Rural Women's Access and Adaptation Strategies to Water Scarcity in Semi-Arid Borno State, Nigeria

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ABSTRACT

The study assessed the extent of water scarcity and women's coping strategies to water shortages in a semi-arid environment through FGDs and interviews conducted during the dry and rainy seasons. Based on interviews conducted with 540 rural women in 18 settlements, the study revealed that per capita water use was 10.58 and 10.66 litres in the dry and rainy seasons respectively which are below the minimum 20 litres per capita recommended by WHO/UNICEF (2006) for rural areas. Differing types of responses to water scarcity which were either means of simply getting by or representing real forms of adaptation were observed. The findings revealed the central role of women in rural water supply and their ingenuity to ensure household survival in times of water stress which ought to be incorporated into sustainable water management debates by incorporating the gender dimensions. This is particularly important in the face of predicted further decrease in water availability due to climate variability and change in semi-arid regions.

Keywords: Water Scarcity, Adaptation, Rural Women, Nigeria

INTRODUCTION

The semi-arid zone of north-eastern Borno State, Nigeria is an area of natural water scarcity characterised by low and highly variable rainfall with an annual average of 250mm and a continuous decline in water availability. The area also lacks adequate water supply infrastructure, increasing populations and other forms of human induced water scarcity all of which occur simultaneously leading to a complex water scenario.

In this area and other parts of rural Africa in general, the provision of household water is a culturally assigned responsibility of women (Majwahuzi, 2002; Wahaj and Hartl, 2007). As primary providers and end-users of domestic water, women are disproportionately affected by water scarcity such that when water supplies dry up or become polluted, women spend additional time and energy that may be used for other productive activities to secure household water. The women in this water scarce environment have developed a range of coping strategies to ensure household survival in times of water stress and in so doing transformed their position from victims of water scarcity to managers of water. The women have accumulated valuable indigenous knowledge and practices which ought to be incorporated in to formal analysis of sustainable water management especially in the face of a continuous and predicted further decline in water availability due to climate change. This study was an attempt to document the central role of women in household water supply and adaptation strategies to water scarcity in rural environments.

DEFINITIONAL AND CONCEPTUAL FRAMEWORK

The framework employed to explore women's access and adaptation to water scarcity in this study is based on the vulnerability and resilience framework. Rockstrom (2003) observes that risks and vulnerability resulting from uncertainty and change can be adequately countered by

ISSN: 2223-9944, eISSN: 2223-9553

building on local and customary adaptive practices that directly confront variability. In arid and semi-arid lands, adaptation is about tackling the effects of declining resource base and environmental degradation mainly through increasing the resilience and capacity to cope with its physical impacts. As observed by Reynolds et al., (2007) adaptation in rural areas of the Third World is largely autonomous and private whereby individuals and households initiate and implement strategies in response to their changing environments.

Examining the situation of rural women within the resilience framework reveals women's capabilities, resourcefulness and opportunities to adapt in spite of physical and human constraints (Mortimore et al., 2009). In essence, the resilience concept moves the analysis beyond the coordinates of vulnerability to risk and uncertainty by embracing a more holistic view that explores the diverse portfolio of adaptive activities that not only enhance livelihoods but also contribute to environmental sustainability. Rather than relying on exogenous technical dimensions of adaptation, indigenous knowledge is identified as a key component of the adaptive system, and of the interactions between human and ecological systems that lie at the heart of arid land management (Reynolds, et al., 2007).

THE STUDY AREA AND METHODOLOGY

Borno state lies in the extreme north east corner of Nigeria between latitudes 9^0 57" and 13^0 44" north and longitudes 11^0 31" and 13^0 45" east. It occupies an area of 69,435 km^2 sharing border with three states namely Adamawa State to the south, Gombe State to the south west, and Yobe State to the west. To the north, north east and east, it is bordered by Niger Republic, Chad and Cameroon respectively.

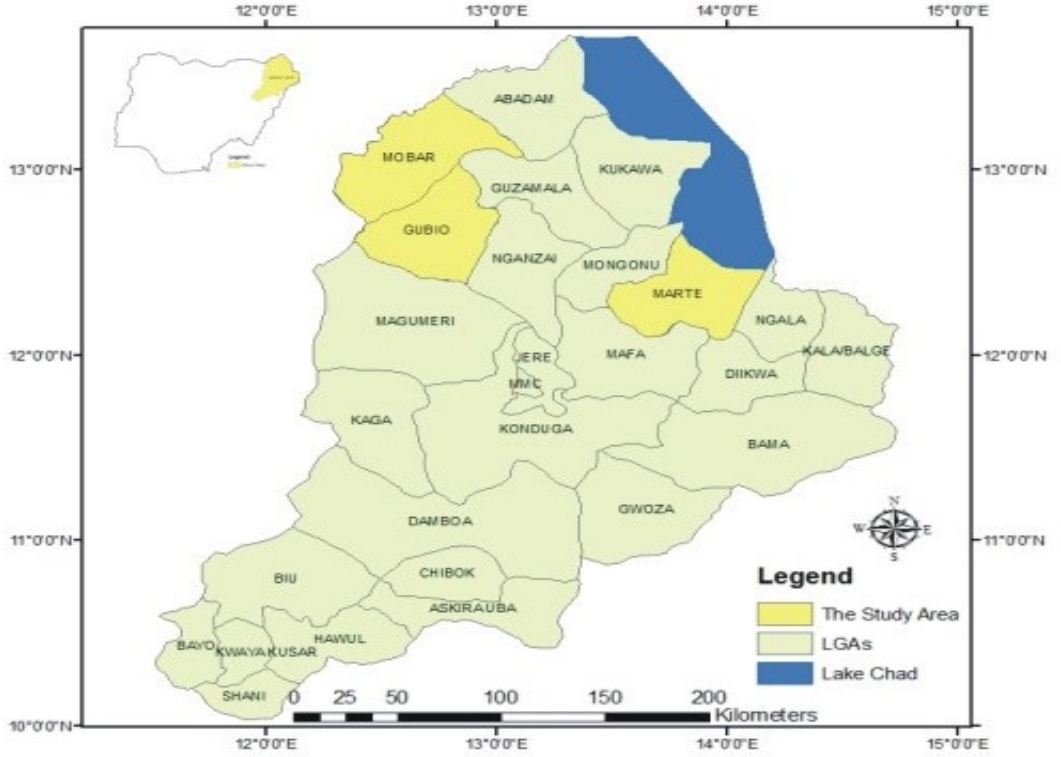

Figure 1. Borno state, Nigeria showing selected LGAs Source: Macmillan Nigeria Secondary Atlas (Dada et al., 2006).

The state comprises of twenty-seven Local Government Areas (LGAs) and nine of these LGAs make up the northern ecological zone of Borno state. Three out of the nine LGAs namely Gubio, Marte and Mobbar were purposely selected for this study and they have a population of about 397,328 according to the National Population Census (2006) split almost

ISSN: 2223-9944, eISSN: 2223-9553

equally between males and females. The area is largely populated by the Kanuri, the largest ethnic group in the state. The Kanuri are ardent Muslims and basically agriculturalist. In accordance with Islamic law, polygamy is permitted and married women are ideally supposed to be secluded. This practice is however rare in rural areas, where the productive and reproductive roles of women are vital to household survival. Figure 1 shows the location of the study area and the sample LGAs.

METHODOLOGY

Areal Sampling

The sample consists of three of the nine LGAs that comprise Northern Borno state namely: Gubio, Marte, and Mobbar LGAs. These LGAs were purposely selected to contrast the diversity of the area in terms of water availability which allows for an analysis of domestic water scarcity under different hydrological conditions. For instance, Gubio LGA does not possess any form of surface water, while in Mobbar LGA, the Komadugu-Yobe river system flows across the area from west to east into the Lake Chad (identified as Africa's largest inland lake). Marte LGA on the other hand is located on the shores of the Lake Chad. Thus, the different water conditions all in a semi-arid environment provided a broad perspective to examine water scarcity.

Northern Borno state is characterized by dispersed settlements with many people living in scattered compounds or households which allows for individual decision-making in domestic water demand and supply. The study therefore covered six dispersed settlements in each of the selected LGAs in order to capture differences in water access and management where they exist.

Respondents Sampling

It has been pointed out in the literature that the inclusion of women as a category of study in geographical research is to produce a better understanding of human occupancy of the earth surface and to provide knowledge useful to the struggle for gender equality (McLafferty, 1995). Gender studies in Geography aim to *"put women on the map of geographic research"* by emphasizing how women's perceptions and experiences differ from those of men, thereby providing knowledge useful to the struggle for gender equality (Mattingly and Falconer Al-Hindi, 1995). Taking into consideration the fact that women are differentially and severely affected by water scarcity compared to their male counterparts (Majwahuzi 2002; Wahaj and Hartl, 2007) this study primarily centred on women.

Women representing the different age groups were interviewed using the accidental sampling technique where every woman available had an equal opportunity of being selected. A total of 540 women with 30 per settlement making 180 in each local government were interviewed. The interviews were conducted in the rainy season (January-February 2014) and in the rainy season (August-September 2014).

The information obtained from interviews was collaborated with additional data collected through Focus Group Discussions (FGDs) and In-depth Interviews (IDIs) with key informant, usually the village head locally known as the *Lawan.* The FGDs composed of six to ten participants controlling for gender and generation differences. Discussions were guided by a checklist of issues and open-ended questions. Two FGDs were conducted in each local government. Thus, the groups selected are as follows:

i. Women group: aged 15 to 45yeras.

ii. Men group: aged 18 to 50years.

ISSN: 2223-9944, eISSN: 2223-9553

In analysing the field data, relevant descriptive statistics were used in explaining the socio-economic status of women under investigation as well as the nature of water scarcity in the area. The level of water scarcity was determined using the WHO/UNICEF (2006) recommended minimum amount of water per person per day (1/c/d), which is 20/1/c/d, within distance of 1 km. The WHO/UNICEF minimum standards was used because it is the official UN body charged with monitoring progress towards meeting the MDG goal on water supply and sanitation. The FGDs were audio-recorded and transcribed.

With regard to the researcher's positionality, one of us being female facilitated easy access to the women because the men may not have allowed their wives to participate if both researchers were male. The Muslim and Kanuri backgrounds also meant that we were not only aware of religious and local customs but also understand the local Kanuri language (majority of the respondents are Muslim and of the Kanuri tribe).

RESULTS

Sources of Water Supply in the Area

Generally, the major sources of water supply are boreholes, cemented and hand-dug wells, and open surface water. Based on the WHO/UNICEF (2006) classifications, protected wells, and boreholes are considered improved sources of supply while the open surface water sources are unimproved. Improved sources are considered better sources in terms of quality and to certain degree, reliability while unimproved sources tend to be highly seasonal and are generally open to contamination and carry health risks. Open surface water for instance is only available during the 3- 4 months rainy season and shortly after. It was also discovered that a single water source serves several dispersed settlements. In Ngetra district of Gubio LGA for instance, the primary source of water is a cemented well that was constructed in 1954. It is 80 metres deep and the only source that serves more than ten dispersed settlements located at various distances from Ngetra village where the well is located. The farthest settlement, Maina Buwarti, is located 7 km away. There are however several abandoned water projects scattered in most of the study sites. The existence of old wells and non-functional boreholes indicate the inability of authorities (the State Water Corporation and the Local Government authorities) to operate and maintain effective and efficient water services and increase supplies to meet the growing demands over the years. As a result, the operational wells are over-exploited such that the wells sometimes reach critically low levels of water yields and drawing water comes to a complete standstill with women spending hours in waiting time for the wells to recharge.

In another part of the study area, (Marte LGA), two private boreholes which have strong pumping capacities were seen but women are not allowed to fetch water from these sources. Rather, they are exclusively used to water livestock by the men while women wait for hours at their assigned boreholes indicating that women's water needs receive lower priorities. The village head however noted that the men in the communities contributed money to construct the borehole and its maintenance and hence the men must have exclusive usage. FGD with the men group in Marte LGA indicate that the men paid for the construction of the boreholes and contribute money for fuelling generators that power the boreholes and therefore must have exclusive access to this particular water source. This clearly reveals that the prevailing power relations between men and women ensure that the water needs of women receive lower priority than those of men. It is a dimension of water scarcity that is related to what Metha (2001) describes as distributional and relational aspects of scarcity which demonstrate the tremendous inequality in access and control over water resources. Six newly installed solar powered boreholes were also seen in Marte LGA but the "traditional" ageing boreholes

ISSN: 2223-9944, eISSN: 2223-9553

remain the choice of domestic water supply despite their diminished pumping capacity. The FGD revealed that women are yet to get used to the solar powered boreholes which work only during the daytime. Women complain that water is needed at homes before sun rise when the solar powered boreholes have not yet begun to operate and even after sunset when they must have stopped operating. The taste of the water from these newly installed boreholes according to the women is unpalatable and so it is used only for other domestic activities and not for drinking and cooking. This seems to support the proposition by Rattgeber (1996) that populations hardly tend to adjust their water related practices to take full advantage of new water sources. This is because engineers and water planners rarely examine the pattern of needs of different groups of potential users and take this information into account when designing or locating the system. In this perspective, the findings revealed that the construction of additional supplies in Marte LGA did not necessarily result in increased use of water by women. The major implication here is the need to fully involve women in decisions regarding the provision, location and management of water supply schemes. Indeed if water supply schemes are intended to be efficiently and effectively utilised, the views of the major user group namely the women need to be incorporated.

The Role of Women in Household Water Provision

As in most parts of rural Africa (Majwahuzi, 2002; Whaj and Hartl, 2007), the study revealed that providing water for domestic use in the area is a women's culturally assigned responsibility. The women involved in providing water are often in the economically active age group and the findings of this study revealed that 88% of the respondents belong to the 15-44 years age groups which are indispensable for water collection.

This gender defined role of water provision is however not static and changes with severity of water scarcity, the seasons and area-specific norms. Thus, it was found that in Gubio LGA, due to the hardship involved in drawing water from deep wells and transporting it home, women are assisted by their husbands and children in fetching water during the dry season. Due to the sheer depth of the wells (usually about 80 metres), women alone cannot draw water to the surface and hence the involvement of men. Household labour is divided in such a way that with the assistance of the women and children, the men draw the water and women transport it home. Some respondents however indicated being the sole providers of water even under such hardships and in such cases, fetching water is usually a group affair involving other women with the assistance of their children. This shows that in times of difficulties, the gender division of labour becomes blurred and the resilience of the whole community to overcome the hardships comes to the fore. Hence, while women are the main providers of water, the level of water scarcity and the absence of farming activities during the dry season sometimes change domestic labour dynamics. A participant so eloquently put it:

> *"Life has become so hard; our intense devotion is just fetching water.... merely for survival".*

Another woman clearly saddened by her situation explained:

> *look at me, I am less than 40 years old, my hair is all grey and my skin as you can see is all wrinkles...this is all due to hardship...one has no time to rest, I cannot afford to stay back at home even after childbirth. A woman in our community gave birth to at the farm the other day..*

During the rainy season however, fetching water is entirely a women's affair when the source of water is no longer the wells but open surface where water is easily scooped into containers and vessels.

ISSN: 2223-9944, eISSN: 2223-9553

In Marte LGA, there seems to be a blurred division between domestic and livestock water needs and as such, men sometimes assist women in the provision of water. This is particularly the case in instances where the men do not find it comfortable to allow their women to fetch water alone at night. The picture is completely different in Mobbar LGA where women are the sole providers of domestic water in both seasons. The women argued that men do not engage in water provision activities under any circumstance. It does not matter if the woman is sick or has given birth; men do not provide water for domestic purposes under any circumstance and in such situations, women rely on the assistance of their fellow women in a collective way that she may receive even more quantity of water than she usually brings home. According to the women:

> *"Life is an endless journey of fetching water, collecting fuel wood, grinding grain, childbirth, and infant care... the most burdensome of these activities is fetching water".*

Interview with male participants in the FGDs in Mobbar LGA as to who is responsible for the provision of water to households received unanimous response where all the men confirmed that it is a woman's duty to fetch water for domestic use. In fact, it is shameful and embarrassing for a man to be seen fetching water for domestic purposes. Men collect water only to make mud bricks and for the watering of livestock. Considering the culturally homogeneous nature of the study area, it was a surprise to discover that men do not participate in fetching water for household use under any circumstance.

The central role of women in household water provision has also affected the level of education which is so low that only three percent of the sampled population attained primary level education and just one percent have secondary level qualification. On the low level of education, FGD Participants revealed that they are burdened with excessive domestic workloads, tending to babies and toddlers, and therefore have no time for schools. As a participant of the FGD explained:

> *"Life here revolves around water, fetching water is the schooling for our women; we are fed up of the scorching heat and spending entire days searching for water".*

The implication of low levels of formal education among women limits their access to information and skills necessary for effective coping and adaptation strategies especially in their receptiveness to new technology and level of participation in water related issues thereby widening the gender inequality gap. The low levels of education is also observed to be a major contributor to early marriage because poor rural households have meagre resources and hence find it difficult to educate, clothe or even feed the child.

Ninety percent (90%) of the respondents were married. In this area, marriage is considered an important determinant of social status, indicator of responsibility and indeed achievement in society such that divorced or widowed in most cases remarry quickly. The latest age at first marriage for females is 14 years in the area. Child marriage, generally defined as marriage before the age of 18 is of high prevalence such that not a single 14 year old unmarried girl was found. Often, cultural, social and economic realities perpetuate the practice of early marriage.

The implication of early marriage is the high rate of fertility since married women are exposed to conception for a larger portion of their reproductive years. The wider consequence is that within rural communities, large households and in particular young girls and boys provide necessary labour in agriculture, assist in water collection and other domestic activities and so marrying off a girl child at the age of twelve implies that such help is available for only a short period of time.

ISSN: 2223-9944, eISSN: 2223-9553

Level of Water Availability in the Area

To determine the availability of water to individuals and household, an attempt was made to determine the size of households because what constitutes a household is usually open to debate in rural African settings due to the existence of varied cultural and ethnic identities. A household could consists of a person or group of persons living together usually under the same roof or in the same building or compound, who share the same source of food and recognise themselves as a social unit with a head of household. This study adopted the definition used by Rosen and Vincent (1999) that is based on the functional criterion that is of interest to the research: women's domestic water role. A household is thus a group of people who secure their water for drinking, cooking, bathing and other domestic activities for their collective use. In this perspective, a woman with her children/relatives securing water for their collective use, using the same drinking pots is considered one household. The co-wives (in a polygamous household) also have their own separate drinking pots are considered another household. This distinction became necessary when it was discovered that a group of women within one compound usually have separate water arrangements. Based on such classifications, the household size in the study area ranged from 2-12 persons. Majority (53%) of the households in the area have 4-6 persons.

To further determine the amount of water available per person per day (1/c/d), all water collected and delivered by women and other members of the household for domestic purposes such as drinking, cooking, bathing and personal hygiene are added up.Using formula below, the volume of water use/person/day was first calculated for each of the LGAs:

$$WUD = VW/ PH$$

Where: WUD is water used/person/day

VW is volume of water used in litres

PH is Total number of persons in households

The mean per capita water use in the dry and rainy seasons was obtained as shown in Table 1.

Table 1. Mean Per Capita Water Consumption per day in dry and rainy seasons

LGA	*Dry Season*	*Rainy Season*
Gubio	7.10 litres/c/d	11.05 litres/c/d
Marte	12.57 litres/c/d	10.35 litres/c/d
Mobbar	12.08 litres/c/d	10.60 litres/c/d
Mean for the Study Area	10.58 litres/c/d	10.66 litres/c/d

The computed mean per capita water use was compared against the WHO/UNICEF (2006) recommended minimum access to safe water for rural areas, which is 20litres/capita/day. The WHO/UNICEF (2006) minimum standards was used because it is the official UN body charged with monitoring progress towards meeting the MDG goal on water supply and sanitation. The results indicate that none of the LGAs met the WHO/UNICEF minimum standards which is probably the lowest estimate taking into account other proffered indicators of basic access such as Falkenmark (1989); Gleick (1998), (African Water Development Report, 2006).

ISSN: 2223-9944, eISSN: 2223-9553

However, various studies that estimated volumes of water use in rural areas of developing countries indicated a rough average in the order of 10 litres per person per day (Rosen and Vincent 1999, citing various studies). A possible explanation for the low level of water consumption may not be unrelated to the inadequate level of water supply sources characterised by the numerous communities depending on one source of water supply. Generally, more water is used during rainy season compared to dry season but it was an unexpected finding that per capita water use in Marte and Mobbar LGAs is higher in dry season compared to rainy season. This may however not mean that more water is consumed during the dry season. It could be due to the fact that activities such as bathing and laundry, often considered to be users of large volumes of water are mainly done at source in the rainy season and so water is not brought home. Another factor that may have influenced the determination of rainy season water use is farming activities when populations are typically occupied with farm work. In this case, much of the day's water drinking takes place at farms and again at the end of the day's work, members of household take their baths at streams and rivers before going back to their homes.

Cost of Water

In terms of monetary issues, the responsibility of paying for water is usually considered a man's role. However, water is generally perceived as a free good which should be obtained free of charge. It is considered a free gift from God and as such, selling or buying water is viewed as unethical by majority of respondents. Thus, water vending is not a common activity in any of the study sites. Payment for water therefore relate to periodic dredging of wells, buying of diesel to operate boreholes, small repairs of broken down boreholes and general maintenance of water sources. Despite the importance of women's roles in water activities, rural life in these communities is dominated by men and so men make the "strategic" decisions regarding water management but the women are left to bear the consequences. It was discovered that men organise and contribute specified amounts for these activities since they are the main contributors to household income. Women do not participate in the operation and maintenance of water sources and they are also not involved in decisions regarding water management. Women's access to water resources is often strictly controlled both directly by their husbands and indirectly by existing cultural norms and practices. As such, women lack channels of reflecting their needs apart from going through their husbands. As a village head in Mobbar LGA put it:

> *"the husbands already know the problems of women in relation to water issues and as such there is no need to have dialogue with them".*

Perception of Water Quality

The concept of water scarcity embraces issues related to water quality because most often degraded water resources are unavailable or at best only marginally available for human use. The setting of water quality standards is often considered the sole responsibility of experts and planners because of the technicalities involved. However, Sheat (1992) has stressed the importance of acknowledging the perception of water users because perception may very well become more important than reality especially where there is little or no choice of alternative water sources. Furthermore, women's perception of water quality is crucial because as end users of domestic water, they play a major role in household health status.

The women revealed the quality of water on a three scale ranging from bad through fair to good where none of the respondents perceived their water to be of bad quality. In general, respondents identified the colour, odour, taste and clarity as yardsticks to measuring water quality where 90% of the respondents opined that the water is of good quality. This may not

ISSN: 2223-9944, eISSN: 2223-9553

be unrelated to the absence of alternative water sources and the hardship involved in drawing water from wells. Indeed research has shown that insufficiency of water hampers people's efforts to practice good personal and domestic hygiene. Even when potentially negative health effects of poor water quality are known, not much consideration is given to decisions regarding its usage (Rathgeber, 1996).

To further gauge women's perception of water quality, an attempt was made to relate the occurrence of diseases attributable to quality of water where women indicated that there are no diseases that can be attributed to the quality of drinking water.

Still on the issue of water quality and its relationship with the occurrence of water-borne diseases, the availability of toilet facilities was examined because most often, the improper disposal of faeces, poor sanitation and other unhygienic practices increase the rate of diarrhoea. Open defecation in the bush was discovered to be the major toilet facility in the area. It is often pointed out in the literature that faecal-oral diseases often have multiple transmission routes from hands to food and dishes and are more likely to be water washed than water borne (Majwahuzi, 2002; IFAD 2008). The implication is that the improper disposal of faeces, poor sanitation coupled with water scarcity aggravates the occurrence of water related diseases. Most of the women interviewed argued that their places of defecation are often located far from water bodies thus indicating some level of awareness of the implication of drinking water contamination by human faeces.

Women's Adaptation Strategies to Water Scarcity

Obviously, water is a resource which has no substitute and human beings depend on it for survival. The women in Gubio LGA explained: *"nji du shi Ro na"* which in the local Kanuri language means "water is life". To cope with water scarcity therefore means to live in harmony with the environmental conditions specific to and dictated by limited availability of water. Thus, coping strategies in this perspective mean actions or activities that women embark upon in order to adjust or cope with water scarce situations. The study identified differing types of responses to water scarcity which could be considered as means of coping or in some cases represent real forms of adaptation.

Distances to Water Sources

A major adjustment strategy to water scarcity is travelling far distances to other locations in search of water. In Gubio LGA, women in Maina Buwarti settlement who usually travel 7 km to the central well in Ngetra would trek to Mallum Fannari whenever there is acute shortage of water. The distance covered increases from 7 km to 8.5 km. It does not matter whether it is day or night time, crucial household water needs have to be met and therefore they spend up to nine hours to fetch a jerry can of water. Usually, women organise and travel in groups and indicated they fear no any form of violence because of travelling at night. In the rainy season, women in Gubio LGA prefer to use surface water which is of less quality, even though the distance is still far. This is to minimise the hardship associated with drawing water from deep wells and the fact that more water can be fetched from surface sources. Thus, women demonstrate a form of resilience by defying distance to fetch water home from longer distances.

In Marte LGA, the major adjustment to water scarcity is travelling to settlements closer to the shores of the Lake Chad when the boreholes are not producing enough water, a common phenomenon during the dry season. The livestock population here are also dependent on the boreholes during the dry season. In Yedi district, women travel up to Chima Settlement which is located 5 kilometres away to obtain water.

ISSN: 2223-9944, eISSN: 2223-9553

Water Rationing

Rationing of water use includes changes in nutritional behaviours such as cooking less frequently and in less quantity and quality due to shortage of water. On the sanitation front, it includes bathing every other day and less washing of clothes particularly for children. Women in the study area confirmed that indeed bathing is not a daily affair and women have very few clothes to wash and it is also not a daily affair. There are few kitchen utensils and there is a common practice of using utensils twice before washing. A respondent in Rimbua district described the condition of the rural woman in the following words:

> *"kamu buladia ye de abi du, kunaa koinoonyia"*which means *"the rural woman consists of nothing but hunger and odour"*.

On further elaboration she explained that by hunger, she means meals can only be cooked once due to lack of water, foodstuff cannot be processed into varieties due to water shortage. By odour, she is referring to the fact that women take bath once in days, wash their clothes in weeks and rarely clean their homes due to the shortage of water. Water for bathing children was found to be virtually non-existent in villages that obtain water from distant sources. Thus, due to reduced availability of water they have changed their sanitation by bathing and washing less frequently especially during the dry season.

In most Muslim communities, there are religious rituals such as ablution to perform the compulsory five daily prayers and compulsory ritual bath (al-Ghusul) performed at the cessation of a woman's menstrual period, after sexual encounters and in preparation of the dead for burial. Women in all the study sites indicated various strategies to cope with these water demands. Using a little amount of water (about 2 litres) to perform this ritual bath and sometimes performing ablution with sand (permitted under Islamic law when there is absence of water). It was also observed that some women are completely ignorant of these practices especially the ritual bath and so do not perform it at all. Lack of sufficient water for cooking and sanitation therefore not only affects the nutritional and health status of women and whole communities but also their religious and cultural practices.

Exchange of Water Gifts

Another important adjustment strategy discovered is that women exchange water gifts with each other during ceremonial activities such as child delivery, wedding ceremonies, and funerals. Other events where women show solidarity with each other by exchanging water include fire out-breaks, sickness or when a woman has travelled. For instance, once the news is spread that a particular woman has given birth, her fellow women begin to visit her with bowls of water which is poured into her water storage facilities even before they go into her room to congratulate her and exchange pleasantries. In so doing, women build strong inclusive social networks among themselves and this plays a key role in shaping adaptation strategies by promoting a sense of cooperation and responsibility. Women are therefore cementing strong social relations with other women against water shortages. This is particularly true of Mobbar LGA where the men do not assist women in sourcing for water under any circumstance. To solve immediate water needs, women sometimes also borrow water from friends and neighbours which is paid back.

Waiting for Wells to Recharge

Another important adaptive strategy that was found to be common to most of the respondents is waiting for hours at wells for water to recharge. Due to heavy dependence on wells, aquifers may be over exploited leading to lowering of water tables and when this happens, women usually wait for water to recharge before they can fetch. This is a major adaptive strategy especially for women who do not want to travel further in search of water. In this

ISSN: 2223-9944, eISSN: 2223-9553

case women spend more than 10 hours waiting. In addition to sharing gossips, women use the period to weave each other's hair, kill the lice found in some women's hair and weave sitting mats and other household utensils.

Harvesting Rain Water

Rainwater harvesting and other "bottom-up" technologies as adaptation to increased variability in water supply and rainfall is well documented. Rainwater harvesting here refers to all the techniques employed to capture water from artificial surface such as rooftops, roadsides and pavements which are easily collected and stored for different uses. Ninety percent of the respondents harvest rain water but complain it is not sufficient to meet all their domestic needs. A major reason is the nature of the houses which are mainly thatch roofs that make the capture of water virtually impossible. The women also revealed that they cannot afford enough basic water capture and storage facilities such as jars, large basins, drums and barrels with which to capture and store water. Indeed the women also point out that even at the peak of the rainy season; it only rains for 2-3 days in a week.

Turn by Turn Access to Water Source

Another adaptation strategy though not restricted to women alone is the allocation of time slots to fetch water from the wells. Due to the fact that several communities depend on a single well, time of using the well is defined such that various communities have access at different times of the day and night. This ensures access of water sources by all and in addition, chaos and conflicts are avoided. The distribution of water is managed by a committee comprised of community elders. There are no written rules but it is based on a social code of conduct that has been followed for over ten years. The committee also ensures regular maintenance and repair of wells. The traditional distribution and management of water sources not only ensures optimum utilization of meagre water resources but also ensures collective action for maintenance and a key for sustainability.

Conducting Prayer Services

This is usually a kind of religious ceremony infused with cultural practices where women come together contributing various food stuff to cook and distribute as service prayer for rainfall. This activity usually takes place in front of the local Mosque. When it was pointed out to the women that this was actually a prayer performed when there is late onset of rains to begin the planting season, their response in Kanuri was: "*ngudu nui do kulo baretinwa"*? Translated: in English: "we quench our thirst first before we think of farming". At the end of the distribution of the cooked food, a kind of prayer and singing session takes place in which women voice their concerns to the Almighty Allah. A stanza in one of the songs reads thus: "*Sadu lan ngurtu kairo waa leram ngurtu nguduwaa*" Translated: "the hippopotamus in the Lake Chad is crying of thirst, it is very thirsty, oh Lord send down the rain...." It is then concluded with a prayer session invoking the name of Almighty Allah to bring rain to the communities.

Migration to Areas of Water Availability

Outward migration is a livelihood strategy and an adaptive behaviour of people reacting to water scarcity which could be on short-term seasonal basis involving individual family members or whole communities. It could also be on a permanent basis. Often, migration is due to a combination of factors in which scarcity of water is but one reason. Other reasons why people migrate according to the respondents include water for livestock, fertile land for dry season farming, among others. Thus, although it is often pointed out that linking migration in water stressed areas directly to water scarcity may oversimplify other motivational factors, migrations in the study area are still largely attributed to water scarcity.

ISSN: 2223-9944, eISSN: 2223-9553

The study takes into account the short term intra-rural migration with a return to the permanent settlement in the rainy season and permanent migrations to other locations. Male participants to the FGD indicate that the water situation in Rimbua is so acute that more than ten households have migrated permanently to Gubio town, the LGA headquarters, and Fuchimiram in neighbouring Nganzai LGA. When asked as to why they have not migrated en-mass due to lack of water for both human and livestock, the men stubbornly insist this is their home and they have nowhere else to go. The FGD also revealed that Ginda community in Gubio LGA migrated permanently and found Ginda in Mobbar LGA. In Marte LGA, the whole of Zaga community with a population of over 400 people temporarily migrate to the Lake Chad floor during the dry season.

CONCLUSION

Rather than the global debates that draw on broad theoretical, political or economic assumptions, this study revealed empirically grounded facts and realities of water scarcity and indigenous adaptation strategies at the micro level. The study examined the water situation in rural areas of Nigeria which partly explains why Nigeria is not on track on meeting the MDG goal on water supply and sanitation even though the goal has been met in other parts of the world.

By examining water use in the dry and rainy seasons and how women adjust their water use behaviour to varying levels of water availability, the study revealed the multi-faceted nature of water scarcity and its linkages to anthropogenic and temporal dimensions.

The study revealed issues of vulnerabilities and unequal access of women, a major user group that are often left out in the water crises narratives. The adaptation and coping strategies demonstrate the ingenuity of rural women to ensure household survival in times of water stress which ought to be incorporated into formal analysis of sustainable water management by Governments and NGOs tasked with water provision. This is particularly important in the face of predicted further decrease in water availability due to climate variability and change in semi-arid regions.

Although this study was carried out in 18 sites covering three of the nine LGAs of northern Borno State, it is the opinion of these researchers that the findings are a true reflection of other areas not covered in the study. This is because the selected sites represented the different water scenarios of the whole area and are therefore microcosms of the bigger picture.

NOTES ON CONTRIBUTORS

Yagana Bukar received her PhD in Geography (Resources and Development) from the University of Maiduguri, Nigeria in 2012. Her research interests are centrally on gender and environmental management; Resource use dynamics and sustainable rural livelihood strategies. Yagana has extensive experience in qualitative methodologies regarding adaptations to climate change in the semi-arid zone of Nigeria and Africa.

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ISSN: 2223-9944, eISSN: 2223-9553

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