Geospatial Location of Crime-Prone Areas in Igangan, Tapa and Ayete Community in Ibarapa North Local Government Area, Oyo State, Nigeria

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Abstract
Due to insecurity, Ibarapa land is believed to be the most challenging zone in Oyo State. Ibarapa axis of Oyo has been the hotbed of several violent clashes between the bandits and the indigenous farmers where farmers can no longer go on their daily faming activities due to kidnapping by the herdsman. This study aimed at depicting the geographical locations of crime prone areas in Ibarapa North Local Government Areas of Oyo State, Nigeria. The study adopted field survey methods which involved field surveying method. IKONOS satellite imagery was employed as a tool to depict the geographical location of crime prone areas. The field surveying method involved the use of Handheld GPS (Garmin 78s) for data ground truth and kidnapping crime hotspots in Igangan, Tapa and Ayete. The study was able to visited Eight (8) crime hotspots in Igangan, five (5) in Tapa community and none in Ayete as all crime areas are in the/along farmland, and due to security reasons, the study cannot further to all the locations. Further processing was done using ArcGIS 10.4 (Arcmap 10.4 version). The results from the study were presented in form of tables, map and map queries. However, proximity of police stations to the crime areas was done to determine how close/near of the crime hotspots to the nearest police station through buffer analysis. Therefore, the study recommends the establishment of more security agents by the government, community vigilante be established also and empower them and as well create more police stations in the study areas.

Keywords: Insecurity, Field survey, Crime hotspots, Geographical location, Proximity

Introduction

No nation can develop when there is high level of insecurity in the society. Nigeria has been ravaged by terrorist activities which have made the country unsafe for Nigerians and foreign investors. The country was named the third most afflicted by terrorism in the 2020 Global Terrorism Index, trailing only Iraq and Afghanistan (GTI, 2021). Nigeria has been ravaged by terrorist activities which have made the country unsafe for Nigerians and foreign investors. The country was named the third most afflicted by terrorism in the 2020 Global Terrorism Index, trailing only Iraq and Afghanistan (GTI, 2021). The security crisis that has presently engulfed the country is traceable to the aftermath of the Nigeria civil war and the adventure of the military

into governance which necessitated the importation and use of arms and ammunitions (Ewetan and Urhie, 2014).

However, Nwolise (2006) sees security as an all-encompassing condition which suggests that a territory must be secured by a network of armed forces. Furthermore, according to Imobighe (2003) Nigeria's security challenges have great effect on the economic growth and development in the country. Dike (2013) when he asserted that lack of security of lives and property of citizens is a major hindrance to meaningful development. Omede (2012) sees security as a dynamic condition which involves the relative ability of a state to counter threats to its core values and interests.

Commission on Human Security (2003) stated that human security is the protection of important aspect of human lives in a way that would enhance human freedoms and fulfillment. To experience a state of complete physical, mental and social well-being security is essential (Meddings, 2001), without security, there can be no stable society rather there will be prevalent fear and danger from violent death (Coupland, 2007). Similarly, to Otto and Ukpere (2012), security relates to the presence of peace, safety, happiness and the protection of human and physical resources or the absence of crisis.

Security, simply put, is the protection of the lives and property of members of the political community. It is the fundamental reason for the existence of a state (Ikyase & Namo, 2018). Human security may be defined to include such chronic threats as hunger, disease and repression. Security means protection from hidden and hurtful disruption in the pattern of daily life in homes, offices or communities. They also define security as a state of being safe and secure from danger (UNDP, 1994). The central pillar of Nigeria national security policy is the preservation of the safety of Nigerians at home and abroad and promotion of the sovereignty of the country as well as her integrity and assets (Nwagboso, 2012).

Secondly insecurity is the state of being exposed to risk or anxiety, where anxiety is a vague unpleasant emotion that is experienced in anticipation of some misfortune. Beland (2005) also defined insecurity as the state of fear or anxiety stemming from a concrete or alleged lack of protection. It refers to lack or inadequate freedom from danger. Coupland (2007) observed that insecurity has a far reaching impact on people's lives and well-being and for this singular reason the government has to be alive to its responsibility of guaranteeing security. Achumba, Ighomereho and Akpor-Robaro (2013), simply see insecurity as the opposite of security which tends to affect human life and existence.

Ogebe (1991) observed that the current problems facing Nigeria is not the only rising incidence in crimes, & but also the gradual shift in the categories of crimes committed from less serious to a more serious and heinous crimes of violence. Oshodi (2011) argues that one sure way of tackling the insecurity situation in Nigeria is to accord the field of psychology a pride of place in policy formulation and implementation to promote national cohesion and integration.

Geographic Information System (GIS) uses geography and computer-generated maps as an interface for integrating and accessing massive amounts of location-based information which allows the police personnel to plan effectively for emergency response, determine mitigation priorities, analyze historical events, and predict future events (Johnson, 2000). Due to increasing number on crime rates this has raised the need to find new ways to handle information about criminality to better understand its causes, local, regional and national security authorities turned to new decision support tools such as Geographic Information Systems (GIS) and other information technologies to help them in finding better solutions (Ferreira et al. 2012). Since

1960's, Geographic Information Systems (GIS) have been applied to a vast number of studies and criminality is not an exception (Brown and Dalton, 1998).

GIS saw a significant development on new research fields, such as crime analysis, relocation of police precincts and crime reduction strategies (Herbert, 1982). Crime analysis involves the manipulation and processing of spatially referenced crime data in order to display visually in an output that is informative to the particular user (Alex and Kate 2001). The most powerful weapon in law enforcement is information technology (Neapolitan, 1996). Francis et al (2006) stated that the level of development in any community depends to a large extent on its state of security. GIS relies heavily on remote sensing which involves aerial sensor technologies that detects and classify objects on earth by means of propagated signal from either aircraft or satellite or both (Ahmed, A & Salihu, R. 2013). GIS technology, by high-end spatial analysis and querying, highlights the crime location, any physical boundaries that were present (that might not otherwise be noticed), and the types of roads and highways that come into both the abduction and body dump sites (Karthik, 2004).

Applications of GIS to crime mapping and management have been successful in many developed countries. Information associated with crime in Lima and Columbus (Ohio) was acquired and integrated in a GIS environment (Murray et al, 2005). Analysis in Lima has spanned crime from 1999 to the present. As a result, the work informed policy and decision making in Lima Police Department activities, particularly with respect to community policing (Murray et al, 2005). According to Yelwa, S. A. & Bello, Y. (2012), GIS allows crime analysts to identify crime hot spots along with other crime trends and patterns. Rossmo, K. (2000), also argued that geographic profiling through the GIS uses the nearest principle as a key to track offenders within a limited range that is comfortable to be arrested by law enforcement officers.

Material and Methods
The study area
The study area covers Igangan, Tapa and Ayete community of Ibarapa North Local Government Area, Oyo State with Ayete as the headquarters. Having 39 settlements consisting of villages and farmsteads. The total population of Ibarapa North Local Government as at 2006 population census was 100,293 and by 2.3% annual population growth, it is 143,300 in 2022 by projection (National Bureau of Statistics (web), 2023 (https://citypopulation.de/en/nigeria/admin/NGA031_oyo)). Wahab and Ogundele (2011) gives the LGA latitudes as 7°30'N to 7°50'N and longitudes as 3°001E to 3°25'E. Igangan lies at approximately 3°10′59.99″ and 7°40′59.99″, Tapa lies at approximately longitude 3°12′51″E and latitude 7°48' 17″ N and Ayete lies between longitude 3°13′50″E and latitude 7°33' 51″ N. The critical aspect of economy in Ibarapa North Local Government Area is farming.

Instrumentation/Equipment Used
i. Handheld GPS (Garmin 78s) (for data ground truth)
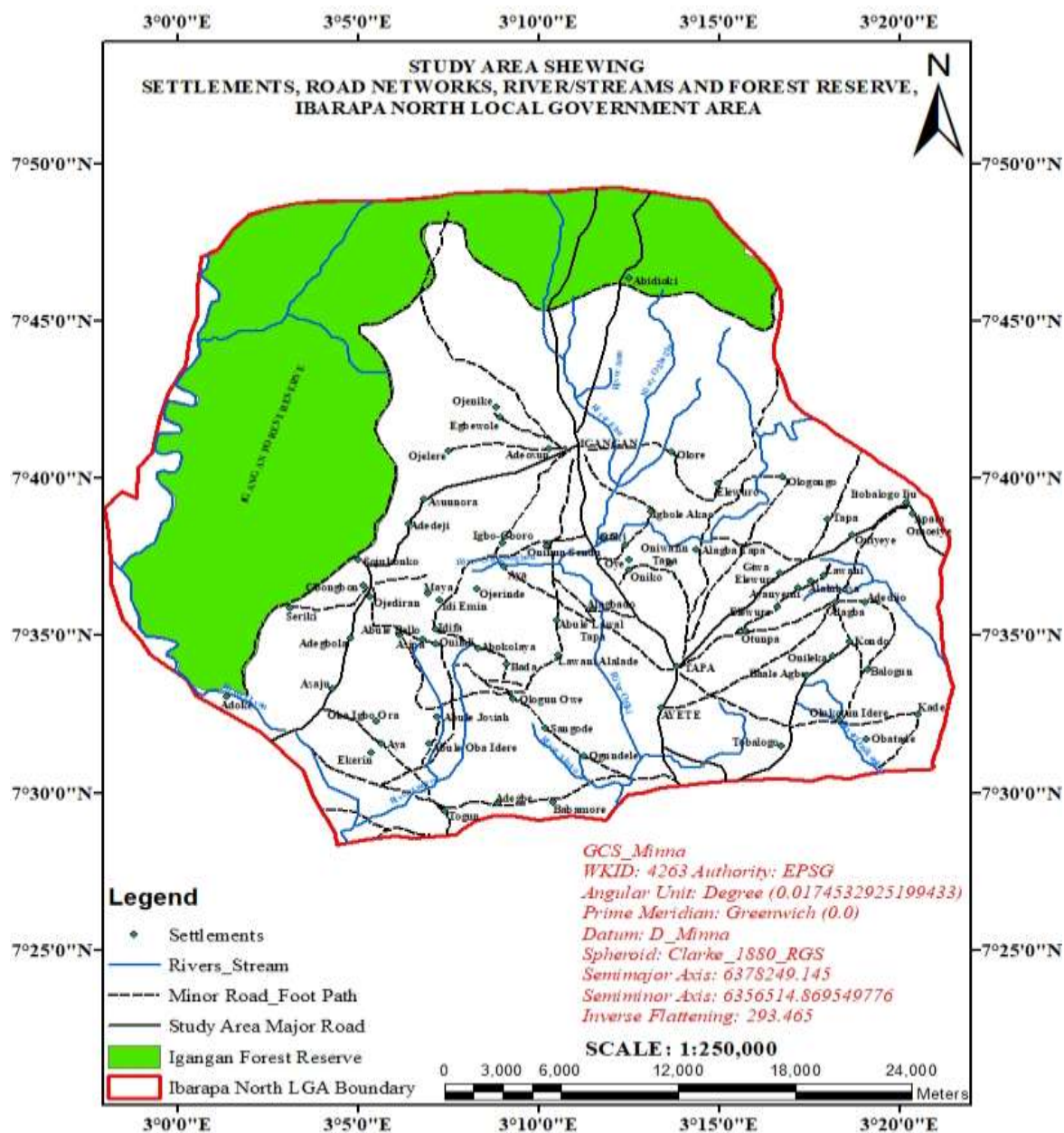ii. IKONOS Satellite (for Imagery image processing

Figure 1: Map showing the study area

Methods of Data Acquisition

IKONOS satellite imagery was used to depict location the crime prone areas in Igangan, Tapa and Ayete. The three locations was visited and the Handheld GPS (Garmin 78s) was use to determine the spatial coordinates used for data ground truth used for further image processing and as well as attacks hotspots and police stations. The IKONOS satellite imagery was used in locating the crime area and handheld GPS to determine the spatial location coordinates of crime areas. The crimes emanated from the study area (Igangan, Tapa and Ayete) communities are kidnapping, Killings/Murderer, abduction, raping and invasion of farmlands with kidnapping being the major leading to collection of ransom and the main area this study focused on. Other

committed crime type in the study areas; armed robbery, Arsoning, raping. However, all other aforementioned crime types above has been curbed by the community and as well as with the help of government through the security agent. Further analysis was carried out using ArcGIS 10.4 (Arcmap 10.4) Software for image processing and map production.

There are many locations where farmers-herders attack occurred and some are far to the community and some are within. The following locations are the Fulani attack hotspots within the community of Igangan, Tapa and Ayete and they includes; Oke-Agbede Igangan, Ojumu Igangan, Olosun filling station Igangan, Iganna road, Apodu Igangan, Idi-Ope, Alagba area, Alagbado area, Dagbere, Oke Arinsa Kopec area in Tapa, Oke Odo, Oke Ayo Tapa Area, Asunnora, and Seriki Fulani location. Other locations are in Alasia, Mobilu, Afoa, Aatan, Afunije, Babaisego and others in Gaa Wakili such as Sarki Alagolo, Gbagabgere, Awikonko which this study cannot reach. Due to the security reasons and what community has faced in the past, this study was unable to visit all the hotspots but some of the locations visited can be seen on thematic map (see figure 3).

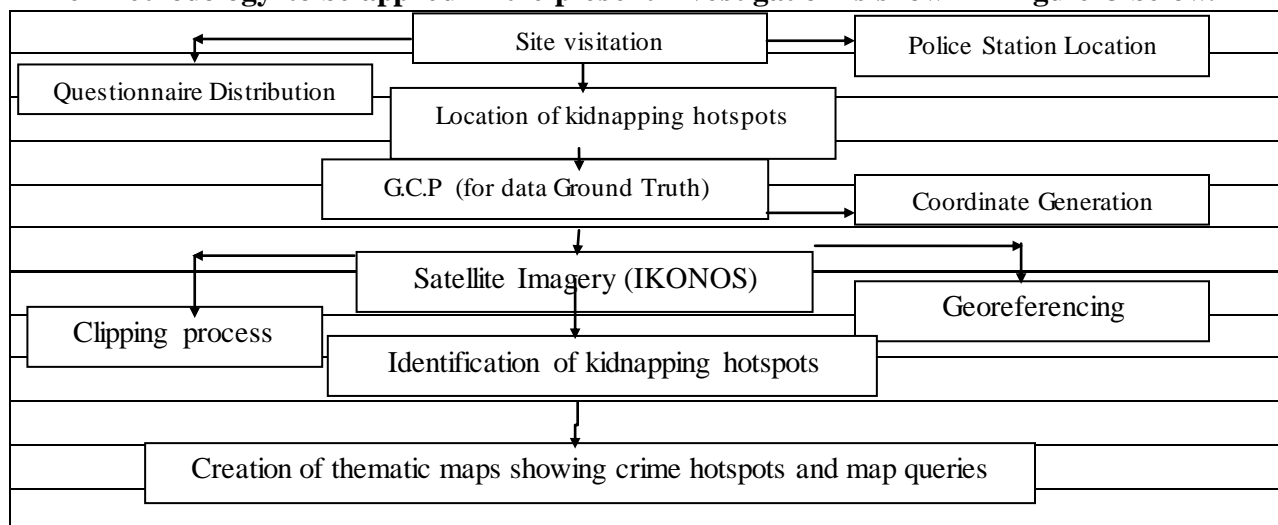**Brief methodology to be applied in the present investigation is shown in Figure 3 below:**

Figure 2: Methodology Workflow for the study

Data processing
Data in this study were processed using IKONOS satellite image of 0.75cm resolution for image processing and map production. The image was georeferenced using the data obtained during the field data ground truth. Data obtained with the handheld GPS was downloaded and sorted out (see table 1).

Image georeferencing
The IKONOS satellite imagery used were georeferenced using the ground truth data obtained during the field data operation. This was done by adding the geographical coordinates (Longitude (X) and Latitude (Y)) to the imported image to make the imagery conform to the exact position on the earth surface. Geographic Location of attack Hotspots in Igangan, Tapa and Ayete

Table 1: Geographic Location of attack Hotspots in Igangan, Tapa and Ayete

Location of attack Hotspots in Igangan	Latitude	Longitude
Oke Agbede Igangan	7°40'18.70"N	3°10'42.535"E
Olosun Filling Stsation Igangan	7°41'27.43"N	3°11'8.286"E
Ojumu Area Igangan	7°41'30.84"N	3°11'34.274"E
Agba Area Igangan	7°40'38.561"N	3°10'49.364"E
Seriki Fulani Igangan	7°38'20.879"N	3°10'51.168"E
Alagba Area	7°44'2.407"N	3°8'13.204"E
Idi-Ope Area	7°38'34.796"N	3°10'22.811"E
Apodun Area	7°41'9.593"N	3°10'58.811"E
Location of attack Hotspots in Tapa		
Oke Odo, Oke Ayo Tapa Area	7°34'24.265"N	3°13'14.336"E
Oke Arinsa Kopec Area Tapa	7°35'18.139"N	3°12'47.275"E
Dagbere	7°35'16.796"N	3°5'24.011"E
Alagbado	7°35'20.389"N	3°10'19.207"E
Asunnora	7°39'14.4"N	3°6'53.989"E
Police stations in Igangan, Tapa and Ayete Community		
Nigeria Police Force Igangan	7°40'21.623"N	3°11'4.474"E
Nigeria Police Force Ayete (Div. HQ)	7°33'51.455"N	3°13'50.347"E
Nigeria Police Force Ayete	7°32'5.150"N	3°13'12.176"E
Town Hall in Igangan, Tapa and Ayete Community		
Iganagn Town Hall	7°40'56.338"N	3°11'1.028"E
Ayete Town Hall	7°33'50.411"N	3°13'51.586"E
Tapa Town Hall	7°33'46.8"N	3°13'47.996"E
Data acquired for Ground Truthing		
Igangan central point	7°40'56"N	3°11'00"E
Tapa central point	7°48'17"N	3°12'51"E
Ayete central point	7°33'51"N	3°13'50"E

Source: Authors' field survey (January, 2023)

Creation of shapefiles and Digitising process

Shapefiles were created for roads (Major and Minor/foot paths), river/streams, and forest reserve. After the shapefiles was added to the map layer, the digitization process commenced on the imagery to show the exact position of roads, river/stream and forest reserves.

Linking of Data

Spatial and attribute data such as points, lines and area features and their attributes were linked together using the attribute table feature in ArcGIS i.e. for every feature created, its attributes are entered into the attribute table (Njoku, et al., 2021). For this study, crime hotspots data were linked/added to the georeferenced image to show the position of crime hotspots, police stations in the study areas.
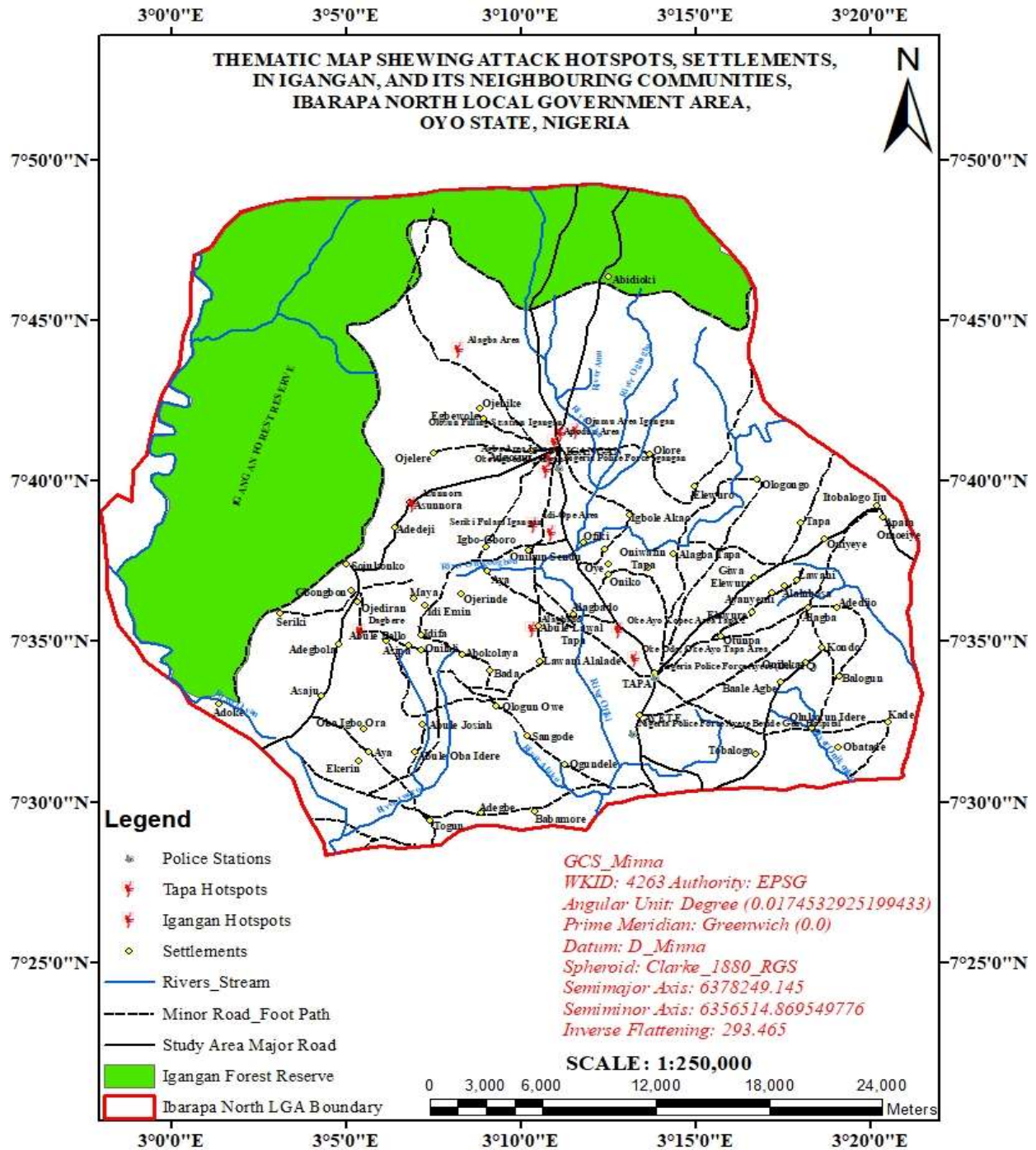
Result and Discussions

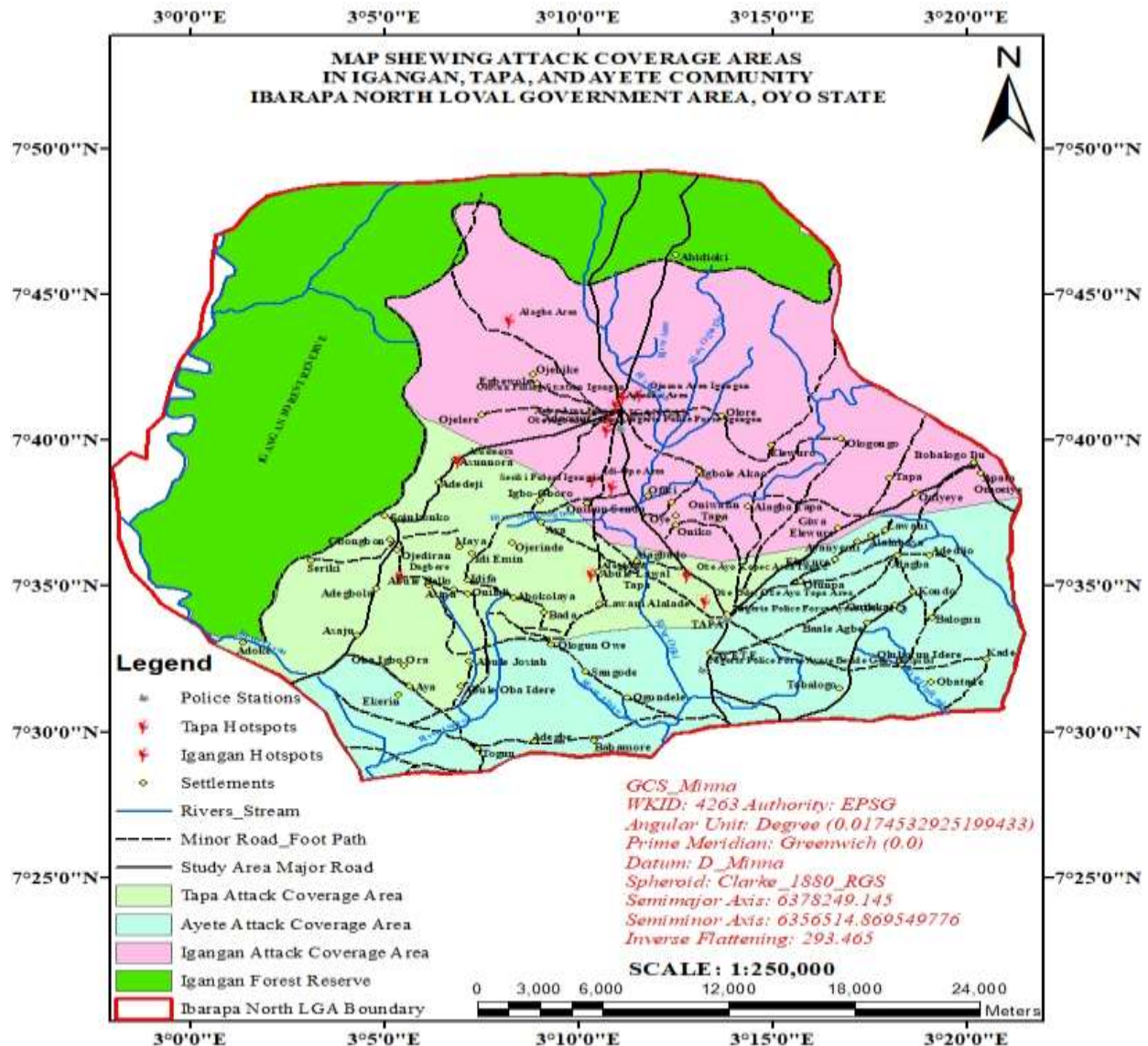

Figure 3: Thematic map of the study

Figure 4: Showing attack coverage areas in Igangan, Tapa and Ayete community

The result from the thematic map revealed that only eight (8) kidnapping hotspots were visited in Igangan community, five (5) in Tapa community and none in Ayete as many of the location falls in farmland and as well as along the farmland and are kidnapping and robbery, and raping as it was revealed by the citizens of the community. The result also revealed that only one police station are in Igangan and as well as Ayete communities and none in Tapa community which shows with the number of police station in the study areas are not enough and even far away from most of the attack locations.

Spatial Queries
Spatial queries are also known as spatial search. The analysis provides solutions/answers for questions about some specific entity in the study area extracted from the database created, based on particular criteria. For this study, both single query and display (where one field result will be

address) and multiple queries (where multiple criteria are involved) will be used to answer specific questions using the Arc GIS query builder module (Njoku, et al., 2021). Queries were built to define the crime location or zones and to determine the particular streets or the crime scene (Francis Fajemirokun et al., 2006). This study adopted queries using selection by location.

Query 1: select location coverage of attack in Igangan community
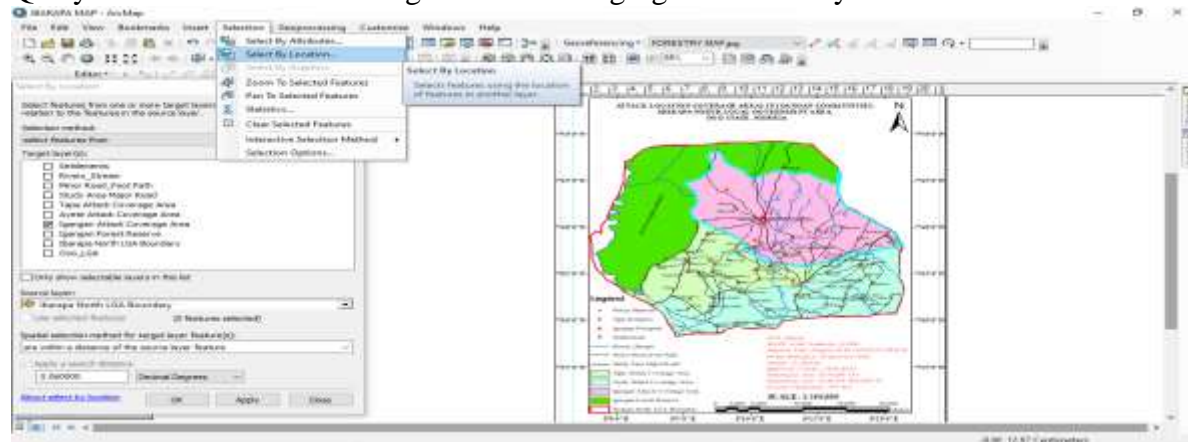
Query 2: select location coverage of attack in Tapa community
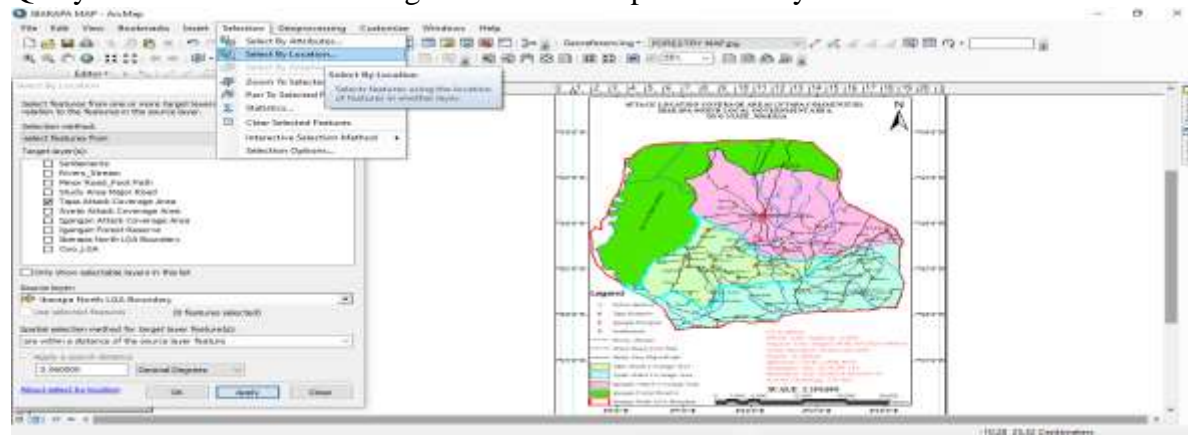
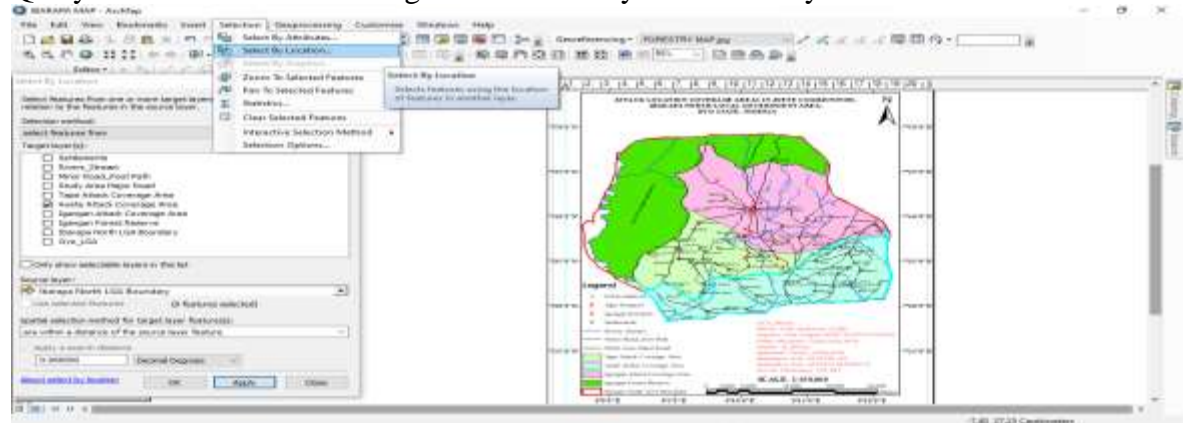Query 3: select location coverage of attack in Ayete community

Figure 5: Showing selection by location of attack coverage area in Igangan, Tapa and Ayete

The research conducted during the survey revealed the coverage areas in Igangan are more than that of Tapa and Ayete communities despite few locations visited.

Proximity of Police Station to the Crime Hotspots in the Study Areas
Proximity is the nearness or closeness of a particular objects to the other having close relationship. For this study, the proximity of Police stations to crime areas was determined using measure in meters in ArcGIS 10.4 environment.
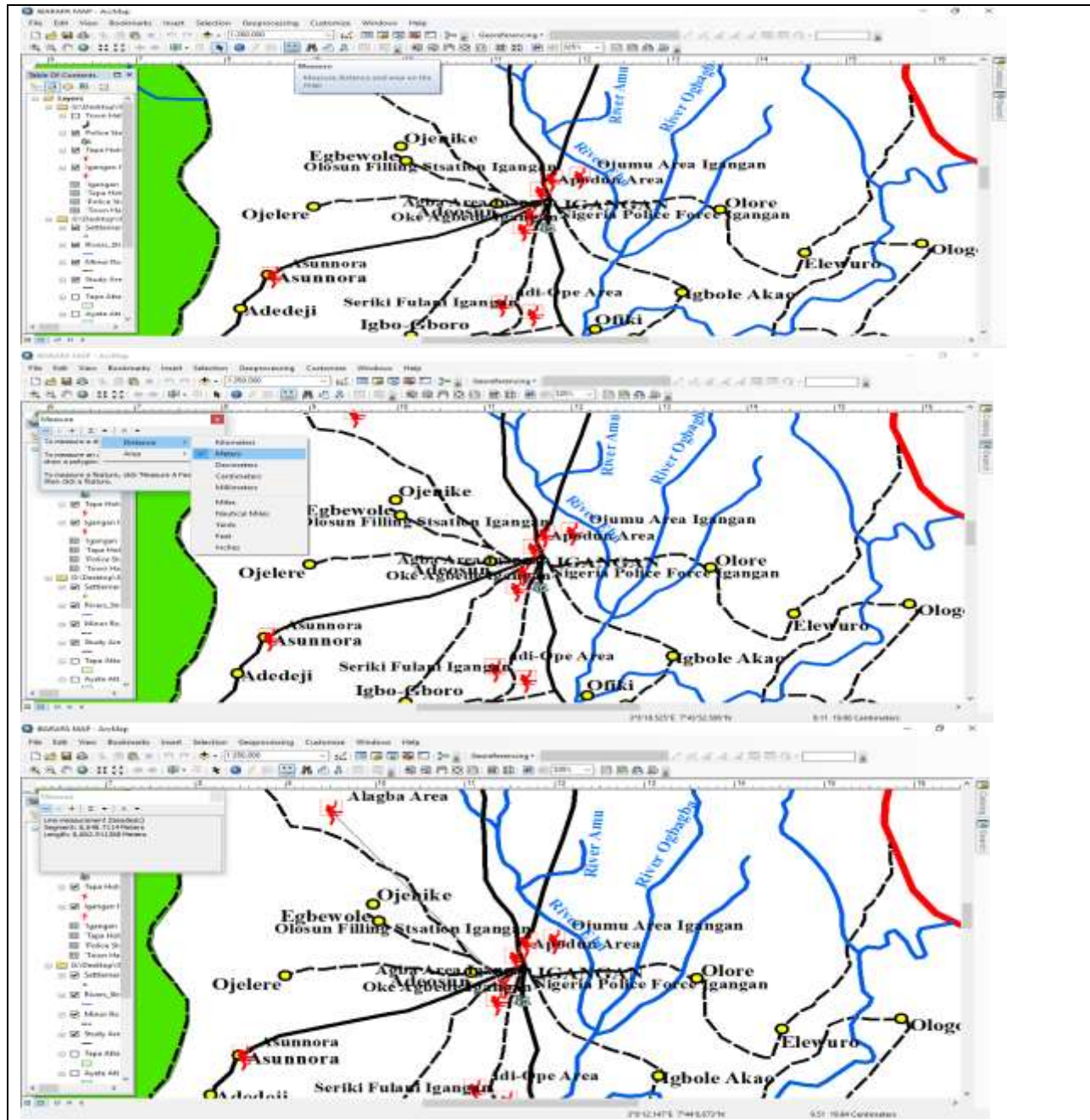

Figure 6: showing process of calculating distance of Police station to the crime hotspots

Table 2: Data on Proximity of Police Station to the Crime hotspots

Proximity of Igangan Police Station to Crime Hotspots in Igangan Community	
Name of Location	**Distance of Police Station to Crime Area**
Oke Agbede Area	675.442m
Ojumu Area	2402.444m ~ 2.402km
Agbaa Area	794.228m
Apodu Area	1,588.799m ~ 1.589km
Olosun Filling Station	2,126.822m ~ 2.127km
Alagbaa Area	8662.911m ~ 8.663km
Idi-Ope Area	3647.438m ~ 3.647km
Seriki Fulani Area	3444.194m ~ 3.444km
Proximity of Ayete Police Station to Crime Hotspots in Tapa Community	
Dagbere	15732.273m ~ 15.732km
Oke-Ayo Kopec Area	3341.517m ~ 3.342km
Oke-Odo, Oke-Ayo	1471.468m ~ 1.471km
Alagbado Area	7022.018m ~ 7.022km
Asunnara Area	16167.831m ~ 16.168km

Source: Authors' compilation (January, 2023)

From table 2 above, only two crime locations in Igangan are less than 1km to the Igangan police station as others ranges from 1.6km to 8.7km and however, in Tapa community, the distance ranges from 1.5km to 16.2km and in some of this locations that the proximities of police stations to the crime areas is far, it is likely to experience re-occurrence of crime in those areas as distance may be barrier for the security agent to reach the crime location at the right time.

Buffer Analysis
Buffer operation refers to the creation of zone distance of a specified radius around point, line or polygon areas, that is,. a zone of specified radius distance around coverage features. No permissible standard distance for citing police stations was established in the Nigeria and lieu of this, buffer zone radius of 2km and 5km were created on the map to identify areas that are within the zone that the police station can serve in this study. With the buffer analysis, it showed that seven (7) are within the buffer zone radius of 5km with only one (1) not within in Igangan and in Tapa community, two (2) is with 5km radius distance while three (3) were beyond.
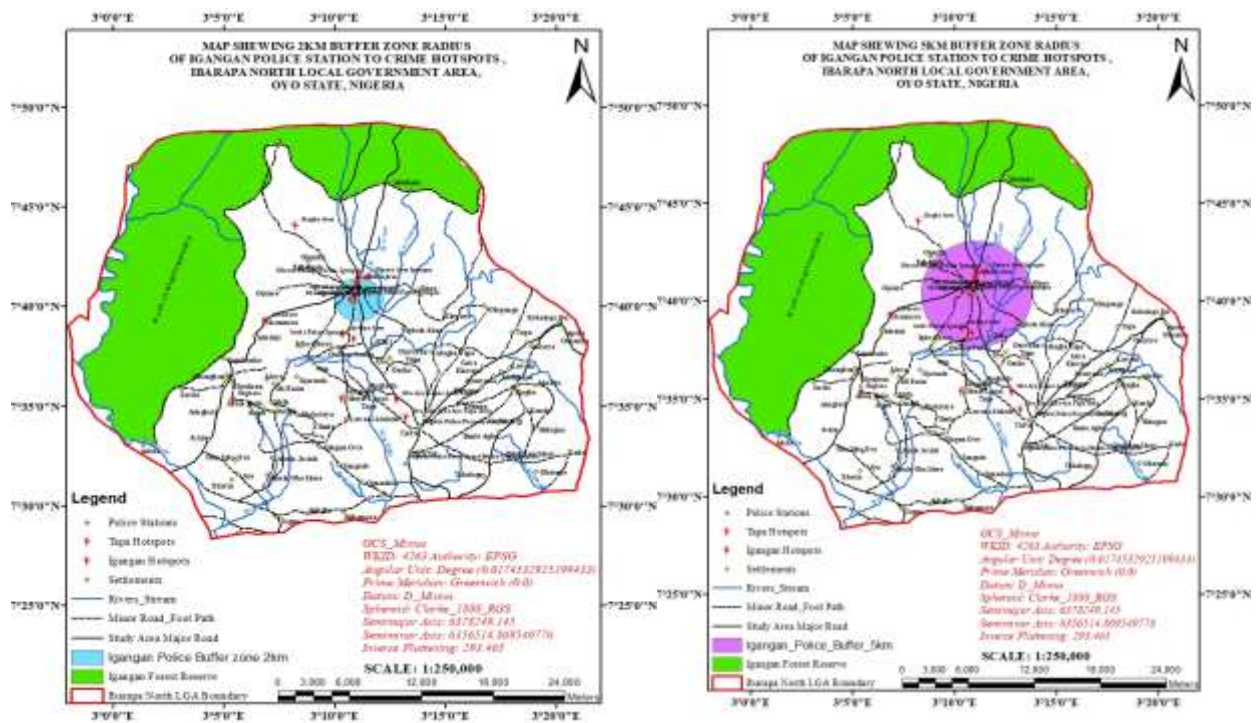
Figure 7: 2km and 5km Buffer zone Radius of Igangan Police station to crime hotspots
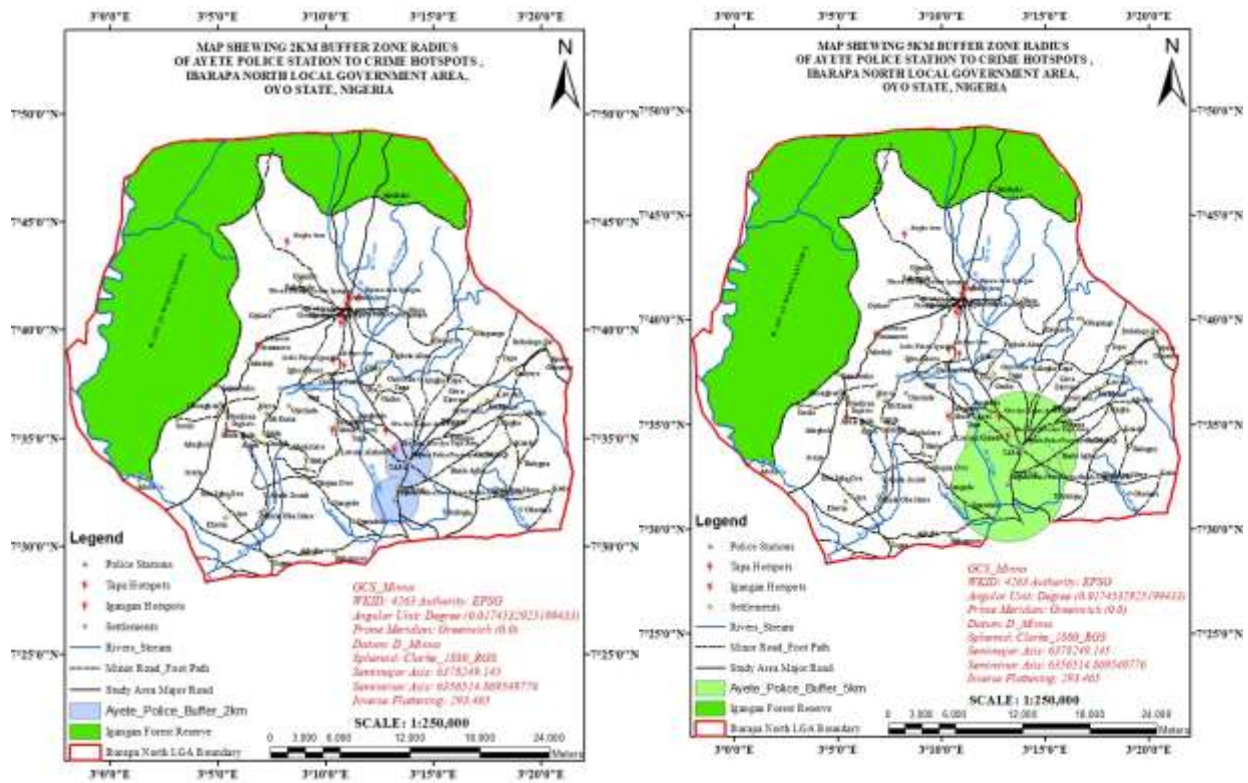

Figure 8: 2km and 5km Buffer zone Radius of Ayete Police Stations to the Tapa crime hotspots

From figure 7 above, Oke-Agbede, Agbaa area and Apodu crime hotspots in Igangan are within the buffer radius of 2km while the remaining five are beyond the 2km radius and onlu Asunnora and Alagba are beyond the 5km radius. However, from figure 8, only one crime hotspot in Oke-Odo in Oke-Ayo Tapa area falls within the radius of 2km and two crime hotspots in (Oke-Ayo Kopec area and Oke-Odo, Oke-Ayo area, Tapa) are within 5km buffer radius

Conclusions

GIS and remote sensing application has been proven as the best tool to determine the areas that are not secure and prone to terrorist attack. The aforementioned applications have been used to depict the spatial locations of terrorist attack. From the findings of the study, it was revealed that most of the attacks in Ayete community occurred in far areas most especially in the farm and as well as along the farm areas with raping being the major as the study was unable to visit any due to security reasons. However, aside some of the locations visited in Igangan, Tapa, and other areas cannot be visited due to security reasons. Therefore, the effective way to combat insecurity can only be through the joint efforts of legislative and judicial in collaboration with government reforms so as to address some serious human security challenges facing our environment and empower both government and community security agents and as well build more police stations within the three communities.

Acknowledgements

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