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Sources, demand and problems of domestic water in Nassarawa Eggon Town, Nigeria

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ABSTRACT: This paper examines the relationship between domestic water sources, demand and associated problems in the context of a rapidly increasing household population in Nassarawa Eggon town, Nasarawa State, Nigeria. The data for this research were generated using a questionnaire survey of systematically selected households, and analysed using descriptive statistics in the form of frequencies and percentages, and are presented as tables and graphs. The study revealed that the major sources of water in the area are hand-dug wells and streams, with no pipe-borne water. This has greatly affected the inhabitants of the locality, resulting in cases of water-related diseases. Consequently, due to the recent inter-communal and ethnic crisis in some parts of the local government area and the state, which led to massive immigration of people into Nassarawa Eggon, pressure on the available sources of domestic water has intensified, resulting in insufficiency in meeting domestic water demand. Against this backdrop, the paper seeks to examine in detail the various sources of domestic water and the problems associated with accessing it.

Key words: Domestic water, Household, Quality, Respondents, Waterborne

INTRODUCTION

Water is a unique substance that has many physical properties distinct from those possessed by other liquid, gaseous, or solid materials existing on the earth's surface. It is not distributed uniformly over the surface of the earth, as some areas are blessed with a fairly uniform and more than adequate supply for human needs, while many other regions have a greater need for water than they can supply (Mather, 1984).

Water as a desirable resource is greatly needed by humanity for virtually all its activities, and the importance of its quality for domestic consumption cannot be over-emphasized. Suffice to say that domestic water should be water of the highest quality, while water meant for other forms of uses can be of good quality (Eziashi, 1999). Man cannot survive without water. It is a vital need, just as air and food are. In fact, apart from the air that man breathes, water is the most important element to humankind (Ayoade, 1988).

Nigeria is endowed with adequate fresh water resources, with a coastline of about 800 km in the south and also the Lake Chad Basin in the north. From big rivers like the Niger, Benue, Kaduna, Anambra, Imo, Gongola, etc., to small lakes, streams and ponds in the rural areas, these water resources are sources of livelihood and wealth-creation for many families on a daily basis. This shows the immense potential and opportunities in the water resources sector for the Nigerian economy.

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However, the challenge of development of the sector has been the inability to implement the integrated, demand-driven approach and effective resource management (FMoWR, 2011).

Water is essential for all socioeconomic development and for maintaining healthy ecosystems. As population increases and development calls for increased allocations of groundwater and surface water for the domestic, agriculture and industrial sectors, the pressure on water resources intensifies, leading to tensions, conflicts among users, and excessive pressure on the environment. The increasing stress on freshwater resources brought about by ever rising demand and profligate use, as well as by growing pollution worldwide, is of serious concern (UN, 2007).

Within recent decades, there have been efforts to increase provision of domestic water for both rural and urban homes. However, water is still unavailable to many, mainly those located in Sub-Saharan Africa, South Asia and East Asia (Ellen and Kellog, 2005). Furthermore, the availability of water varies greatly; while some people pay very dearly for domestic water, others have easy access to adequate clean water and sanitation due to their location and social status in society (Hunter et al., 2009).

Provision of clean domestic water for both rural and urban dwellers should be seen as a necessity by policy makers. However, this is not the case in developing nations where rural dwellers are neglected whenever water supply schemes are contemplated. As domestic water need is increasing by the day, potable water is a must for every household and community. Just as population is increasing and towns are expanding, the demand for potable water in both quantity and quality is equally on the increase (Adeoye et al., 2013).

The number of people who rely on the earth's limited fresh water reserves is increasing every day. In fact, a scarcity of clean, fresh water is one of the world's most pressing environmental problems. Water is life and its importance in the life of man, animals and plants cannot be over-emphasized. However, the task of meeting domestic water needs in rural and urban areas in most developing countries, particularly in Nigeria, is enormous and falls mainly to women and children. Households also spend considerable time and effort fetching water from sources such as rivers, streams, ponds, wells and boreholes. In most cases, these sources of water may be one or two kilometres away from home, and may also be polluted (Arms, 2008). The total domestic water needs in homes with piped water and indoor sanitation is at least 115 litres per head per day. The actual amount used may be greater, depending on the ease and convenience of supply (Ayoade and Oyebande, 1983).

Conflicts of any nature, be they communal, inter-state or political, tend to create instability, involving the breakdown of law and order, massive destruction of lives and property and the displacement of people, leading to humanitarian crises with far-reaching consequences. Local disputes relating to land tend to disrupt the normal cycle of farming, thus leading to food insecurity, water scarcity, loss of income, hatred and distrust among the contending parties, which undermines the mutual cooperation and understanding that is necessary for development to take place (Adeniyi, 2003).

One-quarter of the world's population (1.2 billion), face economic water shortage, 'where countries lack the necessary infrastructure to take water from rivers and aquifers' (UN-Water, 2007). All these are places where shortages of water contribute to poverty. These shortages cause social hardship and impede development. They create tensions in conflict-prone regions. Too often, where we need water we find guns. To quote the words of Ban Ki-moon (UN Secretary General) from the United

Nations Report on Water Scarcity, 'there is still enough water for all of us but only so long as we keep it clean, use it more wisely and share it fairly' (UN, 2011).

Nigeria has adequate surface and groundwater resources to meet the current demands for potable water of its citizens. The pattern for water demand differs from time to time and from place to place. As the uneven distribution in space has turned areas of surplus into areas of scarcity, water shortages are experienced for various needs, particularly during the dry season when the biggest part of the year is spent without rain (Ifatimehin and Musa, 2008).

Regardless of the abundant natural water resources, the proliferation of waterworks in the country coupled with a robust policy that spells out strategies and attainable targets mean that the water situation in Nigeria could best be described as precarious, and over the years, improvement in domestic water supply has not been impressive (Olajuyigbe, 2010).

Water conflicts can arise in water-stressed areas among local communities and between countries, because sharing a very limited and essential resource is extremely difficult. Almost one-fifth of the world's population (about 1.2 billion people) live in areas where water is physically scarce. One-quarter of the global population also live in developing countries that face water shortages due to a lack of infrastructure to fetch water from rivers and aquifers (known as economic water shortage). Water scarcity forces people to rely on unsafe sources of drinking water. It also means they cannot bathe or clean their clothes or homes properly (FAO, 2007).

Residents of Nasarawa State have resorted to wells as alternative sources of water, following scarcity of water in the state in recent times. The situation has forced many into buying water from water vendors who walk long distances before getting the supply from the few wells in parts of the state. Places like Nasarawa Local Government Area, Keffi and Lafia now get water from the Water Board at three-day intervals, as opposed to one-day intervals before (Ahmed, 2010).

Many households in Nassarawa Eggon depend on rain harvesting during the rainy season as a source of domestic water. In the dry season, the inhabitants resort to buying water from water tankers at a high price, the quality of which is questionable since the source is a major stream in the town. Other major sources of water that do not meet the demand of the inhabitants of the study area are wells, streams and a few boreholes. The absence of a proper geophysical survey in Nassarawa Eggon to determine the best points for the location of boreholes, has greatly affected the long-term functioning of the boreholes. Usually, in the study area, residents sink boreholes and dig wells with the assumption that every point in the area is suitable for groundwater exploration. Eventually, these wells or holes are abandoned after a few years since they no longer function.

This paper intends to examine the sources, level of demand and associated problems of domestic water in Nassarawa Eggon town of Nasarawa State, through the following questions:

i) What are the various sources of domestic water in Nassarawa Eggon town?
ii) What is the quantity of water being procured by households from the various sources identified?
iii) What are the problems associated with water use in the study area?
iv) What are the effects of conflict in accessing the available sources of domestic water in the study area?

MATERIALS & METHODS

Study area

Nassarawa Eggon Local Government Area (LGA) is located in Nasarawa State (Fig.1)

and lies between latitudes 8°33' and 8°52' north and between longitudes 8°14' and 8°39' east. Nassarawa Eggon town is the administrative headquarters of Nassarawa Eggon Local Government Area and it is located on the ever-busy Abuja-Makurdi road. The majority of the inhabitants are farmers and traders (Laah and Ayiwulu, 2010). Nassarawa Eggon shares common boundaries with Akwanga Local Government Area to the north, Lafia Local Government Area to the south and Keffi to the west (Fig.2). The study area covers a landmass of about 1,208 square kilometres (Wikipedia, 2012). It has an estimated population of 149,129 (77,888 males and 71,241 females) at the 2006 national population census (NPC, 2007).

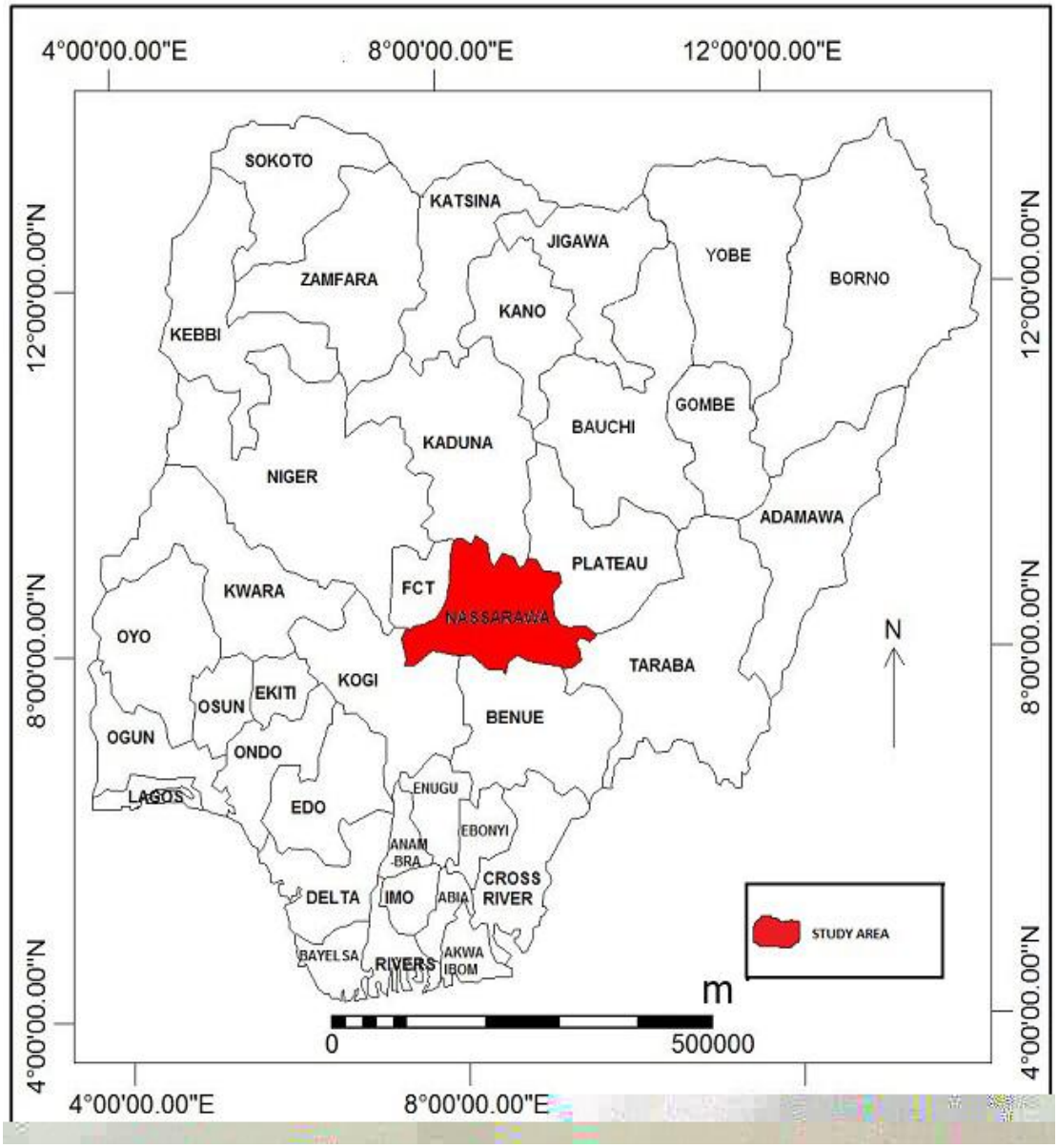

Fig. 1. Nigeria showing Nasarawa State

Fig. 2. Nasarawa State showing Nassarawa Eggon LGA

The climate of Nassarawa Eggon falls within the tropical savannah (Aw) climate with two clearly marked seasons, wet and dry. It has a mean temperature of 15.6 °C and 26.7 °C with an annual rainfall between 1317 mm and 1450 mm. 1t rains from April to October, and the months from December to February experience the north-east trade winds, and thus the dry Harmattan (NSG, 2001) winds. The onset of rains in April ushers in a noticeable decline in temperature. This continues in the cessation period, ending by October when a further decline is made possible in November/December by the coming of the Harmattan winds (Ayiwulu, 2012).

Nasarawa State shares the same characteristics with the Jos Plateau in geologic features, to the north, and it belongs to the Benue Formation resulting from the deposits of the Benue Trough in the southern zone of the state. Nassarawa Eggon and its surrounding settlements are within the Mada River Basin of the Benue Valley Platform, and the state lies within the north-central highlands of Nigeria (Akwa et al., 2007).

It is amazing that Nassarawa Eggon town, which is located at the foot of the mountain, has no major river but only two streams (Iyaka, 5 km along the Nassarawa Eggon-Lafia road and Broni, 2.5 km along the Nassarawa Eggon-Akwanga road).

Sources of data and analytical methods

The major instrument used in the study was a questionnaire entitled "Public View on the Sources, Demand and Problems of Domestic Water in Nassarawa Eggon Town". It consists of three sections: Section A, covering household socioeconomic and demographic characteristics such as age, sex, occupation, family size, marital status, educational status and average annual income of household; Section B, covering sources and demand of water supply (sources of water to the household, quantity of water needed daily, and uses of water by household); and Section C, capturing water use problems (such as water-related diseases, contamination, distance to source of water supply and effect of conflict). Before distribution to respondents, the instrument was tested for reliability.

Procedure for data collection

The data for this study were collected from primary and secondary sources. Primary data gathering involved field surveys, which included reconnaissance survey, interviews and observations. A total of 160 samples of the questionnaire were administered to 160 households spread across the four political wards in Nassarawa Eggon town at the rate of 40 households per ward; this was done by the researchers with the assistance of three trained research assistants. A systematic random sampling technique was adopted for the administration of questionnaires, where household heads were randomly interviewed based on streets. Four streets were selected from each political ward using stratified random sampling and 10

questionnaires were administered on each street. Secondary data included technical reports of government at various levels, textbooks, map, the Internet, journals and related literatures.

Data analysis

Data generated were analysed using descriptive statistics in the form of frequencies and percentages, and were presented as tables and graphs. Information collected from the field was presented based on the four political wards, and further analysed according to various issues that were researched with the aim of revealing a true picture of the research problem. Quantities of water used per household were provided in numbers of buckets by the respondents, and later converted into litres by the researchers for easy interpretation.

The study was carried out between November 2013 and April 2014. To come up with a scientifically viable account of the nature of domestic water supply and demand in Nassarawa Eggon town of Nasarawa state, one hypothesis was stated and tested using analysis of variance (ANOVA):

i) H0: There is no significant variation in the quantity of water demanded by households in Nassarawa Eggon town before and after the inter-ethnic conflict in parts of Nassarawa Eggon Local Government Area.

ii) H1: There is significant variation in the quantity of water demanded by households in Nassarawa Eggon town before and after the inter-ethnic conflict in parts of Nassarawa Eggon Local Government Area.

The F-ratio ANOVA statistical test can be represented mathematically thus:

Step 1: $X_i = i/n\sum X_{1i}$ = Mean within each group, where X_i stands for the mean and $\sum$ stands for summation.

Step 2: $X_i = \sum iXi /a = X_1 + X_2 + X_3 +\ldots\ldots /a$ = Overall mean, where 'a' is the number of groups.

Step 3: $S_B = n (X_1 – X)^2 + (X_2 – X)^2 +$..... = Between-group sum of squares, where 'n' is the number of data values per group.

F_B = a-1 = Between-group degrees of freedom.

$MS_B = S_B / F_B$ = Between-group mean square value.

Step 4: S_W = Within-group sum of squares is the sum of all squared values.

$F_W = a (n-1)$ = Within-group degrees of freedom.

$MS_W = S_W / F_W$ = Within-group mean square value.

Step 5: The F-ratio is $F = MS_B / MS_W$, which is followed by decision level.

RESULTS & DISCUSSION

Sources and demand of domestic water supply

Globally, there is enormous variation in the withdrawal of water for municipal purposes. In many large cities in the industrialized countries, the current water withdrawal is 300-600 litres per day per person, in contrast to the deplorable situation in the developing countries of Asia, Africa and Latin America, where water withdrawal is about 50 litres per capita per day. In some localities in the developing countries, the domestic water consumption may be as extremely low as 10 litres per capita per day (Aswathanarayana, 2001). It can be deduced from Table 1 that hand-dug wells and streams are the most utilized and readily available sources of domestic water in Nassarawa Eggon town.

From oral interviews, it was gathered that in most places in the study area, hand-dug wells dry up before the next rainy session, and as such, they are left with the option of going to streams or buying from water tankers. Some of the respondents complained of the difficulty of getting water tankers when needed. Sometimes, customers had to

follow them to the extraction point (a stream in the town). According to some residents interviewed, the number of water tankers in the town is inadequate to allow for sufficient water supply to various households at appropriate times and quantities.

Table 1. Major sources of domestic water in the town

Major sources of domestic water/Number of respondents					
Ward	**Hand-dug wells**	**Stream**	**Borehole**	**Water tanker**	**Total**
Alizaga	23	10	5	2	**40**
Makama	17	7	8	8	**40**
Jarmai	12	9	7	12	**40**
Galle	21	12	5	2	**40**
Total	**73(45.6%)**	**38(23.8%)**	**25(15.6%)**	**24(15.0%)**	**160**

Source: Field Survey, 2014

The quantity of water demanded by households in Nassarawa Eggon town before and after the unfortunate inter-ethnic crisis (Table 2) which engulfed some villages in the local government area varies significantly from the hypothesis tested and the table presented. Due to the unexpected population increase as a result of sudden and unanticipated emigration out of affected villages (Burumburum, Igga, Ikka Wangibi, Alhamis Ezzen, Bassa, Barikin Abdullahi, Tudun Adabu, Arugbadu and Assakio) to Nassarawa Eggon town, the pressure on the limited sources of domestic water experienced a sporadic increase.

The interview survey found that those who could afford to buy water from water tankers were becoming incapacitated and economically weak due to the extra mouths they were not prepared to supply with water. Some of the respondents noted that their affected relations lost everything in the crisis and came to finally settle in Nassarawa Eggon town. This calls for urgent measures to curb the increasing water demand in the town.

Table 2. Quantity of water demanded by households

Before the inter-ethnic conflict		
Litres	Household Demand/Day (Respondents)	**Percentage**
50-100	15	9.4
101-150	50	31.3
150-200	77	48.1
Above 200	18	11.2
Total	**160**	**100**
After the inter-ethnic conflict		
Liters	Household Demand/Day (Respondents)	**Percentage**
50-100	7	4.4
101-150	19	11.9
150-200	49	30.6
Above 200	85	53.1
Total	**160**	**100**

Source: Field Survey, 2014

Population size is directly connected to quantity of water supply. For any government to have an effective and adequate water supply to its citizenry, population density is an essential parameter to consider. Of the 160 respondents interviewed, 38.8% (62) had a household size of between one and four persons while a household size of 5-10 persons accounted for 53.1% (85). The remaining 8.1% (13) covers household size of 11 persons and above (Fig. 3). This is no surprise, as most of the respondents are farmers and traders, whom studies have shown to have high numbers of children.

With more than 50% of the respondents having a household size of above five persons in an area without pipe-borne water and sufficient boreholes to source for their water demand, it is clear that a great deal is required to meet the water needs of the inhabitants.

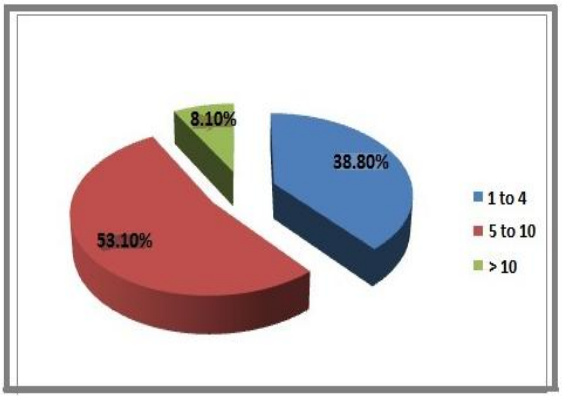

Fig. 3. Percentage of respondents by size of household

Domestic water use problems

Water supply is associated with multiple adverse health outcomes, including diseases associated with water contaminated with faecal and other hazardous substances (Bates et al., 2008). Contaminated water serves as a mechanism to transmit communicable diseases such as diarrhoea, cholera, dysentery, typhoid and guinea worm infection. Estimates by the WHO in 2008 showed that diarrhoeal disease claimed the lives of 2.5 million people. For children under five, this burden is greater than the combined burden of HIV/AIDS and malaria (WHO, 2011). Table 3 illustrates some of the diseases contracted by the households in the last four months as a result of water supply problems.

The majority of the respondents identified typhoid fever and dysentry as the major waterborne diseases that affected them. This agrees with the findings of Alao, who reported that residents of Saki complained of typhoid fever, cholera, diarrhoea and malaria as the major waterborne diseases in the area (Alao, 2003).

Oral interviews showed that the majority of the households in the study area do not regard water treatment as a precautionary measure, as few of the respondents treat their water before consumption. Contamination of source and distance to source of water are also some of the problems being faced.

Table 3. Water use problems/types of waterborne diseases

Source of water /Type of problem	Well water	Stream	Borehole	Water tanker	**Total**
Cholera	1	5	0	1	**7**
Typhoid fever	19	15	5	12	**51**
Dysentry	16	8	2	15	**41**
Schistosomiasis	0	8	0	0	**8**
Guinea Worm	0	2	0	1	**3**
Contamination	9	15	0	6	**30**
Distance to source	1	6	3	3	**13**
No response	2	4	1	0	**7**
Total	**48**	**63**	**11**	**38**	**160**

Source: Field Survey, 2014

Demand for water is fast outpacing its availability for consumption, and the supply of domestic water is seriously constrained by the rising population in Nassarawa Eggon town. On account of this, the price of water, of whatever grade, increases daily, and this is not helped by commercial water vendors who adopt arbitrary pricing of the product. The absence of tap water (pipe-borne water) and the dilapidated/abandoned waterworks (Lilley-Aboshon) in the town (located at 5 km along the Nassarawa Eggon-Akwanga road), has made life difficult and unsafe for accessing quality and potable water for domestic uses in Nassarawa Eggon town and its environs.

Some respondents interviewed in Jarmai ward noted that efforts were made by the present government of the state to address the problem of pipe-borne water in the town, but they barely receive a tap water supply once a month, and the quality and colour is appalling.

Insufficient and inadequate supply of water is the greatest single barrier to a healthy population and a productive community (Oguntoyinbo et al., 1983). Northern Nigeria experiences a general decline in water availability due to rainfall seasonality and variability (Woo and Tarhule, 1994). The need for water is constantly increasing because of the high rate of population growth and urbanization, which have not been accompanied with corresponding growth in water-producing sectors (Musa et al., 2009).

Seventy-five litres of water a day is necessary to protect against household diseases and 50 litres a day is necessary for basic family sanitation. The international consumption figures released by the Fourth World Water Forum (March 2006) indicate that a person living in an urban area uses an average of 250 litres/day; but individual consumption varies widely around the globe (Abaje et al., 2009). This is far above what is obtainable in Nassarawa Eggon as a semi-urban town, where about 80% of the households consume 100-200 litres per day as against the 250 litres/day per person posited by the Fourth World Water Forum in 2006.

The water supply situation in the rural areas is worse than in the urban areas. Very few rural areas can boast of safe sources of water supply in the tropics. Most rural inhabitants do not have access to good quality water, and as such they depend on traditional sources of water supply such as rain, springs, streams, ponds and hand-dug wells, whose quality is doubtful.

Access to clean water for drinking, cooking, bathing and other household needs is fundamental, but over one billion still lack a safe domestic water supply. Studies have also shown that, when water is polluted by microbes, the following diseases may ensure: dysentery, typhoid, diarrhoea and cholera (Ruth et al., 2001). Cases of waterborne diseases were also experienced by the inhabitants of the town. Distance to sources of water, especially borehole and streams, is one of the problems identified by the respondents (Table 3).

CONCLUSION

The study agrees with the findings of Gamedze et al. (2012), who through their study of the Siphofaneni area of Swaziland, discovered that average domestic water use per person per day was only 10 litres, and most households had unmet water demand for most domestic uses. Their findings suggested that income, household size and distance from homesteads to water sources are the major determinants of domestic water demand.

In the same vein, the findings of Adeoye et al. (2013), who appraised rural water supply in Kwara State, showed that more than 90% of the rural dwellers still depend on contaminated streams, rivers and unprotected shallow wells for their water needs. They also found out that only about

31.1% subject the water to some form of treatment before use.

With the appalling state of the water supply and the waterworks (abandoned for decades) in Nassarawa Eggon town, international donor organizations, federal government, Nasarawa state government and private individuals must come to the rescue of the people of this ancient town, to save the Eggon people from the imminent dangers of waterborne diseases if streams, hand-dug wells and water tankers are to be relied upon.

The very few boreholes in specific places within the town (mostly drilled and owned by individuals) are grossly inadequate to provide better and reliable quality and quantity of water for the ever-increasing population of Nassarawa Eggon town, especially with the sudden increase of inhabitants as a result of inter-ethnic and communal conflicts in parts of the state and Nassarawa Eggon Local Government Area. Water should be considered as an economic resource which requires adequate planning, design, implementation, operation and maintenance. Women, who play major roles in the domestic use of water, should be involved in planning, operation and maintenance of this economically scarce resource.

The politics of water must not be substituted for anything personal, as it affects every living thing (both plants and animals). Urgent legislative and executive processes aiming towards adequate, affordable, accessible and potable domestic water should be the top priority of the governments of Nigeria and Nasarawa State.

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