

Analysis of Gender and Other Social Dimensions of Household Water Insecurity in Ngamiland, Botswana

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Abstract

This paper analyzes impacts of water insecurity on men, women and children in Botswana, a middle income and semi-arid country. The paper contributes to the burgeoning literature on water security. Households in different settlement categories of Ngamiland, Botswana experience water insecurity. Men, women, girls and children living in water insecurity lifeworlds, play various roles in ensuring household water availability. Women and girls have the greatest agency in ensuring household water availability by spending considerable time transporting water containers loaded on their heads and engaging in rainwater harvesting. Water insecurity negatively affects personal hygiene and gives rise to household interpersonal conflicts. Countries facing water insecurity, e.g. Botswana need to promote research that can inform appropriate water policies, legal frameworks, technologies for water supply and financial mechanisms for enhancing household water security.

Keywords: actors, Botswana, gender, social, water security

1. Introduction

A global water crisis unfolded in the last century as a result of rapid economic development, population growth, urbanization and climate change and variability (Bogardi et al., 2012; Hoff, 2009). While developed countries have been able to put in place measures (i.e., policies, institutions, financial mechanisms and technologies) that help to ensure water security (Grey & Sadoff, 2007; UNDP, 2006); almost all developing countries are being negatively affected by the global water crisis (Lougheed, 2013). This has led to an imbalance in daily water availability per capita for citizens of developed countries, for example: 151 L/day for a citizen of the United States of America (USA); whilst the per capita use for developing countries is 5 L/day (UNDP, 2006). As a result, the 1.1 billion of people lacking adequate clean water are from developing countries (Chamberlain, 2008).

Drinking or use of unsafe water kills an estimated 1.6 million children annually mainly from developing countries as a result of waterborne diseases (Lougheed, 2013). In order to reduce the number of people who die due to lack of access to clean water, the Millennium Development Goal (MDG) 7, target 10 aims at halving the proportion of people without reliable access to safe drinking water and basic sanitation by 2015 (UN, 2013). Access to clean water, in this context, means that the improved source (i.e. household connection, public standpipe, borehole, protected dug well, protected spring or rainwater) is less than 1 km away from its place of use and that it is possible to reliably obtain at least 20 L per member of the household per day (WHO, 2013). While households in some African countries have improved water sources, they do not always have access to water from such sources (UN, 2013). This forces such households to resort to using untreated water sources (Kujinga, Vanderpost, Mmopelwa, & Wolski, 2014; Manzungu & Chioreso, 2012a; Manzungu, Mangwanyana, & Dzingirai, 2012). This has been the case even in countries classified as middle income (e.g., Botswana, South Africa and Jordan) (UNDP, 2013). In Botswana, statistics suggest that 97% of the population has access to clean water through improved sources (Jefferies & Kenewondo, 2013). This figure however, only considers the presence of improved sources and does not consider reliability of water supply. These statistics mask the contradictory reality associated with access to water as it is in real life (Kgomotso & Swatuk, 2006). It therefore becomes imperative to understand these realities empirically.

Women, girls and children in developing countries constitute two thirds of the millions of people who currently struggle on a daily basis to locate and transport water for drinking, cooking and washing needs (Lougheed, 2013). In sub-Saharan Africa, e.g., women spend 40 billion hours per year collecting water and therefore have less time to fulfill all their domestic responsibilities, engage in money-making activities, participate in politics or other public activities, attend school, acquire other skills, or simply rest (UNFPA, 2009). Girls are sometimes kept home from school to help fetch water, thereby perpetuating the cycle of disempowerment. The high prevalence of diseases such as malaria, HIV and AIDS in Africa, increases the burden on women as they are the ones who have to fetch water for the sick (Omari, 2010).

This paper analyzes impacts of water insecurity in Botswana, a middle income and semi-arid country. The analysis focuses on gender i.e. women and girls who physically bear the brunt of water insecurity through spending prolonged periods of time fetching water which they carry in containers loaded on their heads. In addition there are other social dimensions: use of various assets, rainwater harvesting, personal hygiene and the inter-personal politics of fetching water from neighbour's standpipes. The paper also contributes to literature on water security and hopes to influence the development of policies and strategies which enhance water security by governments of developing countries such as Botswana.

2. Analytical Framework

Gender and other social dimensions of water insecurity experienced by households in various settlement categories of Ngamiland are analysed using the actor-oriented approach (Long, 1988, 1992; Long & van der Ploeg, 1989b; Long & Van der Ploeg, 1994) and the concept of water security (Cook & Bakker, 2012; Grey & Sadoff, 2007; GWP, 2000; Lautze & Manthrilake, 2012; Vörösmarty et al., 2010). 'Security' here refers to freedom or protection from serious risks and any threats to human well-being (Soroos, 1994). Water security thus, entails protection from the risk of water shortages, waterborne disease due to poor water quality and death. Water security refers to the availability of, and access to water in sufficient quantity and quality to meet livelihood needs of all households throughout the year (GWP, 2000). Water insecurity refers to unavailability and inaccessibility of enough water of good quality to meet households' domestic, productive and environmental needs (Webb & Iskandarani, 1998).

The entry point in an actor-oriented analysis, is the social actor which is a social and cultural construction referring to individuals, households, groups and institutions (i.e. government ministries and departments, water supply institutions and NGOs) performing an action (Magadlela, 2000). In the scenario of this paper, social actors are households, and individuals within households, who are negatively affected by water insecurity and who take active roles in ensuring household water availability. The analysis of gender and associated social dimensions of household water insecurity, using the actor-oriented approach, facilitates the identification of the involved actors, their interests, objectives and organising strategies (Magadlela, 2000). A 'household' refers to a social institution of two or more people (not necessarily permanent), whose primary feature is co-residence, eating and pooling of resources together with their involvement in the provision of essential resources required for a living (Beall & Kanji, 1999; Rakodi, 1991; UN, 1976).

The reality of water insecurity enters the lifeworld of actors (Long, 1990b). A 'lifeworld' refers to how the actors in a particular physical, social, political and economic context view themselves and their situation, their everyday lives and encompasses how they view the outside world and interpret new innovations using the conceptual tools acquired in their own world view (Long, 1990a; Magadlela, 2000). A lifeworld includes: gender roles, social relations and expectations (in this instance: for women to fetch water for household use).

Where households face water shortages and unavailability, women and men have the agency to take an active role in ensuring household water availability by going to other sources using various types of household assets. This is 'human agency', which attributes to the actor/s the capacity to process social experience and to devise ways of coping with life, even under difficult conditions (Long, 1992). Household members may take active roles in enhancing household water availability during shortages. This paper analyses the agency of men and women in Ngamiland as they strive to ensure household water availability in the context of water insecurity. It also identifies limitations to their agency.

Adult men and women and children from the same or different households can adopt heterogeneous strategies for ensuring household water availability. The concept of heterogeneity helps to analyse the numerous strategies adopted by men and women within the same or different households and settlements in order to ensure water availability at the household level (Long & Villarreal, 1994). The responses of actors may differ even when they are exposed to similar situations, as in the conditions that appear to be relatively homogenous such as those influenced by water insecurity (Long, 1990a). Responses of the actors will be as a result of the assets, income

and networks they have.

In the process of endeavoring to ensure household water security, individual actors from different households can create beneficial networks based on other actor's assets. For example, negotiating the use of donkey drawn carts or vehicles used to fetch water. Any network is a more or less homogenous set of ties between and among actors. These networks, are not always horizontal or balanced, a network may be asymmetrical, unbalanced and is sometimes more like client-patron relations (Tilly, 1995).

3. Materials and Methods

3.1 Study area

The study sites are located in the North-West District (also known as Ngamiland) of Botswana (Figure 1) which has a population of 158,104 (Central Statistical Office, 2011a). The district is under the administration of the North West District Council (NWDC) which is sub-divided into Maun and Okavango sub-district authorities, administered from Maun and Gumare respectively. The district's main administrative center is Maun Village which has a population of 60,263 (Central Statistical Office, 2011a).

The Okavango River is part of a river basin shared by Angola, Botswana and Namibia, and is the main physical feature in the district (Figure 1). This Okavango River in Botswana forms a large, delta-like feature (actually an alluvial fan) which is a World Heritage site, known as the Okavango Delta (McCarthy & Ellery, 1998).

Tourism and livestock rearing are the main commercial activities in the district (Motsholapheko, Kgathi, & Vanderpost, 2010). Ngamiland has a poverty rate of 37.6% as opposed to the national rate of 20.7% and 15.3% of the economically active population is unemployed (African Economic Outlook, 2013; Central Statistical Office, 2011b, 2011c). The high poverty and unemployment levels in the district do not sit well with the classification of Botswana as an upper middle income country (UNDP, 2013). In addition the district had an HIV and AIDS prevalence of 27.3% in 2007 (MFDP, 2007).

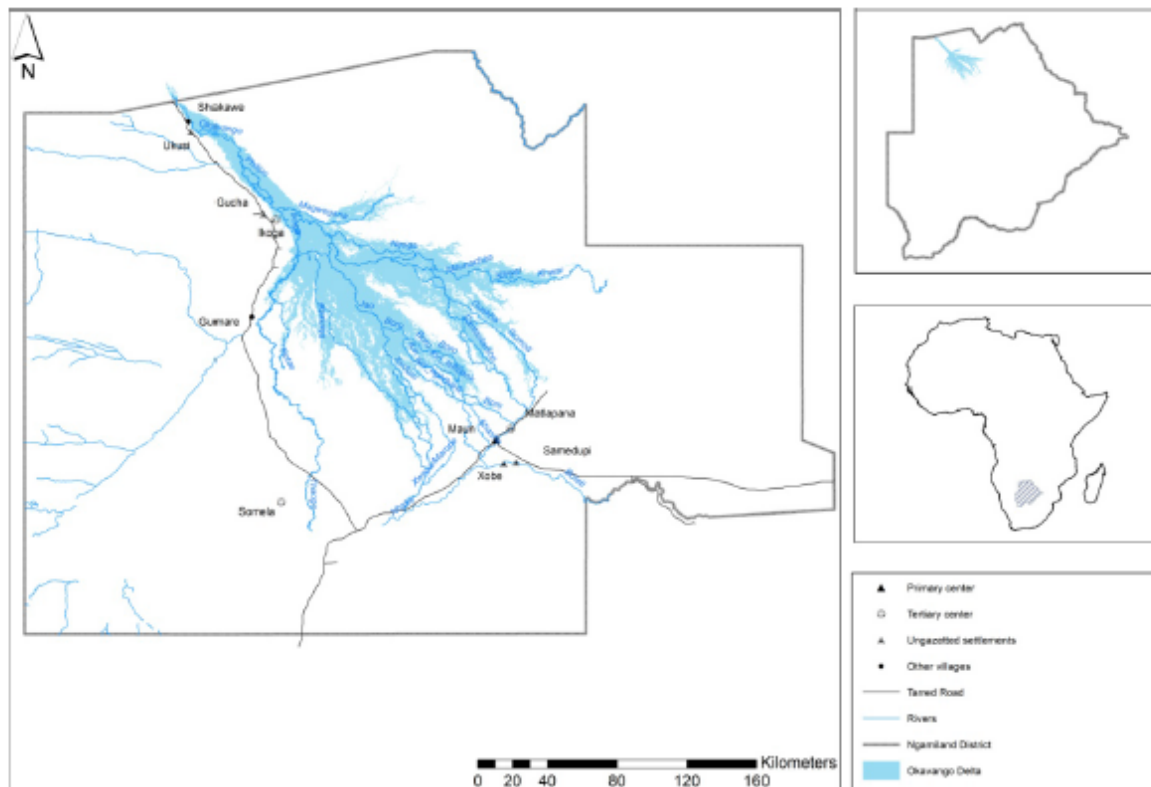


Figure 1. Study sites in Ngamiland District

The study was undertaken in gazetted and ungazetted settlements of Ngamiland (Government of Botswana,

2009). Gazetted settlements are formal settlements which receive services such as water supply, roads, schools, health and police. Entitlement to the provision of these services is based on population size, economic potential, employment generation, natural resources availability such as water for sustaining the settlement (Government of Botswana, 1998). Three levels make up gazetted settlements, i.e. primary, secondary and tertiary centers (Government of Botswana, 1998).

Primary centers have a minimum population size of 20,000, with a high development potential, a sound industrial base to serve as national market centers and high order infrastructure services (Government of Botswana, 1998). These are subdivided into I, II and III. Primary centers I, are cities (e.g. Gaborone) with a population of at least 100,000. Primary centers II, have a population range of 50,000 – 99,999 and primary centers III, have a population range of 20,000 – 49,999 and are referred to as large Villages: e.g. Maun Village in Ngamiland.

Secondary centers have a population range of 10,000-19,999 and may have a weak economic base but play a key role as district or sub-district headquarters such as Gumare (Government of Botswana, 1998).

Tertiary center settlements (sub-divided into I – IV) have population ranging from 250 – 9,999 (Government of Botswana, 1998). These have the following population ranges:

Tertiary centers I, 5,000 – 9,999.

Tertiary centers II, 1,000 – 4,999.

Tertiary centers III, 500 - 999.

Tertiary centers IV, 250 – 499.

Ngamiland does not have any category I tertiary centers, only categories II – IV are found in the district.

Ungazetted settlements are informal with population of less than 250 people. They do not have legal entitlement to vital social services delivery (Kgomotso & Swatuk, 2006).

3.2 Water Supply Services

The Water Utilities Corporation (WUC), Department of Water Affairs (DWA) and District Councils (DCs) were responsible for domestic water supply in Botswana until the 31st of March 2013. WUC supplied water to urban centers, DWA to major villages and DCs to small/medium rural villages (Swatuk & Kgomotso, 2007). This arrangement created poor coordination amongst the institutions involved (Government of Botswana, 2009). Under the water sector reforms, which commenced in 2009, WUC supplies and distributes water to all settlements in Botswana. The WUC took over water supply and distribution to all settlements in Ngamiland on the 1st of April 2013.

3.3 Data Collection Methods

Data were collected using qualitative and quantitative methods between February 2012 and March 2014. Qualitative methods gathered data on meanings, opinions, feelings and perceptions regarding gender and other social dimensions of water insecurity. These were not experimentally examined or measured in terms of quantity, amount, intensity or frequency (Neuman, 2000; Schwandt, 1994). Qualitative methods enabled the researchers to interact closely with the actors, i.e. households, men, women and children from settlements affected by water insecurity. The methods used include key informant interviews, participant observation, unstructured/informal interviews and focus group discussions (FGDs). Key informants included village development committee members, ward councilors, traditional leaders and relevant officials from the WUC, NWDC and DWA. The FGDs were conducted with ordinary community members. Participant observation was done in all the settlements where one of the researchers spent some time. The researcher resided in Matlapana for three years, a settlement affected by water shortages. Qualitative data collected include factors behind water insecurity, household responses to water insecurity, fetching of water by gender during periods of water insecurity, assets used to fetch water, rainwater harvesting practice, bulk water supply and water conflicts.

Quantitative data collection was carried out through the use of a structured household questionnaire between May and August 2012. This was used to collect information on general household characteristics i.e. gender and age of household heads, number of household members and income, household water sources, amount of water used for a variety of activities and at different times (i.e. day, month and year), extent of water insecurity in each settlement, how water insecurity impact on men, women and children and assets used to fetch water during periods of water insecurity.

3.4 Sampling

The study was undertaken in 8 purposively sampled sites. The settlements were purposively sampled for various reasons (Table 1).

Table 1. Purposively sampled settlements

Settlement	Settlement category	Location in relation to Maun Village	Reasons for purposive sampling
Maun Village	Primary center III		The only primary center settlement in Ngamiland where water insecurity has been experienced by households for years.
Matlapana	Tertiary center II	10 km NE of Maun	A settlement where water insecurity has been experienced by households for a number of years. Purposively sampled because one of the researchers lived in this settlement for 3 years undertaking participatory observation.
Ikoga	Tertiary center III	315 km NW of Maun	Sampled to understand water insecurity in a gazetted settlement that gets water supply from a surface water treatment plant.
Somelo	Tertiary center IV	70 km SW of Maun	A gazetted settlement which last received reliable water supply services in 2009 when its source located almost 40 km was submerged by floods. Groundwater resources in the settlement are saline and therefore unfit for domestic use.
Gucha	Ungazetted	320 km NW of Maun	A settlement that has a water supply transmission line passing through it but not receiving water supply services. Households are located further away from perennial water sources.
Ukusi	Ungazetted	370 km NW of Maun	A settlement receiving water supply services despite its status.
Samedupi	Ungazetted	15-20 km S of Maun	Settlements located close to a perennial surface water source. Situated close to Maun, but do not receive water supply services because of their status.
Xobe	Ungazetted		

A 30% household sample size in all the settlements was adopted (see Table 2) using population information obtained from the Central Statistics Office, NWDC and local village leadership. Households in each settlement were listed and each (household) was assigned a number and a random number generator selected households for the survey. Trained enumerators administered questionnaires to household members from the age of 15. Sixty-two percent (62%) of the respondents were women with information on household water issues. A total of 554 questionnaires were administered.

Table 2. Sample sizes by settlement

Settlement	Settlement category	Population size (2011)	Total number of households listed	Number of households sampled
Maun	Primary Center III	4,105 ¹	933	295
Matlapana	Tertiary center II	1,449	329	99
Ikoga	Tertiary center III	673	153	46
Somelo	Tertiary center IV	600	41	41
Gucha	Ungazetted	88	20	20
Samedupi	Ungazetted	286	65	20
Ukusi	Ungazetted	261	60	19
Xobe	Ungazetted	260	60	20
Total		7,722	1571	554

¹ This is the population of Boyei and Wenela wards.

Participants for FGDs were randomly picked from male and female headed households from different areas of each settlement. At least one FGD was held in each study settlement and attended by at least 16 participants.

Key informants were purposively sampled from DWA, WUC, NWDC and from community leaders such as councilors, traditional chiefs and village development committees.

3.5 Data Analysis

Quantitative data collected through the use of a structured household survey questionnaire were analyzed using the Statistical Package for Social Sciences (SPSS) version 21. Variables which include settlement category, settlement, household, income and main sources of water and gender were used as independent variables in the analysis. Kruskal-Wallis 1-way ANOVA, a non-parametric test was used in the analysis since the data were not normally distributed. The test was used to determine differences between attributes of non-parametric variables. The Pearson's chi-square test was used to determine association between variables, which include monthly income and settlement, settlement and type of main water sources, water insecurity and sourcing of untreated water, water insecurity and use of different assets, water insecurity and fetching of water by either men or women, water insecurity and the practice of rainwater harvesting by gender and water insecurity and inter-personal conflicts over water within households.

Data from FGDs, key informant interviews and participant observation were categorized into broad themes of socio-economic background of households, water sources, household water insecurity, responses to water insecurity by gender and social relationships during times of water insecurity.

4. Results and Analysis

4.1 Socio-Economic Background of Households

Fifty-three percent (53%) of the households across all the study settlements are female headed while 47% are male headed. The average household size across all the studied settlements is 5.9 as opposed to 4.4 for Ngamiland District (Central Statistical Office, 2011a). There is no statistical association between gender of household head and size. Each household uses an average of 69 liters (or 11.6 L per person) of water per day during periods of water insecurity security while an average of 250 L (or 56 L per person) is used when it is readily available.

In terms of monthly household income, there is a statistical association between settlement and income (Pearson's chi-square = degrees of freedom = 35, $p=0.000$), significant at 5% level. Gazetted settlements (e.g. Maun and Matlapana) households have relatively higher incomes compared to ungazetted settlements which have lower monthly incomes (Figure 2). However, there is no statistical association between gender of household head and income.

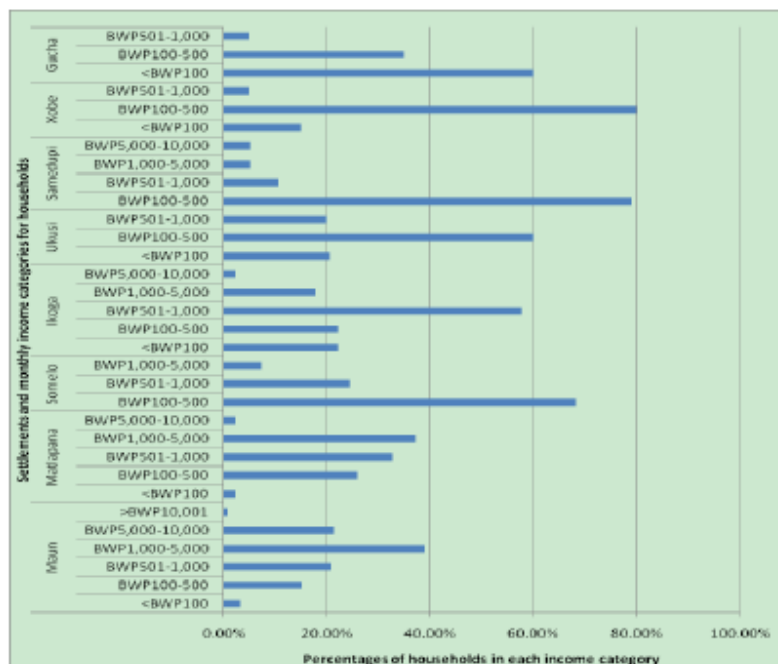


Figure 2. Household income (Note 1)

The generally low incomes in the district is in stark contrast to the classification of Botswana as an upper middle income country whose per capita income is pegged at USD13,102 (UNDP, 2013).

Some of the households possess assets such as vehicles and donkey drawn carts used for fetching water. There are statistical differences between the various settlements in terms of ownership of light vehicles used for fetching water (Kruskal-Wallis 1_way ANOVA test = $p=0.000$, significant at 5% level). Nine percent (9%) of the households have access to vehicles from other households. Twenty-six percent (26%) of households across all the settlement categories own motor vehicles. In terms of ownership of donkey drawn carts, 16% of households own these assets while 17% have access to donkey drawn carts owned by other households.

4.2 Government of Botswana's role in Household Water Supply

Botswana has improved water sources coverage for 97% of the population (UNICEF/WHO, 2008). Successive governments of Botswana have pursued policies of planned intervention by installing improved water sources in gazetted settlements (Long & Villarreal, 1994). Women and girls at FGDs from gazetted settlements, emphasized that whenever water supply is available, they do not have to walk longer distances to fetch water.

Eighty-eight percent (88%) of Ngamiland's gazetted settlement households access water from improved sources whenever supply is available (Figure 2). There is a statistical association between settlement category and type of main water sources used by households (Pearson's chi-square = degrees of freedom = 42, $p=0.000$), significant at 5% level. Improved water sources in gazetted villages include: public standpipes (23.1%), standpipes in yard outside the house (46.8%), standpipes inside the house (10.8%) and neighbour's standpipes (7.2%) (Figure 3). Households accessing water from untreated sources (12%) are mainly from ungazetted villages.

The Okavango Sub-district Authority supplied water to 20 ungazetted villages (e.g. Ukusi) located along water transmission lines. Political leadership in the area pressurized the sub-district authority in the 1990s to do so, since their connection did not involve much financial investments. After the connection of the 20 ungazetted settlements, more such settlements (e.g. Gucha) mushroomed along water transmission lines anticipating water supply. This prompted the sub-district authority to stop connecting such settlements for water supply to discourage their mushrooming. The WUC has continued supplying the 20 ungazetted settlements with water.

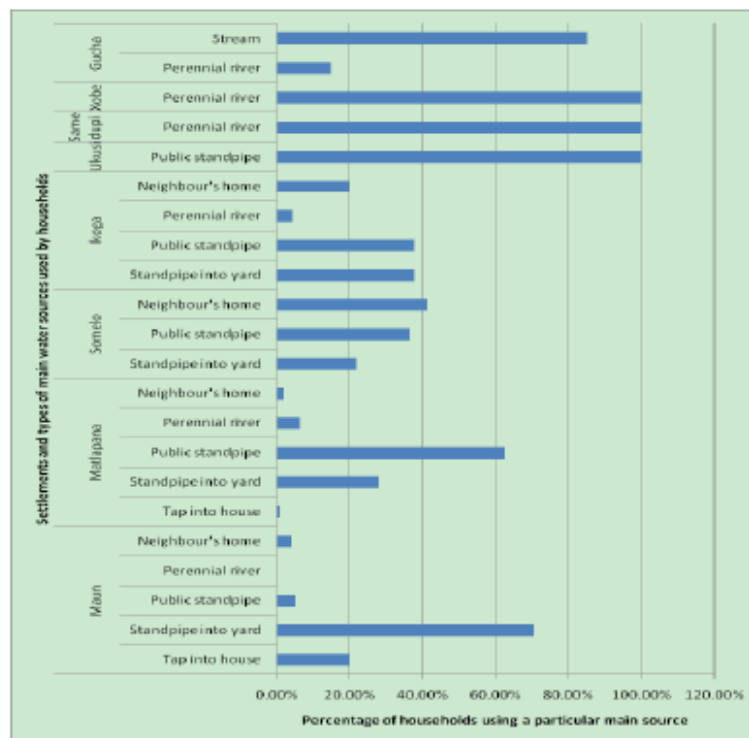


Figure 3. Main water sources for households

Maintaining the functionality of public standpipes is a challenge across all settlement categories (Table 3).

Table 3. State of public standpipes by settlement

Village		Number of public standpipes	Functional standpipes	Non-functional public standpipes
Ikoga		9	4	5
Maun	Boyei	10	1	9
	Wenela	3	1	2
Matlapana		10	2	6
Somelo		3	1	2

DWA and NWDC officials accused residents of damaging public standpipes and expect them to be repaired by their service provider. Maun residents said that the DWA closed down public standpipes as a way of forcing households to invest in private standpipes. In February 2014, an official of the WUC told a meeting of residents in Matlapana that the Corporation has plans to install pre-paid public standpipes which do not have taps that are easily damaged by either people or livestock. Households will be accessing water using pre-paid cards.

4.3 Household Water Insecurity

Water security is regarded by households as the presence of improved sources, and availability and accessibility of good quality water from such sources all the times. Water insecurity is viewed as unavailability of water from improved sources for 1 hour to years and availability of bad quality water, i.e. discolored, bad smell or with sediments. Ungazetted settlement households further regard water insecurity as the lack of improved water supply sources and services in their areas.

Sixty percent (60%) of the households across all the settlement categories highlighted that between 2005 and 2011 they faced serious episodes of water insecurity. There are no significant statistical differences between male and female headed households and water shortages experienced. The situation worsened as 74% of households across all the settlements faced water shortages 12 months preceding the survey. Thirty-three percent (33%) of the households had no water supply within the previous 24 hours of the survey and 32% did not have water supply at the time of the survey.

In March 2011, residents of Maun demonstrated over poor water supply and quality at the DWA offices. During the demonstration, a petition was presented to the District Commissioner who was requested to pass it on to the Minister of Minerals, Energy and Water Resources. The petition implored the Minister to intervene as residents were going for up to a month without water since 2000. No formal communication came back from the Minister and no improvement in water supply was immediately experienced.

Households (100%) from Matlapana and Somelo last received water supply services in 2009. On the hand, households in Maun could go for a month without water supply. All (100%) of households from Gucha, Samedupi and Xobe said that they have always lived in a lifeworld of water insecurity since they use untreated water for domestic purposes. They share their water sources with domestic and wild animals that pollute the water through their droppings.

4.3.1 Response to Household Water Insecurity

There is a statistical association between water insecurity and accessing untreated water by households across all the different settlement categories (Pearson's chi-square, degrees of freedom = 7, $p=0.000$), significant at 5% level. Household from Maun Village (35%), Matlapana (96%) and Ikoga (93%) regularly access untreated water whenever they experience water supply shortages. Matlapana and Maun households access water from Thamalakane River while Ikoga Village households do so from Ikoga River.

Households from Samedupi (100%) and Xobe (100%) access untreated water from Boteti River while those from Gucha (100%) from Kwenookore stream. The Boteti River is perennial but dries up during other years, e.g. between 1987 and 2006. During this period household members from Samedupi and Xobe dug unprotected wells in the floodplain from where they accessed water for domestic purposes.

4.4 Fetching Water during Periods of Water Insecurity

Women and girls (10 years and above) (96%) across all the different settlement categories, are responsible for ensuring household water availability. Participants at FGDs and informal interviews said that the majority of men see their main duty as that of taking care of livestock while women do other duties which include fetching

water. Chi-square test of independence shows that there is strong association (degrees of freedom = 7, $p=0.000$, significant 5% level) between water shortages and male household members who do not want to assist in fetching water.

However, changing circumstances within the lifeworld of households in different settlement categories is driving some of the men to become active actors in the provision of water during periods of water insecurity. In Somelo, where water insecurity has been acute, all (100%) of the able bodied men participate in fetching water. In 27% of the households across different settlement categories, male members assist women in fetching water. Such men realise that their assistance is crucial given the multiplicity of tasks that have to be performed by women on a single day such as cooking, general cleaning, fetching firewood and doing laundry. However, men prefer to use assets such as donkey drawn carts and vehicles which do not cause much physical strain on them when fetching water.

4.4.1 Time Taken to Fetch Water

There are significant differences between different settlements and the average time women spent fetching water during periods of insecurity (e.g. shortages) (Table 4). Women from ungazetted settlement take 1:3 as much time as those from gazetted settlements fetching water from untreated sources. Women from gazetted settlements households spend an average of 68 minutes per trip (i.e. Maun, 83, Matlapana, 56 and Ikoga 60 minutes respectively). Women from ungazetted settlements spend an average of 91 minutes per trip fetching water. As a result of the time taken to fetch water by women, they encounter difficulties in balancing time for children and biological needs of their spouses.

Table 4. Time taken by women to fetch water (Kruskal-Wallis 1-Way ANOVA test)

Village to village relationship	Significance level
Matlapana-Ikoga	0.000**
Matlapana-Xobe	0.000**
Matlapana-Samedupi	0.000**
Matlapana-Maun	0.000**
Matlapana-Gucha	0.000**
Matlapana- Ukusi	0.264
Ikoga-Xobe	0.082
Ikoga- Samedupi	0.000**
Ikoga-Maun	0.000**
Ikoga-Gucha	0.000**
Ikoga-Ukusi	0.000**
Xobe-Samedupi	0.556
Xobe-Maun	0.000**
Xobe-Gucha	0.000**
Xobe- Ukusi	0.000**
Samedupi- Maun	0.004*
Samedupi – Gucha	0.000**
Samedupi-Ukusi	0.000**
Maun-Gucha	0.005*
Maun-Ukusi	0.000**
Gucha-Ukusi	0.478

**Highly significant at $p=0.000$

*Significant at $p=0.05$

In order to minimize the number of trips per day, all able bodied adult female members and children of households go to fetch water using containers of various sizes. The majority (78%) of the women fetch water two times a day, early in the morning and late in the afternoon or evening. School going children usually fetch water once after school and at least two times a day during weekends and holidays.

Some women from households in Maun prefer fetching water from the river despite the fact that storage tanks were put up by DWA in their areas. This is, because of the time spent queuing for water as it takes 7:21 minutes to fill one 20 L container at some of the storage tanks. There could be more than 80 containers to be filled. A number of women leave their containers in the queue and request someone to push them forward while they go back home to do other domestic duties.

In Somelo village, women and men usually wait for the water tanker to deliver freshwater from Maun which is off loaded in the village's 20 m³ tank. The water is accessed through public and private standpipes. Pressure of the water from the functional public standpipe is usually low as one 20 L container can take up to 6 minutes to fill up. Each household could come to the public standpipe with up to 10 x 20 L containers resulting in people queuing for more than 3 hours and others failing to get the water as it get finished quickly.

4.4.2 Assets Used by Different Gender Groups to Fetch Water

Water insecurity generates differential patterns of responses (heterogeneity) in terms of the assets used to transport water by men and women based on gender and socio-economic status (Long & Van der Ploeg, 1994). The most common assets used by women, girls and children when fetching water are 20 L or 25L plastic containers. Men usually use donkey drawn carts while households which are economically well off, use light vehicles.

4.4.2.1 Head Loading Water Filled Containers

Carrying water on the head using containers is an arduous task which takes up considerable time and energy. There is a statistical association between water shortages and the use of 20 L plastic containers by women and girls to fetch water (Pearson's chi-square test, degrees of freedom = 4, $p=0.002$), significant at 5% level. However, there is no statistical association between children aged between 5 and 11 and the use of any particular types of containers used for fetching water. This age group uses an assortment of containers ranging from 2 L to 10 L.

Women from different settlement categories complain of head loading water containers as this results in pain around the neck and back. The situation is exacerbated when one is pregnant or carrying a child on the back. The majority of women at FGDs highlighted that they always feel physical pain associated with head loading of water but they do not have any option as they are expected to fetch water.

4.4.2.2 Use of Donkey Drawn Carts

Kruskal Wallis 1-Way ANOVA test shows that there are highly significant differences ($p=0.000$, significant at 5% level) between households owning donkey-drawn carts used for fetching water and those without, across the different settlement categories. Donkey drawn carts are used by male members of households from the age of 15 from Gucha (20%), Ukusi, Maun (4%), Matlapana (25%), Xobe (35%), Samedupi (35%), Ikoga (18%) and Somelo (27%) to fetch water from different sources during times of water insecurity or where there are no supply services. The use of donkey drawn carts allows the transportation of 0.5 m³ of water or more on a single trip. Some of the households (17%) without donkey drawn carts either hire or borrow from those who own them to enable them to transport water.

Water transported by a donkey drawn cart can last the household for more days, depending on household size and uses, than the one collected by head loading. This relieves pressure on women from making many trips to various water sources on a daily basis. One male household head in Gucha can transport 0.4 m³ of water on a single trip from a neighbouring village situated 5 km away. However, whenever the cart breaks down, the wife walks 4 km to a nearby stream to fetch water using a 20 L container with a child strapped on the back.

4.4.2.3 Use of Light Vehicles

Sixteen percent (16%) (i.e. Maun, 12% and Matlapana, 2% in and 1% in Samedupi, and Somelo respectively) of households across all the settlement categories use light vehicles during periods of water shortages to transport water in small containers from areas where it is available. There is also a statistical association between households using light vehicles to fetch water and monthly income (Pearson's chi-square test, degrees of freedom = 5, $p=0.000$), significant at 5% level. Eighty-percent of households using light vehicles have monthly incomes of BWP5000 and above.

Informal interviews and FGDs revealed that male members of households prefer to fetch water using vehicles as it is easier than using a single container carried over a certain distance. They refrain from fetching water whenever light vehicles used are not available for the task. In such cases, female members of households are compelled to use containers to fetch water from other sources.

4.4.2.4 Bulk Water Supply and Buying

Water shortages in Maun and Matlapana resulted in the formation of a bulk water supply and buying market. Direct observation and informal interviews conducted with bulk water suppliers, revealed that the market emerged around 2000. Water is supplied to households, business premises and educational institutions which can afford the charges that are much higher than WUC charges (e.g. BWP150 for 2.5 m³, BWP300 for 5 m³ and

BWP600 for 10 m³). The suppliers abstract water from Thamalakane River, private boreholes or buy from WUC and then put a markup. Trucks which carry storage tanks ranging from 2.5 m³ to 10 m³ are used to transport the water.

The businesses of bulk water supply are all owned and run by men as well as the deliveries. Women interviewed said that they have never considered venturing into this business. Men are preferred to drive the trucks and operate the water pumps because they have the requisite driving licenses for the trucks used and are seen as able to cope with the physical demands of such a job as deliveries can be done during the day, at night, weekends and public holidays.

Both male and female headed households which are economically well off and who prefer bulk water, buy it. Households which buy 5 m³ are able to last for more than a month with this water. In such cases, female members of the households do not have to go and fetch water elsewhere using containers.

4.4.2.5 Rainwater Harvesting

Sixty-three (63%) of households across the different settlement categories practice rainwater harvesting. There is a statistical association between water insecurity and rainwater harvesting (Pearson's chi-square test, degrees of freedom = 7, $p=0.001$), significant at 5% level. Traditional rainwater harvesting, using open containers ranging in sizes from 20 L to 210 L are placed below the rooftops during the rainy season, is mainly practiced by women in 58% of the households. This technique is preferred by 100% of women because it is simple and there are not much costs involved. Through this activity, women are able to reduce the number of trips to other water sources. If a household is able to harvest 0.5 m³ of water, this can result in this water being used for a number of days depending on the size of the household and amounts used for different activities. One household in Matlapana reported harvesting more than 200 L from a single heavy rainy event. The majority (89%) of households harvesting rainwater view its quality (i.e. in terms of taste and color) as better compared to that from untreated sources and improved sources.

Direct observation and case studies revealed that men in Maun, Matlapana, Somelo and Ikoga assist women in rainwater harvesting by designing improvised rainwater harvesting systems from rooftops into storage tanks ranging from 0.210 m³ - 0.5 m³. Water from the rooftops is channeled through polythene or polyvinyl chloride (pvc) pipes.

Five percent (5%) of households across the different settlement categories practice rainwater harvesting using proper equipment. These are mostly from Wenela ward in Maun and those residing in government houses at health centers and schools in gazetted settlements. The houses are fitted with gutters which channel water into 5 m³ or 10 m³ storage tanks. Some of the households are able to use the water until the next rainy season since they only use the water when there is no supply from their main sources. The households are not worried by the fact that the quality of the water degenerates with time.

4.5 Water Insecurity and Personal Hygiene

Individual actors from different households value personal hygiene especially bathing but this is usually negatively affected by lack of/ or less water. This results in household members, both men and women, reducing the frequency of bathing, amount of water used for bathing or do not bath at all. In 72% of the households, water availability determines whether household members have to bath. There is a statistical association between water availability in the household and bathing (Pearson's chi-square, degree of freedom = 7, $p=0.000$), significant at 5% level. Kruskal Wallis 1-Way ANOVA test shows that there are significant differences ($p=0.000$) in the amount of water used by household members to bath between different settlement categories of Ngamiland when there are water shortages.

Seventy-one percent (71%) of the women and 57% of the men across the different settlement categories prefer to bath two times a day when water is readily available. However, when water insecurity persists, they all bath once a day. In some instances, bathing is skipped for between one day and 5 or more days especially by male members of households.

Women (100%) feel that they are more disadvantaged by water insecurity more than men. While men can go for a longer time without bathing, it creates serious challenges for them due to the fact that they experience monthly menstrual periods which creates the need for them to bath regularly.

4.6 Social Relationships during Times of Water Security Problems

4.6.1 Inter-Personal Conflicts over Water

Participants at FGDs and informal interviews revealed that household members across all the different settlement

categories experience conflicts over the use of water stored in households during times of water shortages. There is a statistical association between water shortages and misunderstandings between and among household members (Pearson's chi-square test, degrees of freedom = 7, $p=0.000$) highly significant at 5% level. Across all the settlement categories, 61% of the households' members have misunderstandings related to water usage, amount used and purpose of use. Most of the conflicts are verbal in nature.

In Somelo village there is usually a lot of pressure on the functional public standpipe and households cannot agree on how many containers each person should fill up before giving others a chance. Most households go to the standpipes with as many as 11 containers resulting in some households failing to get water. Those at the back of the queue usually complain that they would be denied water since it gets finished before they can fetch any.

Health personnel in Somelo used to allow households to fetch water from a standpipe within the health post premises but this changed in May 2014 when households were denied access. Households were told that they were damaging the standpipe just like they destroyed their standpipes. The move angered the households who called for a meeting which was addressed by the traditional leader of the area. The households told health post personnel that the water and the standpipe was theirs and they should not be denied access. They further threatened the health post personnel with expulsion from the village if they continued denying them access to the standpipe. The threats did not yield any changes from the health post personnel. However, whenever other health post personnel are not present, the security guard who is from Somelo, allows members of households to fetch water from the standpipe.

4.7 Fetching Water from Neighbour's Standpipes

Some private properties in Maun and Ikoga always have water available from their standpipes when others do not have any. Ikoga village has one residential property which always has water available during times of shortages. Other households were allowed to fetch water from this private standpipe during periods of water shortages. Until January 2014, owners of this property paid a fixed monthly fee of BWP5.75 because the standpipe did not have a meter. In February 2014, WUC installed a meter on the standpipe and this resulted in the household denying other households access to their standpipe fearing high water charges. As a result some of the households secretly fetch water at night when the owners are indoors or asleep.

Some households in Maun which always have uninterrupted water supply, while other households would be experiencing shortages assist those experiencing acute shortages. In one case, a property with continuous water supply is inhabited by women who are mostly into commercial sex work. As a result some men go to this property pretending to be fetching water but in actual fact seeking services of the women. Some of the households with standpipes with continuous water supply in Maun charge BWP5 for each 20 L container filled with water from their standpipes.

Water shortages in Somelo led to the sexual exploitation of women in 2011 and 2012. This was as a result of men from a mineral prospecting company based closer to the village that had water brought for them by a water tanker. Some women and girls from the village in dire need of water fell vulnerable to the men who lured them into sexual relationships in exchange of water.

5. Discussion

The greatest global development failure by the international community in the 20th century which has spilled over into the 21st Century, is the inability to provide clean and safe water to all as 1.1 billion people are water insecure (Onda, LoBuglio, & Bartram, 2012). Factors behind global water insecurity include rapid population growth, rural-urban migration, increased per-capita water use, pollution of water resources, over-abstraction of groundwater, poor water governance and climate change and variability (Jones, Vardanian, & Hakopian, 2009; Vörösmarty et al., 2010). Ineffective water governance could be the major contributor to global water insecurity because of lack of resilient institutions, collaborative efforts and sound capacity at all levels to manage scarcity and water related risks (such as floods and natural disasters) in developing countries (Harris, Goldin, & Sneddon, 2013). Countries facing water insecurity need to put in place policies and institutions that promote good water governance with the capacity to implement programmes that ensure water security.

Though countries such as Botswana, South Africa and Namibia pursued policies of planned intervention which resulted in the provision of improved water sources (Long & van der Ploeg, 1989a), in some instances, as in Ngamiland, households do not always have reliable water supply from such sources. Information on access to water in some developing countries masks the reality of water security at the local level. Data is mostly given in relation to the physical infrastructure installed and not about its functionality, e.g. in Botswana, 97% of the population has access to improved water sources, but in Ngamiland, 74% of households are encountering water

insecurity. In South Africa, 95% of the population has improved water sources but this does not entail access to clean water (Rademeyer, 2013). Demonstrations against poor service delivery, including poor water supply in urban centers in recent years in South Africa points to water insecurity (Rademeyer, 2013). In Jordan, 97% of the population has access to improved water sources, but this does not always guarantee access to water as the country is water scarce (Hadadin, Qaqish, Akawwi, & Bdur, 2010). There is need for the use of water security (i.e. access, availability, quality, quantity, reliability and affordability) as a measure of access to water rather than considering the presence of improved sources only.

The analysis of gender and other social dimensions of water insecurity at a micro-level through the use of the actor oriented approach, has shown that households, men, women, girls and children actors existing in water insecurity lifeworlds, play different roles in ensuring household water availability. Women and girls have the greatest agency in ensuring household water availability during periods of water insecurity as they sacrifice time for other activities in order to ensure that there is water at the household level. Women's agency during periods of water insecurity is mainly limited to the use of small containers loaded on their heads which have to be carried over an average distance of 3.5 miles each day from untreated sources (Thompson, 2001). This head loading of water containers has potential long-term health effects as it makes demands on the metabolism of the body not met by the nutritional intake and by regularly putting an excessive strain on the skeleton, leading to spine deformities and early onset of arthritic diseases (Geere, Hunter, & Jagals, 2010).

Research elsewhere has confirmed that women, girls and children are the most common water carriers around the world, and they spend considerable time supplying water to their households (Ngwenya & Kgathi, 2003; Sorenson, Morssink, & Campos, 2011). There is generally a direct positive association between water scarcity and women as water fetchers (Sorenson et al., 2011). For example, in Mauritania, 70% of water carriers are women in households without improved water sources (Sorenson et al., 2011). In cases where men assist in carrying water, they prefer to use assets such as donkey drawn carts or light vehicles as they do not want to carry containers over long distances.

The gendered division of labour in other sectors of the economy is also found in the water sector as women are expected to provide water for the household while men engage in water related business such as bulk water supply markets (Kjellén & Macgranahan, 2006). Such markets emerge across the developing world where water shortages are common (Hinkfuss, 2013; Manzungu & Chioreso, 2012b). In Dar es Salaam and Nairobi, where women carry water home, men constitute the majority of water vendors (Kjellén, 2000).

In the context of increasing water insecurity, i.e. failing or absence of conventional portable water supply services, rainwater harvesting by households can supplement water for domestic use (e.g. drinking, washing and cooking) (Warm & van Hattam, 2006). Women practicing traditional rainwater harvesting are well aware of the limitation of their lifeworlds (Long, 1990a) in terms of access to water and they view this activity as an option that enhances household water availability. Water policy in Botswana can focus on training households on how to practice rainwater harvesting, i.e. putting the infrastructure in place as well as maintaining it. Incentives which include provision of tanks and gutters can be put in place so as to motivate households to practice this activity. The capturing of rainwater helps women to minimize trips to collect water from untreated water sources. Australian states like South Australia and Victoria put in place regulations which require all private property owners to install at least a 5 m³ tank for rainwater harvesting to enable the capturing of rainwater for the household's own use (Imteaz, Shanableh, Rahman, & Ahsan, 2011).

Water insecurity generally impacts negatively on personal hygiene as those actors affected forego basic chores such as bathing making them prone to water related diseases (Mukuhlani & Nyamupingidza, 2014). Households usually act rationally during periods of insecurity and prioritise important aspects such as drinking and cooking and neglect essential aspects such as bathing (Mukuhlani & Nyamupingidza, 2014). The same strategies were observed in Harare and Bulawayo as households internalized prevailing water shortages (Manzungu & Chioreso, 2012b; Mukuhlani & Nyamupingidza, 2014). Diseases related to unsafe water, poor sanitation and lack of hygiene are some of the most common causes of illness and death among the poor of developing countries (Tarrass & Benjelloun, 2011).

Within the lifeworld of water insecurity, households strive to develop networks with other households and individuals which yield water related benefits (Tilly, 1995). Some studies on water security have shown that households have the tendency of assisting each other during periods of water shortages (Chaminuka & Nyatsanza, 2013). Households with private water sources which always yield water, sometimes share water from these sources with their neighbours for free or for cash. It was noted that in Malawi, households without their own private water connections buy water from those owning private connections (Manda, 2009).

Policies and programmes aimed at addressing water insecurity on a short and long term basis in developing countries (i.e. low and middle income countries) are important as they contribute towards gender equity and social development (Savenije & Van der Zaag, 2008; Sorenson et al., 2011). Failure to provide adequate and safe water through improved sources will continue to disadvantage women, girls and children as they are culturally expected to ensure water availability at the household level (UNFPA, 2009). It is imperative for countries to ensure that infrastructure installed for supplying households with water do so on a sustainable basis so that women and children will not be disadvantaged when the sources fail to provide water as what is obtaining in gazetted settlements in Ngamiland.

Countries facing water insecurity need to put in places policies, strategies and interventions capable of enhancing household water security. In the short-term, WUC needs to ensure the functionality of improved sources on a sustainable basis and where challenges are encountered, water tankers can be used to provide clean water for households. This will reduce the distance travelled by women to untreated water points. Households from ungazetted settlements such as Gucha which are located along water transmission lines could be connected to these to allow households to access water from public standpipes as is the case with Ukusi. Other ungazetted settlements such Xobe and Samedupi can get state assistance to sink solar powered boreholes (operated and maintained by trained villagers, both men and women) along the floodplain of Boteti River which can enable households to access water from central locations. In order to phase out head loading of containers by women, the wello water wheel, a drum which can be filled with water and rolled home on the ground with minimum effort can be introduced (Rahman, 2011).

Long-term efforts to curb water insecurity need to focus on the crafting of clear and effective policies, legal frameworks and strategies coupled by proper planning, political will and financial and material resources. Countries facing water insecurity can learn from developed world countries (i.e. France, Germany, United States of America and United Kingdom) which managed to put in place a package of policies, laws, financial mechanisms and technologies which enhanced water security during the 19th Century in cities that were previously centers of infectious diseases due to water insecurity (UNDP, 2006). Water security was placed at the center of the development agenda. If developing countries adopt the same approach of making water security a development priority, there could be a drastic improvement.

6. Conclusion

Households in Botswana in general and Ngamiland in particular are being negatively affected by water insecurity despite the fact that gazetted settlements have improved water sources. Access to clean and safe water in Botswana and other countries is still defined terms of the presence of improved sources which can go for prolonged periods of time without providing any water. Water security has to be defined in terms of improved sources as well as access, availability, quality, quantity, affordability and reliability of water supply.

Water insecurity has gender and other social dimensions. Women, girls and children are the actors expected to ensure water availability during periods of water insecurity and this takes a considerable amount of their time which could be used for other productive activities. Women and girls mainly use containers which they load on their heads to transport water to the homestead while men prefer to use assets such as donkey drawn carts and vehicles to transport water as these do not cause much physical strain on them.

Rainwater harvesting contributes significantly to household water supply and limits the number of trips to untreated water sources by women. There is need for policy to promote rainwater harvesting in countries like Botswana in general and Ngamiland in particular where households face water insecurity. Incentives such as the provision of rainwater harvesting infrastructure at subsidized rates can go a long way in encouraging households to adopt the activity.

Water security compromises personal hygiene of household members and also breeds conflicts in households as members do not agree on quantities of water to be used on certain activities. This makes it imperative for the implementation of measures which can address water insecurity.

Countries affected by water insecurity need to craft and implement policies and strategies that enhance water security (e.g. in both gazetted and ungazetted villages) as this will address issues of gender inequity and negative social issues associated with water insecurity. Policies need to focus on ensuring that improved water sources infrastructure provide water on a sustainable basis. Households can be made to be active participants in the provision of water through rainwater harvesting. Policy and programmes need to ensure that ungazetted settlements receive water supply services.

Research has to underpin any policies and programmes aimed at enhancing household water security. This

include policy options for rainwater harvesting, functionality of the already installed water infrastructure, connection of ungazetted settlements located along water transmission lines, the supply of water to other ungazetted settlements and impacts of head loading of water by women. More research is needed on the appropriate water fetching assets that can be used by women to fetch water away from the homestead.

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