WATER SCARCITY MEASUREMENT IN THE YOBE REGION OF NIGERIA

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Citation: Baba-Adamu, M. & Jajere, I.A. (2020). Water scarcity measurement in the Yobe region of Nigeria. *KIU Interdisciplinary Journal of Humanities and Social Sciences, 1*(2), 265-280

ABSTRACT

Water is an indispensable natural resource, critical to human well-being, socio-economic activities and development, access to which is a human right that guarantees poverty reduction. Despite the importance of water to mankind, rural areas often suffer the most of water scarcities that have been attributed to various characteristics and dispositions. However, the statistical indices developed and used for the measurement of the domestic water scarcity were highly inappropriate and fall short of depicting the actual picture of the situation. Thus, this study measured the rural households' susceptibility to water scarcity using WSVI and the basic descriptive statistics. The mixed data for the study were primarily collected through a household survey on water availability and demand, whereas relevant research works and reports were reviewed as secondary data sources. Findings show hand dug-wells, boreholes and surface water bodies as the sources of water that the households depend upon for daily supplies – the service for which remained on women and girls. The WSVI computations revealed that the overwhelming majority of the studied households were experiencing high to acute water scarcities. Thus, the study recommends increased investments in the rural water supply sector, which would also reduce the socio-economic conditions on the population. The YSWSSP which has been highlighted with data inadequacies should be critically strengthened to enhance effective rural water service. Additionally, pieces of training to strengthen the methods of adaptation to water scarcity used by the households have been suggested.

Keywords: Household, Index, Scarcity, Vulnerability, Water

INTRODUCTION

Water is the most important natural resource to mankind. Its adequate and safe supplies guarantee the quality of human life, poverty alleviation and overall human socio-economic development. A study by Abubakar (2019) opined that providing adequate and improved drinking water is an increasingly significant challenge for authorities, development agencies and water sector organizations, more especially in countries with rapidly growing human populations. The United Nations (2020) report on the 2019 progress in the Sustainable Development Goals (SDGs) highlighted that 785 million people remain without access to basic drinking water service, and 700 million could be displaced by intense water scarcity from now to 2030 – as nearly 2 billion people continue to live water stress regions. The scarcity of water resource poses strong potential threats to human survival, especially among the economically disadvantaged rural households. However, the water scarcity involves how the spatially spread societies and their activities are able (or unable) modify the environment with mobilized financial resources and power to shape the patterns of access to water for diverse uses of the resource (Inkani, 2015). This means that the developing countries, with weak public water supply institutions, are at great risk of severe water shortage in the 21st century due to the huge differentials in households' characteristics (Balogun et al., 2017). For instance, in sub-Saharan African countries, only 24% of the population had access to safely managed drinking water as the 2015 statistics have shown, compared with 65% in Latin America and the Caribbean, 90% in West Asia and North Africa and 94% in East Asia and South-east Asia (UNICEF/WHO, 2017 as cited by Abubakar, 2019). He maintained that the sub-region is also home to about 319 million people or about half of the world population using an unimproved drinking water source, which resulted to over half of the countries in the region not meeting the Millennium Development Goal (MDG) of drinking water target. Similarly, out of the global population that relied on surface water for domestic supplies, 70% of them live in sub-Saharan Africa, eight times more than any other regions (Abubakar, 2018). This has proved the prominent reliance of the high populations of the sub-region the on-groundwater resource for domestic needs. Tukur et al. (2018) posited further that reliance on groundwater resource accounts for 71.43%, 50%, 47% and 28.9% in the Niger Republic, Botswana, Ghana and Nigeria respectively.

In the Nigerian case, it was noted that 51% of the total rural population suffers from the domestic water-related problem such as diseases and poverty (Kithinji, 2015); which may be attributed to their reliance on unimproved water sources such as surface water and dug-wells. This indicates that water sourcing in such places is a daily struggle embarked upon by household members – endangering their livelihoods with an increase in water scarcity. The extent of households' vulnerability to domestic water scarcity was neither sufficiently studied nor scientifically established in Nigeria, due to the lack of appropriate model of measurement. However, the appropriate model for measuring the problem is another issue to contend with, in the face numerous indices developed for various scales of measurement (see Table 1.1). Nonetheless, a review of various kinds of literature by Inkani (2015); Nepomilueva (2017); Damkjaek and Taylor (2017) demonstrated that several indices have been developed to assess water scarcity at various scales, as shown in Table 1. Inkani (2015) believed that since domestic water scarcity occurs principally at the household level, the model that utilises household-level data is necessarily needed for the scientific evaluation of the extent of the problem. As a result, effective situational measurement of water scarcity in the neglected rural environment, would not only guarantee the availability of adequate water quantities to sustain human health and well-being remains but also signifies commitment towards the attainment of target 6.1 of SDGs in addition to other local development priorities. It's against the background that this study measured the rural households' susceptibility to water scarcity in the rural communities of Nigeria. The work contributes to the ongoing water discourse, essential for policy redirection and the overall human socio-economic development.

Table 1 **Water Scarcity Indices/Indicators**

Index/Indicator	Author(s)	Spatial Scale of Measurement	Data Requirements
Water Stress Indicator	Falkenmark (1989)	Country	Total annual renewable water resources population
Vulnerability of Water Systems	Gleick, (1990)	Watershed	Storage volume of dams, total renewable water resources, consumptive use, proportion of hydroelectricity to total electricity, groundwater withdrawals, groundwater resources and time-series of surface runoff
Basic Human Needs Index	Gleick (1996)	Country	Domestic water use per capita
Water Resources Vulnerability Index (WRVI)	Raskin (1997)	Country	Annual water withdrawals, total renewable water resources, GDP per capita, national reservoir storage volume, time-series of precipitation, percentage of external water resources
Indicator of Relative Water Scarcity	Seckler et al. (1998)	Country	Water withdrawals in 1990 and 2025
Indicator of water scarcity	Heap et al. (1998)	Country and Region	Annual freshwater abstractions, desalinated water resources, internal renewable water resources, external renewable water resources, ratio of the ERWR that can be used
Water availability index WAI	Meigh et al. (1999)	Region	Time-series of surface runoff (monthly), time-series of groundwater resources (monthly), water demands for domestic, agricultural and industrial sector
Water Resource Sustainability	Loucks and Gladwell (1999)	Country	Infrastructure, environmental quality, economic and finance, institutions and society, human health and well-being, planning and technology

Social Water Stress Index	Ohlsson (2000)	Country	Distributional equity, political participation, education and HDI
Access to drinking water and sanitation services	WHO (2000)	Country	Percentage of population with access to drinking water, and percentage of population with access to sanitation services
Dry Season Flow by River Basin Model	WRI (2000)	River Basins	Time-series of surface runoff (monthly data) and population
Indicator of water scarcity	OECD (2002)	Country and Region	Annual freshwater abstractions and total renewable water resources
Index of Watershed Indicators (IWI)	EPA (2002)	Watershed	15 condition and vulnerability indicators
Water Poverty Index (WPI)	Sullivan (2002)	Country and Region	Internal renewable water resources, external renewable water resources, access to safe water, access to sanitation, irrigated land, total arable-land, total land area, GDP per capita, under-5 mortality rate, UNDP education index, Gini coefficient domestic water use per capita, GDP per sector, Water quality variables, use of pesticides, environmental data (ESI)
International Water Management Institute Indicator	IWMI (2008)	Country	Renewable water resource: desalination plants, water withdrawals, adaptation to infrastructure enhancement

Source: Modified from Inkani (2015); Nepomilueva (2017); Damkjaek and Taylor (2017)

MATERIALS AND METHODS

Study Area Setting

Fune Local Government Area is one of the rural geo-political units in Yobe State, with a projected population of 388,771, landmass of 4,985km² and a population density of 78 persons/km² (NPC, 2017). It falls within the Nigerian arm of the Chad Basin, dominated by three geologic units namely Fika Shale, Kerri-Kerri and Chad Formations. The Chad Formation has upper, middle and lower water-bearing aquifers according to Baber and Jones (1960) as cited by Offodile (2002); and the water occurs under water table conditions (Audu, 2017). The groundwater potentials of the horizon which have an average depth of 30m is estimated to be high, judging by the yields observed from existing domestic water sources in the area - boreholes and hand-dug wells (Offodile, 2002; Makinde et al, 2010). The depth to the top of the aquifer in the area of flowing wells ranges from 240m to 380m near the Basin, while the free-flowing yields from the aquifer range from 21l/min to as high as 90m³/hr and the maximum positive artesian heads recorded were of the 18 – 21m above the ground level (Audu, 2017). In general, however, yields from this aquifer increase towards Lake Chad due to surface water recharge and vice versa. Kerri-Kerri Formation, on the other hand, is a continental, lacustrine and deltaic-type geologic unit of Paleocene age, consisting of thin and thick beds of sandstone, grits, and clay (Adegoke et al, 2014). Coarse gravel is common in the Formation and the clays are usually massive and gritty. The groundwater in the aquifers of Keri-Keri Formation occur mainly under water table condition but locally in confined or semi-confined aquifers, where thick and laterally extensive lenticular clays are interbedded with sands and chiefly recharge by precipitation (Okuson, 1995; Oruonye, 2009; Audu, 2017). Oruonye (2009) stated further that the Formation which is associated with the sequence of composed permeable sandstones; allows water to infiltrate to great depths of up to 50m. Yusuf et al. (2018) described the Formation as one characterized with deep layer aquifer, water yields and much of the arenaceous beds are with little or no water. Similarly, the Fika Formation (or Shale) is gypsiferous and with intercalations of thin limestone beds (Okuson, 1995; Adegoke et al, 2014). It was reported by Okuson (1995) and Nwankwoala (2015) that Fika Shale has a maximum thickness of 890m (Okuson, 1995) and its aquifers are limited in extent, confined to the fracture and weathered zones, resulting in poor water yields due to its argillaceous nature. However, the lithological characteristics of the three geologic formations in the study have been described in Table 2.

Table 2. Lithological Characteristics of the Geologic Formations

Geologic Age	Formation	Lithology and Environment of Deposition
Pleistocene	Chad Formation	Clays, sands and gravels medium to coarse sands felspathic lacustrine in origin
Paleocene	Kerri-Kerri Formation	Laterite, oolitic sands, sandy clay, continental lacustrine/deltaic
Senonian	Fika Shale	Black and blue shales, poorly exposed with cotton soil characteristic feature and gypsiferous

Source: Adopted from Offodile (2002); Adegoke et al (2014); Audu (2017)

Sample Size Determination

The population targeted were rural communities of the study area and the employment of multistage sampling approach was necessitated. Firstly, observations show challenges in access to water supply and the study area was purposively selected. Secondly, the geologic map of Yobe State divided the area into the Chad Formation, Kerri-Kerri Formation and Fika Shale, which were adopted as study zones and three communities were purposively sampled from each zone (see Table 3). Thirdly, household heads (respondents) were drawn using systematic random sampling, which were proportional to the size of the communities.

Table 3 Details of the Sampled Communities

Geologic Zones	Studied Communities	Longitudes	Latitudes	No. of Households	Households Samples
Fika Shale	1. Daura	11.405567	11.553658	183	31
	2. Murba	11.504024	11.660501	243	41
	3. Ngelshengele	11.60465	11.550527	201	34
Kerri-Kerri Formation	1. Dadume	11.360187	11.839857	69	13
	2. Kafaje	11.251558	11.918324	99	16
	3. Kolere	11.286100	11.882700	165	28
Chad Formation	1. Dufuna	11.182238	12.257496	303	51
	2. Jajiburawa	11.148437	12.215455	165	28
	3. Gurungu	11.068409	12.13727	207	35
Total of households				1635	277

Source: Fieldwork, 2019

Data Sources and Analysis

The data for this were sourced from both primary and secondary, as the study used the mixed methods of data collection - quantitative and qualitative. The primary data were quantitatively collected through designed households survey (with household heads who served as respondents of their households) and researchers' observations, whereas the secondary data were sourced through a desk review of relevant kinds of literature. The study designed an observation paper that was used for the collection relevant information such as the water sources from each of the studied communities, presence and use of surface water bodies like the streams, rivers, ponds and dams, water provision facilities, time for collecting water and the methods of conveyance, distance to reach the water sources. The data were analysed using the basic descriptive approach and the Water Scarcity Vulnerability Index (WSVI) evaluation techniques of water domestic water scarcity. The WSVI was developed due to lack of known indicator for measuring the problem of susceptibility to water scarcity at the household level and first used by Inkani (2015) in her study on Households Vulnerability and Adaptation to Water Scarcity in the Rural Areas of Katsina State, Nigeria. As a result of its critical relevance to development studies, the model was employed in the analyses of this study, though there is high insufficiency of studies that used it in respective cases, which made the situation difficult to contextually discuss the findings of this work. It is computed as the ratio of water availability to demand of a household. Depending upon the ratio between the demand and availability, the model values could be as low as 0% and as high as 100% - meaning the lower the values, the lower the vulnerability of a household and the higher the values, the greater the vulnerability to water scarcity. The vulnerability classification system used for the interpretation of the results of WSVI analyses as shown in Table 4 involved serial quantitative data mining activities with the help of excel followed by frequency analyses. The model assumed that;

$$WSVI = 1 - \left(\frac{HHWA}{HHWD}\right) X\ 100 \quad \text{.............................. Eq. (1)}$$

Where;

- *WSVI = Water Scarcity Vulnerability Index*
- *HHWA = Household Water Availability*
- *HHWD = Household Water Demand*
- *1 = the value of water sufficiency a household*

Table 4 WSVI Interpretation Table

Vulnerability Class	Range of Values for HWSVI	Class Definitions
I	0%	No Water Scarcity
II	0 – 5%	Low Water Scarcity
III	6 – 15%	Moderate Water Scarcity
IV	16 – 35%	High Water Scarcity
V	Above 35%	Acute Water Scarcity

Source: Adopted from Inkani (2015)

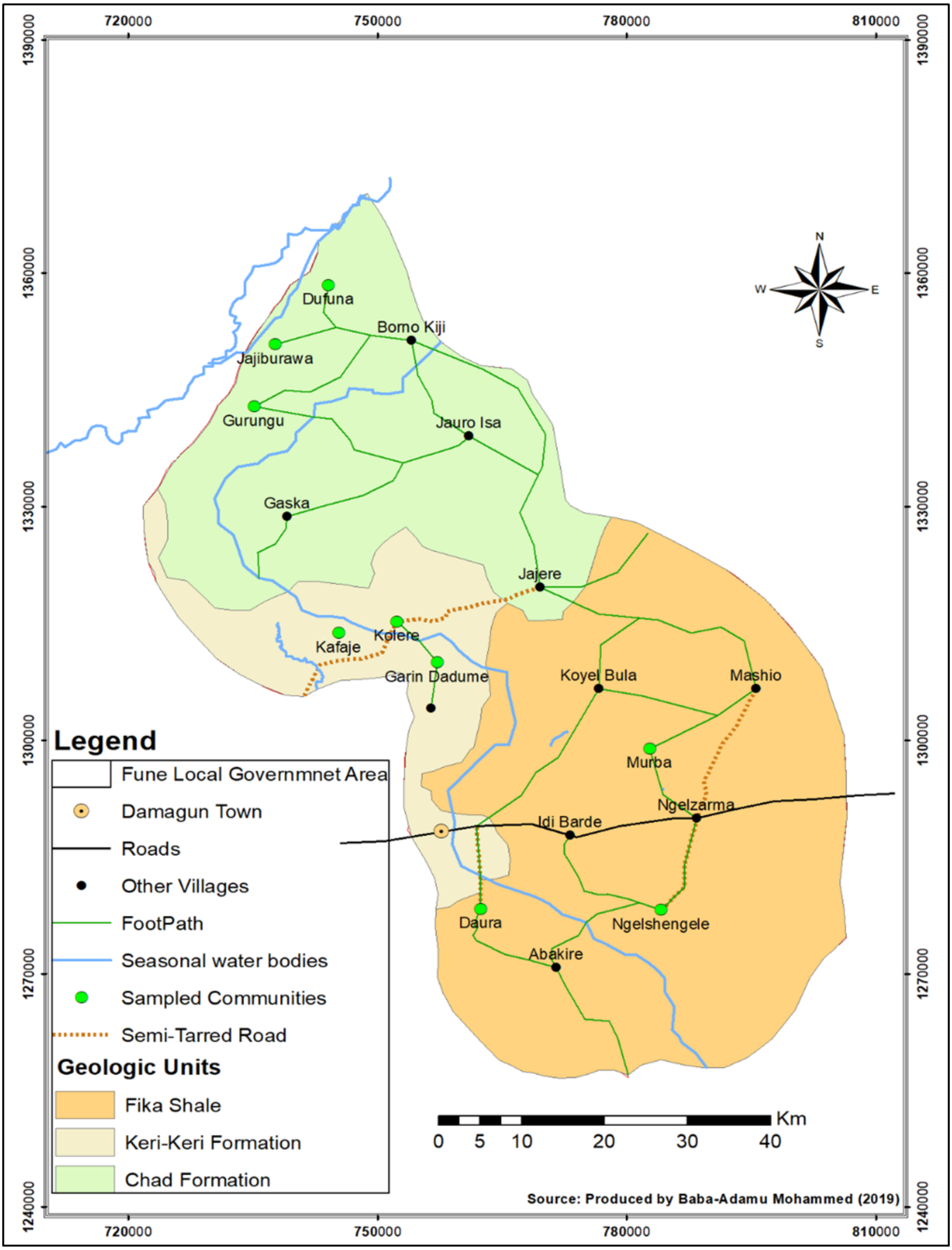

Figure 1 The Mapped Study Area with the Sampled Communities

RESULTS AND DISCUSSIONS

Water Sources

The primary sources of water relied upon for daily supply were the hand dug-wells (53.1%), boreholes (29.2%) and surface waters (17.7) as shown in Table 3.1; and observations uncovered that the water provision, which involves the high expenditure of time and energy, was shouldered by the young girls, active and the aged women. The use of the surface waters in the rainy season and barely after may vary with the geologic formation of the area and incidence of diseases could be high. Studies by Ezenwanji (2012); Obeta and Chickwu (2013) opined that the Nigerian rural population continue to use rivers, ponds, lakes, springs and rainwater as their main sources of water supply, faces great risks to their health and wellbeing. These water sources are classified as unimproved according to the WHO/UNICEF (2006) classifications as quoted in the studies by Obeta and Chikwu (2013) as well as Bukar and Daura (2015). The improved sources are considered better sources in terms of quality and to a certain degree, reliability while unimproved sources tend to be highly seasonal and are generally open to contamination and carry health risks (Bukar & Daura, 2015). The study finding also positioned the households as the poor and marginalized fraction of the population, faced with water scarcity – as about two-thirds of them depends on the lower rung of the water service ladder. Various kinds of literature (Fair et al., 1971; Tebbutt, 1991; Steel and McGhee, 1991; Metcalf & Eddy, 1991; John De Zuane, 1996 as quoted by Lukman et al., 2016) described the detailed impurities of such water sources and need for prompt treatment before consumption. The FGDs added the prevalence of diseases such as typhoid fever, malaria fever and bilharzia, which could be associated with the water scarcity and confirmed the insecurity of the water sources and the poverty extent of the households. A study by Bukar and Daura (2015) revealed that domestic water provision is a culturally assigned responsibility on women and children, who are often economically active, in the semi-arid environment and indeed rural Africa. The UNDP (2006) reported the annual loss of 40 billion productive hours and 443 million school days to fetching water in sub-Saharan Africa. These have the potential to magnify the decline in the households' socio-economic productivity, growth and development, by exposing them to social violence, increase in school drop-out, among others. This study finding corroborates Sule et al. (2016) that 70% of the households in rural communities of Nigeria do not have access to improved water supply, it also paralleled the reports by UNDP (2012) and WHO/UNICEF (2012) that 61% of households in sub-Saharan Africa, where the study area is part, have access to improved water supply sources. The observed abandoned water projects point to the inability of public institutions, principally the Rural Water Supply and Sanitation Agency (RUWASSA) to provide efficient water supply service to the growing population. As a result, the pressure is mounted on the unimproved and the relative secured water sources, necessitating the growth in competition for water, increase in time expenditure for water collection and the decline in productivity of the households. With about 90 million of the population without access to safe and adequate water supplies in 2015 (Marks et al., 2013; Adah & Abok, 2013), it means that the country (ranked behind Ghana, Rwanda, Botswana, and Sierra Leone) did not meet the MDG target of halving the population without adequate access to improved drinking water sources, which constitutes challenges to achieving the 2030 SDGs and the 2025 African Water Vision. It might thus be argued that reliance on unimproved water sources is likely to have livelihood implications such as a decline in productivity, income level and the potential disease outbreak.

Table 5: Water sources

Water Sources	Frequency/Proportion
Dug-Wells	147 (53.1)
Boreholes	81 (29.2)
Surface Waters	49 (17.7)

Source: Fieldwork, 2019

Water Scarcity Vulnerability

In establishing the extent of water scarcity presence in the study area, the perspectives of the households in the zones of the study were computed using the WSVI. The proportion of the households in the various categories of the pegged water scarcity are shown in Table 6 and 7. In Table 6, barely 3.6% of the households in the Chad Formation were affected by 'Moderate Water Scarcity'. While the 'Low and No Scarcity' situations were distanced from the study zone, 'High Water Scarcity' was witnessed by 37.7% of the studied population of this zone and 58.7% were in the "Acute Water Scarcity' category. Further analyses in Table 3.3 shows that the households facing 'High Water Scarcity' were 14.7%, 14% and 9% in Dufuna, Jajiburawa and Gurungu respectively. Relatively, those in the 'Acute Water Scarcity' position constitutes 28.7%, 21% and 9% of the households in Dufuna, Jajiburawa and Gurungu. The ranged findings between high and the acute water scarcities were observed to have extremely disturbed the Dufuna (43.4%) and Jajiburawa (35%) communities more than Gurungu (18%) (see Table 6 and 7) and might associated with how the surface waters are most used in the rainy season, the water sources are climate change sensitive. The soil characteristics of the area which are usually sandy, with low water retention capacity further encourage high evaporation and confounded the water supply challenges of the area. Studies by Offodile (2002) and Makinde et al. (2010) revealed that despite the promising groundwater potentials, the Chad Basin has water yields that decrease away from the Lake Chad, which the study area could not be exempted from the menace. However, the somewhat similar scenario of the Chad Formation is found amongst the households in the study zone Kerri-Kerri Formation – whose households in 'Moderate Water Scarcity' condition was only 5.3% (see Table 3.2). In the same Table 3.2, those in the 'High Water Scarcity' and 'Acute Water Scarcity' constitutes 29.8% and 64.9% respectively. Additionally, 13.8%, 8.2% and 7.8% of the households in Dadume, Kolere and Kafaje

were respectively in the ‘High Water Scarcity’ vulnerability incidence; whereas 24.4%, 20.5% and 20% in Dadume, Kolere and Kafaje face the vulnerable susceptibility to ‘Acute Water Scarcity’ conditions. The pattern of the problem of water scarcities in this zone of the study appears to have covered all the communities, whose dependency on groundwater resource remained very high. The groundwater in the zone occur mainly under water table condition, locally in confined or semi-confined aquifers and chiefly recharge by precipitation (Okuson, 1995; Oruonye, 2009; Audu, 2017; Yusuf et al., 2018); which could also be prone to climatic variability.
In the zone of Fika Shale, only 0.9% in Daura community experience ‘Low Water Scarcity’ status despite the support of the Local Government Area in the provision of water. The households in the ‘High Water Scarcity’ level includes the 19.1%, 12.3% and 9.2% in Ngelshengele, Daura and Murba respectively. Meanwhile, those in the ‘Acute Water Scarcity’ category were 28.5%, 19.9% and 10.1% of the households in Daura, Ngelshenele and Murba, respectively. The situation here highlighted that in both communities, particularly the first two (Daura - 40.8%, Ngelshengele - 39% and Murba - 19.3%) experiences the water scarcity that ranged between high and acute extents were evident justified by the findings. These levels of the problem might not be unconnected with the water-bearing aquifers of the geologic formation, though the clayey characteristic of the area retains water in the rock fractures for various uses including domestic provision. This is because, the Fika Formation is reported to have limited aquifers in extent, confined to the fracture and weathered zones, resulting in poor water yields due to its argillaceous nature (Okuson, 1995; Ofodile, 2002; Audu, 2017). In contravention with Inkani and Mashi (2016) who used the same model in the similar rural setting of Katsina State, Nigeria and concluded that water scarcity tends to decrease from south to the north in the reflection of the rainfall amounts, this study uncovered that the pattern of the vulnerability to water scarcity is in response to geologic characteristics and the complex nature of aquifers behaviour. The findings established the highly clear presence of water scarcity and its consequences that leads to the evident ravaging of the socio-economic activities of the area, which households continued to struggle with. In general, the study postulated how abilities of the studied communities to supply water for the various human needs is far from being adequate and the stress is most serious on those in the lowest stratification of the population. Inkani (2015) quoted WHO (2010) to have reported that only 32% of the rural population in developing countries, which this study is part of, have access to safe drinking water; and Dada (2009) notes that a large percentage of the rural population in developing countries continues to live without adequate access to safe and convenient water supply and sanitation and water supply is still unreliable.

Table 6: Summary of Households' Water Scarcity Vulnerability

Water Scarcity Vulnerability Index	Study Zones		
	Chad Formation	Kerri-Kerri Formation	Fika Shale
No Scarcity (0%)	0 (0%)	0 (0%)	0 (0%)
Low Scarcity (1 – 5%)	0 (0%)	0 (0%)	1 (0.9%)
Moderate Scarcity (6 – 15%)	4 (3.6%)	3 (5.3%)	0 (0%)
High Scarcity (16 – 35%)	43 (37.7%)	17 (29.8%)	43 (40.6%)
Acute Scarcity (36% - Above)	67 (58.7%)	37 (64.9%)	62 (58.5%)

Fieldwork(2019)

Table 7 Proportional Distribution of HWSVI in the forms of Water Scarcity

Study Zone	Studied Community	Proportional Distribution of Households Under various Forms of Vulnerability to Water Scarcity				
		No Scarcity	Low Scarcity	Moderate Scarcity	High Scarcity	Acute Scarcity
Chad Formation	Dufuna	0	0	1	14.7	28.7
	Jajiburawa	0	0	1	14	21
	Gurungu	0	0	1.6	9	9
Kerri-Kerri Formation	Dadume	0	0	0	13.8	24.4
	Kafaje	0	0	2.1	8.2	20.5
	Kolere	0	0	3.2	7.8	20
Fika Shale	Daura	0	0.9	0	12.3	28.5
	Murba	0	0	0	9.2	10.1
	Ngelshengele	0	0	0	19.1	19.9

Source: Fieldwork, 2019

The Adaptation Strategies to Water Scarcity

The adaptation strategies in response to water scarcity revolve around getting water from alternative sources or limiting the water use in the household while varying differences have been reflected in the geographical characteristics or socio-political responsibility (Inkani, 2015). Observations show that the strategies employed include a decline in domestic water use, the use of alum for local water treatment, water conservation, periodic digging and deepening of wells and a reduction in livestock watering. The reduction in the domestic water uses for bathing, washing, cooking and sanitation, was clear in the appearance as well as living conditions of the people studied – whose concerns have been distanced from constant neatness to rather means of livelihood and went further to regard the call for safety and hygiene as a luxury. Generally, however, these methods of adaptation are traditional and reduce very little from the high incident problem of water scarcity in the study area, particularly that geologic differentials mattered into it. Training on the strategies was never held, people area ancestral knowledge to use them.

CONCLUSION AND RECOMMENDATIONS

It was found in the study that most of the households use the domestic water sources that classified as unimproved by the global health organizations of the United Nations. These sources of water include the hand dug-wells and the surface water bodies upon which more than 70% of the population struggles to live with. The women and children who serve as the prime water collectors cover long distances and spends considerable time in the search for water supplies, which similarly divorce from their productive activities such as farming and worsens the economic conditions of the households. The study has also scientifically established that glaring majority of the households were vulnerable to the extent of water scarcity which has ranged between 'High and Acute Water Scarcities' status of the model. The zero households in the 'No Water Scarcity' category, one in 'Low Water Scarcity' bracket and the only 8.9% of them that experiences 'Moderate Water Scarcity' in the study area proved the consolidation of the extent of the problem. As a result, one may argue that the water scarcity is linked to the prevalence of climate change events, water governance crises, socio-economic characteristics of the households and the geologic conditions of the area. Thus, in the light of these findings, some recommendations are placed. These include the requirement for increased investments in the rural water supply sector – which would reduce the social and economic stress on the population. The identified geographic factors of the problem such as spatial distance to the water sources, time expenditure for water collection, mode of water conveyance and the demographic-biases in the collection activity would also be modified by the provision of improved water sources. The decade-old Yobe State Water Supply and Sanitation Policy (YSWSSP) should be strengthened with rich variables such as the use of households and geographic data. The water users should form part of the stakeholders of their communities – who strengthens the water policies, its implement and maintenance of the water sources. The locals should be encouraged with training on improving the employed adaptation strategies and the importance of environmental sanitation, personal hygiene and the dangers of open defecation to their livelihoods. In the same vein, there is the need for governments and concerned stakeholders to increase research funding in the area of domestic water supply and livelihoods, especially in rural places, to generate scientific data for proper planning and development.

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