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ASSESSMENT OF URBAN WATER TRENDS, SECURITY AND POPULATION GROWTH IN YOLA TOWN, ADAMAWA STATE, NIGERIA

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Abstract

The objectives of the study include examining the trends of population growth and the socioeconomic factors that influence water demand in selected communities of Yola town, analyzing the pattern of water demand, supply and consumption in selected communities in Yola town and forecasting of future water demand based on pattern of population growth within the selected communities in Yola town. A multi stage sampling techniques was used in first selecting the communities, and 395 respondents were randomly selected for questionnaire administration, the random selection was to elicit objective responses that will be a good representation of the whole population. Data on network coverage and capacity of the water storage and distribution infrastructure was obtained from the Adamawa State Water Board. Data on Population and was obtained from National Population Commission. Results from the study shows an unprecedented population growth projected to grow about 300% in 2055, with a commensurate raise in water demand of up to eight (8) folds- from 1,882,600 L/D to 14,268,180 L/D in 2055. The pattern of water consumption also indicate that none of the communities have a per capita water of 60L/C/D as recommended by WHO,2006 and UNESCO,2012. Based on the results, some recommendations, which include Adamawa State Water Board, should develop a long-term strategic plan for the expansion of water storage and supply infrastructure to reflect future population growth projections, Government should formalize and regulate water vending to ensure stability in pricing and safeguard water quality and safety were made.

Key Words: Assessment, Consumption, Demand, Population, Supply, Urban and Water,

1. Introduction

Urban expansion and local climate variability are some of the most common threat to sustainable urban water security in most Nigerian cities. The growth in the urban population and the pervasive fluctuations in climate often termed as climate change has resulted to increasing challenge in sustaining urban water supply in Nigeria. Records have it that up to 63 million Nigerians lacked access to potable water supply (Obinna, 2014). With the high rate of population growth and near absence of expansion and improvement of the existing water supply, water scarcity becomes a prominent challenge of urban management. The impact of urbanization is increasingly being felt all over the world; urbanization as a process, affects urban structure, urban infrastructure and efficiency of urban services including water supply (Mela, 2018). Urban water

security defined as the capacity of a population to safeguard sustainable access to adequate quantities and acceptable quality water for sustainable livelihood, human well-being, and socio economic development, for ensuring protection against water borne pollution and water related diseases, and for preserving ecosystem in a climate of peace and political stability (Jensen and Wu, 2018). In the context of this study, urban water security is evaluated using the following indicators-water resource availability, water storage capacity, diversity of water source and water supply capacity. Urban expansion and population growth without commensurate improvement in water supply facilities create a supply gap, thus making water supply to the rapidly growing population a major challenge to governments across the world (Mohammed and Sahabo,2015). The threat to water security is also partly due to inefficient water management and governance, hence the inclusion of issues relating to cost and cost recovery strategies in the management of urban water supply in the study area. The main thrust of this study is the assessment of urban water trends, security population growth as a threat to sustainable urban water supply and management. The specific objectives of this study include examining the trends of water supply, water security and population growth.

2. The Study Area and Methodology

2.1 Study Area

Yola town is one of the townships that constituted the Yola metropolis. It is located between Latitude 9^0 $24^{'}$ – 9^0 $30^{'}$ N and Latitude 12^0 $6^{'}$ – 12^0 $36^{'}$ E. The basement complex, with discontinuous patches of sedimentary rocks, underlines the area. It is drained by river Chouchi and Mayel Lumo, which empties its water into the River Benue (Bashir, 2001). Yola has a tropical climate with distinct rainy and dry seasons that runs nearly 6 months respectively; rainy season particularly last from late April to early October with an average annual rainfall of 800mm- 1000mm (Tukur,et al,2016). Yola is an urban area with a cocktail of urban land uses that exert much stress on the existing water resources and water supply and distribution infrastructures. The major sources of water supply is river Benue, this is complemented by public and private boreholes and wells.

2.2 Methodology

Pretested structured questionnaire were administered to 395 randomly selected respondents across the communities, the random selection was to elicit objective responses that will be a good representation of the whole population. The number of respondents selected from each community is a reflection of the population of the community. The selection process in this study is a multi-stage one, first a random sampling of communities was done where nine (9) communities were selected from about 26 traditional communities (locally called *Fattule*) that constituted Yola town. Each of the communities stands an equal chance to be selected, because they all have almost common characteristics and similar socioeconomic composition. Yola town is mainly an unplanned traditional setting in contrast to its twin city, Jimeta Township.

The respondents selected for this study, are persons of 18 years and above (due to their being economically active within the family though not being heads of house hold) or household head within the selected communities. Data on population was obtained from the National Population Commission, 1991 Census data was used as the basis upon which projection were made, this is due to the fact that the most recent 2006 census data was not disaggregated to community level . Based on the analysis of the trend in population growth the future water demand was estimated. The data from questionnaire were analyzed into frequency distribution and percentages and presented on tables for ease of comprehension and cross-examination.

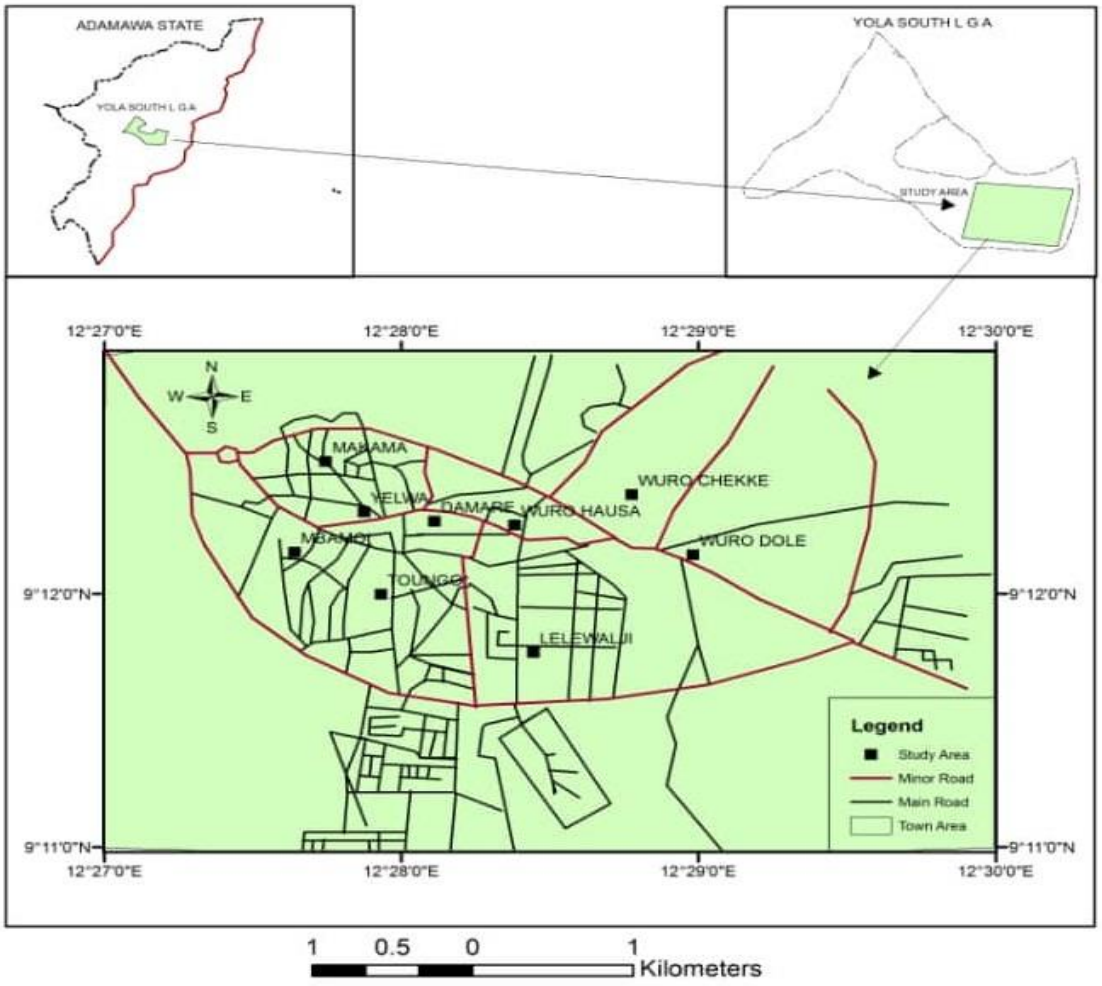

Figure 1: Yola Town Showing the Selected Communities

3. Results and Discussion

3.1 Analysis of Urban Water Trend and Security in Yola Town

At present, the water supply situation in Yola town is characterized with acute shortage of water supply especially during the dry season. The situation is worsening as a result the limited capacity of water storage facilities as presented on Table 1b.

Table 1: Analysis of Water Demand, Supply and Consumption in Yola town

Community	Average Consumption (L/P/D)	Estimated supply Based on Per Capita Consumption (L)	*Existing Water Demand (L)	Supply Gap (L)	Percentage of Demand met by the Supply
Makama	43	526,535	734,700	208,165	72
Wuro Hausa	44	649,176	885,240	236,064	73
Wuro Dole	38	302,442	447,540	175,098	68
Mbamoi	42.3	193,014.9	273,780	80,765.1	70
Lelewalji	34.8	116,754	201,300	84,546	58
Damare	43.2	227,750.4	316,320	88,569.4	75
WuroChekke	41.6	209,955.2	302,820	92,864.8	69
Toungo	37.8	55,603.8	88,260	32,656.2	63
Yelwa	40.2	550,539	821,700	271,161	67

Source: Fieldwork, 2019

*Based on the population of the community and a Minimum Consumption of 60L/C/D as recommended by UNESCO and WHO.

As shown on Table 1 none of the communities has a supply that meets the prevailing demand, on the average the current supply across the communities is such that only 58-73% of the demand was met, with Lelewalji having only 58% of its demand met due the fact that it is located at the outskirt of the town where supply lines were not extended to and the pressure on the existing supply is much increasing as development has tilted so much towards that direction. The critically poor state of water supply could be well appreciated if the data on Table 2 is appreciated.

Table 2: Indicators of Urban Water Security in Yola

Sub-indicators	Description	Status as of 2017/2018	Metrics Unit
Water resource availability	Renewable surface water renewable groundwater per year per capita	*River Benue* Aug/Sep flow (max) 4.40m^3/s Mar/Apr flow (min) 1.01m^3/s Capacity Per/day (380,160 m^3). (87,264 m^3) Per/month (11.41 x 10^6) m^3 (2.62 x 10^6) m^3 Per/year (136.86 x 10^6) m^3 (31.42 x 10^6) m^3	m3/yr/cap
Water storage capacity	Total volume of water stored in water reservoirs (m3) expressed as a multiple of average daily demand	Yola WTP (V) = 2000 m^3 *Yola town Distribution station* EWT (V) = 1250 m^3 GLWT (V) = 1000 m^3 (not functional)	No. days
Diversity of water sources	Contribution of alternative sources (all sources excluding the largest source) by volume to total available water resources	Yola WSS Sanda ward (EWT = 60 m^3) 5.5hp pump 6hrs daily Jippu Jam (GWT = 100 m^3) 5.5hp pump 8hrs daily	%
Capacity Water supply capacity	Total water treatment capacity×(1−NRW) per day/average demand per day	Yola WTP Output capacity 350 m^3/hr Operating circle of 8hrs = 2,800 m^3/day Approx. 30% NRW Available (V) = 1,960 m^3/day	
Water supply coverage	Percentage of households with access to tap water supply	Yola, Jimeta, Mubi and Numan A total 17,000 House connections Registered out of which 3,500 approx house regularly pay monthly bills	
Quality Raw water quality	Proportion of samples at intake point meeting locally applicable quality	• *Nigerian Standard* • About 23 parameters are checked • UV – Spectrophotometric analysis • Colorimetric titration method • Remark - as satisfactory or not • Recommendation – as safe drinking water, good for human consumption and domestic use or not • Certified by Name • Date and sign.	95 % Acceptable

Source: Information Unit ASWB, Yola, 2019

As revealed from the data in Table 2 above, the total connectivity of water coverage of the entire state's four (4) zones namely, Yola, Jimeta, Mubi and Numan is 17,000 households. Out of these total households, Yola town have only 4,400 households connected out of the 23,543 households representing only 19%. This scenario is worrisome, as most of the households in Yola town depend on shallow wells and hand pump boreholes for their drinking water and for domestic purposes despite its position as seat of the government. Studies have shown that shallow wells are often less 10 meters depth and are potentially prone to contamination especially; when latrines are located 30 meters away from the wells. This Result is in agreement with a similar study by Bashir,(2002) and Bashir and Olalekan (2012) who reported that high level of contamination of household water supply within Jimeta-Yola townships was as a result of Proliferation of shallow wells and their proximity to dumpsites and septic tanks. The gap in water supply in most communities is filled by the supply from informal water vendors, whose original sources of water supply are unprotected boreholes and shallow hand dug wells, thus the data reveled that about 65% of the respondents across all the communities obtain their supply through water vendors, 24%of the respondents across all the communities their supply directly from boreholes while 11% rely on hand dug wells for their household water supply. The implication of this is majority of inhabitants of these communities rely on water sources that are not protected, their quality not guaranteed and the supply grossly insufficient as such they become increasingly exposed to waterborne and water related diseases.

3.2 Population Dynamics and the Socio Economic Profile of respondents

Population dynamics especially population growth is one of the major factors that determine urban water demand. Yola metropolis as a major urban centre has an ever-growing population with a commensurate high demand for potable water supply. The pattern of population growth within the selected communities that made up of the study area (Yola area) is shown on Table 3 below.

Table 3: The Pattern of Population Growth in the Selected Communities

S/No	**Communities**	**Gross Area in hectares**	**1991 Population**	**2019 Projected Population**	**2022 Projected Population**	**2055 Projected Population**
1	Makama	88.9	5,588	12,245	13,398	42,803
2	Wuro Hausa	68.7	6,732	14,754	16,143	52,315
3	Wuro Dole	53.5	3,633	7,959	8,709	28,536
4	Mbamoi	44.4	2,082	4,563	4,993	16,646
5	Lelewalji	45.0	1,530	3,355	3,671	11,890
6	Damare	38.2	2,407	5,272	5,768	19,024
7	Wuro Chekke	40.4	2,303	5,047	5,522	16,652
8	Toungo	65.7	671	1,471	1,610	4,756
9	Yelwa	52.2	6,264	13,695	14,985	45,181
	TOTAL	**497**	**31,210**	**68,361**	**74,799**	**237,803**

Source: National Population Commission, 2006

From the analysis of population growth pattern on Table 3, the result clearly revealed that the population of the study area is increasing at an alarming rate. The result of the projected population of the communities that made up Yola town shows the population is expected to increase by over 300% in 2055. This will exert much impact on the critical urban infrastructure including water storage capacity, distribution and supply infrastructure. Analysis of the socio economic profile of the respondents presented on Table 4, provides the basis of understanding the water demand and consumption pattern within Yola Town, it will also assist in understanding the perception of the inhabitants regarding to quality and cost recovery efforts to enhance the supply system.

Table 4: Socio Economic Profile of the Respondent

Community/ Socio Eco Variables	MKM n = 71	W/HSA n = 86	W/dl n=47	Mbm n= 28	Llwj n=20	Dmr n=32	W/Ck n= 28	TNG n=08	YLW n =75	% of Total N= 395
Age (years)										
15-25	06	12	07	06	04	06	04	02	09	14
26-35	11	18	11	06	05	06	02	01	12	18
36-45	42	47	22	07	06	07	04	03	42	46
46-55	09	06	05	04	03	11	15	02	09	16
55 and above	03	03	02	05	02	02	03	00	03	06
Educational Attainment										
Non-Formal Educ.	38	35	26	11	08	17	18	04	50	52
Primary Educ.	18	29	15	10	06	09	06	02	22	30
Secondary Educ	13	18	04	03	04	03	01	01	02	12
Tertiary Educ.	02	04	02	04	02	03	03	01	01	06
Estimated Monthly Income (~~N~~)										
	45	55	26		12	18	21	04	54	63
Less than 30,000	13	20	13	13	05	12	03	02	16	24
30,000-45,000	11	08	06	11	02	01	02	01	03	09
46,000-60,000	02	03	02	02	01	01	02	01	02	04
Above 60,000				02						
House Hold Size (Persons)										
	06	15	14		06	11	07	01	32	25
Less than 3	07	12	18	06	02	09	06	02	16	21
3-5	50	41	11	11	08	10	12	04	23	42
6-10	08	18	04	09	04	02	03	01	04	12
Above 10				02						

Source: Field Work, 2020

Key= **MKM (Makama), W/HSA(Wuro Hausa), W/DL(Wuro Dole), MBM (Mbamoi), LLWJ(Lelewalji), DMR(Damare), W/CK(Wuro Chekke), TNG (Toungo), YLW (Yelwa)**

Table 4 shows that out of the 395 respondents, 11% are within the 15-25years age range, 36-45years age range has the majority with 36% Majority of the respondents, 51% had no formal education with only 7% having tertiary (higher education), 62%of the respondents (66%) have a house hold size of 6-10 person. The combined effects of the socio-economic characteristics of the respondents has the potential of shaping their perception of the water quality and quantity they are currently using, Thus the low level of educational attainment, Low income and high household sizes have limited their access to alternative water resources and have also limited their ability to adequately pay for much cleaner water even if the agency responsible is able and willing to provide the services. Soares et al,(2002) reported a similar situation in their study of Inequities in access to and use of drinking water services in Latin America and

the Caribbean, they reported that access to drinking water as well as total and per capita household expenditures on drinking water show an association with household income, economic conditions of the household, household size and location.

3.3 Forecasting of Future Water Demand

The population of the selected communities was projected based on the 1991 census due to the fact that, the 2006 census figures are not disaggregated to the wards level. On Table 5, the water demand projection for communities in Yola Town from 1991 to 2055 is presented. The population of these communities in 1991 was 31,210 while the projected population in 2055 will be 237,803. Water demand in estimated to increase from 1,882,600L/Day to 14,268,180L/Day as shown on Table 5 below. This is in agreement with findings of Abdullah, et al (2019) Who reported a similar trend for Maiduguri where the water demand is estimated to increase from 31,973M^3/Day in 2006 to 154,443 M^3/Day in 2056.

Table 5: Projected Water Demand for Selected Communities in Yola (1991-2055)

Years	Projected Population	Projected Water Demand (L/D)
1991	31,210	1,882,600
2009	68,361	4,101,660
2022	74,799	4,487,940
2055	237,803	14,286,180

Source: Fieldwork, 2019.

The situation earlier presented on Table 1 and the escalating water demand forecasted on Table 5 is an alarming situation, especially when the importance of water to human lives is considered. Already the communities in Yola town are faced with the challenges of potable water supply, in order to avert the worsening of the precarious situation it will be pertinent for Adamawa State Water Board to develop a strategic long term plan that will address local peculiarities of each of the communities as far as adequate and sustainable water supply is concerned.

4. Conclusion

The ever-growing population, un expanding and poorly maintained storage and distribution infrastructure are indeed a serious threat to urban water security and sustainable water supply in Yola metropolis. Whereas the WHO, 2006; UNESCO, 2012 recommended 60L /P /D as the daily minimum for water consumption in developing countries, the situation in Yola Metropolis is such that the average consumption is 40.5 L/P/D with a supply gap ranging between 27-42% across the communities, the supply is grossly sufficient. Closely related to the supply situation is the proliferation of obsolete and limited water storage and distribution infrastructure that results to massive leakage of supply amongst the connected households and persistent shortage of supply to communities that are not connected to the supply network, this has

resulted to an equally wide supply gap which is filled by informal water vendors.

5. Recommendation

To achieve a relative stability and sustainability of water supply the following recommendations were made:

i. There is a need for constant monitoring trends in population growth by the National Population Commission for adequate planning that will creates for an enabling environment for provision of clean, accessible, affordable water supply in the study area and beyond.
ii. There is need for the government (through the Adamawa State Water Board), to construct a standard water treatment plant that will supply adequate water to the inhabitants since there are abundant potential water sources in the study area.
iii. Adamawa State Water Board should develop a long term strategic plan for the expansion of water storage and supply infrastructure to reflect future population growth projections
iv. There is need for both the Adamawa State Water Board and local councils to have collaboration in over hauling the water supply networks and put on new water supply networks to areas that were not covered in the study area.
v. Adamawa State Water Board and Ministry of Water Resources should formalize and regulate water vending to ensure stability in pricing and safeguard water quality and safety.

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