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Population and Spatial Analysis of Fire Service Provision in Gombe Town

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ABSTRACT

People's lives and properties need to be protected against any accident especially those that are caused by fire, because is one of the most dangerous calamities in human history. People should put in their mind that unwanted fire fighting is every body's business; as such government, stakeholders, private organizations, individuals etc, should key in to see that fire and other related accidents are curtailed to the barest minimum. Hence, this research aimed to study population and spatial analysis of fire service provision in Gombe Town. And this is achieved through identifying the availability of fire stations and their absolute locations in Gombe Town, *to know the rate of fire incidences from Jan, 2019 to April, 2019 among various wards in the metropolis, to know the estimated lost and estimated saved of property in the study area and to assess whether there are modern firefighting equipment in the region or not, to assess the ratio of fire personnel and fire trucks in relation to population in the study area and lastly to test whether there is any significant difference between fire frequencies among various wards and the amount of property lost and property saved between the various wards in Gombe Town. Descriptive statistics, R-Studio, GPS and Google Earth Maps were used to analyze data obtained from the field. Results show that; Gombe* Town *is grossly in short supply of fire stations, personnel, fire trucks, and modern fire equipment. Chi-Squire test using R-Studio shows a significant difference between property losses and saved as well as fire incidences among the various wards in the study area. It is highly recommended that; Governments and Philanthropies should immediately come to aid to rescue this great institution from total collapse by providing any type of help possible.*

Key Words: *Population, Fire Service and Spatial Analysis.*

INTRODUCTION:

People's lives and properties need to be protected against any accident especially those that are caused by a fire accident, because is one of the most dangerous calamities in human history. People should put in their mind that unwanted fire fighting is every body's business; as such government, stakeholders, private organizations, individuals, etc should key in to see that fire and other related accidents are curtailed to the barest minimum.

According to Cambridge Dictionary, 2019, "Fire Service therefore, is an organization that works to prevent unwanted fires and stop them from burning" Fire Service department offers multiple services to people in order to protect their lives, properties and the environment, these services include: fire fighting, fire prevention and public education, search and rescue services, humanitarian services, hazardous materials response, disaster and terrorism response, technical and swift water rescue, industrial fire and life safety, wild and fire prevention, suppression, and mitigation, aircraft rescue and firefighting etc. (Agbili, 2013 and U.S.A White Paper, 2017).

No country in the world is free from fire and other related disasters, According to International Association of Fire and Rescue Services, (2018), in 2016 U.S.A recorded 1, 342,000 fire outbreaks, Russia recorded 139,500 fire outbreaks and Qatar recorded 1,444 fires with several deaths of 3390, 8749 and 1 death respectively with huge lost of properties in the countries, (Brushlinsky, et al. 2018). Nigeria in five years lost an estimated 6 trillion in different fire incidents Izuora, (2017). This leads to a serious threat to the national economy because many materials were damaged, it leads many people to be poor, and it destroys the environment and many other unpleasant situations.

Constantin Schlachetzki of Siemens Acting and Vice Chairman of the German Mirror Committee for TC268 (2014) said: "Standardized life safety indicators such as those in ISO 37120 can help cities around the world benchmark their operations, improve their service levels, enhance fire safety education and perhaps even save more lives,". However, the U.S. average is 167 full-time firefighters per 100,000 populations, according to the National Fire Protection Association (NFPA) (Karayannis, 2014**).** Other studies show that; in the United State fire fighting department, protecting 10,000 people or more had a range of 1.1 to 1.41 firefighters per 1000 population (Evarts and Stein, 2019). According to Fire Engineering, (2019), stated that the International City Managers Association announced that the average American city with over 10,000 people now has 1.52 full-time firefighters. Boston, San Francisco, and Los Angeles had 2.8, 2.5 and 1.4 fulltime firefighters per 1,000 Population respectively. According to Calling, (1991) the standard distance and ratio for, fire trucks and personnel, in relation to population, is stated as follows: 2.4kms from residential, recreational, commercial and institutional zones while 3.2kms distance of fire stations from agricultural and industrial zones, 1.5 firemen per 1000 population in urban town and 1 fire truck per 20,000 populations.

Since the creation of Gombe State in 1996, Gombe has been experiencing an influx of people from different part of the country which increase tremendously the population and housing demand and production in Gombe and this lead to the expansion of the state in all angles especially the capital city which is Gombe Town. However, there is an inverse relationship between the increase in population and housing with fire service provision in the state. Fire service sector in Gombe state in general and in Gombe Town is faced with serious neglect which leads to poor infrastructure and services delivery. Hence, the state constantly experiences fire disaster all around. According to Gombe State Fire Service, from January to December 2018 fire

incidents caused twenty (20) deaths and lots of properties valued over N417.1 million were destroyed in fire disasters in the state, (Haruna, 2019). In 2015 Gombe State Fire Service Department recorded 301 cases of fire outbreak across the state rescued 2,200 people, just as 23 persons lost their lives during the year under review. Properties worth over N340m were lost while some worth over N2.5bn were saved, (Muhammad, 2016). Now the questions are: are there any fire stations in Gombe? Where are they located? What is the estimated property lost and saved within the study period? Are the firefighters enough to meet the present demand of the Gombe population? Are there enough fire trucks and other modern equipment to curtail fire incidents in Gombe Town? These are the questions that needed to be answered in this study.

Different studies were conducted concerning to fire service both nationally and internationally among which are: Algharib (2011), whose research showed that some parts of Kuwait were not covered by fire service stations based on the benchmark of four (4) minutes attendance time. Meaning, to reach those households outside the coverage fire service truck had to travel more than four (4) minutes which is not ideal because it might lead to delay in responding to a fire incidence. Statistical Bulletin (2016) stated that firefighters in England were predominantly male and aged 36 years and above. Adekunle, et al. (2018) conducted research in Lagos which stated that fire death is higher in males than in females and is also higher among old than among the younger age group. Isa, et al. (2016) also made a spatial analysis of fire service stations in Kano metropolis and stated that the old city of Kano is fully served while the other parts of the metropolis were underserved. Other researchers who looked at the spatial pattern of fire service stations in different places include Ayuba, et al. (2016), Corcoran, et al. (2007) as well as Habibi, et al. (2008).

However, none of the above studies were conducted in Gombe Town as such research of this kind is pertinent in Gombe due to the increase in population and housing production which lead to the metropolis expansion. None of the above studies explain in details about the frequency of fire incidences as well as property loss and property saved among various wards in Gombe Town from Jan 2019 to April 2019. None of the above studies adequately investigates the ratio of fire trucks and firefighters concerning the population in the study area. Hence, this research aims to study population and spatial analysis of fire service provision in Gombe Town. And this is achieved through identifying the availability of fire stations and their absolute location in Gombe Town, to know the rate of fire incidences from Jan 2019 to April 2019 among various wards in the Town, digging into the estimated loss and saved of property in the study area and to assess the ratio of fire personnel and fire trucks in relation to population and lastly to test whether there is any significant difference between property lost and property saved among various wards in the study area.

STUDY AREA

Gombe Town is located approximately at the center of Gombe State. It is bounded by Kwami L.G.A in the North and almost surrounded by Akko Local Government Area in the South East and South West, and occupies an area of about 45km^2 (Ministry of Land and Survey, Gombe, 2008). Its geographical coordinates range between latitudes 10° 14' 30" N and 10^0 19' 30"N and longitudes 11° 7' 0" E and 11^0 13' 30" E (Satellite Images of Gombe, 2005). According to National Population and housing census, (2006) priority table, Gombe Town has a population of 266,844 people, with males having 146,721 and females having 120,123 people, (National Bureau of Statistics, 2012). However, if the above population of Gombe is projected to the present time (2019) the population will be estimated to be 410,219 a 3.3% growth rate, this

shows an increase of 143,375 people within 13 years. According to Joseph Greenberg's (undated) in Abba, et al, (2000) stated that "linguistic classification, the most dominant linguistic to be found in this area belong to the Afro – Asiatic and Niger-Congo family of languages. Thus the ethno-linguistic composition of Gombe State includes, amongst others, the Fulbe, the Bolewa, the Tera, the Tangale, Tula, Waja, Wurkum, Jara, Dadiya, Cham, Awak, Pero, Kamo, Kushi, and Bangunji".

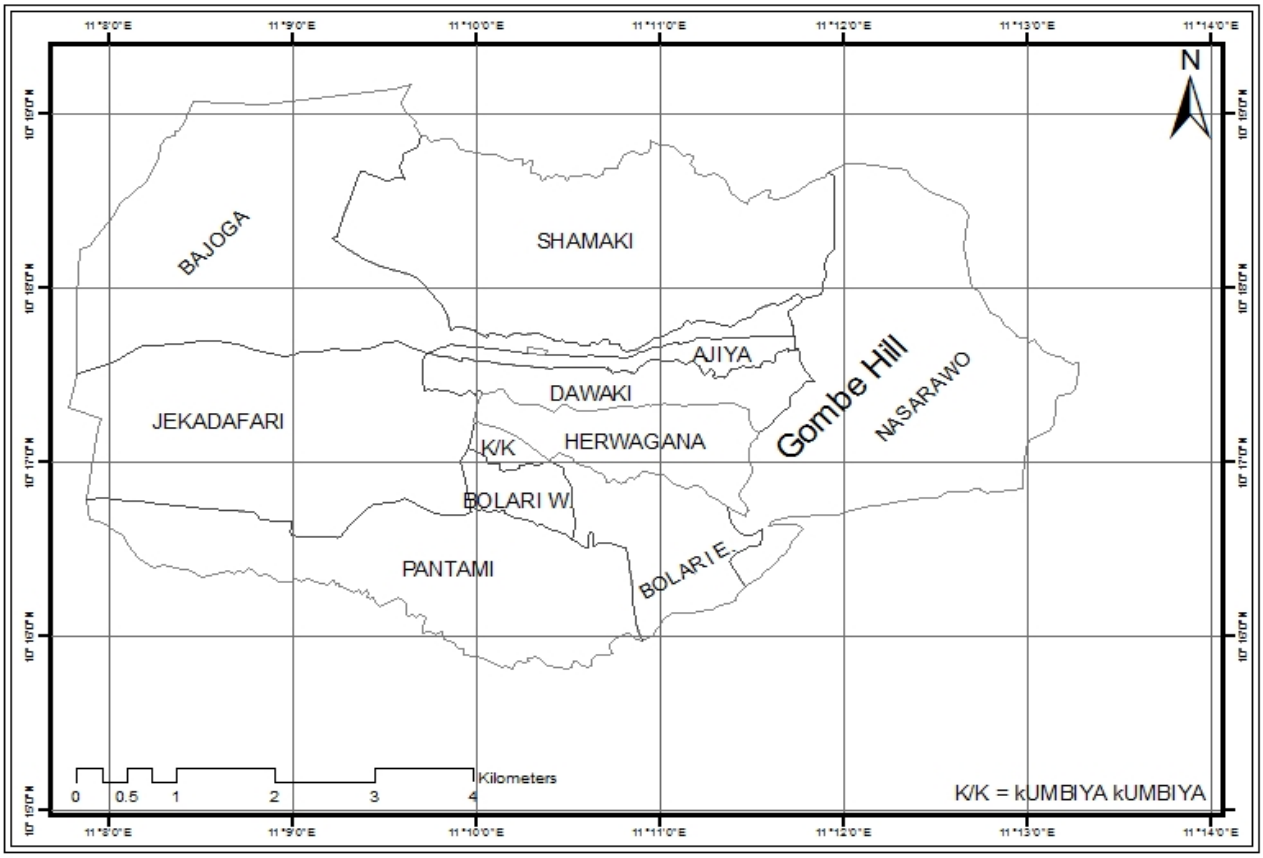

Figure 1 Gombe Local Government Area.
Source: Geographic Information System Laboratory, State University Gombe (2017).

METHODOLOGY

This study involves a survey of all fire service stations in the study area. The information was obtained directly from the heads of fire service stations in Gombe Town through the use of an

interview schedule. Other secondary information was obtained from Gombe State Fire Service Daily Fire Incident and Rescue Report Form, textbooks, journals, published materials and internet sources. Data obtained from the respondents were both qualitative and quantitative. The qualitative data involved information obtained from the Director fire station Gombe L.G.A through interview schedule. While the quantitative information is the number of fire personnel, fire trucks, number of incidences, number of death and injuries and estimated amount of property saved and lost in the study area. Geographical coordinates of each of the fire stations were also obtained through the use of Global Positioning Systems (GPS). This research also involved the use of both descriptive (frequency table, percentages, and ratio) and inferential statistics (Chi-Square Analysis) using R-Studio to analyze data obtained from the field.

RESULTS AND DISCUSSION

Results obtained from the field were analyzed using different statistical and GIS tools. The first objective was achieved by the use of mapping using geo-coordinates, the second and third objectives were achieved through the use of descriptive statistics and the last objective was achieved through the use of chi-square analysis.

Absolute Locations of Fire Service Station in Gombe Town

This section identified the exact locations of fire service stations in Gombe Town. The data were obtained by the use of the Global Positioning System (GPS) and depicted by the use of the map bellow.

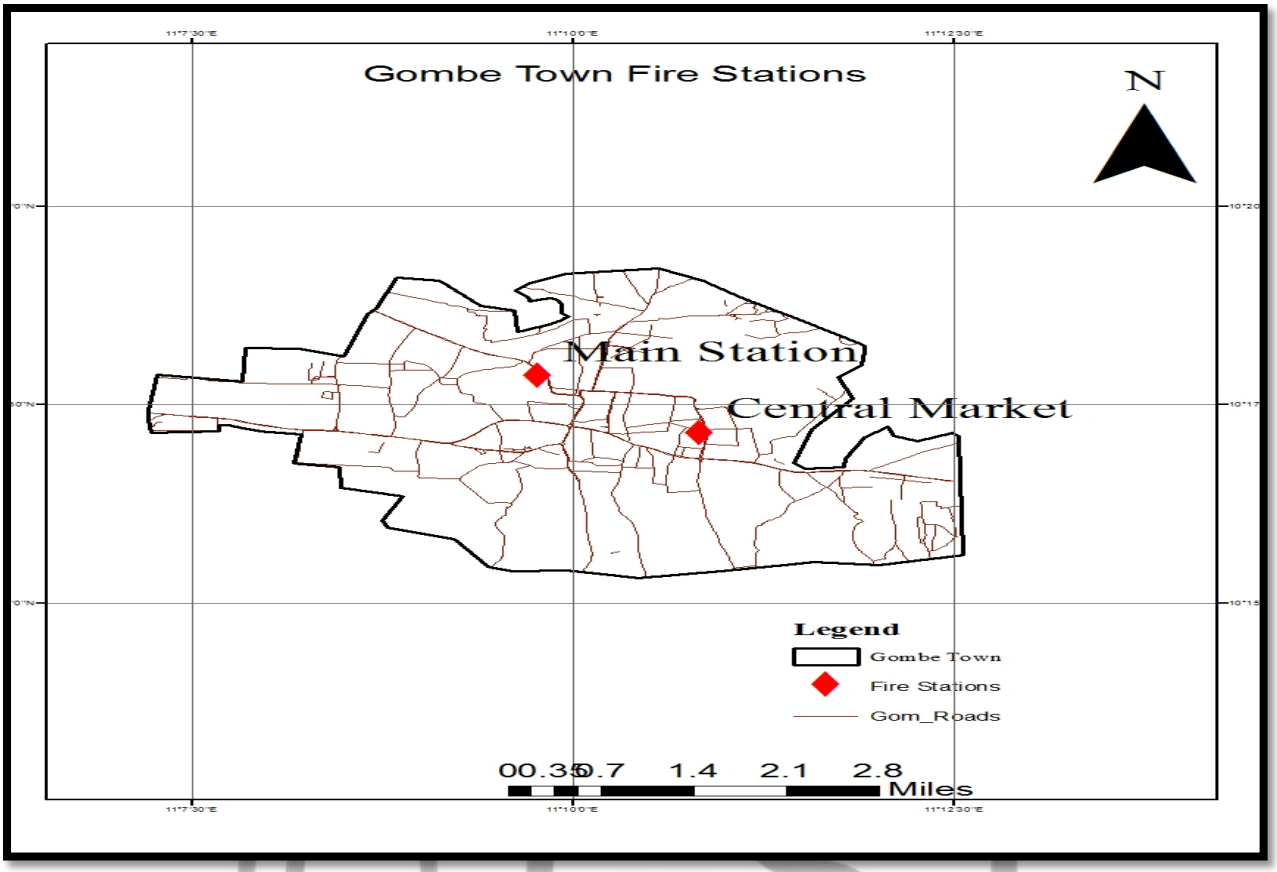

Figure 2 Absolute Locations of Fire Stations in Gombe Town.
Source: Geographic Information System Laboratory, Federal University of Kashere (2019).

Figure 2 shows the absolute location of fire stations in the study area. The Main Station located at latitude 10.2857823^0EW and longitude 11.1805449^0NS while the Central Market Fire Station is located at latitude 10.297751^0 EW and longitude 11.162755^0 NS. The former is situated in the Shamaki ward while the later is situated in the Herwagana ward. These fire stations are the only fire stations servicing the whole of Gombe Town**.**

Rate of Fire Incidences in Gombe Town from Jan – April 2019

Many fire incidences occurred in different parts of Gombe Town from January 2019 to April 2019 which resulted to some deaths, injuries and property loss, but many of them were curtailed by the swift action of firefighters which saved a lot of lives and properties from destruction by

fire disasters. Below is a diagram showing the inventory of fire occurrences, property saved and lost in the study area.

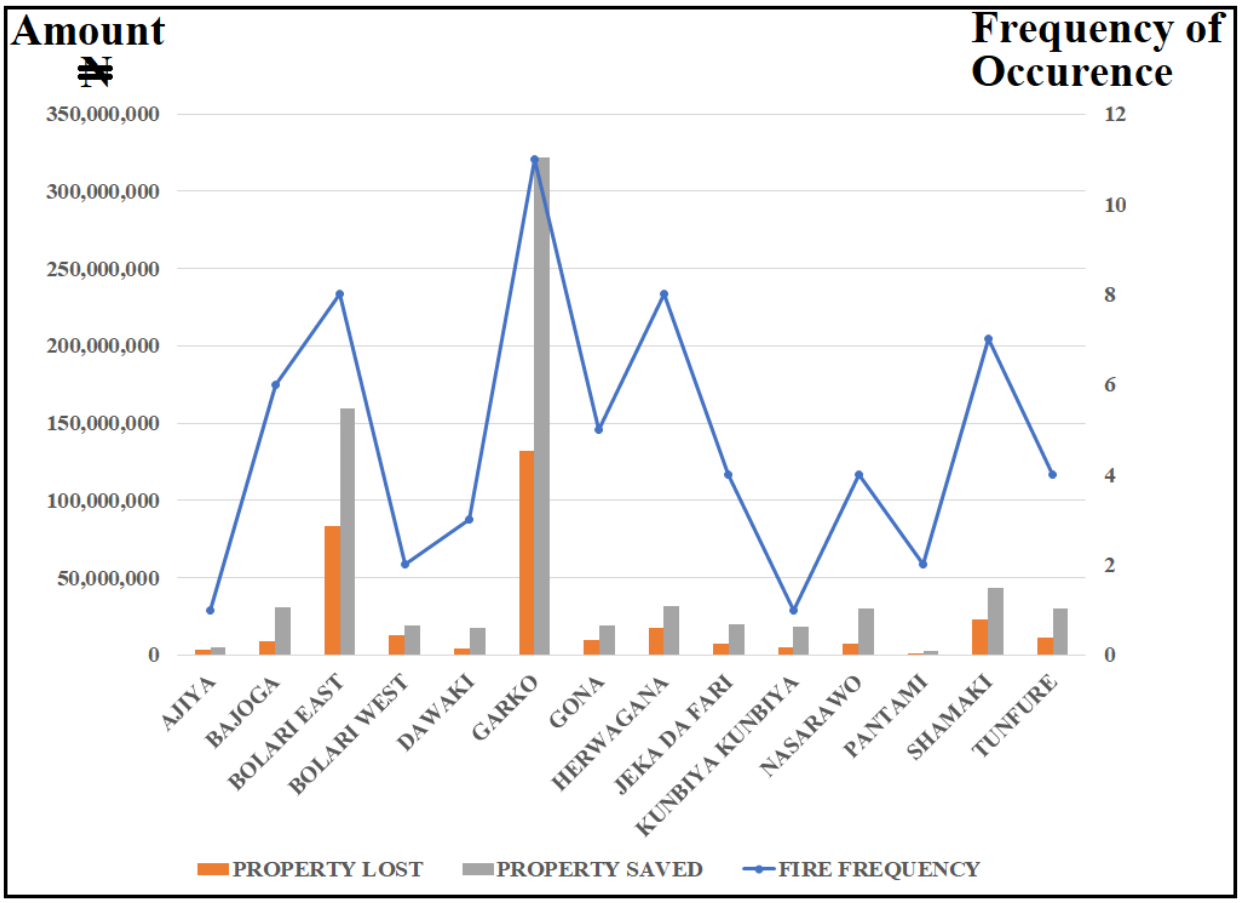

Figure 3 Fire Incidences in Gombe Town from Jan 2019 to April 2019
Source: Field Survey, 2019

Figure 3 above clearly shows that Garko Ward in Akko L.G.A which is located on the outskirt of Gombe L.G.A has the highest number of fire outbreaks, property loss, property saved and the number of death and injuries. The region is a high population density area and most of the heads of household heads are low-income earners. One of the most dangerous areas in that ward is a place called bypass where big Lorries normally courses accidents and results in fire outbreak which leads to injuries, death, and loss of properties. Other places with high occurrences of fire

incidences are Herwagana, Bolari East, Shamaki, and Bajoga. However, the wards with fewer incidences are Ajiya and Pantami Wards which are all located in Gombe L.G.A.

Further results according to the information collected from Gombe State Fire Service Daily Fire Incident and Rescue Report Form, (2019) it shows twelve (12) deaths which all occurred in Garko ward and fifteen (15) injuries of which 14 were from Garko ward while one (1) from Gona ward. Furthermore, most of the fire incidences in Gombe Town were caused by an electrical fault which could be a result of a wrong connection, overloading of an electric circuit and high voltage problems.

TEST OF SIGNIFICANCE

Table 1 Chi-Square results

	Fire Frequency		Property Lost		Property Saved	
	X Square	P-value	*X* Square	P-value	*X* Square	P-value
Fire Frequency			29.40	0.01***	20.50	0.08*
Property Lost					46.92	0.00***
Property Saved						

*** Significant at less than 99% confidence level

** Significant at 95% confidence level

* Significant at 90% confidence level

The p-values of 0.01 and 0.08 indicate a statistical significance difference of fire frequency among the thirteen wards in the study area, meaning some wards experience more fire outbreaks than others. Further results show a statistical significant difference on the property lost and property saved at the p-value of 0.00 in the regions. This inferred that the level of property saved and lost among various wards differ i.e. some experience high property save and lost while others experience low property saved and lost.

Inventory of Fire Trucks, Personnel and Modern Fire Equipment In Relation To Population in Gombe Town

Firetrucks, personnel, and modern equipment are major things to consider in effective and efficient fire fighting in a place. Below is an inventory of personnel, equipment and modern fire fighting in Gombe Town.

Table 2 Inventory of Fire Personnel, Fire Trucks and Modern Fire Equipment in Gombe Town

Observations	**Frequency**	**Projected Population of Gombe Town 2019**	**Ratio**
Fire Personnel	85	410,219	0.21
Functional Fire Trucks	1	410,219	0.05
Fire Stations	2	410,219	0.24
Modern Equipment	0	410,219	0

Field Survey, 2019

Table 2 above shows gross shortage of fire personnel (0.21, per 1000 population), fire trucks (0.05, per 20,000 populations), fire stations (0.24, per 50,000 populations) and modern fire equipments (0) in relation to the population of the study area. This conforms to the findings from the study carried out in Kano by Liman, et al. (2016) and Ayuba, et al (2016) which shows scarce provision of fire stations in some parts of the regions. This is contrary to the developed world where for every 1000 residents there are 3.67 fulltime firefighters in Washington; while in Boston there are 2.22 firefighters per 1000 population. It is also not to urban planning standard of one (1) fire station for every 50,000 population (Habibi, et al. 2008) as well as one (1) fire truck for every 20,000 population and 1.5 firemen for every 1000 population (Calling, 1991). The above results are really dangerous for the environment, people and their properties in the study area because no single person is safe in that region because fire incidence can occur at any time and any place.

CONCLUSION

Fire service is an important institution in any region or community of people because of its tremendous role in protecting lives and properties, but the institution is faced with serious neglect by the government and well-meaning philanthropies in Nigeria at large and in Gombe State in particular. Hence, fire service in Gombe Town is grossly in short supply of most of their requirements. Thus, the number of firefighters and trucks is inadequate, with virtually no modern facilities or equipment to curtail the menace of fire disasters in the region which could result to death, injuries and loss of properties. The population of Gombe State especially Gombe Town keeps increasing day in day out which results in to increase in the construction of more modern houses, industries, fuel filling stations, markets, etc but with insufficient fire fighting facilities.

RECOMMENDATIONS

Because of the above acute problems of fire service provision in Gombe Town, this study proffers the following solutions:

i- People should put into their minds that, unwanted fire fighting is every body's business; as such government, stakeholders, private organizations and individuals should key in to see that fire and other related accidents are curtailed to the barest minimum.

ii- The Government should seriously assist to this great institution because of its importance. Thus, more fire stations at least six (6), more personnel at least five hundred and thirty (530), more functional fire trucks at least twenty (20) and modern fire equipment should be supplied to the study area to meet the required standard.

iii- Philanthropists should also help the Government to provide anything that will enhance the efficiency of firefighters which could be a provision of fire trucks, water tankers, boreholes, equipment, etc.

iv- More awareness on how to prevent fire incidences and to aid the fire institution is needed among different population in the study area which could be through social media (facebook, whatsapp, twitter, instagram etc), television, radios, as well as organizing conferences in schools to educate and enlighten the communities on how to prevent and to assist the institution to reduce fire disaster in Gombe metropolis.

v- Population and development geographers are key to resource allocation as such there is a need to integrate them in any resource allocation in a community.

vi- It is also recommended that fire service authorities should be trained on how to use Global Positioning Systems (GPS) to pick absolute locations of fire incidences and depicts in maps.

REFERENCES

Abba, A.S., Shehu, A. and Abba, A. (2000). Gombe State: A History of the Land and the People. Ahmadu Bello University Press Limited.

Adekunle, A., Umanah, I.I., Ibe, K.E and Rukewe, I.M. (2018). Statistical Analysis of Fire Outbreaks in Homes and Public Buildings inNigeria: A Case Study of Lagos State. *International Journal of Engineering Research and Advanced Technology 4 (8).*

Agbili, M.O. (2013) *Fire Service in Nigeria*. https://my.firefighternation.com/profiles/blogs/fire-service-in-nigeria

Algharib, S.M. (2011). Distance and Coverage: An Assessment of Location-Allocation Models For Fire Stations in Kuwait City, Kuwait. Ph.D. Dissertation , Kent State University.

Ayuba, H.K., Aguacha, o. and Medugu, N.I (2016). Fire Vulnerability Assessment of the Federal Capital City, Abuja, Nigeria. *International Journal of Innovative Science, Engineering and Technology*, 3 (5).

Brushlinsky, N.N., Ahrens, M., Sokolov, S.V and Wagner, P. (2018). World Fire Statistics. International Association of Fire and Rescue Services, Centre of Fire Statistics. http://www.ctif.org/world-fire-statistics

Cambridge University Press, (2019) Fire Department https://dictionary.cambridge.org/dictionary/english/fire-department

Calling, G.C. (1991). *How to Plan Development of Municipalities and Barangays*. Published by Rex Book Store.

Corcoran, Higgs, Brunsdon & Ware (2007). The Use of Comaps to Explore the Spatial and Temporal Dynamics of Fire Incidents: A Case Study in South Wales, United Kingdom. *Journal of Professional Geographer* 59 (4).

Evarts, B. and Stein, G. (2019). U.S Fire Department Profile 2017. https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Emergency-responders/osfdprofile.pdf

Habibi, K., Lotfi, S. and Koohsari M.J. (2008). Spatial Analysis of Urban Fire Station Locations by Integrating AHP Model and IO Logic Using GIS : A Case Study of Zone 6 of Tehran. *Journal of Applied Sciences, 8 (19).*

Haruna, W. (2019) Gombe Fire Claims 20 Lives, Destroys Property worth N417.1m https://leadership.ng/2019/01/11/gombe-fire-claims-20-lives-destroys-property-worth-n417-1m/

Geographic Information System Laboratory, Federal University of Kashere (2019).

Gombe State Fire Service Daily Fire Incident and Rescue Report Form, (2019).

Fire Engineering, (2019). 1.52 Firemen Per 1,000 Population. https://www.fireengineering.com/1948/05/01/216137/1-52-firemen-per-1-000-population/#gref

Isa, U.F., Liman, M.A., Mohammed, M.U., Mathew, O.S. and Yaro, Y.R. (2016). Spatial Analysis of Fire Service Station in Kano Metropolis, Nigeria (2016*). Journal of Humanities and Social Science.*

Izuora, C. (2017). Fire Outbreaks Cost Nigeria 6trn in 5 Years https://leadership.ng/2017/09/10/fire-outbreak-costs-nigeria-n6trn-5-years/

Karayannis, G. (2014). Dissecting ISO 37120: Fire and emergency response indicators -- how safe is your city? https://smartcitiescouncil.com/article/dissecting-iso-37120-fire-and-emergency-response-indicators-how-safe-your-city

Muhammad, A. (2016). Nigeria: Gombe Fire Service Records 301 Cases in 2015 https://allafrica.com/stories/201601290124.html

National Population Commission (2006). *Population and Housing Census of the Federal Republic Of Nigeria.* Priority Table Volume 1.

Schilling, D.; Revelle, C.; Cohon, J.; & Elzinga, J. (1980). Some models for fire protection locational decisions. *European journal of operation Research* 5: 1-7.

U.S.A White Paper, (2017). Understanding the Roles, Challenges and needs of our Nation's Fire and Emergency Services. USA Sprinkler Fitters Association.