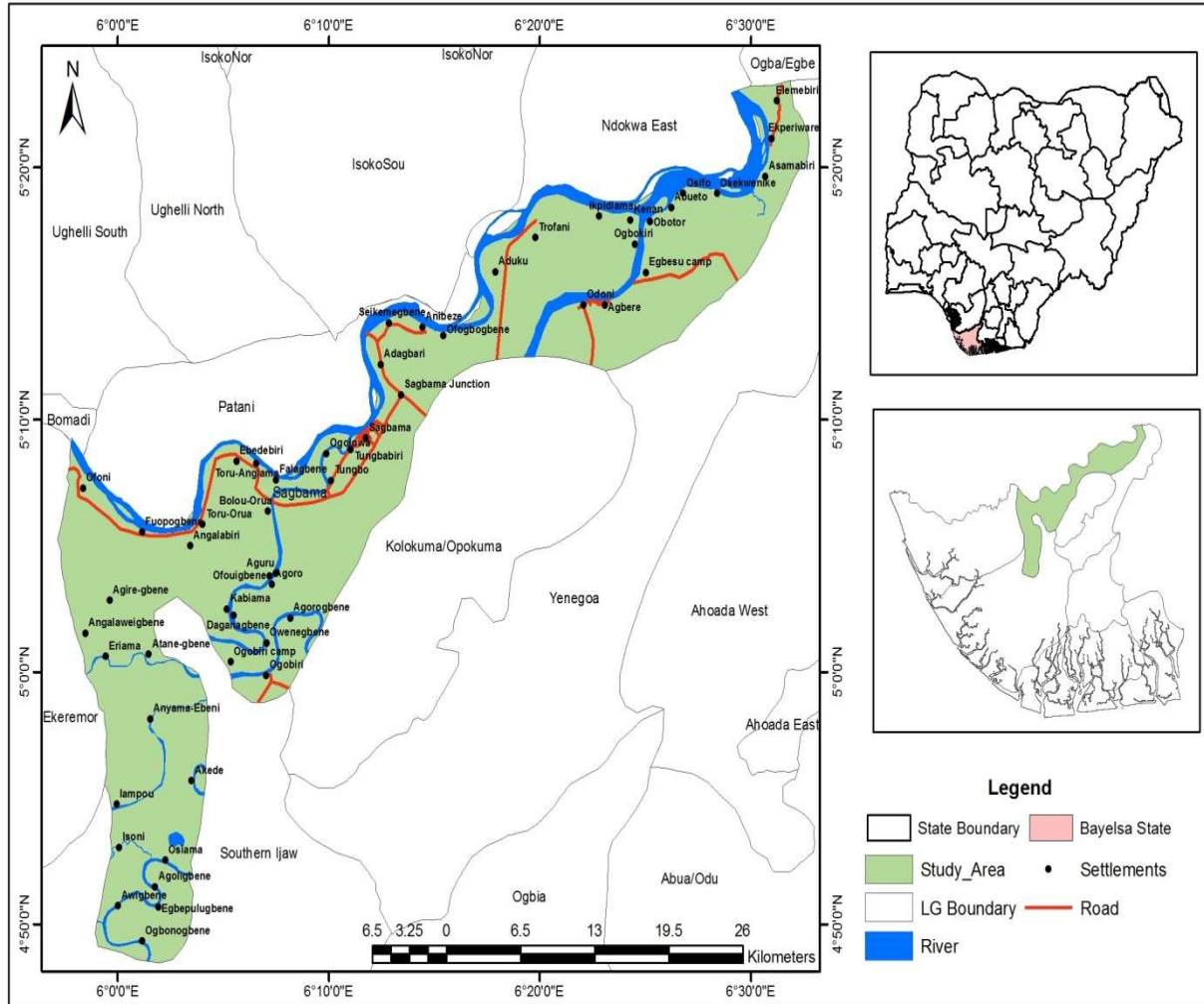


Figure 1: The study Area

Source: Adapted from the administrative map of Bayelsa State

Material and Methods

For this study, primary and secondary data were both used. The primary data were collected from a field survey in Sagbama LGA of Bayelsa State, Nigeria. This was done through acquiring the geographic coordinates of the police division/stations using Garmin eTrex^R 20x Handheld GPS Receiver with an accuracy of at least 5 meters. The secondary data such as the administrative map and the police strength of the study area were gotten from the urban planning section in the Ministry of Lands and Survey, Bayelsa state and the Sagbama Police Division via the approval of Bayelsa State Police Commissioner respectively. The strength of police personnel were collected for the span of five years from 2014 – 2018. Because of the unreliable and inconsistent system of storing and retrieving data relevant to crime in the Nigerian Police Force (NPF), it was restricted to five years. The population data of the area were collected from the National Population Commission (NPC), Bayelsa State, Nigeria.

Table 1: Projected Population Size by Wards

Ward	Population 1991	Projection 2018
Agbere	10,438	21,416
Angalabiri	11,403	23,472
Ofoni I	10,892	22,420
Ofoni II	4,993	10,278
Ebedebiri	13,757	28,317
Ossiamma	7,142	14,701
Asamabiri	4,817	9,915
Odoni	6,400	13,174
Trofani	3,162	6,509
Sagbama	12,565	25,864
Agoro	15,724	32,366
Toru-Ebeni	11,439	23,546
Adagbabiri	11,403	23,472
Osekwenike	4,938	10,164
Total	129,073	265,614

Source: NPC, Bayelsa (2019)/Author's Compilation (2019)

A total of fourteen wards were used in order to analyze the accessibility of police services in the study area. They include: Agbere, Angalabiri, Ofoni I, Ofoni II, Ebedebiri, Ossiamma, Asamabiri, Odoni, Trofani, Sagbama, Agoro, Toru-Ebeni, Adagbabiri and Osekwenike. The population figures of 2018 of the study area as projected from the 1991 National population and housing census results according to Newman's (2001) method was used (see Table 1). The basis for the use of 1991 population census instead of the 2006 census results was due to the fact that the 2006 population census results were not disaggregated into localities in order to find the proportion of people in the respective wards. The wards population figures were projected to 2018. The projection was based on the average population growth rate of Bayelsa State that is 2.92%, using the Newman's (2001) formula: $P_n = P_o + \left(\frac{1+R}{100} \times P_o\right) n$. Where: P_n = population in the recent year, P_o = population in the base year (129,073), R = Annual growth rate (2.92%), n = number of intermediary years (2018-1991=27). Thus the projected population is 265,614 people.

The data acquired were summarized using simple descriptive statistics to get the frequencies and proportions between the police strength and the projected population of 2014 - 2018. The United Nations' recommended ratio of police staff to population ratio is 1:450 (Ahmed, et. al., 2013). To achieve this objective, the 2006 population figure of the study area was used. The population numbers are projected for 2014 to 2018. The projection was based on the Bayelsa State's annual population growth rate of 2.92 per cent using the Newman (2001) formula (see Table, 3). Also the total number of Sagbama LGA police strength acquired from the Sagbama Police Division each year was used. The projected population figure of each year was then divided by the total number of police strength in the study area.

$$\text{Security personnel per population ratio} = \frac{\text{Projected Population}}{\text{Total Number of Police Strength}}$$

The administrative map at a scale of 1:50,000 of Sagbama LGA was obtained, scanned, georeferenced and used to digitized roads, rivers etc. in ArcMap environment of ArcGIS 10.5

software. For the geo-referencing of the scanned administrative map of the study area, spatial coordinates of four locations were obtained and used. Shapefiles were generated and imported into the ArcMap environment where digitization was performed on-screen on images of the study area that were subsequently used for the presentation of data.

Police divisions/stations geographical coordinates and their attributes were stored in Microsoft Excel as a CSV (comma delimited) format that was imported into ArcGIS 10.5 software where it was overlaid on the study area geo-referenced map. In order to classify the area entirely served by the police stations, a 2 km buffer operation was carried out. Using the Nearest Neighbour Analysis (NNA) inferential statistical instrument in ArcGIS10.5 software, the distribution pattern of police divisions and stations in the study area was calculated. This approach was also employed by Ahmed, *et. al.*, (2013) to assess the spatial pattern of Kano Metropolis police stations.

Results and Discussion

The Spatial Distribution of Police Divisions/Stations in Sagbama Local Government Area

In the study area, there were five (5) police divisions/stations/post and an area command. These were the police divisions of Sagbama and Angalabiri, the police stations of Toru-Ebeni and the police posts of Agbere and Ofoni I and the Sagbama Area Command. Table 2 presents the police divisions/stations/post.

Table 2: Number of Police Facility and Population Distribution

Ward	No. of Police Division/Station/Post	Population Projection 2018
Agbere	1	21,416
Angalabiri	1	23,472
Ofoni I	1	22,420
Ofoni II	-	10,278
Ebedebiri	-	28,317
Ossiam	-	14,701
Asamabiri	-	9,915
Odoni	-	13,174
Trofani	-	6,509
Sagbama	2	25,864
Agoro	-	32,366
Toru-Ebeni	1	23,546
Adagbabiri	-	23,472
Osekwenike	-	10,164
Total	6	256,614

Source: Author's Analysis (2019)

Table 2 shows that there were a total number of six (6) police installations in the study area. There were 2 police divisions among the administrative wards, 1 in Angalabiri established in November, 2018 and 1 in Sagbama with an area command, Toru-Ebeni had one police station while Ofoni and Agbere each had one (1) police post. There was no police presence in the remaining nine (9) administrative wards, comprising 64.3 percent of the total wards. Agoro did not have any single police facility with the highest population number. The researchers found that Ofoni I only had 3 police personnel with more than 22,000 people during surveillance of the police facilities in the study area. The presence of police stations may be affected by the presence of highly prominent

individuals and politicians coupled with political intervention and economic growth. This could be responsible for why the Sagbama and Toru-owa communities in administrative wards of Sagbama and Angalabiri respectively had the highest number of police facilities and staff. Such settlements appear to be dominated by highly influential individuals and politicians, higher education institutions (University of Africa and Adaka Boro College of Education), non-indigenous individuals, certain business activities, and government and private business offices. This could be attributed to the fact that the Headquarters of the police divisions has various departments, such as the Criminal Investigation Department (CID).

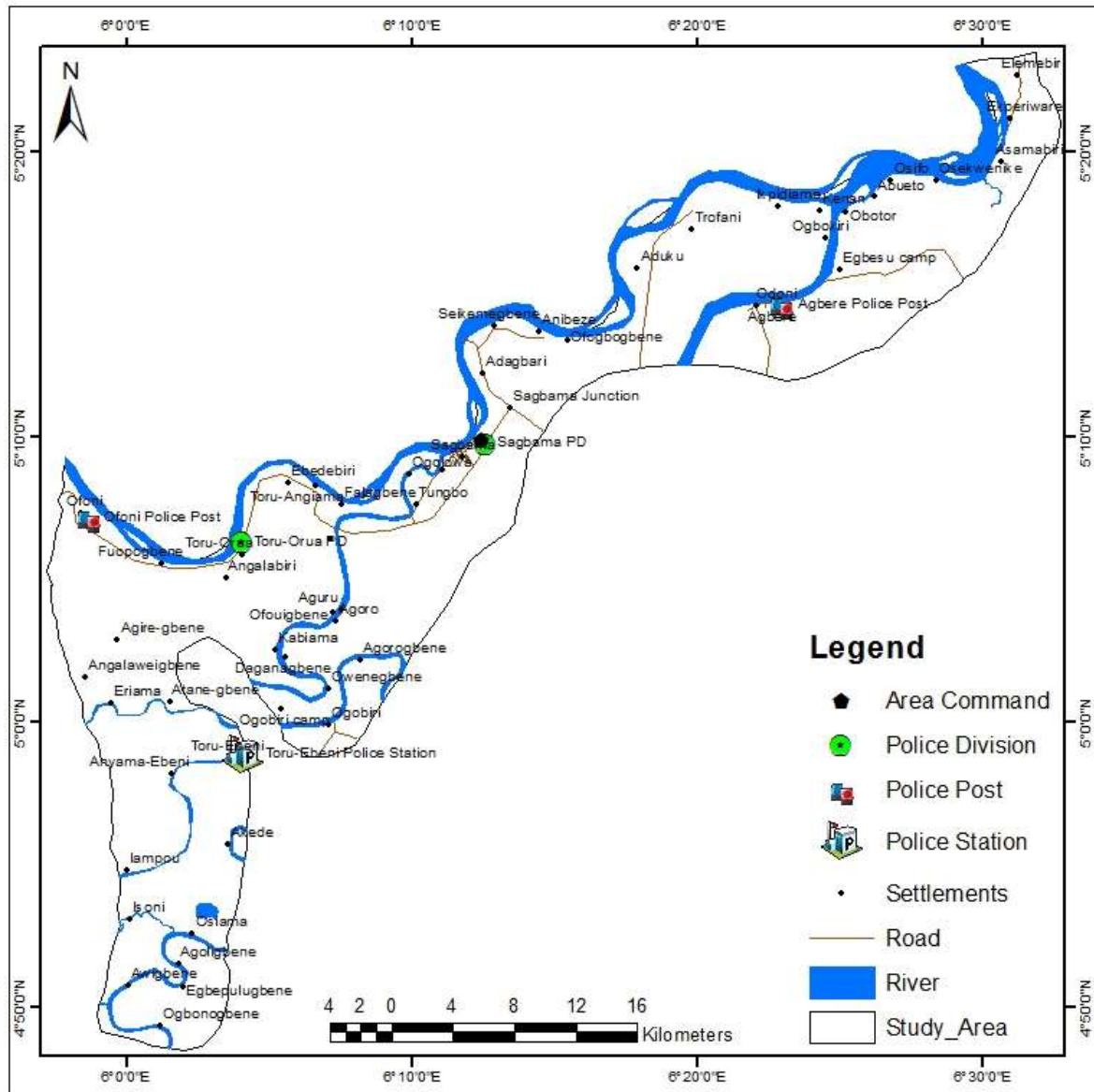


Figure 2: Location of Police Facility

Source: Author's Analysis (2019)

Figure 2 also shows that most of the police divisions/stations/posts are located along the Forcados and Nun Rivers that connect the study area's major villages and towns. Towns such as Sagbama, Toru-Orua, Ofoni, and Toru-Ebeni, for instance, had a police presence. Influential citizens and

officials, higher schools, economic growth and land mass, and some commercial activities and offices of both government and private institutions are distinguished by these towns.

The Ratio of Police Strength to Population in Sagbama Local Government Area

The ratio of police strength to the study area's estimated population from 2014 to 2018 is shown in Table 3. In general, from 2014 to 2018, there was a constant reduction in police staffing. The study results showed that the number of police officers fell from 117 in 2014 to 58 in 2018. None of the years complies with the UN advice of 1 police officer to 450 people. In 2014, for example, the ratio fell from 1 policeman to 2,098 (1:2,098) to 1 policeman to over 4,700. The constant reduction of the police strength can be due to the rural nature of the study area. Many police officers tend to work in the state's urbanized area. That can also be due to the non-consideration of the population size in posting new policemen. The gross decline in staff numbers could also be due to a rise in the number of staff attached to political officials residing mainly in the state capital of Yenagoa and a lack of clear-cut recruitment of more people into the Nigerian Police Force. The findings of this study were also supported by those of Ikharo and Ikharo (2019), whose study results showed that the population-to-police ratio in the Bauchi Metropolis was much lower than the recommended figure of 450:1.

Table 3: Police Strength and Projected 2006 Population

Year	Police Strength	Projected Population	Ratio
2014	117	245,471	1:2,098
2015	105	252,796	1:2,408
2016	88	260,122	1:2,956
2017	85	267,447	1:3,146
2018	58	274,772	1:4,737

Source: Sagbama Police Division (2019)/Author's Analysis (2019)

Distributional Pattern of Police Division and Stations in Sagbama Local Government Area

The distribution pattern of the police division/post is to analyze the spatial pattern of the police facilities within the study area. To determine the spatial pattern in the data, the Nearest Neighbour Analysis (NNA) inferential statistical tool in ArcGIS10.5 was used. The result in Figure 3 showed that as computed by the ArcGIS 10.5 software, the observed mean distance between the police division/post is 9323.36 meters as opposed to the expected mean distance of 5869.2 meters. The result further showed that with Z-scores of 2.76, the spatial distribution of the police division/post in the study area is dispersed, i.e. there is less than 1% possibility that this dispersed pattern of police installations may be attributed to random chance. The dispersed pattern of the police facility could be the result of inequalities in population distribution, inequalities in the presence of influential people and politicians, variations in industrial development and the presence of government facilities (schools, health care facilities, etc.) in some political centers than others.

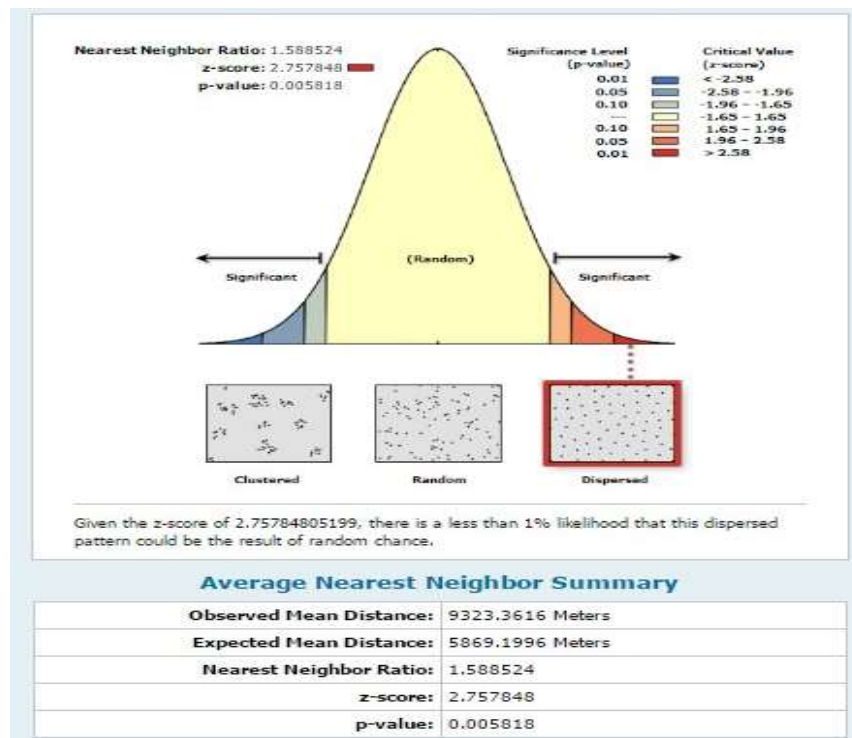


Figure 3: Spatial Pattern of Police Facility

Source: Author's Analysis (2019)

Obviously, the formulation of standards for assessing police presence and comparing it to crime rates calls for the solution of an issue that is logically prior. By implication of this findings, it is clearly necessary to note that the police will have little or no control over the study area in which they work. This is due to the fact that the presence of police installations does not cover most political wards. This also means that with limited resources, the police had to cover much larger areas and patrol their entire jurisdictions. On average, their activities will tend to be centered on or around their police stations, so it is more important that rural police stations are optimally placed. Accessibility, on the other hand, is not globally uniform, but 9 administrative wards, representing 64.3 percent of the political wards without police facilities, had to cover a minimum distance of 5 kilometers to access police services. This also means that most Elemebiri, Isoni, Awigbene, Asamabiri, Aguri, etc. residents characterized by poverty and low connectivity due to lack of roads may not be able to report crime due to high water transport costs that are normal for police service access.

Buffer Zones of Police Division/Stations in Sagbama Local Government Area

In order to locate a police station around areas vulnerable to crime, the distance of the police station from various locations in a given area needs to be identified. Nevertheless, there is no standard distance for citing Nigerian police stations (Ahmed, et. al., 2013). But on the map, a 2 km buffer was built to classify areas that are or are not completely served (see Figure 4).

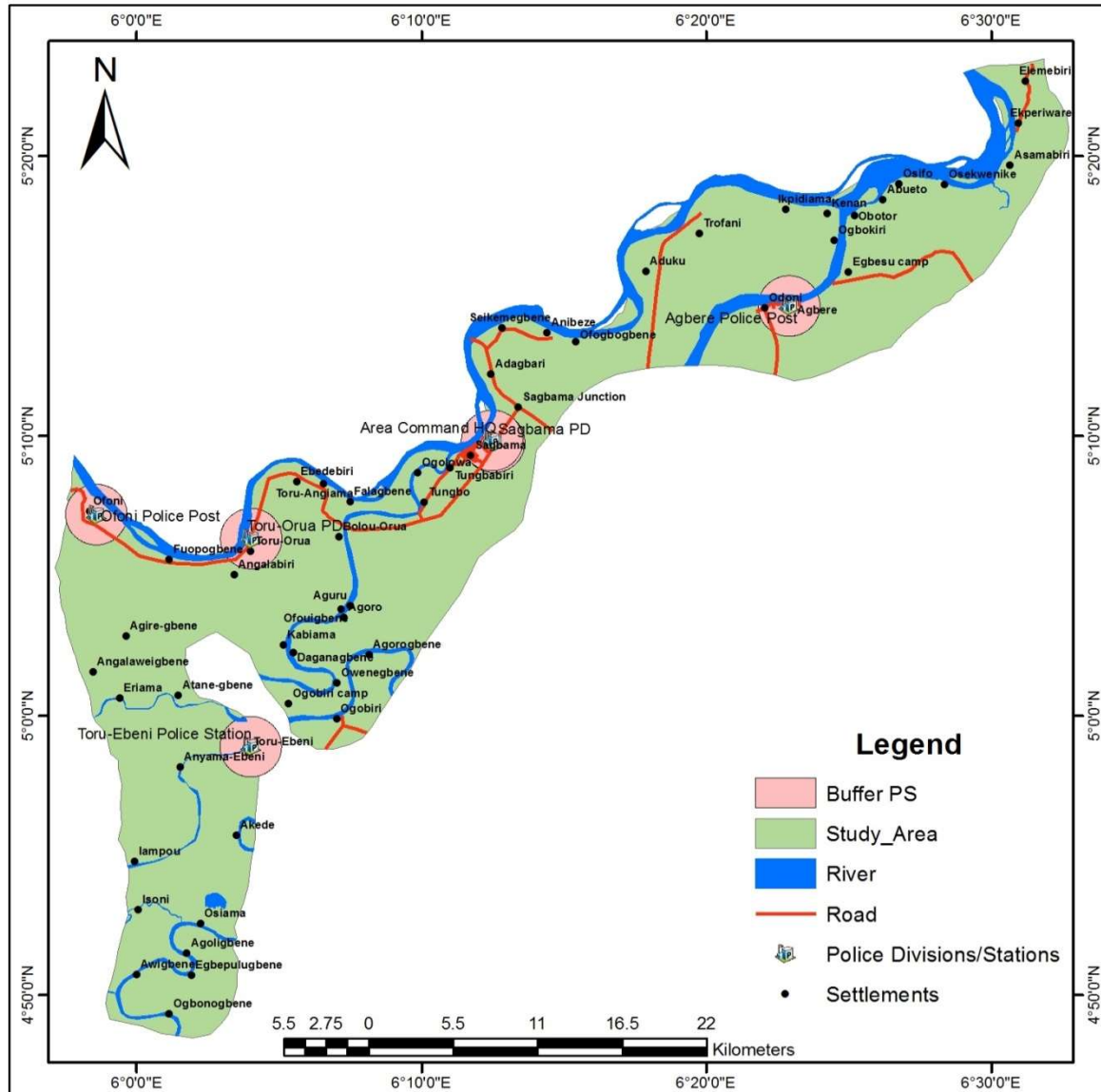


Figure 4: Buffer Zone Analysis of Police Division/Stations

Source: Author's Analysis (2019)

The outcome in Figure 4 indicates the areas entirely served by police divisions/stations within a buffer service radius of 2 kms. The study revealed that Agbere, Odoni, Sagbama, Angalabiri, Ofoni I and Toru-Ebeni administrative wards are well served, while Ebedebiri, Ossiama, Asamabiri, Odoni, Trofani, Agoro, Adagbabiri and Osekwenike administrative wards are underserved in the extreme southern and eastern part of the study area. Residents in most parts of the extreme southern and northern portion of the study area have to drive more than 5kms to reach the closest police facility to access police service. In these areas, most communities are totally surrounded by water without usable roads. This indicates that local decision-making by police planners can be tacitly motivated by the same mechanics that are responsible for the creation of central areas, postulated in Central Location Theory. The results of this study corroborated those of Ahmed and Salihu (2013) in Dala LGA, Kano State, whose study found that some residents had to move more than a kilometer or two to reach the nearest police station.

Conclusion

Different parameters such as crime-prone areas, distance from major rivers/roads, distance from other police stations, involvement of prominent individuals and politicians, political intervention and industrial growth impact the location of a police station or police services at an appropriate location. This research, using geospatial and statistical techniques, examined the current distribution of police stations in Sagbama LGA, and how their spatial structure affects the population's access to police facilities. The findings of the study showed that the pattern of distribution of police stations in the Sagbama LGA had been dispersed. According to this study, the strength of police men in the population of Sagbama LGA has increasingly decreased from 2014 to 2018. The results also showed that most of the communities in the extreme north and south of the study area, which are largely surrounded by water with no motorable roads, had to cover more than 5 km to reach the nearest police station.

Recommendations

The research makes the following as its recommendations:

1. Police authority should be using population size, industrialization and crime volume as factors in the distribution of police stations that could be used to set benchmarks for assessing future changes, as well as to compare future access to police stations as population changes.
2. There is a need to recognize the importance of geography in the placement of new police facilities in order for the police to effectively prevent and control crime. For example, most of the communities in the extreme north and south of the region are completely surrounded by water with no accessible or motorized roads, so the police authority needs to set up police facilities or new police stations to facilitate people's accessibility to police stations.
3. The results of the analysis show that in the five years from 2014 to 2018, there was a gross reduction in police personnel. Thus the number of staff attached to political officials in urban areas should be reduced by the police authority, whereas those attached to individuals who are not entitled to personal police protection should be withdrawn and efforts should be made to recruit more people into the police force to be deployed to the area.

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