

Assessing Factors Influencing Domestic Water Supply Schemes in The Biu Plateau Region, Borno State, North-East, Nigeria

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Abstract -- Access to safe portable water by households is very crucial for both health and developmental issues at the national, regional and local levels. The Biu plateau region is principally underlain by crystalline and sedimentary rocks, and the most reliable sources of domestic water are from underground water since most surface water sources are seasonal. The area usually experiences water scarcity due to the seasonal nature of rainfall being responsible for underground recharge, and the associated problem of climate change worsened by insecurity that has ravaged the region for the past 8 years. Household heads were randomly selected and interviewed from 48 settlements across the 5 Local Government Areas that constitute the Biu plateau region located in the southern part of Borno State. The study reveals that households have to travel long distance sometimes over 10km in order to obtain their daily water supply. The mean per capita household water consumption in the Biu plateau region is generally below 25 litres per person per day which falls far below World Health Organization minimum standard. In some communities, as high as 10 man-hours are used daily by women and children in the process of water procurement for domestic purposes leading to conflicts among water users over water points are common at both household and community levels. Using the correlations test at 5% significant level, there was no significant relationship between the income of household heads and the other factors of domestic water supply and consumption in the Biu plateau region. As a way forward to the daily challenges households in the region face, this paper recommends for greater individual participation in the provision of domestic water sources so that per capita consumption rate can be increased significantly in the long run.

Indexed Terms: Household, per capita, distance, water consumption and domestic.

I. INTRODUCTION

Water is that precious commodity that is very vital for socio-economic development in the environment. It can be a matter of life or death depending on how it

occurs or how man manages it and if properly managed can be an important instrument for economic survival and growth (Ndububa, 2014; Ohwo and Abutu, 2014). Generally, water for domestic uses is viewed as the most significant infrastructure for development in any given society (Nwaiwu and Okuofu, 2006). Therefore, water scarcity can place great restrictions on development and certain forms of livelihood. Developing countries generally are facing increased water demands and shortages. Authors like Fau, et, al (2013) and Navascues (2017) have observed that domestic water consumption in the rural areas is highly influenced by factors such as water supply patterns, the characteristics of household heads, use of water appliances at home and vegetable gardening. In addition, domestic water supplies schemes may be affected by the intensification of extreme natural events such as drought floods etc, that are usually enhanced by climate change (Navascues, 2017). Hence the question of types and extents of adjustments to water needs by households in local areas need to be investigated in order to understand their potential adaptive capacity to these environmental limitations.

In every settlement visited during the course of this research, domestic water was rated high and considered the most significant infrastructure for development. Water scarcity places great restrictions on economic advancement and certain forms of livelihood such as recreation and entertainment. As early as 4 am in the morning, for the women and children in the villages the day's work has already began and top on the list is the daily trek for water (People and Planet, 1993). This daily trek in search of water for domestic uses covers varying distances depending on one's location. The women will return by 8am with their precious head load of water. The water is then divided into three: one part is put into water jars "Glam" and stored for drinking, the second

for household use, while the third for the evening bath. The morning bath is usually taken at source. Similarly, laundry is tied in a bundle and strapped to the back for the trek to the riverside where it is washed. Women have to sweep their home and do other domestic chores and the morning is well-advanced. They are too exhausted to go to the farm or engage in other economic activities, as some household heads remarked that “water hunger is killing us here” (Bwala, 2011). Nothing goes well wherever water for domestic uses is scarce. On week days when the children eventually make it to the classrooms, they are worn out by water-fetching too and end up sleeping during the lesson hours while in school. Thus the focus of this paper is to examine the major socio-economic factors that influence household consumption pattern of water used for domestic purposes in the Biu Plateau area.

II. STUDY AREA AND METHODOLOGY

The Biu Plateau region of Borno State is located approximately between latitudes 10° and 11° 30’ N of the equator and longitudes 11° E and 13° E of the Greenwich meridian. The Biu Plateau is volcanic in origin and is characterized mainly by Sandstone, Granite, Gneiss, Biotite and Basalt rocks. Thus, many flat-topped hills are found especially in the southern part. Extinct volcanoes are also found all over the Biu plateau region, some have well developed craters such as Tilla Lake (Davies, 1956 and Prusag, 1996). Throughout the region there are a number of prominent hills such as Walama, Marama, Bilatum, Ngwa, Kwaba, e.t.c. with the highest point at Tilla hill with a height of over 900 meters above sea level. Topographically the dominant physical features of this region are the Biu Plateau and Plains. The main Biu plateau stands some 760 meters above sea level and surrounded by the plains or lowlands. The Biu plateau covers an estimated area of 5,200 km square and has scarp all round it which slopes off gradually to the north while the southern part has steep precipitous escarpments. To the east and west it falls down in steps, such that in the western part of the plateau there are areas roughly 250 meters lower than the main Biu plateau.

Thus the Biu plateau region refers to the former Biu Division which now consists of five Local

Government Areas (Biu, Shani, Kwaya-Kusar, Bayo and Hawul LGAs) in southern Borno State. Administratively, the Biu plateau is found mainly in Biu, Hawul and parts of Kwaya-Kusar LGAs, while the plains are mostly found in Bayo and Shani LGAs. This region is bounded to the east and south by Adamawa State, to the west lies Gombe State while the northern section is bounded by Yobe State and Damboa and Chibok LGAs in Borno State. The most urbanized settlement in the region is Biu town, which lies 185 Km south of Maiduguri the Borno State capital. This region covers a total area of 8,641-kilometer square with population of 534,171 persons (National Population Commission, 2007). Thus, the profile of the Biu Plateau region makes a study of this nature worth undertaking.

The baseline data for this paper comes from my Ph.D thesis (Bwala, 2011) which has been updated to capture recent developments in the Biu plateau region of Borno State and the northeastern parts of the country. Thus interview schedule forms the main instrument of collecting primary data while other forms of primary data were also collected through formal interviews with community opinion leaders conducted in each of the sampled settlements. Primary data collected from the selected respondents include socio-economic characteristics such as size of household, income of household heads, ownership of domestic water source, educational status of the household head and household domestic water consumption pattern. The distribution of sampled respondents is as presented in Table 1.

Table1; Administration of questionnaires in the Study area

LGA	Population	Total no. of settlements	No. of sample settlements	No. of selected households
Biu	120,314	86	9	113
Bayo	56,500	61	6	72
Hawul	176,072	135	14	171
Kwaya Kusar	102,317	65	7	82
Shani	78,978	118	12	105
Total	534,171	465	48	543

Source: Field Survey, 2017

From table 1, the sample size for each LGA was calculated by using stratified random selection of 10%

of households in each of the 5 LGAs making up the Biu Plateau region. The stratification of settlements in the study area was based on administrative functions and population size. The method of Ahmed and Smith (1988) was adopted for estimating the daily per capita domestic water consumption at household levels. Statistically regression analysis and also ANOVA were used to test for differences in Per capita consumption (PCC) of domestic water among the five LGAs that make up the Biu plateau region.

III. RESULTS AND DISCUSSION

The major socio- cultural parameters that are responsible for shaping the current pattern of domestic water consumption by households in the Biu plateau area as presented and discussed below.

A. Accessibility to Water Supply Sources

Households in the Biu plateau region have to travel varying distances in order to obtain their domestic water supply. There are many dimensions to the distance covered in this process as captured in Table 2. The significance of distance mostly lies in the availability and accessibility of water as well as the time spent in its procurement daily.

Table 2: Mean distances covered by households to fetch water daily

Distance of household domestic water sources	Bayo LGA	Biu LGA	Hawul LGA	K/Kusar LGA	Shani LGA
Households that have their water sources within	6 (8)	19 (17)	13 (8)	11(13)	0 (0)
Households that cover < 1Km	50 (69)	77 (68)	98 (57)	44(54)	23(22)
Households that cover between 1- 2Km	15 (22)	15 (13)	58(34)	24(29)	72(69)
Households that cover 3Km and above	1 (1)	2 (2)	2 (1)	3(4)	10(9)

Source; Field survey, 2017

Generally majority of households in this region obtain their domestic water supplies from sources that are located at distances usually less than 1 Km away from their homes. At the L.G.A. level similar pattern can be observed except that in Shani LGA majority of the sampled households obtained their domestic water supply at distances above 1 Km away. Thus it followed that Shani LGA has the longest mean distance of 1.2Km that every household in the area covers daily as well as the highest mean duration of 43 minutes per trip. Therefore Shani LGA had amongst the lowest mean daily trips per household and a resultant low per capita consumption per day in whole region. The situation was such that in Shani LGA about 78% of households had to cover over 1km to fetch water for domestic uses; in Hawul LGA it was 35% and 33% for K/Kusar LGA while those in Biu and Bayo LGAs were 15% and 22% respectively.

Individual settlements where households had to go very long distances were such that in Grim some had to cover up to 5km to fetch domestic water daily. Those that had to go 3 Km were recorded in places like Biu, Wuyo, Wallama, Kwaya-Kusar and Peta, and yet others had to cover up to 2Km as in Bilatum, Azare, Pelachroma Briyel, Kigir, Gusi, Gasi, Shani, Gundiri and Borkulok. It was also observed that areas where very high number of households fetched their domestic water within were also areas dominated by correspondingly high levels of private participation in domestic water supply.

B. Time spent in procuring Domestic Water

As early as 4am and dawn has not yet fully commenced, but for the women and children in the villages the day’s work has already began and top on the list is the daily trek for water (People and Planet, 1993). This daily trek in search of water for domestic uses covers varying distances depending on one’s location as can be seen in Table 3. The century-old water procession in the region is such that around midnights especially on moonlit nights and during the hot dry season women and children stay awake for this is the time most favoured for bathing and fetching water.

Table 3; The pattern of man-hours used in domestic water procurement

Mean daily man-hours	No. of settlements	Location of the settlements
Below 2hours	2	Balbaya, Guwal
2-3 hours	16	Durkwa, Bilatum, Yimirshika, Marama, Briyel, Jaragol, Dampitam, Wurojam, Nggabu-Naira, Tagja, Biu, Waka, Kimba, Wakama, Wandali, Billa
4-5 hours	15	Hema, Nggabu, Pelachiroma, Wuyo, Teli, Budam, Bakaina, Lakundum, Pajala, Mandafuma, Yamarkumi, Mirnga, Kwaya-Kusar, Milda, Peta
6-7 hours	9	Azare, Grim, Sakwa, Gwaski, Kwajjafa, Shani, Gundiri, Borkulok, Gusi
8-9 hours	4	Kwaya-Bura, Gwangzang, Gasi, Gur
10 hours and above	2	Wallama, Kigir

Source; Field survey, 2017

From the available data, it can be observed that the number of Man-hours involved in searching for domestic water by households in the region varies from one location to another. However the situation becomes clearer when we translate the man-hours to look at how much time is actually utilized at the household level. The highest number of hours used comes from Shani LGA with 6 hours and 30 minutes and closely followed by Hawul LGA with 5 hours and 19 minutes; Kwaya-Kusar LGA with 4 hours and 26 minutes and Biu LGA has 4 hours per household per day. While in Bayo LGA on daily basis every household loses only 3 hours in search of domestic water during the same period. The implication is that much of the day is wasted in search of water for domestic uses at the expense of doing other socio-economic activities as well as the associated risk. Thus, situations like these are responsible for slowing down the rate of economic development in this region. It was also noted that the higher the number of man-hours used, signifies the level of water scarcity in that location during the period of study.

At the regional level households in Shani LGA tend to trek longer distances in order to obtain their domestic water supplies as an average household has to cover about 1.2km daily to look for water from the available sources locally. In Biu LGA households travel the shortest distance of 429m daily to fetch water for their domestic needs followed closely by Bayo, Hawul and K/Kusar LGAs respectively. The distance covered in the process of obtaining domestic water must have influenced daily per capita consumption in the area. For instance Shani LGA has the farthest mean distance as well as the lowest per capita consumption while Biu LGA has the least mean distance and a very high per capita consumption. This implies that distance to a water source is a factor in domestic water availability in the Biu Plateau region.

As observed by Nwaiwu and Okuofu (2006) water can be a limiting factor to the development of a community as well as its members. Hence water shortages always have devastating effects on members of such water-scarce locations or settlements. The effect is such that sometimes it takes the entire family almost the whole day to fetch enough water for domestic use. A community leader in Azare the Headquarters of Hawul LGA once observed during a focus group discussion(FGD), that during the peak period of water crisis our women (wives) hardly get pregnant, as they spend all day and night hours at the few water sources while the men take watch at home with the children. He therefore called for immediate intervention from those concerned before the situation goes beyond their capacity to cope.

C. Educational status of Households

As we all know education is a strong factor in character modeling, hence it is expected that certain behavioral pattern should be seen between those with formal education and those without. Educationally, most of the respondents (Households heads) fall within the range of not having any form of formal education and maximum of having gone through Secondary School level (O/Level). While the proportion continues to decline with increasing level of education up to Postgraduate level (see Table 4).

Table 4; Educational characteristics of Households and their water consumption

Educational status	No. of House holds	House hold size (mean)	Years of residence(mean)	Per capita consumption(litres)
No education	72	11	36	30
Quaranic edu.	68	15	30	26
Primary Sch.	103	10	31	28
O/level	153	9	18	32
A/level	103	9	16	33
Degree	35	6	14	43
Postgraduate	9	6	15	43

Source; Field survey, 2017

A closer observation with regards to Table 4 will reveal that there is an inverse relationship between household size, educational level as well as the years of residency. The combined effect of these factors leads to increased domestic water consumption at the household level which is easily translated into higher per capita consumption on daily basis. Hence with higher educational qualification the rate of per capita consumption increases indicating improvement in living standard. Statistically, education correlates negatively with other factors such as household size, distance to water sources, Time taken to fetch a trip of water, the number of trips, quantity fetched and total daily household consumption. However there appears to be a significant relationship between educational status and household size, the number of trips fetched per day as well as the quantities fetched and consumed daily at 5% level of significance.

D. Household income

In this study, the estimated average income of households is about 28,586 Naira per month with a minimum of 5,000 Naira and maximum monthly income of about 200,000 Naira. This tends to suggest that the income of household heads in the Biu plateau region varies from one household to another and from one settlement to the next. Statistically there was no significant difference in the income level of individual households at 5% significant level using T test. And also using the correlations test at 5% significant level, there was no significant relationship between the income of household head and the other factors of domestic water supply and consumption in the Biu

plateau region. Therefore income alone has not played any dominant role in the provision and consumption of domestic water at the regional scale as far as this study is concerned.

E. Duration of residency

The mean duration of residency in the region was observed to be highest amongst households with lower educational cadre of Primary, Quaranic and those who have not been to school at all (have spent between 21, 30 and 36 years respectively). However, the mean duration of residency continued to drop rapidly from 18 years to 14 years with increasing level of education. Similar pattern can be seen at the LGA level, with Hawul LGA recording as high as 50 years as the mean duration for those without formal education, while Shani LGA recorded the least mean duration of 5 years for those with degree and equivalent. The duration of residency reported by the respondents varied and also influenced by their educational status. It was observed that education plays a critical role in determining occupational pattern and to some extent income levels. These factors combine to affect water consumption pattern in this region. Based on the analyzed data, the mean years of residency can be observed in Table 5.

Table 5; Duration of Household residency and educational status

Educational status	Bayo LGA	Biu LGA	Hawul LGA	Kwaya-Kusar LGA	Shani LGA
No education	18(years)	33(years)	50(years)	31(years)	31(years)
Quaranic	42 “	31 “	23 “	26 “	22 “
Primary sch.	40 ”	21 “	37 “	29 “	23 “
O/level	22 “	18 “	18 “	14 “	16 “
A/level	17 “	14 “	20 “	12 “	15 “
Degree	19 “	17 “	10 “	8 “	5 “
Postgraduate	0 “	12 “	16 “	22 “	0

Source; Field survey, 2017

It could be observed from Table 5 that those households with very low educational levels tend to stay longer in a particular location than those with higher educational qualifications. This suggests that with higher educational qualifications the tendency to

migrate in search of economic prospects in the urban centers is usually higher. Hence households that are always on the move are not likely to invest in the ownership of their domestic water source. More so the less mobile households do not usually invest in acquiring modern facilities that require more quantity of water to maintain. It was also observed that with higher education (in the range of A/level and above) are mostly in the civil service and are subject to transfers or even change in jobs. Although the unskilled labourers (those without formal education or with O/level and below) tend to be mobile too, but when viewed from the household perspective the picture appears different. This is because a well established household finds it difficult to migrate as a result of socio-cultural and economic ties in their communities.

F. Household Size

For the purpose of this Study, household size refers to the number of people living together as one family. The mean household size for the whole region is put at 10 persons per household. The survey result also shows that there were 7 single households and only one household had up to 40 persons. A further breakdown of household characteristics in the Biu plateau region reveals that 7% have between 20-40 persons per household; 35% have between 10-19 persons per household and 58% have less than 10 persons per household, while the highest concentration of households lies in the range of 7 and 8 persons per household.

Thus it can be observed that household size has some degree of relationship with other variables of water consumption. Hence household size was found to have negative and significant correlation with educational level at 5% significant level. Which implies that those with very large household sizes tend to have little or no formal education while comparatively those with smaller household sizes tend to have higher levels of education. By implication, fertility levels of household heads with higher educational qualifications are lower than those without education. Similarly, house size had a significant relationship with the number of trips per day per household, the number of man-hours utilized in fetching domestic water as well as the total quantity consumed in a day.

Means of Fetching Water

Majority of Household members (85% of sampled households) in the region still use physical labour by carrying domestic water into homes using containers being carried mostly on their heads. Some carry water by use of animals such as donkeys especially in the rural settlements and very common among the few and scattered Fulani settlements (locally called “Riga”). Other privileged families use the common bicycle cart or “Kuskus”, Bicycles, motorcycles and to some extent private cars. Generally it was observed that the terrain influences the location of domestic water sites and accessibility restricts the free movement of any form of modern transportation system. So the use of human head as the most vital mode of transporting domestic water is a matter of necessity rather than choice.

Table 6: Means of water transportation by Households in the LGAs

Means	Hawul	K/Kusar	Shani	Bayo	Biu	Total
Donkey	0	0	1	3	0	4
Bicycle	3	1	7	1	2	14
Motorcycle	1	0	2	3	3	9
Cars	0	0	0	0	1	1
Kuskus	1	14	14	15	9	53
Head	166	67	81	50	98	462

Source; Field Survey, 2011

Table 6 gives the picture of the common means of transporting domestic water in the area apart from carrying it on the head. The use of “Kuskus” and Jega are recent introduction and becoming more popular by the day as excesses fetched could be sold outside the family for an income to those without.

G. Timing for Water Fetching by Household

In localities where households could fetch water at any time of the day, it means that most households own their water sources (i.e. having private wells located within the compound), and also where potable water is readily available hence no competition on such sources locally. Therefore the lower percent of those households who fetch water at anytime in Shani and Hawul LGAs signifies some measure of scarcity, while of course, the higher percent for Bayo and

Kwaya-Kusar LGAs indicated more availability even at the peak of water scarcity in the region.

Thus, gives a comparative analysis of the different periods of the day that are usually devoted for fetching water used locally. Thus in the region as a whole, 71% of households surveyed usually fetch their water during the morning and evening hours of the day; another 16% of households reported that their most convenient hours of fetching water was during the morning hours (between 6 am-9 am) while 8% prefers the evening hours (4 pm-6 pm). Only 5% of households are reported to have no fixed time for fetching water in the day, but at any time the need arises. However the men prefer late night hours between from 10pm-12 midnight and also very early morning hours from 4am-6am so as to avoid peak pressure periods that are usually dominated by women and children. For school pupils the evening hours are the most preferred after they have returned from school.

H. Purchase of Domestic water

Result of the interviews conducted on households in the region reveals that out of the 543 respondents only 244 households do purchase water to supplement the quantity fetched daily. By this, about 45% of households do purchase water from vendors who rely on local sources and also do charge between 5 Naira to 40 Naira per 20 litres of jericane. The proportion of households engaged in purchasing water for daily use tends to vary from one LGA to another and also from settlement to settlement. In some instances, no household was found to be buying water as all required quantity was procured by the use of family members.

At the LGA level, about 56% of households in Bayo LGA do purchase water for daily uses; 52% of households in Shani LGA; 51% of households in Kwaya-Kusar LGA; 45% of households in Biu LGA and only 32% of households in Hawul LGA. The observed high proportion of households engaged in the buying of water is mostly attributed to local scarcity, religious obligations(such as the practice of keeping women in Pudah) where husbands become the sole provider as well as accessibility of water sources. Whereas settlements where the proportion of domestic water buyers is low are usually localities with relative water abundance and are also characterized by higher

per capita consumption. Hence respondents in Guwal and Billa (K/Kusar LGA); Gur, Mandafuma and Mirnga (Biu LGA); Hema, Durkwa, Gwangzang, Pelachiroma and Nggabu (Hawul LGA); and those of Nggabu-Naira, Wallama, Pajala, Tagja and Gundiri (Shani LGA) were not engaged in the purchase of domestic water. Settlements where the rate of water purchase is significantly high include Kwaya-Kusar town where about 93% of households buy water from vendors daily; in Azare is 90% of households; Marama is 70%; Wakama is 64%; Wuyo is 55% and lower in Kwaya-Bura at 36% and Briyel with only 22%. While in Biu and Shani towns almost every household is engaged in buying of water daily for domestic uses.

Health wise, the quality of domestic water bought by households was sought, and it was that in Bayo LGA, 71% of the households engaged in buying water do not usually care to ask vendors the source of water they supply. The respondents claim to know the vendors personally as well as the sources of supply, since the vendors are locals. The remaining 29% of households do care to find out the particular source of water they buy for domestic uses especially as it concerns drinking water. Respondents in Guwal and Billa do not engage in buying water for their domestic uses but that each household was responsible for drawing enough domestic water by respective members. In Biu LGA, 78% of buyers care to know from vendors the sources of water before they buy while 22% of such buyers do not usually care to ask. For Hawul LGA, 61% of the buyers reported that they do care to know the source of water they buy through inquiry from the vendors before purchase while 39% of such households do not usually ask. And in Shani LGA, only 5% of buyers do care to know from these vendors before buying while majority of buyers (95%) here do not care to ask since they said that the water points are known to all. The reasons given by the respondents why some households care to know the sources of water sold to them before buying is because of reasons such as taste preference and other perceived quality differences in the various sources to be use for domestic purposes.

I. Estimated Domestic water Demand Model for the Region

Having considered the various circumstances households undergo in their effort to procure water for

daily consumption. The study also investigated the relationships among the identified variables of domestic water consumption. Therefore, correlations test conducted shows that per capita consumption of domestic water by households in the Biu plateau region correlates negatively with household size, distance of water sources, time taken to make a trip, the number of trips per day and the quantity consumed per day. And also per capita consumption rate tends to have a significant relationship with household size, distance of water source, time taken to make a trip and educational level of household head at 5% significant level. These observed relationships were further investigated using regression analysis in order to establish the pattern of relationship existing between these factors of consumption. The socio-economic variables considered in developing the resultant model include the size of household, income of household head, educational qualification of the household head, years of residency of household, per capita consumption, total daily water consumption per household, duration of time spent in fetching domestic water and the number of trips made per day. Regression analysis was conducted involving these 8 variables of which consumption was regressed against and the resulting regression equation is as follows;

$$\text{Consumption} = 124 + 0.0002 \text{ Time} + 1.10 \text{ Education} + 14.8 \text{ Household size}$$

Thus 3 variables entered that is; Time, Education and Household size. This gives us the domestic water demand model that can be used for purposes of predicting daily household domestic water consumption in this region. The calculated coefficient of determination (R²) indicates that about 32% of the variation in domestic water consumption in the Biu plateau region is accounted for by these 3 variables. While all the 8 factors combined gives R Square = 0.717 which means that they accounted for approximately 72% of variation in daily household water consumption.

IV. CONCLUSION AND RECOMMENDATIONS

The central role played by water in every household on daily basis is a known fact that needs no emphasis. However the huddles that has to be overcome in the process of domestic water procurement in the Biu

plateau region is unique due to the nature of the terrain. The following socio-economic factors have been identified as the driving force in determining the overall quantity of water consumed by individual households as well as per capita daily consumption in the region. These factors are household size, educational status, duration of residency, income level, distance to water source and the amount of time spent in fetching water for domestic purposes. Statistically, domestic water consumption in this region is principally driven by household size, the level education and time spent in water procurement.

Therefore for most communities in this region to attain the desired minimum per capita daily water consumption of 25 litres as recommended by World Health Organization, there is the need to educate the individuals on benefits sustainable utilization of available water sources used for domestic purposes. The paper also suggests that individual households especially in the rural areas should try and own their respective domestic water sources within reasonable distances from the home so to free women and children from the of fetching water over long distances with attendant hazards. The conflicts that are usually experienced at water points could be better resolved through regular meetings with opinion leaders. The sitting of water sources like community wells and boreholes by external agencies should be done in agreement with the benefiting communities in order to achieve sustainable use by all.

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