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Geospatial assessment of raphia palm wine production and consumption points in Owerri senatorial district, Imo State, Nigeria

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Abstract

Raphia palm wine occupies a very important position in the traditional activities of Owerri senatorial district and the Igbo ethnic group in Nigeria generally. A lot of benefits have been derived from Raphia palm, which can be grouped under cultural, health, religious, culinary and economic benefits. The main objectives of this study were to investigate the existing distribution of Raphia palm wine production and consumption points, to ascertain the best route and finally to map their hot spot and cold spot zones. The location coordinates of the existing Production and Consumption points were collected using a GPS based on snowball sampling technique. Nearest neighbour analysis was used to analyse the pattern of distribution, the route analyst tool was used to analyse the best route and lastly, Getis-OrdG a spatial statistics tool was used to determine the hotspot and cold spot zones. One of the findings showed that Raphia palm wine production points are randomly distributed across the study area, while the consumption points were clustered particularly around Owerri North, Owerri West, and Mbaitoli Local Government Area. It was recommended that there should be the enactment of state laws to reduce the felling of Raphia palm trees in the face of rapid urbanization.*

Keywords: Raphia palm, Urbanization, Culture, Geospatial, planning.

Introduction

The name Raphia palm was first used by Beauvois to describe the palm-bearing fruit he saw during his four years' research work along the coast of West Africa, from 1859 to 1863, in the compilation of his findings in 1906[1]. Raphia palm is one of the indigenous genera of the palms. Borassus, Elaeis, Hyphaene, Phoenix and Raphia were among the few palms taped for palm wine, while Raphia *hookeri* and Raphia *vinifera* species produced the highest yield of palm wine respectively when taped[1]. Ogbulie *et al.*[2] asserted that the unfermented fresh palm wine is colourless, clean and sweet with no alcohol but shortly after, react with natural yeasts in the air during the process of extraction, and become milky less sugary and intoxicating. As a result of this, it is being referred to as a traditional alcoholic beverage consumed in most parts of the world by WHO[3]. However, the local government authority has no control over its consumption. In most rural areas, in developing countries of the world palms are major sources of many products, in which palm wine is one of such, it plays a vital role in nutrition, income and the social-cultural life of the people[4]. The activities of palm wine make a lot of economic fortune due to its popularity as well as medical, pharmaceutical domestic and industrial usefulness[4].

Palm wine is consumed in most countries in the Middle East, West Africa, Asia, South America and North Africa[5]. As a result of its popularity and the important place it occupies in the history and custom of different people that consume it. It is identified with various nomenclatures such as Tuba in Mexico, in South India it is called Htan Yah, while in China it is called Panamcullo, Manjevo in Angola and Poyoin Sierra Leone. In the Democratic Republic of Congo it called samba while in Ghana, it is called Doka. In Nigeria it called Emu, while in the Igbo speaking part of the country, it is known as Nkwoocha, Nkwuenu and Mmayangwo.

Raphia palm is a tropical tree crop requires needs high temperature, rainfall, high relative humidity and sunshine to survive[6]. The most suitable soil for its development is of arenaceous formed sedimentary rock origin, sandstone and coastal palm sands. A lot of benefits have been derived from Raphia palm, which can be grouped under cultural, health, religious, culinary and economic benefits. Ikegwu[7] stated that in traditional occasions such as the celebration of the arrival of a newborn child into a family, traditional wedding, funeral events, town hall meetings, age grade meetings festivals like new yam, oruowere, ugwuuzo festivals especially in the Igbo speaking part of Nigeria, palm wine is very essential. Mbuagbaw and Noorduyn[8] stated that Raphia palm helps to improve vision. According to Tiepma *et al*[9] moderate consumption of unfermented palm wine helps to reduce the risk of cardiovascular diseases, as well as help lactating mothers who have limited production of breast milk improve, and the treatment of conjunctivitis. Also, most traditional healers infuse some medicinal herbs into palm wine for the treatment of patients due to its rich minerals and vitamin content. Ewuim *et al*[10] examined the insects' association with Raphia palm.

Adakaren[11] investigated the marketing of Raphia Palm Wine in the South-South geopolitical region of Nigeria. In the study, attention was given to the existing market structure for the product in the study area. Mbuagbaw Noorduyn[8] examined the hazards associated with the palm wine business as well as its medical relevance to man.

Geography as a field of study is involved in the study of how different features are distributed in space. Tony *et al*[12] in their study investigated the spatial distribution of alcohol outlets in Philadelphia city of the United State of America. In their study, they adopted an analytical approach to predict the spatial impact of alcohol outlet in the city, following the state government decision to exit from an Alcohol Beverage Control state. Omodele *et al*[13] examined the contributing factors accounting for the spatial distribution of poultry production in Delta state. Their findings revealed that the topology of the region influenced the level of production, as lowlands recorded higher production than the highlands this they explained to be influenced by the high human population in the lowlands.

This study is therefore designed to: i. map the existing distribution of Raphia palm wine production and consumption; ii. determine the best route and distance from a Raphia palm wine production point to a consumption point; iii. determine the closest production point to consumption points in Owerri Senatorial District and lastly, iv. map the hotspot and cold spot zones, of Raphia palm wine production and consumption points in the study area. The hypothesis states that there is a clustered distribution of Raphia Palm wine production and consumption points respectively in Owerri. This research is relevant because it would arouse the interest of agro investors to promote efficient distribution of Raphia palm wine and reduce the constraints affecting the distribution of the Raphia palm wine in the study area.

Study Area: The study area Owerri senatorial district is located in Imo state, the south-eastern part of Nigeria, it is often referred to as Imo East senatorial district, and comprises of nine local government areas; Aboh-Mbaise, Ahiazu Mbaise, Ezinihitte Mbaise, Ikeduru, Mbaitoli, Ngor-Okpala, Owerri North, Owerri Municipal, and Owerri West, with a total population of 1,482894 people. The zone is dominated by three major activities commercial, administrative and agricultural activities. Over 98% of the inhabitants are Igbo, with 96% Christians; more than 65% of the Christians are Roman Catholics. The zone is well known for festivals like Oruowere, Iri Ji Mbaise, Uguzu Emekuku, Okazi Emi and a host of other festivals. Owerri indigenes are fondly said to be eating African salad and drinking palm. This is because of the abundance of the resource and the value attached to it in the area. Owerri senatorial district is located within latitude 5°11'N and 5°38'N and longitude 6°54'E and 7°22'E, it is bounded in the North by Okigwe senatorial district (Imo North), and in the East by Abia state, in the west by Orlu senatorial district (Imo West) and at the south by River state, with a land size of 1,919.16/Km². Two main seasons (rainy and dry season) are expirenced. The rainy season starts by April and last till November, and then the dry season sets in late December till March. With annual precipitation ranging from 1500mm to 2200mm, and an average annual temperature of 26.4°C creating a relative humidity of 75%. The climate and Geomorphology of the zone favour the following crops predominant in the zone; oil palm, Raphia palm, cassava and maize which are produced in large quantity.

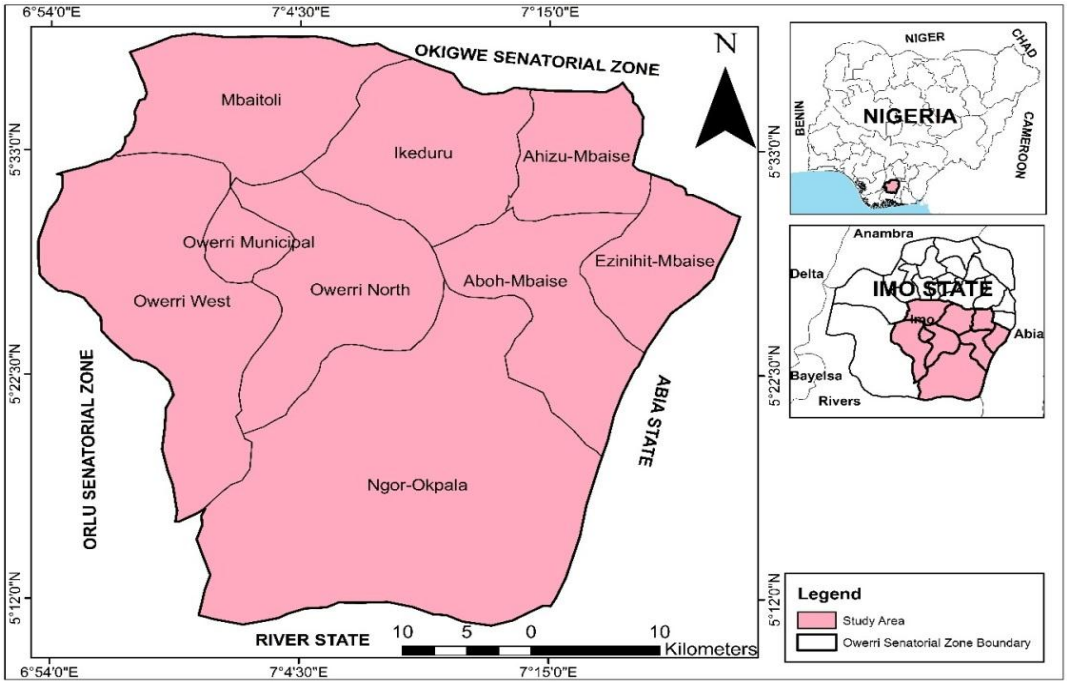

Figure-1: Map showing Owerri Senatorial District, Imo State, Nigeria.

Methodology

This research made use of primary and secondary data sources. The first-hand primary data for this research were obtained through direct observation, interview and Global Positioning System (GPS). The direct observation was done by personally visiting the Raphia palm wine farms and consumption locations, while through oral interview relevant questions were directed to the palm wine tappers in the farms and the retailers at the consumption locations. Some of the required information are: i. number of Raphia palm trees in the farm; ii. average number of Raphia palm tapped in a day; iii. the average output for the day iv. months with the highest production and the month with the peak of production; v. the cost of palm wine per litre and vi. where do the buyers of the palm wine come from. The retailers at various retail locations were asked some questions such as; where they buy their palm wine from, the average quantity of palm wine sold daily, cost of a litre of palm wine, who are the major consumers and where do they come from, months and seasons of the year with the highest sale, the nearest palm wine consumption outlet in that location.

Global Position System was used to obtain the Geographic coordinate points of the various Raphia palm wine farms and the consumption outlets visited. The secondary data for this research were obtained from relevant published and unpublished materials such as journals magazines, government agencies and relevant organizations. These data include the analogue administrative map of Owerri senatorial districts, list of the names and locations of registered palm wine tappers in the study area and Satellite image of Owerri senatorial district. The sources of these secondary data are; Imo state Ministry of land and Survey Owerri, the chairman palm wine tappers association for eight LGAs, google earth pro software. The map was scanned into digital format and brought into ArcGIS environment where it was digitized using ArcGIS 10.5 software. The satellite image of the study area was obtained using google earth pro software, from which the road network and water bodies were digitized. Information containing the list of the registered palm wine tappers in each of the LGAs was obtained from the Chairman Palm wine tappers association. Snowball sampling technique was adopted in collecting the Geographic coordinate point of 160 Raphia palm wine consumption locations across the LGAs in the study area**.** This sampling technique was used, as a result of the unavailability of the record of Raphia palm wine consumption point outlets in the study site. This is because the retailers at the consumption points do not have an organized association like the palm wine tappers in the study area.

Geographic Information Systems (GIS) analysis was used to address the objectives and hypothesis of this study. To map the existing distribution of Raphia palm wine production and consumption location in the study area, a map of Owerri senatorial district, its road network and water bodies and the Geographic coordinate points of the production and consumption locations in the study area were digitized. The same also was done for the best route and the distance to a consumption point in the study area. However, to determine the closest production point to consumption points in the study area Owerri Senatorial District, the road network of the area and geographic coordinate points of the production and consumption areas were digitized. Finally, the map of the hotspot and cold spot zones of Raphia palm wine production and consumption points were also produced. The production points obtained was inputted into the Microsoft Excel software and imported into the GIS environment for further analysis. The spreadsheet included three columns, the first column consisted of the names of the various production location where the points were taken. The next column consisted the longitude of the selected point and the last consisted the latitude of the selected production outlets respectively. That is, each individual row had the name of the production outlet as well as a specific longitude and latitude of that particular production point.

Results and discussion

The geographic coordinate point of a total of 46 valid production locations and 160 consumption locations was superimposed on the administrative map of the study area, alongside the digitized road network and water bodies. This provides a visual insight into the existing distribution of Raphia palm wine production and consumption location in the Owerri (Figure-2).

The first hypothesis which states that there is a clustered distribution of Raphia palm wine production pointswas analyzed using Nearest Neighbour statistical tool. The result of the Nearest Neighbour Analysis is as follows: (Nearest Neigbour ratio: 1.081834; zscore: 1.061807; p-value: 0.288323). This implies that given the z-score of 1.061807, the pattern does not appear to be significantly different than random. This outcome can be explained on the bases that Raphia palm wine grows mostly along river banks and on suitable soil of arenaceous formed sedimentary rock origin, sandstone and coastal palm sands. Ubokudom and Okorji[14]noted that the tapping of palm wine is a major economic activity for most rural communities residing along the coast. Therefore, the hypothesis is rejected. A graphical presentation of the result is shown in Figure-2.

The second hypothesis which states that there is a clustered distribution of Raphia palm wine consumption points in the study are was also analyzed using Nearest Neigbour tool of ArcGIS. The result is as follows (Nearest Neigbour ratio: 0.695930; z score: 7.335045; p-value: 0.000000). This suggests that there is a less than 1% likelihood that the clustered pattern of distribution of the consumption points could be the result of random chance. This clustered pattern could be explained by the rapid population growth in the state capital Owerri Municipal, forcing the upspring of satellite towns in neighboring LGAs like Owerri North, Owerri West and Mbaitoli, and good road networking linking the various production points to these

satellite towns, which is witnessing rapid population growth but still retains some of her rural characteristics and cheaper space for business activities, with limited restrictions when compared to the state capital Owerri Municipal. Therefore, the hypothesis is accepted.

The network analysis was performed on the major roads linking the various production points to the consumption points in the study area. The Network Analysis map is shown Figure-5 below, followed with a table showing the connection between the production points and consumption points, and the distance covered from one production point to the consumptions points.

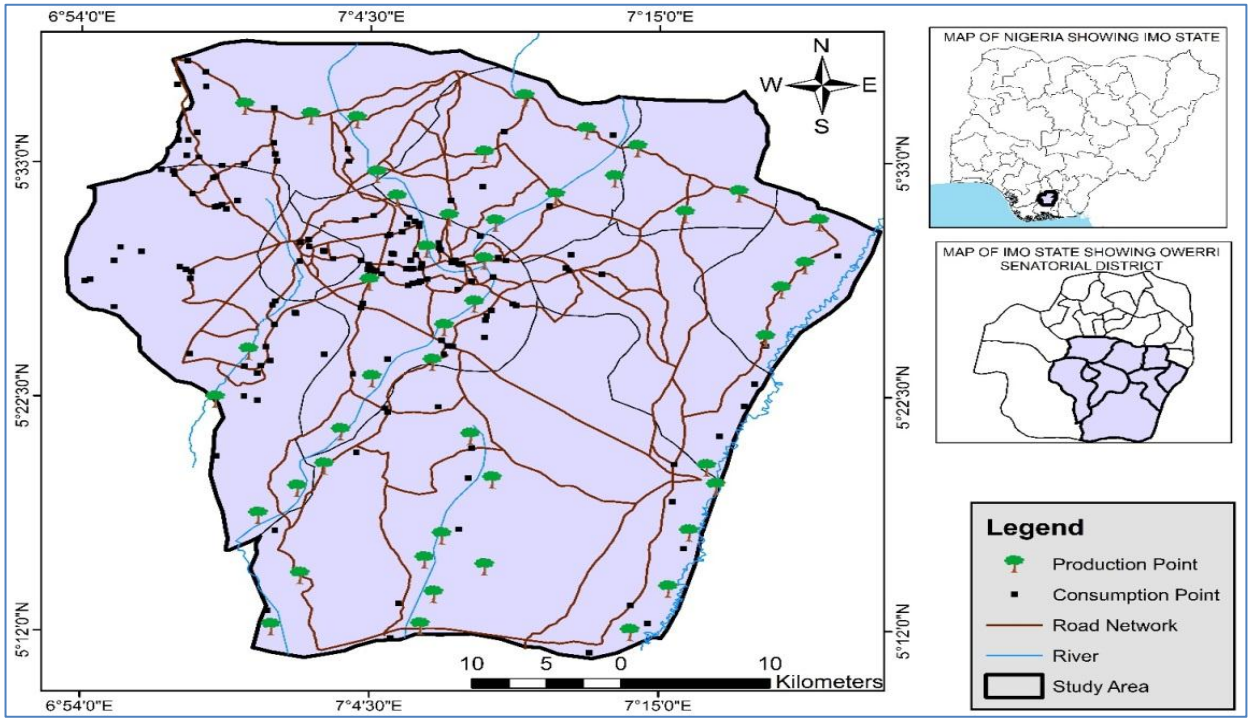

Figure-2: The Distribution of Raphia Palm Wine Production and Consumption Points in the Owerri Senatorial District.

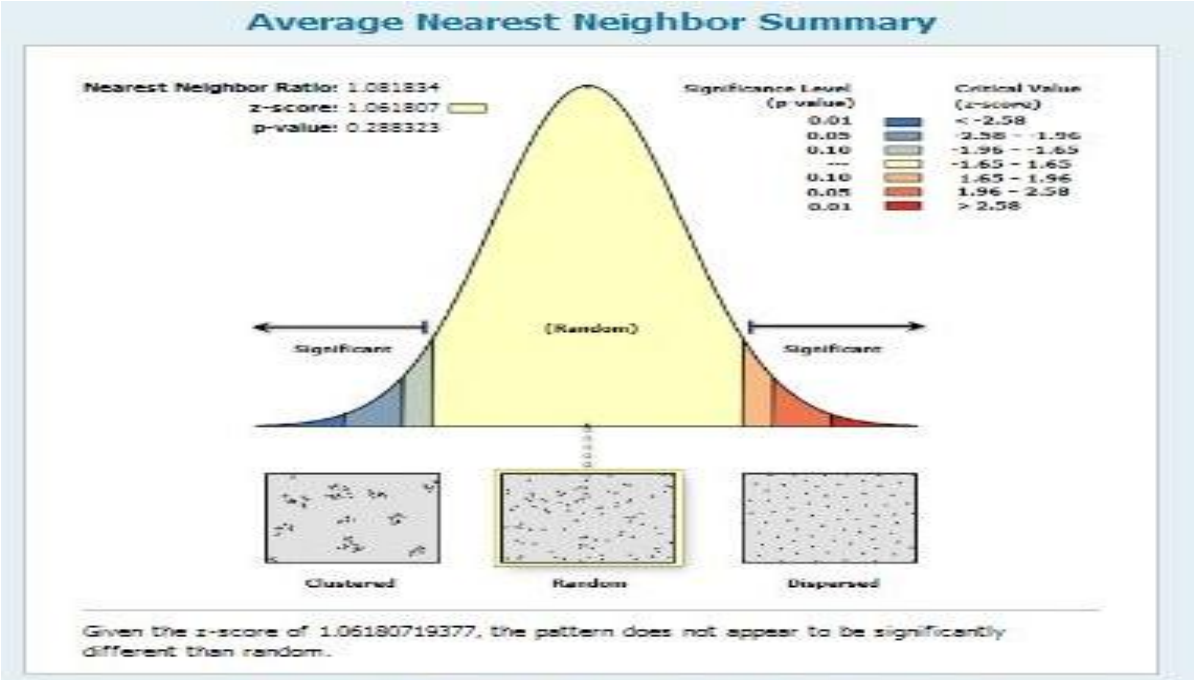

Figure-3: The result of the Nearest Neighbour Analysis for the production points.

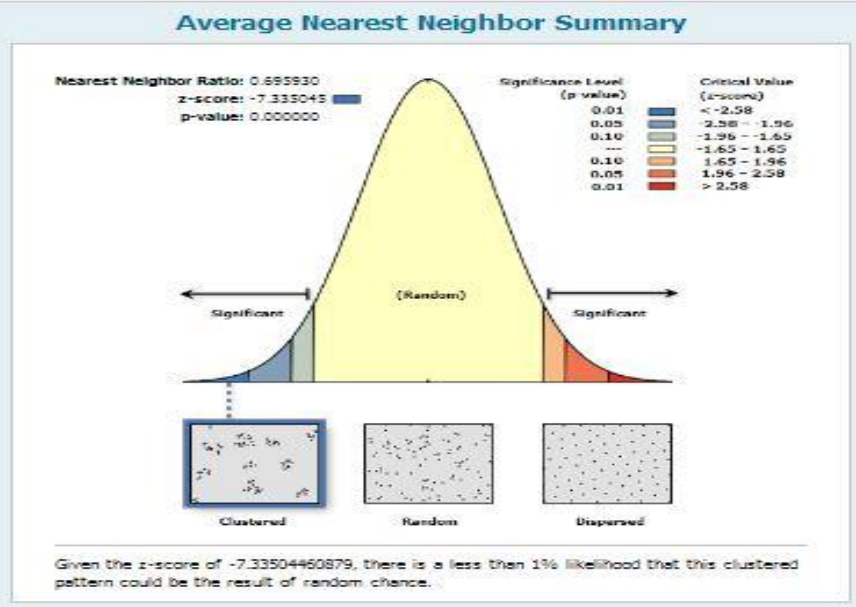

Figure-4: The result of the Nearest Neighbour Analysis for the Consumption points.

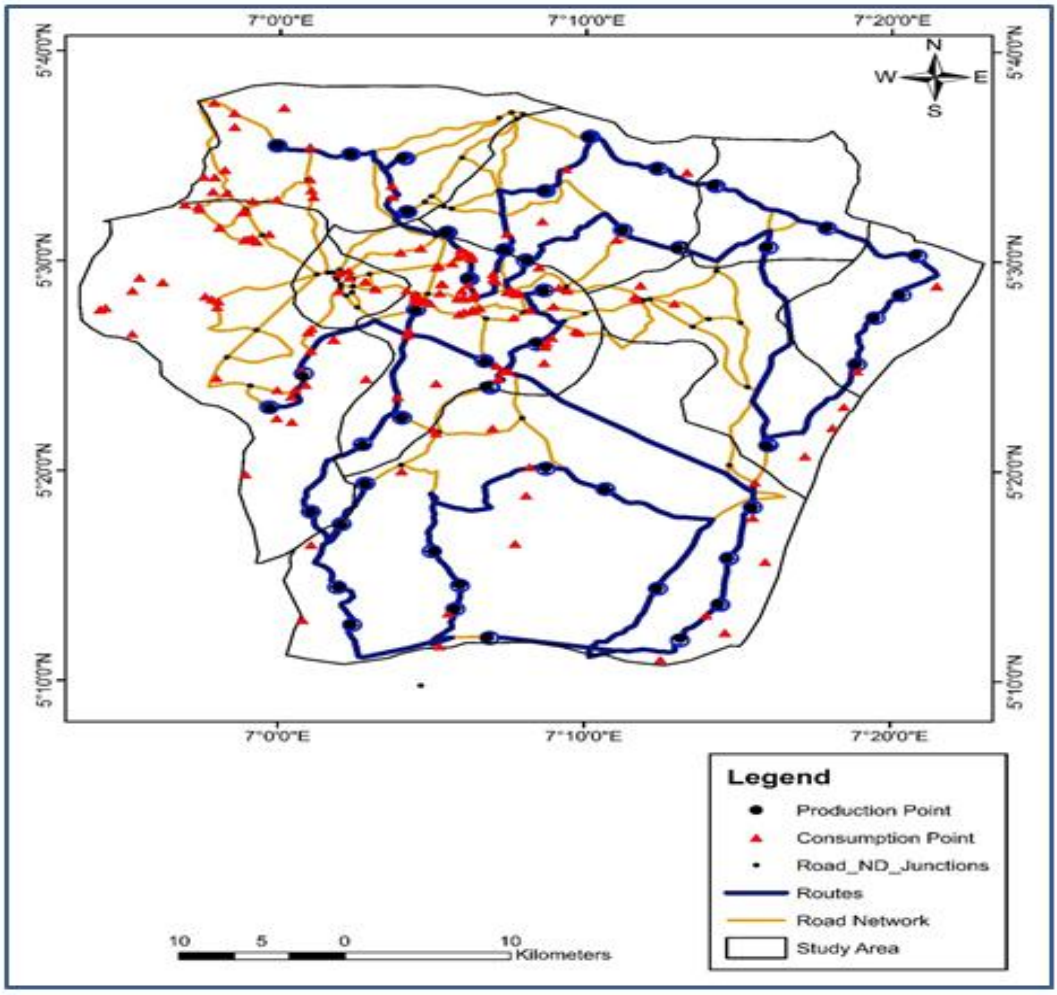

Figure-5: Best route from the production point to the consumption point.

Table-2: The distance from a Production Point to Consumption points along Major and Main Road Networks.

Production Point	Consumption Point	Distance (km)
Orodo Mbaitoli	Umunoha, Ogbaku Orodo	4.7
Orogwe Mbaitoli	Akabo Mbaitoli	5km
Akabo Mbaitoli	Akabo, Ubomiri	7.5
Ngugo	Emule Ngugo	4.6
Uzoagba	Amaawom, Umuoyima, Uzoagba	4.6
Okwu Emeke	Ezeogba Ezedibia, UmuosU Umuawuka	4.6
Owalla Uratta	Owalla, Ihittaogada, Owaelu	7.0
Amaimo Ikeduru	Owalla Amaimo	8.4
Atta Ikeduru	Atta Ikeduru	6
Ugiri	Obohia	5.4
Akpordim	Akpordim	4.1
Obohia	Obohia	7.9
ItuAhiazu Mbaise	Eziudo	6.5
Umuchoko Itu Mbaise	Umuchoko	5.0
UmueluItu Mbaise	UmueluItu	2.6
Ife Ezinite	Ife Ezinite Mbaise, Lorji Mbaise	4.6
Umuogu	Umuogu	10.6
Ekwereazu Mbaise	Inyeogugu Mbaise	19.2
Akabo Ikeduru	Eziala Obama	8.1
Amakohia Ikeduru	Amakohia	3.9
Abor	Ubowala	9.2
Obama Mbaise	Azaraowala, Obama Mbaise, Nkwo Emeke	5.6
	Umuocham, Azaraegbelu	
Eshiala Emi	Eshiala Emii, Umunwari Emi	7.7
Umuofor Egbu	Egburoad, Mbari, Relief Market	7.5
Upe	Umunanu Ndama Ulaku	10.1
Obeke	Obinze, Obeke Ngor	4.1
Ochicha Ngor	Umuekene	7.7
Amafor Ngor	Amafor Ngor	7.0
Emeabiam	Umuekwene	4.2
Umunanau	Umunanu	7.1
Umunanu Ngor	Umuikori	4.7
Orisaeze Ngor	Orisaeze Ngor	13.9
Elelem Ngor	Elelem, Ochicha Ngor	2.6
Elelem Ngor	Elelem Ochicha Ngor	4.2
Ochicha Ngor	Ochicha Ngor	16.3
Ochicha Ngor	Ochicha Ngor	4.3
Umuikoro Ngor	Umuikoro Ngor	30.4
Eleme	Alulu	16.1
EweiAlulu	Obike Ngor	12.7
Umuonyealulu Ngor	Umuonyealulu	4.4
Obokwe Ngor	Obokwe Ngor	4.4
Umuohie Uku Ngor	Umuohieuku	5.3
Umuokunaze	Umunaze	23.6
Obinze	Umerim Obinze	19.2
Ihiagwa	Obinze, Ihiagwa	4.7

Production Hotspot and Coldspot: Getis-Ord G*, a spatial statistics tool was used to analyze the production at the hot spot and cold zone. The result revealed the presence of the production hot spot at the north-east part of the map, precisely in Ezine and Ahiazu Mbaise Local Government while a cold spot was seen very at Owerri North LGA, less than 4km from the state capital. Figure-6 below is a map showing the production hot spot and cold spot zones in the study area.

Consumption Hotspot and Cold Spot: Hotspot analysis shows the consumption points that consumed the highest quantity of Raphia palm wine in the study site. The result of the analysis showed a high concentration of Raphia palm wine consumption at the hot spot around Amakohia Ogbaku and Obinze area all in Owerri West LGA while pockets of cold spots were found in Ochicha Ngor, Obike Ngor, and Awaka. Figure-7 below is a map showing the hot spot and cold spot consumption zones.

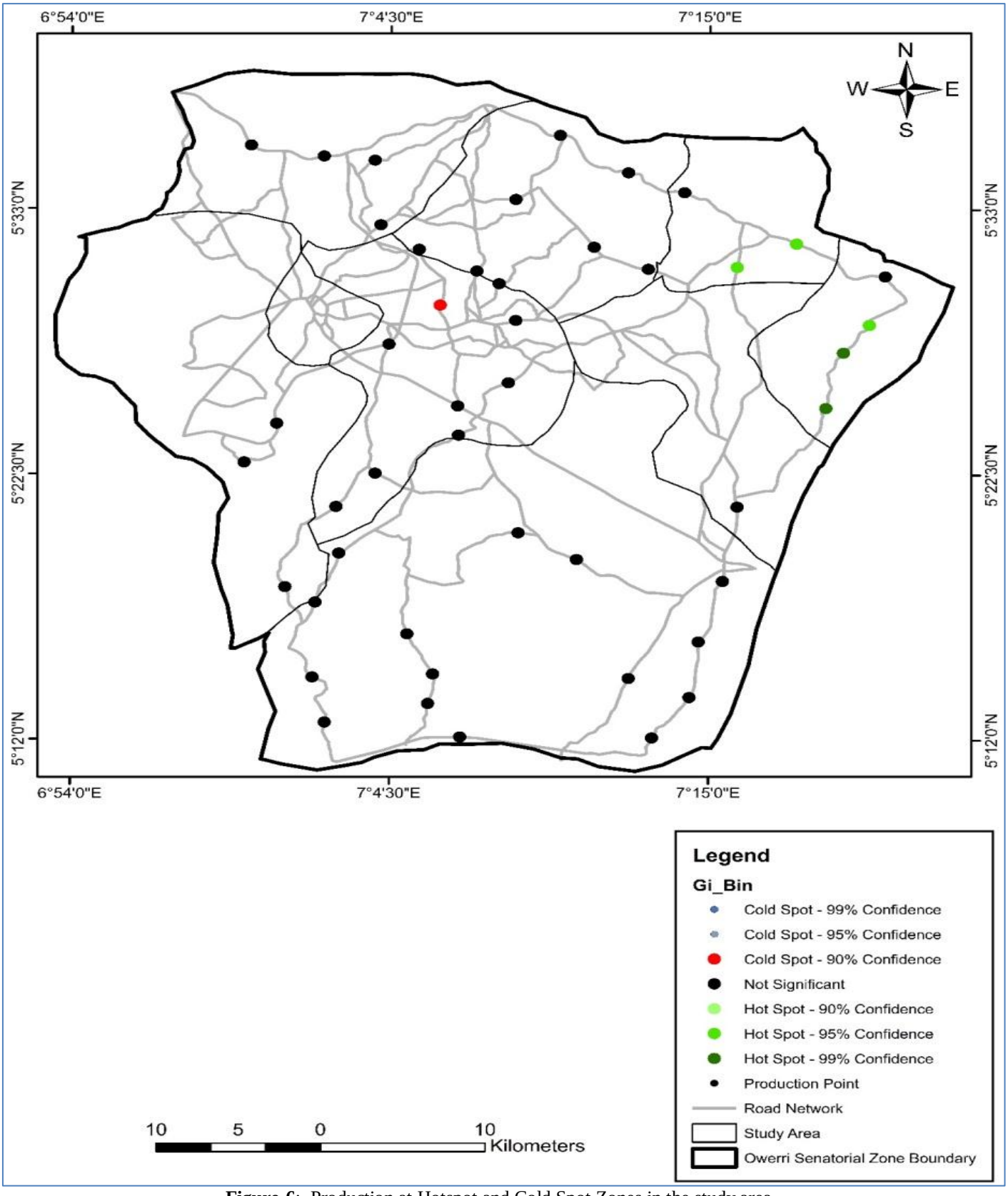

Figure-6: Production at Hotspot and Cold Spot Zones in the study area.

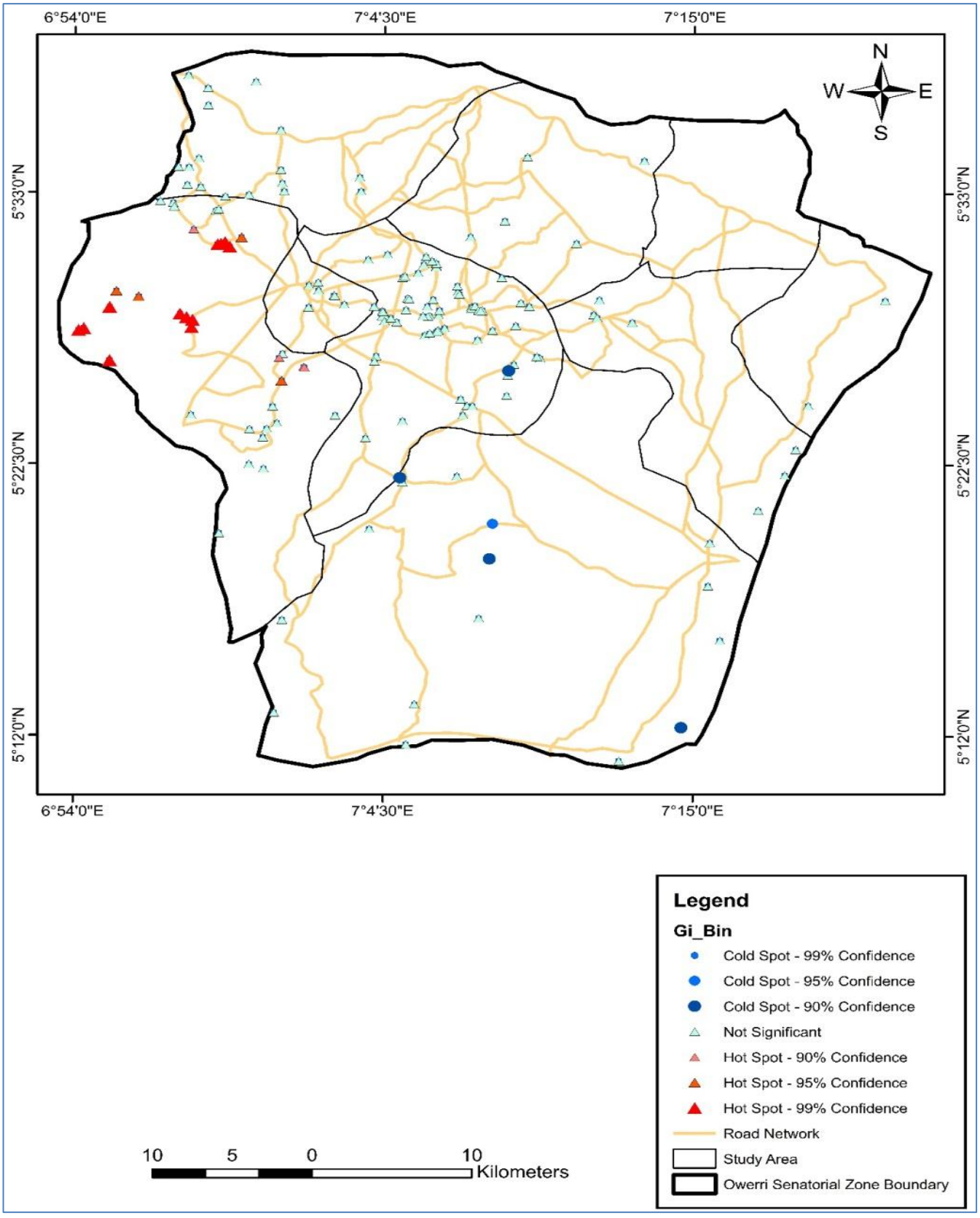

Figure-7: Consumption at Hotspot and Coldspot zones.

Conclusion

Geographic Information Systems (GIS) should be promoted as it is a system with outstanding capabilities that should be harnessed to further analyze the impact of urbanization on Raphia palm trees. The state government should enact laws, and ensure the compliance of this law by engaging the local inhabitancies of the area through the various traditional leaders, to ensure the stop the felling of Raphia palm trees, especially in most local government in the study area witnessing rapid urbanization. The rapid urban growth in most states in Nigeria and especially the study area Owerri zone is in no small way pushing what use to be a common tree to the interior rural areas where massive vegetation destruction is not yet taking place. This makes it difficult for a child growing up in the urban area to have first-hand knowledge of what a Raphia palm tree is like.

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