Differentiated vulnerabilities and capacities for adaptation: A case study on household adaptation to water shortage in Gaborone

JOSEFINE LUND SCHLAMOVITZ | DIVISON OF RISK MANAGEMENT AND SOCIETAL SAFETY | LTH | LUND UNIVERSITY, SWEDEN

Differentiated vulnerabilities and capacities for adaptation:

A case study on household adaptation to water shortage in Gaborone

Josefine Lund Schlamovitz

Supervisor: Per Becker

Lund 2019

Differentiated vulnerabilities and capacities for adaptation: A case study on household adaptation to water shortage in Gaborone

Josefine Lund Schlamovitz

Number of pages: 55
Illustrations: 14

Keywords: Adaptive Capacity; Botswana; Climate Change Adaptation; Gaborone; Intersectionality; Vulnerability; Water Shortage.

Abstract
Provision of freshwater to urban residents remains a significant global challenge. A challenge whose impendent success in many regions is further threatened by climate change and urbanization projections, subsequently increasing the pressure on urban water supply. Employing an intersectional lens, this case study explores household implications of and responses to water shortage in Gaborone, the capital of Botswana, with special attention to residents' differentiated adaptive capacities and vulnerabilities. Informed by 58 interviews with residents and key informants, the research illustrates the intricacies of household adaptation to water shortage. The study finds that households from all socio-economic backgrounds face numerous implications vis-à-vis water shortage among others: disruption of lives and livelihoods, direct and indirect health challenges as well as social exclusion and embarrassment. To reduce exposure and impact, households engage in various coping and adaptive strategies most notably: water conservation efforts, storage, investment in structural equipment and finding alternative sources. The choice of which to engage in is however dependent on a household's adaptive capacity and vulnerability – properties that this research finds are not uniformly distributed between the participants or within their associated social groups. Utilizing intersectionality as a heuristic device when analyzing the narratives of the participants allows for an exploration of the underlying reasons for the participants' differentiated vulnerabilities and capacities for adaptation. It is argued that the intersection and interplay of identity markers such as gender, nationality, age and socio-economic background coupled with the contextual factors of health, caregiving, unemployment and land and housing tenure influence the adaptive capacity and vulnerability of the participants. Concludingly, the study posits intersectionality as a helpful framework, as it enables a multidimensional analysis identifying asymmetrical power relations at various levels that either enable or delimit individual agency in adaptation to water shortage.

Riskhantering och samhällssäkerhet
Lunds tekniska högskola
Lunds universitet
Box 118
221 00 Lund

http://www.risk.lth.se

Telefon: 046 - 222 73 60

Division of Risk Management and Societal Safety
Faculty of Engineering
Lund University
P.O. Box 118
SE-221 00 Lund
Sweden

http://www.risk.lth.se

Telephone: +46 46 222 73 60

ACKNOWLEDGEMENTS

This study would not have been possible without the support of many people, and I would like to extend my sincere gratitude to all of them. A special thank you to; Francine and Premiere, Ann and Mattias, Iepeleng, Piet, Iben and Carsten, and Leif. You were all instrumental in each your own way to help me realize this research. Furthermore, I would like to extent my gratitude to my supervisor Per Becker who provided invaluable guidance and encouragement right from the beginning when this was nothing more than a vague idea and throughout the research process.

Moreover, this study was carried out within the framework of the Minor Field Studies (MFS) Scholarship Programme, which is funded by the Swedish International Development Cooperation Agency, Sida. I am very grateful for the opportunity that the MFS scholarship awarded me, without which I would not have been able to conduct this research.

Lastly, a heartfelt thank you to all the participants I had the pleasure of interviewing. Thank you for taking time out of your busy schedules to talk to me about your lives and experiences and for contributing to this research.

TABLE OF CONTENTS

LIST OF ACRONYMS

ESNO..... El Niño Southern Oscillation

IPCC..... Intergovernmental Panel on Climate Change

WASH..... Water, Sanitation and Hygiene

WUC..... Water Utilities Corporation

GLOSSARY

Batswana ..... People of Botswana in plural form

Ee..... Setswana word for yes and positive affirmation

Eish ..... Informal exclamation; used to express surprise, annoyance, pain etc.

Kgotla..... A public meeting, community council or traditional law court of a Botswana village

Motswana..... Singular form of Batswana; meaning a citizen of Botswana of any ethnic background

Setswana ..... Language of the Tswana people and one of the two official languages in Botswana

LIST OF TABLES AND FIGURES

1. INTRODUCTION

Freshwater plays a pivotal role in society. It is a prerequisite for life and underpins livelihood opportunities. It is also a finite and non-substitutable resource, unevenly distributed in time and space. Scholars have long called for attention to the societal implications of its scarcity vis-à-vis human development, population growth and anthropogenic induced climate change (e.g. Alcamo, Kaspar, Wetterdienst, Siebert, & Döll, 1997; McDonald et al., 2011; Vörösmarty, Green, Salisbury, & Lammers, 2000). The insufficient access to freshwater to satisfy basic human needs and sustainable development has created a global water crisis. Today, around 4 billion people experience severe water shortage[1] during at least one month of the year (Mekonnen & Hoekstra, 2016), and approximately 844 million people lack access to basic drinking water (WHO & UNICEF, 2017). Concurrently global water demand is projected to increase by 55% to 2050 (OECD, 2012).

The global water crisis is increasingly manifesting itself in the urban sphere as rapid urbanization is outpacing public services and, currently, one quarter of large cities globally face issues pertaining to freshwater shortage[2] (Padowski, Carrera, & Jawitz, 2016). According to the United Nations (2018), over 55% of the world's population resides in urban areas, a number estimated to increase to 68% by 2050. The interplay between climate change, natural water variability and availability as well as societal water demand and supply in urban settings is highly complex and site-specific. Notwithstanding that urban areas for the most part have been successful in adapting their water resource management systems to natural climate variability, anthropogenic induced climate change challenges these systems through increased uncertainty (Burton & May, 2004), modified precipitation and evaporation patterns (Ludwig, van Slobbe, & Cofino, 2014) and changes in the severity and frequency of climatic events such as droughts (Jiménez Cisneros et al., 2014).

One city where climate change and demographic trends are projected to present a fundamental challenge for freshwater provision is Gaborone; the capital of Botswana. Located in a region with a high propensity for periodic drought, climate change, already manifesting itself through a warming increase of 1.0°C against pre-industrial levels (Nkemelang, New, & Zaroug, 2018), is a major influencer on domestic water supply and availability. In 2015/2016 Botswana experienced its worst drought in over 30 years that severely strained its domestic water supply. In Gaborone, the dam level fell well below 20% leaving the city on the brink of running out of water (New &

[1] The term 'water scarcity' was used in the original source. The use of these concepts will be elaborated on in the conceptual framework, chapter 2.1.

[2] The term 'water stress' was used in the original source. The use of these concepts will be elaborated on in the conceptual framework, chapter 2.1.

Bosworth, 2018). According to the Inter-governmental Panel on Climate Change (IPCC), Botswana will most likely experience similar events in the coming years as the country is predicted to face severe water shortage in the future due to the impact of climate change (Hoegh-Guldberg et al., 2018).

Notwithstanding the current and anticipated rise in global urbanization and subsequent vulnerability (Schaer, 2015), the majority of research on climate change adaptation in developing countries has a geographical bias towards rural areas, predominantly focusing exclusively on poorer communities with often only sex aggregated data as a measure for differentiated adaptive capacity (e.g. Eriksen, Brown, & Kelly, 2005; Pritchard & Thielemans, 2014; Quinn, Ziervogel, Taylor, Takama, & Thomalla, 2011; Singh, 2014). In viewing people not just as passive victims of circumstance, but instead active agents of differing opportunities and constraints (Eriksen et al., 2005), it becomes increasingly important to understand the dynamic interaction between nature and society in the urban sphere. This, as adaptive responses becomes central as the consequences of climate change will unfold on regional and local stage (Berkes & Jolly, 2001). In the context of Botswana, case studies on water shortage has primarily focused on rural areas in the northern regions (e.g. Kujinga, Mmopelwa, Vanderpost, & Masamba, 2014; Kujinga, Vanderpost, Mmopelwa, & Masamba, 2014). Thus adaptation to water shortage in an urban setting remains insufficiently researched. Considering the above, the purpose of this thesis is therefore to explore household implications of and responses to water shortage in Gaborone with special attention to residents' differentiated adaptive capacities and vulnerabilities. To this end a case study employing qualitative data is conducted in Gaborone guided by the following research questions:

- *What are the implications of water shortage for the residents of Gaborone?*
- *What are the underlying factors influencing how residents of Gaborone are affected by water shortage?*

1.1. Delimitation

The study area is restricted to only encompass Gaborone city. Merging satellite extensions or what is generally considered the Greater Gaborone Area is therefore excluded in this research. The reason for this limitation is twofold: First, Gaborone city is supposed to have the best water supply in all of Botswana making this geographical area particularly interesting to examine. Secondly, due to time limitations it was not possible to thoroughly include this area in the research.

Furthermore, while this research centers around and notes various multilevel power relations producing inequalities vis-à-vis vulnerability and adaptation, it is however outside of the scope of this research to make a thorough in-depth analysis of these based on the beforementioned time limitation.

1.2. Thesis outline

To answer the research questions stated above, the thesis will first present the conceptual framework upon which the research is based. This includes a presentation and discussion of how water shortage is interpreted and utilized throughout the research as well as relevant concepts that will guide the analysis of data such as coping, adaptation, vulnerability and intersectionality. Chapter three will then provide a brief overview of the case study context of Botswana and the study area of Gaborone. The following chapter four will proceed to outline the research design and the methodological considerations that have guided the research. More specifically, the chapter will present the rationale for deploying a qualitative case study and an intersectional framework as a research strategy, the use of semi-structured interviews for the data collection as well as outline research limitations. In chapter five, the findings based upon the analysis of the semi-structured interviews will be presented under appropriate subsections. Subsequently chapter six proceeds to elevate key findings into a broader discussion drawing in part on the conceptual framework as well as additional literature from academia to gain a deeper understanding of the implications of water shortage in Gaborone and the underlying factors influencing people's vulnerability and adaptive capacity. A conclusion will complete the research by summarizing the findings and offer an answer to the stated research questions.

2. CONCEPTUAL FRAMEWORK

This chapter is dedicated to outlining and briefly discuss the relevant concepts that underpin this research. The concepts that comprise its conceptual framework are: water shortage, adaptation and coping, vulnerability and intersectionality.

2.1. Water shortage

When examining academic and grey literature on the issue of insufficient availability of freshwater to meet human needs, no commonly accepted definition exists. In the literature several concepts are used interchangeably such as 'water scarcity', 'water shortage' and 'water stress' without proper definition or demarcation of either (e.g. Falkenmark, 1989, 1990; Poste, 2000; Shandas, Lehman, Larson, Bunn, & Chang, 2015; Showers, 2002; Vairavamoorthy, Gorantiwar, & Pathirana, 2008). While some sources make a distinction between water scarcity and water shortage (see e.g. FAO, 2012), this research will employ the latter without subscribing to any such distinction. The choice is not academically founded but is due to water shortage being the expression that the research participants themselves used to describe their situation when faced with inadequate provision of and access to clean freshwater to meet their needs. The choice of choosing to define concepts based on their utility and ability to identify and make sense of certain phenomena through their embeddedness in everyday language is supported by Hearn (2012) who argues that one should not discard everyday conceptions as they encode the practical experiences of the speakers and the collective wisdom that underpins its usage.

2.2. Adaptation and coping

The concept of 'adaptation' is considered an important and necessary pillar in the response to climate change (Mimura et al., 2014) and can be defined as "the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities" (IPCC, 2018). Closely related to adaptation is the concept of 'coping' here defined as "the ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters" (UNISDR, 2009). Each concept encompasses a range of strategies that a system, such as for example a household, can use when faced with climate stimuli stresses. Both concepts, or types of responses, are on a continuum in time and space in which they differ in terms of timeframe and sustainability (Davies, 1993). Typically coping strategies are the immediate reactive responses to a situation whereas adaptation strategies are long-term strategies that may be implemented after or in anticipation of an event (Berkes & Jolly, 2001). As such, while coping strategies might reveal a household's capacity to withstand

immediate threats, these strategies do not function as long-term solutions or decrease future vulnerability. Moreover, frequent use of coping strategies may deplete resources needed for future coping or that otherwise would have been available for adaptation (Adger, 1996). The two types of responses may however overlap and coping strategies can potentially develop into adaptive strategies over time (Berkes & Jolly, 2001).

The strategies underpinning these concepts come in huge variety and have in risk, adaptation and vulnerability literature been differentiated and categorized according to numerous attributes. The most common differentiations pertain to their temporal scope (anticipatory or reactive) and form (structural, legal, behavioral, financial or technological) (Adger, Arnell, & Tompkins, 2005; Downing, Ringius, Hulme, & Waughray, 1997; Smit & Pilifosova, 2001; Smit & Wandel, 2006). Moreover, scholars argue that the choice of strategy employed by a system is not isolated from other decisions but depends on the system's characteristics and occurs within a dynamic social, economic, technological, biophysical and political context (Smit, Burton, Klein, & Wandel, 2000; Smit & Pilifosova, 2001). In turn, these choices are therefore not made freely but are constrained by, among other things, institutional processes, regulatory structures, property rights and social norms (Adger et al., 2005). The interplay of these complex factors thus influences the capacity of the system to respond (Smit & Pilifosova, 2001), whereby it, in other words, influences the system's 'adaptive capacity'. In this context, adaptive capacity is understood as a critical system property that is made up of a system's potential, capability or ability to anticipate or respond to perceived or current climate stimuli stresses, whereby this property greatly influences a system's vulnerability by modulating exposure and sensitivity (Engle, 2011; Smit & Pilifosova, 2001).

2.3. Vulnerability

Notwithstanding considerable diversity in existing literature, the concept of 'vulnerability' in relation to climate change is generally understood as the degree to which a system is susceptible to harm stemming from the adverse effects of climate change, generally characterized by the system's exposure, sensitivity and adaptive capacity (IPCC, 2007; Luers, 2005; Smit & Pilifosova, 2001; Srinivasan, Seto, Emerson, & Gorelick, 2013; Turner et al., 2003; Wisner, Blaikie, Cannon, & Davis, 2004). When referring to individuals or groups of people, Wisner and colleagues (2004), outline the following understanding of vulnerability: "the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (p. 11). It is widely recognized that climate change will affect people differently according to their respective cultural, economic, environmental and social context. And while a number of studies highlight the importance of social differentiation as a crucial determinant of vulnerability (e.g. Adger & Kelly, 1999; Ribot, 2010), traditionally, literature on vulnerability has identified entire groups of people as inherently vulnerable, irrespective of stressor, simply due to their association with certain social groups such as for example; women,

children, elderly, persons with physical or mental illnesses, indigenous peoples to name but a few (see for example ESCAP & UNISDR, 2012; Morrow, 1999). This view is however contested by Buckle (1998), who argues that categorizing entire groups of people as supposedly vulnerable is problematic as vulnerability is not a homogeneous property. According to Buckle (1998), such false labeling ignores the issues of differential exposure and subsequent vulnerability of people within and between these groups just as it ignores the underlying reasons why certain people within these groups may be vulnerable in the first place. Furthermore, such generalizations impede the recognition of attributes and experiences of individuals within these groups that may reduce their vulnerability. This notion is supported by Djoudi et al. (2016) who argue that the victimization of e.g. women as vulnerable by default to climate change relies on the assumption that women are a homogeneous group and thus ignores the crucial importance of other contextual factors. Vulnerability is thus not a fixed property that is uniformly distributed among social groups, but is dynamic, spatially variable and scale dependent (Arora-Jonsson, 2011; Srinivasan et al., 2013). Vulnerability therefore changes over time, and while it is always experienced locally, it is rooted in social, economic and political processes creating underlying causes which may be remote from the triggering event itself (Ribot, 2010; Wisner et al., 2004).

2.4. Intersectionality

Originating in black feminist research, the term 'intersectionality' was first coined by critical race theorist Kimberlé Crenshaw (1989) in her scholarship on intragroup differences and the existence of multiple axes of identity governing an individual's relationship to power. It is based on the assumption that social categories are constructed and dynamic (Cho, Crenshaw, & McCall, 2013; Davis, 2008). Furthermore, intersectionality acknowledges that an individual can belong simultaneously to multiple disadvantaged and privileged groups in which these axes of privilege and oppression intersect and interact (Osborne, 2013). The intersectional approach has since transcended into other research areas, although the concept remains novel within the realm of climate change and vulnerability research (Djoudi et al., 2016; Kaijser & Kronsell, 2014).

In the context of climate change, intersectional analysis has been praised by proponents as important for successful climate change adaptation interventions and programming as it helps illuminate "how individuals and groups relate differently to climate change, due to their situatedness in power structures based on context-specific and dynamic categorisations" (Kaijser & Kronsell, 2014, p. 417). While it has long been noted in climate change adaptation literature that a person's vulnerability is shaped by several factors such as e.g. race, gender, age etc., what is less studied is the intersectionality of these factors. An intersectional framework recognizes that it is the interplay of these factors, together, that shapes an individual's position and how they experience space and place, which in turn influence what they do, how they do it, when they do it, with what resources and to what ends (Kaijser & Kronsell, 2014; Osborne, 2013; Thompson-

Hall, Carr, & Pascual, 2016). An intersectional approach can therefore, according to Kaijser and Kronsell (2014), help shed light on how the "responsibility, vulnerability, and decision-making power of individuals and groups in relation to climate change can be attributed to social structures based on characteristics such as gender, socio-economic status, ethnicity, nationality, health, sexual orientation, age, and place" (p.420), and make possible to ask "how particular positions both enable and delimit individual agency" (p.422). Furthermore, the multilevel dimension of intersectionality makes possible to recognize complex web of interaction and impact stemming from both policies at different levels (vertical interactions), inter-community asymmetrical power relations (horizontal interactions) as well as intra-community and household asymmetrical power relations (Djoudi et al., 2016). As such, intersectionality gives way for a more robust understanding of dynamic assemblages of power and how these shape sensitivity and adaptive capacity (Thompson-Hall et al., 2016).

It is important to note however that a debate currently exists among scholars on the nature of intersectionality as some regard it a theory, some a concept, others a heuristic device and others still a reading strategy (Davis, 2008). While some scholars have argued for a coherent framework and conceptualization (see McCall 2005), others argue that the vagueness of intersectionality is what makes it a useful tool for researchers (Davis, 2008). Along similar lines an unresolved theoretical dispute exists over whether intersectionality should be an approach reserved for research on people who embody marginalized subject positions only (Hillsburg, 2013). This research aligns itself with scholars who position themselves differently in this debate, and instead are of the belief that it can be applied to everyone since all subjectivities are characterized by the interplay of several different identity markers. For the purpose of this research, intersectionality is used as a heuristic device, guiding the analysis by providing a methodological lens through which the data is examined which will be elaborated on further in the methodological framework, chapter 4.1.

3. THE GABORONE CASE STUDY CONTEXT

The following chapter provides a brief introduction to aspects of Botswana relevant to this research as well as to the study area of Gaborone. This is done to provide context to the country and city within which this research takes place.

3.1. Botswana

At independence in 1966, Botswana was among the poorest nations in the world. However, with the discovery of diamonds shortly after as well as the implementation of sound macroeconomic policies coupled with good governance, Botswana's growth rate was among the highest in the world between 1966 and 2005 subsequently making them an upper middle-income country (Juana, 2014; Selolwane, 2012; The World Bank, 2019). Notwithstanding its ranking as such and its relative small population of approximately 2,2 million people (The World Bank, 2019), Botswana continues to grapple with significant challenges of uplifting the welfare of its population. More specifically, Botswana struggles with a prevalent HIV/AIDS pandemic, high unemployment rates as well as growing income inequality and urban poverty (Acquah, Kapunda, & Legwegoh, 2014; Matandare, 2018; Rankokwane & Gwebu, 2006; Ritsema, 2008).

Due to its arid and semi-arid conditions, Botswana is endemic to drought and subject to significant interannual climate variability in precipitation and temperature driven primarily by the El Niño Southern Oscillation (ENSO) (Nkemelang et al., 2018; The World Bank, 2010). The intensity and duration of ESNO is furthermore significantly affected by the current changes in climate, making climate change yet another significant challenge facing the country (Juana, 2014). Botswana has an average annual precipitation rate of 416 mm/year (Juana, 2014), ranging from 650 mm in northern Botswana to 250 mm in the southwest and evaporation rates reaching as high as 2.000 mm/year (Segosebe & Parida, 2006). The majority of the annual rainfall typically falls between October and March, when temperatures and evaporation rates are at their highest (The World Bank, 2010). This results in relatively low annual rates of groundwater recharge and surface runoff, limiting the opportunities for water storage. Consequently, Botswana have for decades been struggling with water shortage (Ganesan, 2001; The World Bank, 2010). An issue compounded not only by climate change but furthermore by increasing water demand due to progressively higher living standards among the population as well as industrial growth (Hambira, Moalafhi, & Mulale, 2011). Concurrently, Botswana's limited water sources which consist primarily of unevenly distributed surface and underground water in aquifers - some of which with no recharge (Government of Botswana, 2013), are increasingly drying up (Hambira et al., 2011). Hence with reference to how climate change may impact the country's future water supply Nkemelang et al. (2018) argue that "Botswana is already water-stressed; the projected decreases

in mean annual rainfall, as well increased dry spell length, will escalate stress, leading to more frequent water shortages in today's urban and agricultural supply systems" (p. 9). Moreover, temperatures are rising resultant in more frequent heatwaves than hitherto experienced (Ministry of Health & Wellness, 2018).

In 2015/2016, Botswana experienced its worst drought in over 30 years: A result of an existing ongoing drought in Southern Africa coupled with one of the strongest ENSO's on record (New & Bosworth, 2018; Siderius et al., 2018). The drought severely impacted urban water supply in Botswana as the main dam supplying the capital city Gaborone with drinking water ran dry dropping to historical lows. The city was subsequently on the brink of running out of water which left certain areas with no reliable water supply for weeks at a time (New & Bosworth, 2018; Siderius et al., 2018). Although the country had been subject to government-imposed water restrictions since 2012 (WUC, 2012), the intensity of the 2015/2016 drought nonetheless caused demand to surpass supply in the Greater Gaborone Area by 18,2 million liters a day in December 2015 (Siderius et al., 2018). Notwithstanding the dam subsequently recharged to near full capacity (Statistics Botswana, 2017), it continues to be vulnerable to climate fluctuations and water restrictions remain.

3.2. Study area

The research is situated in Gaborone, Botswana's capital, located in the south-eastern part of the country. Gaborone is a city characterized by rapid urbanization and development stemming largely from extensive public and private investments and rural-urban migration caused by drought induced rural agricultural problems and urban livelihood opportunities (Acquah et al., 2014; Legwegoh & Hovorka, 2013; Rankokwane & Gwebu, 2006). Gaborone remains the principal destination for many moving from the rural areas and currently, approximately 234,000 people reside in the city, which is just below 11 per cent of the total population (Statistics Botswana, 2018). Table 1 shows the increase in urbanization from 1981 till 2017.

Table 1: Percentage of Population Residing in Gaborone Year 1981-2017

1981	**1991**	**2006**	**2017**
6,3	10,1	10,7	10,9

Sources: (Central Statistics Office, 2008; Statistics Botswana, 2016, 2018)

While the demographic shift towards urbanization and the urban sprawl of Gaborone has brought economic prosperity and development to the city, sustainability remains an increasingly important issue (Keiner & Cavric, 2004; Sebego & Gwebu, 2013). Not only from an urban planning perspective but further from a socio-economic perspective; prosperity from development and economic growth is unequally distributed among Gaborone residents as growth has not been accompanied by commensurate increases in formal sector employment opportunities (Rankokwane & Gwebu, 2006), resultant in among other things, significant food insecurity among the less affluent households (Acquah et al., 2014) and continuous health struggles related to the prevalent HIV/AIDS epidemic (Ritsema, 2008).

In Gaborone, water provision is governed by the parastatal organization Water Utilities Corporation (WUC), which is furthermore residents' primary source of water. Table 3 listed in Appendix A display the different areas where the participants' households are located.

4. METHODOLOGICAL FRAMEWORK

This chapter will explain the methodology underpinning this research. It will outline and provide reasoning for the choice of a case study, the choice of adopting an intersectional framework, the data collection process and analysis before finalizing with a brief discussion on the limitations of this research.

4.1. Research design and strategy

To answer the proposed research questions, a qualitative single case study with an inductive approach to the relationship between theory and research was employed. Given the exploratory nature of the research questions, this approach was deemed well-suited as it allows for the participants respective perspectives to be meaningful information that can contribute to the development of new knowledge on a micro level (Bryman, 2012; Yin, 2011). The case location of Gaborone was not chosen due to its uniqueness, but rather to exemplify a representative case of household adaptation to urban water shortage. Hence, the type of case analyzed in this research is what Bryman (2012) refers to as an exemplifying case.

This research adopts an intersectional approach to the analysis. Currently, no consensus exist in literature on how to apply intersectionality in practice nor which methods are most appropriate (Cho et al., 2013; Davis, 2008; Kaijser & Kronsell, 2014). Hence, it is up to the individual researcher to create a research design that can incorporate the complexities associated with an intersectional framework. Researchers employing set framework describe it as a tool guiding critical thinking providing a way to analyze and discuss the inherent complexity of a given context (Ackerly & True, 2013; Kaijser & Kronsell, 2014). The aim of intersectional analysis is not to include as many analytical categories as possible, but to widen the perspective and critically reflect upon which factors may be relevant in a particular setting, while conscious of keeping an open mind (Kaijser & Kronsell, 2014). In this research, although concerned with social categories for analysis, intersectionality is employed as a heuristic device for understanding social contexts rather than a categorical one.

4.2. Data collection

The data collection method used to inform this research is semi-structured interviews collected during an eight-week field study between January and March 2019. Due to the nature of this research, being an exploratory study of people's differing vulnerabilities and adaptive capacity to urban water shortage analyzed through an intersectional lens, it was necessary that the interview

method allowed for both structure and flexibility. To this end, semi-structured interviews was deemed most appropriate, as they allow for the interviewees to shape the conversation and freely articulate and express their own ideas and perceptions (Bryman, 2012). For this to materialize, Yin (2011) stresses the importance of the researcher to be as nondirective as possible so that the "participants vocalize their own priorities as part of their own way of describing the world as they perceive it" (p. 134). As adaptation to urban water shortage is insufficiently researched, in particular with an intersectional lens, this method enables the revealing of unexpected views and perceptions. In addition, this method of interviewing allows the researcher to take initial impressions, findings and curiosities, as well as direct observation, into consideration to inform future interview themes and questions. Due to the intersectional approach to this research, pre-established questions pertaining to the demographic characteristics of each interview participant and their respective household introduced the semi-structured interviews with residents of Gaborone. These demographic questions also functioned as an icebreaker, creating a natural transition into the semi-structured part of the interviews. The data stemming from the demographic part helped create a better understanding of the context within which each resident was situated in, which later helped inform the analysis.

Overall, 58 interviews were conducted. These can be categorized into two groupings: primary interviews and key informant interviews. The primary interviews were conducted with residents of Gaborone and comprise of 55 interviews. The key informant interviews, comprising 3 interviews, were made with professionals working with: climate change adaptation in the context of Botswana, health care services and marginalized population groups. Table 2 displays the type of organization that the key informants worked for as well as their area of expertise.

Table 2: Key Informants

	Type of organization	*Area of expertise*
Key informant 1	Local NGO	Working with the LGBTQ+ community and HIV/AIDS positive, with special focus on sexual health and right services.
Key informant 2	Academic institution	Working with climate change adaptation in the context of Botswana, with a special focus on gender.
Key informant 3	Health service provider	Working with the general population with a special focus on people living with HIV/AIDS and non-nationals.

The choice to include key informants in the data collection was made to provide perspectives and views from community representatives and professionals which could complement those of the primary interviews. In addition, due to societal stigma surrounding certain social groups in Botswana, it can be difficult to interview people who openly associate with these. For example, even though a large percentage of the population in Botswana are HIV/AIDS positive, the societal stigma makes many HIV/AIDS positive people not want to openly discuss this – especially not to a foreign researcher. The sensitivity of the matter further makes it inappropriate to openly ask people about people's respective health status. Consequently, with the limited timeframe available to conduct the field work, it was thought that including community representatives as key informants would help express views and perspectives perhaps otherwise not represented in the primary interviews.

Interviews were conducted in either English or Setswana depending on the preference of the interviewee. Interviews in Setswana was conducted with the help of a professional researcher who functioned both as an interpreter and cultural guide. Additionally, interview guides comprised of relevant themes and topics was created to help guide the conversations. Due to the exploratory nature of this research, the interview guide for the primary interviews was adapted slightly during the data collection process as is custom in qualitative research employing semi-structured interviews (Bryman, 2012; Yin, 2011). Similarly, the interview guide for the key informants was slightly altered and adapted to each of the key informants depending on their work. The main themes informing the interview guides for the primary and key informant interview as well as the themes for the demographic questions to primary interviewees can be found in Appendix B.

Due to the nature of this research, principally every resident in Gaborone would be of interest for this study. To get a selection of respondents from various communities and with varying socio-economic backgrounds, gender, age and nationality among others, purposeful sampling was used both of context (neighborhoods) and participants (Bryman, 2012). This was sought done due to the importance of obtaining "the broadest range of information and perspectives on the subject of study" (Kuzel as cited in Yin, 2011).

4.3. Data analysis

The analysis was conducted using coding methodologies commonly associated with grounded theory (see Charmaz, 1996; Hahn, 2008) using the qualitative analysis computer software Nvivo. The goal with this analytical method was to take the data output from the empirical data collection and slowly through several stages create categories or themes from where a theory could form. The data was in other words first disassembled in order to then reassemble it into meaningful categories or themes. The analytical process started with a level 1 coding where

transcripts of the interviews were coded line by line, given codes worded closely to the original statement without making many decisions about the statements' overall relevance, as it is imperative that the researcher at this stage remains openminded. This process created several hundred codes which became the foundation for the level 2 coding where similar level 1 codes were grouped together into broader concepts and categories. During the level 3 coding process, the now substantially reduced number of level 2 codes was grouped together into broader categories or themes. The final output informing the analysis is thus derived from an iterative process of disassembling and reassembling the data until meaningful categories or themes were created.

In addition to being a helpful tool in gathering an overview over the level 1, 2 and 3 codes, using Nvivo furthermore made it possible to create cases out of each of the transcripts and assign each certain case classifications. Creating a separate case for each of the 55 primary transcripts enabled that the information gathered from the demographic questions was assigned to each case. This in turn facilitated the possibility to create queries and easily see the demographic characteristics belonging to each statement which was helpful when trying to discern patterns linked to an intersectional framework.

4.4. Research limitations

Several limitations should be noted with regards to this research. To begin with, this research is based upon an interview sample of 58 participants, subsequently limiting the validity of any statistical generalizations for the population of Gaborone. This was however never the intention of this case study. According to Yin (2011), lessons learned from exemplifying cases can be assumed to be informative about experiences in similar cases and contexts. The finding from this research on adaptation to urban water shortage in Gaborone can therefore potentially still contribute to the larger body of literature on adaptation to urban water shortage in a broader context.

Additionally, as mentioned earlier, the sensitive nature of disclosing personal information about oneself, such as for example health status, might have kept certain participants from revealing how these factors might impact their lives vis-à-vis water shortage.

It should furthermore be noted that during the time of the data collection process, the Water Utilities Corporation (WUC) was fixing the pipeline on what is commonly referred to as the North-South Carrier project where water is transported from a dam further north to Gaborone. The maintenance was expected to create water cuts for certain areas.

Lastly, some of the interviews were conducted in Setswana facilitated by an interpreter and it should therefore be acknowledged that this increases the risk of misunderstandings or

miscommunication. Furthermore, there was one area, a former squatter settlement named Old Naledi, where the interpreter did not feel comfortable doing interviews due to safety concerns. Consequently, the research then employed a local non-experienced interpreter to help facilitate four interviews with participants from households in Old Naledi. By using an interpreter with no prior experience, the risks of misunderstandings or inadequate translations increase. This was however considered a necessary trade-off as it was inferred that these interviews, due to the locality of the households, could provide invaluable insights to the research.

5. FINDINGS

This chapter comprises of findings that were derived from analyzing the primary and key informant interviews. The chapter is divided into subsections resultant from this analysis. First, participants' experiences with water access and shortage is outlined before providing an overview of the various coping and adaptation strategies that they employ. The chapter then continues by examining how water shortage disrupts participants' lives and livelihoods followed by a subsection on the health challenges associated with water shortage in Gaborone as well as a subsection on how water shortage leads to social exclusion and embarrassment for some participants. Next follows a subsection on the intersecting barriers to adaptation encountered by the participants before concluding with a small subsection on the nexus between water shortage and heat.

5.1. Water access and water shortage experiences

All 55 of the participants stated that their primary source of water is municipal water provided by the parastatal organization Water Utilities Corporation (WUC). The ways in which this water is accessed by each household is however different depending on their respective type of water connection (Figure 1).

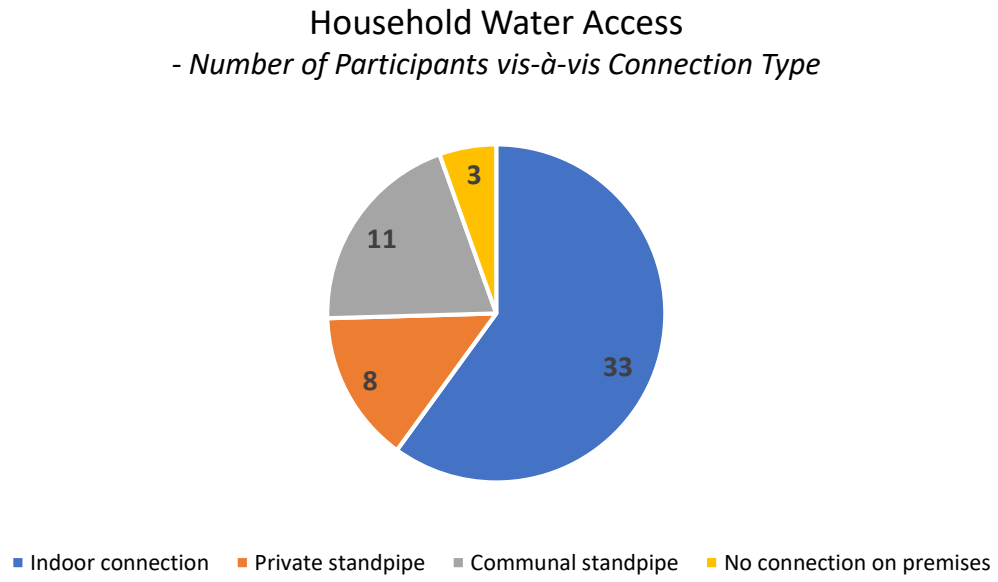

Figure 1: Household Water Access

Due to the nature of urban development and planning in Gaborone, many neighborhoods have a mixture of low- and middle-income housing in close proximity to each other. Only high-income neighborhoods seem to be slightly more secluded. Residential areas therefore often consist of households with differing access to water, depending in part on their socio-economic background and housing tenure. For example, all participants with communal standpipe access rent their housing while 22 out of 33 households with indoor connections own their housing.

When asked to describe their experiences with water shortage, only one participant said that they have never experienced water shortage of any kind in the three years they have lived in Gaborone. The remaining 54 respondents have, at least one point in time, experienced water shortage. These have been both warned and unwarned water cuts due to pipe maintenance and water rationing, as well as undesirable water quality. The exposure to and extent of water shortage is in part spatially determined. From the interviews it is evident that water shortage is not experienced equally throughout Gaborone. According to the narratives of the interviews, in some neighborhoods water rationing equals a complete absence of water, or a water cut, while in others it means a very low pressure. The duration of water shortage furthermore differs across the city ranging from a few hours up to several weeks during periods of severe shortage. Participants from neighborhoods that they themselves characterized as having minor exposure to water shortage gave differing explanations as to why that particular location was not as badly affected as its neighboring counterparts such as its close proximity to: ministers, government officials and embassies, industries, hospitals, the Gaborone dam and furthermore being located on the original water infrastructure grid.

5.2. Employed coping and adaptation strategies

Sufficient access to clean water is one of the highest priorities for the interviewed participants and their respective households. Unlike the absence of other household utilities, water is considered an essential resource. A participant summarizes it as follows: “You can regulate your life around that there is no electricity, but you can't regulate your life around there being no water. No, water is hygiene, water is life, hydration, cooking, washing, you know, water is absolutely important”. The consequences of not having water within the household are significant, and the households therefore engage in various strategies to protect themselves from exposure to water shortage as well as lessen its impact. As outlined above, households are not uniformly exposed to water shortage, nor do they have similar sensitivity and the response of the households hence differ according to their adaptive capacity. Figure 2 illustrates the different categorizations of strategies that the participants employ vis-à-vis water shortage. The figure moreover shows how these differ in temporal scope.

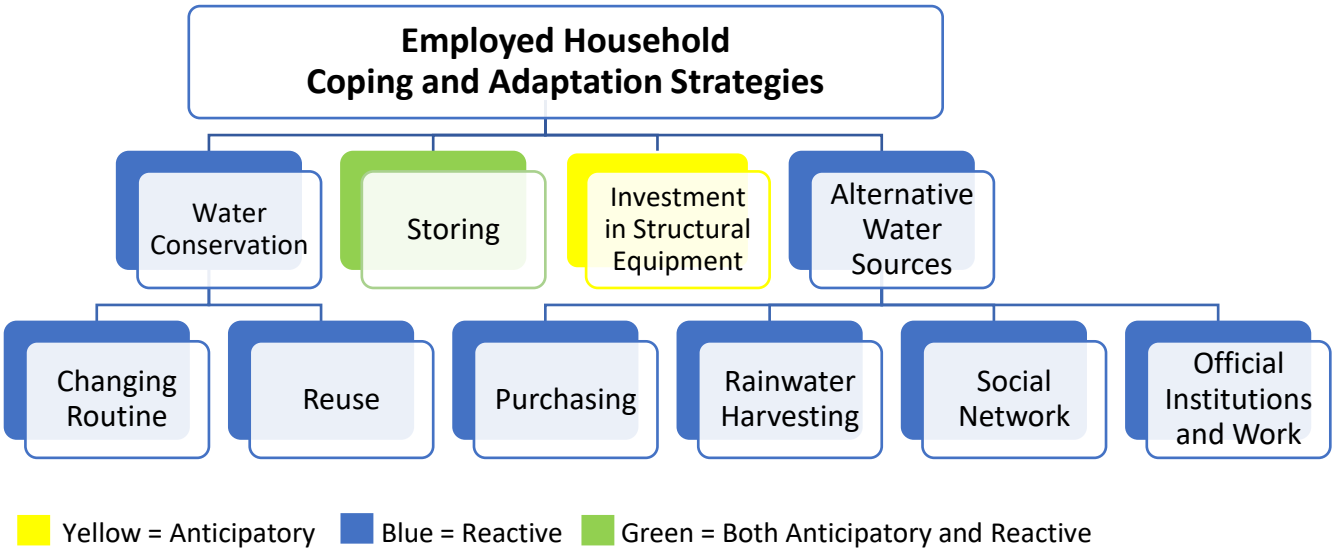

Figure 2: Employed Household Coping and Adaptation Strategies

The figure illustrates how the majority of strategies employed by households are reactionary, and thus primarily strategies associated with coping to water shortage rather than adapting to water shortage. These include water conservation such as changing in routines pertaining to bathing, laundry and cooking as well as reusing water. In total 33 participants stress water conservation as one of their means to lessen the impact once exposed to water shortage. Another coping strategy adopted by 25 households as a last resort is getting water though their social network, including friends, family, neighbors, colleagues or fellow church members. Nine households furthermore turn to official institutions such as colleges and universities or their workplace to fetch water if pressed. These coping strategies are adopted by households from both low and middle socio-economic backgrounds. Investment in structural equipment on the other hand, is an adaptation strategy that only eight participants have employed. In this context, structural equipment refers to changes to the structure of the physical environment of the household such as installing grey water systems, installing gutters to connect to large water tanks for rainwater harvesting or to connect a tank to the municipal water infrastructure and the indoor tap for storing.

The most utilized risk reduction measure that, if employed anticipatory, can minimize the exposure to water shortage, is storing of water in various size containers. These containers are henceforth referred to as either buckets, drums or JoJo tanks (see Appendix C for photos of the different water storage containers and their approximate volumes that are utilized by the participants). Of the 55 participants, only five declared that they currently do not own any containers to store water, and subsequently solely rely on tap water or purchasing water on a needs-based basis. While the remaining 50 participants does have water storage, their

relationship to storage however differs. Among the 22 participants without an indoor water connection, storing water in containers is a common practice argued by the participants to be time saving, irrespectively of the issue of water shortage. Albeit that their average storage capacity generally is limited to a few buckets of approximately 20-25L each, this practice inadvertently makes these households less vulnerable to shorter unwarned water cuts as their households always have stored water. With regards to storing, the remaining 28 participants, all with indoor water connections, can be divided into two groups. The first comprise of 22 participants who always store water as they argue "we never know when water will be cut off" which resultantly means that "we always have to be prepared". They thus utilize storage as an anticipatory adaptive strategy meant to decrease exposure and subsequent vulnerability to water shortage. The second group, comprising of 6 participants store water only when they are already experiencing low pressure or have been told in advance that there might be issues with the water supply. This group contrarily adopts water storage as a reactive measure, which can help them cope once exposed to water shortage.

When discussing household preparedness, here understood as self-identified needs to decrease vulnerability which in turn would make the participants feel more secure, an interesting pattern emerged. With only few exceptions, what constituted preparedness for the households and what they themselves saw as a viable long-term adaptation strategy was hierarchical, informed by their current means of coping and adaptation coupled with their respective socio-economic backgrounds (Figure 3). For example, participants with only one or two 20-25L buckets would say that their optimal preparedness would be an increase in buckets and perhaps a drum. Participants who had both buckets and drums would argue that their optimal preparedness would be a JoJo tank for rainwater harvesting and so on.

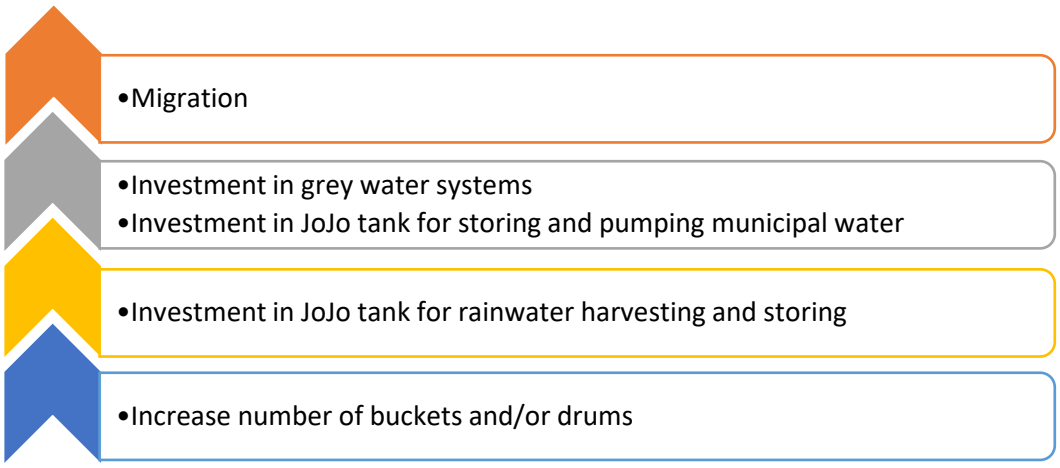

Figure 3: Hierarchical Order of Self-Identified Long-Term Adaptation Needs

Figure 3 visualizes how the vast majority of households identify appropriate needs to increase adaptive capacity and decrease vulnerabiltiy based on current means within a hierachical order rather than based upon a uniform measure for long-term adaptation. From this can be interpreted that there among the participants is no unanimous understanding of what constitues adaptation to water shortage, or the equipment needed to reach the point where a household has successfully adapted to this.

Figure 3 furthermore includes migration, a long-term adaptation strategy only mentioned by three male participants of varying socio-ecnomic backgrounds. For all three participants, migration is considered the last resort. Two of the men from lower and middle socio-economic backgrounds respectively, are considering moving out of Gaborone. As one of the participants argues*:*

> "we are kinda at that point whereby we can no longer put water in each and every household. It makes me feel really scared. Even wanting to move out has already been part of the ways in order to get water elsewhere. Move out of Gaborone and go maybe up North where there is plenty of water."

This adaptation strategy however brings with it its own set of issues as job opportunities outside of the city are scarce. If choosing to migrate, the households will have an additional cost of commuting to the city for work every day. A cost one of the participants is not sure he can cover, hence migration being the last resort. For one of the participants from a high socio-economic background, migration however refers to cross-border migration. A long-term strategy that he argues might become an inevitability:

> "So long term, the viability of Botswana as a country is problematic. And for me being a father, long-term I am thinking, you know, when my daughter is my age, will this be a viable country for her to exist in? I have a strong feeling that Botswana is gonna be one of the places where we become climate refugees (…) So, part of my long-term planning is to make sure that if we had to emigrate, my family would have the resources to do so."

While water shortage may not be the only factor influencing the thought process behind this quote, it does play a part in it. The quote encompasses a notion of uncertainty of the future and the possible consequences hereof that only people of a certain socio-economic background has the privilege to prepare for. Something which the participant also himself acknowledges, arguing that millions of his countrymen will not be afforded that opportunity should his prediction come true.

5.3. Disruptions of lives and livelihoods

A recurrent theme among the participants is the disruption of daily life that water shortage generates. Many argued that water shortage creates inconveniences ensuing interruptions of plans and it even "changes the lifestyle itself" causing feelings of frustration among many of the participants. Smaller more frequent water cuts lasting a few hours or a day or two predominantly changes if and when everyday chores are done, a young woman recalled the day before her interview: "I was busy washing my clothes. When I got there, no water. Ah. I just had to stay and wait for it to come. (…) So that day I had to stay home". During more severe periods of water shortage such as for example during the 2015/2016 drought, water shortage generated sustained and pro-longed adjustments to everyday life. A male participant from Old Naledi, a poor low-income neighborhood, explained how there would be no water at all in his area and so people had to travel to other parts of town during the night to try and find water, he recalls:

> "During the day there was no water, so we had to be there, all night in the queue somewhere in the government schools or in the government departments or sometimes in the industries, in the shops (…) We will go there around maybe 12 o'clock, midnight, we will be there until four. In a serious queue, people are coming from different areas ee. We are there, in the queue. Yeah but, the little that we get, it was important."

For other areas, water rationing during this time meant that water was only available during the night until the early morning where it would be cut off around seven am. In many of the households comprised of both adult men and women, women are responsible for ensuring adequate access to water. During severe periods of water shortage this responsibility thus disproportionally affected women's sleeping patterns as they were forced to wake up between three and five am to fetch water to store for the rest of the day's activities.

For 11 participants, water shortage further interferes with their livelihoods or the livelihood of someone from their household. Consequently, many engage in risk reducing measures such as storing water and changing their reliance on water by for example using buckets instead of hosepipes for cleaning of cars and automobile parts or sell food that requires less water to cook. Job diversification is, however, not an opportunity afforded to everyone. A Zimbabwean man from a predominantly poor neighborhood explains why he cannot simply change his job a mechanic to a less water-dependent job:

> "Ah, eish, we are limited. We are very much limited. Yeah because mostly, ah we are limited, because mostly they will tell us we are not a local person. They say 'you want

to do a better job than the one you are doing?' They tell you this one is reserved for Batswana[3] (…) The truth is I am limited, especially in terms of jobs."

As the quote illustrates, nationality, when intersecting with low socio-economic status might impede a person's ability to diversify income (see Figure 4 for visualization of intersecting identity markers). This is problematic, as diversification can become a necessity; he explains how many of his non-national friends who previously worked as gardeners got fired during the 2015/2016 drought as a result of the government-imposed restrictions that prohibited the use of municipal water for gardening purposes.

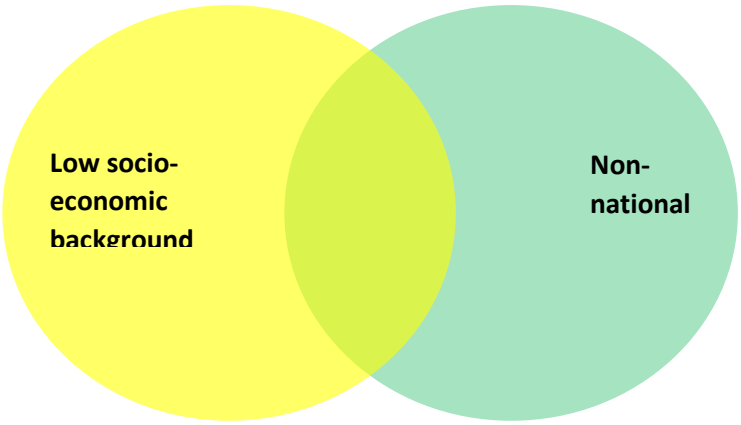

Figure 4: Intersection of Low Socio-economic Background and Non-national

It is however not only non-nationals that have issues diversifying livelihoods. During the interviews eight Motswana[4] participants, all from low socio-economic backgrounds, stated that they depend on their government allocated land plots and kettle posts outside Gaborone for domestic food production and to breed and subsequent sell domestic animals. While five of the eight relied on the land to decrease expenditure on store bought food and subsidize household income with small-scale vending, the remaining three, all between 50 and 75 years of age lived off the land on a subsistence basis. Two of the participants are retired while one is too sick to work thus relying on his kettle post to provide an income (see Figure 5 for visualization of intersecting identity markers). This participant further explained that he became poor after the 2015/2016 drought as most of his animals died as a result, and is currently struggling to survive. A struggle that is exacerbated by the consequences of water shortage.

[3] Batswana is the official word used to describe citizens of Botswana in plural form
[4] Motswana is the official word used to describe a citizen of Botswana.

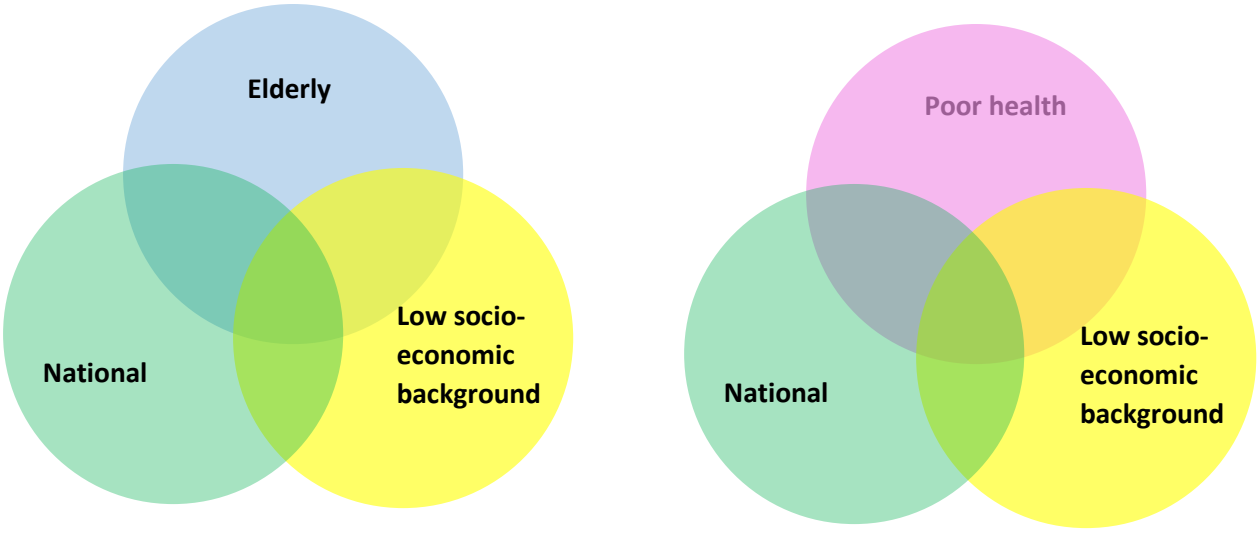

Figure 5: Intersection of Low Socio-economic Background, National and Elderly or Poor Health

5.4. Health challenges

Health challenges related to poor water quality is another issue that came up repeatedly during interviews. In fact, 24 participants mentioned that they were concerned with the health implications of drinking the municipal water. Some explained that they had experienced stomachache or diarrhea after consumption while others were concerned due to either poor taste, color or smell. According to a key informant in the healthcare sector, these concerns are not unwarranted. Previously the water in Botswana was safe for drinking, however, as the key informant asserted: "we know that the actual water in the tap right now is not reliable". In the fall of 2018, an outbreak of diarrhea resultant in dehydration was detected in various places in Botswana, including Gaborone. While the source of the outbreak was claimed to be due to contaminated water, WUC denied all responsibility claiming then, and continues to claim, that the water is safe for human consumption whereby they, according to the participants are contradicting the advice of other government bodies, as one participant argued: "Water Utilities insists that the water is clean, but the Ministry of Health has gone on the radio and newspapers to warn us to boil water". Many participants expressed frustration over the uncertainty and the lack of transparency from the WUC. This frustration had for six participants manifested itself as an overall lack of trust in the government and parastatal organizations. The outbreak primarily affected children under the age of five and ultimately led to the premature death of at least 31

children country-wide[5]. In response to this outbreak and out of fear for future ones, 20 participants from varying socio-economic backgrounds, 15 of which are living with children predominantly under the age of five, are actively engaged in measures of risk reduction through either boiling or purchasing potable water from stores. While some are doing so out of precaution, others started after their children were hospitalized. A father of three young children recounts:

> "We have stopped drinking this water from Water Utilities after that outbreak of that bug which attacked. Because my, my, all my kids they nearly died from that. They got attacked by that bug, then I took them to private hospital, Gaborone private hospital, that is where they found out: No that is this borne disease from the drinking water they were drinking."

On the basis of the narratives in the interviews, arguably children with less developed immune systems are more susceptible to the health challenges associated with contaminated water, which in turn increases their family's vulnerability to the effects of water shortage and add pressure on them to find sustainable solutions, the most frequent being purchasing potable water and boiling. Purchasing water is however not a luxury everyone can afford. Notwithstanding the financial implications of relying on store bought potable water, several households from low socio-economic backgrounds found ways to compromise on other household utilities and purchases to finance this expenditure. Most commonly is the compromise made on the purchase of more expensive food items such as meat, which traditionally is a significant component of the Botswana cuisine. The other risk reducing measure in relation to contaminated water is boiling. Boiling water on the other hand is considered by many participants to be a tedious and time-consuming task, which is also the reasoning many other participants gave for not bothering to boil the water, even though they know it would significantly decrease the risk of getting ill from the water. Consequently, a few participants therefore only boil the tap water when they experience poor taste, smell or color or when the media reports on suspected water borne disease outbreaks. But where Batswana can access the health system without issue, a key informant in the health sector stress how non-nationals of lower socio-economic background, both legal and illegal, are increasingly vulnerable to for example contaminated water as it is not uncommon that if they get ill and go to the hospital or clinics to get help "they get turned away because they don't have papers or they don't have enough days on their passport. And when I say turned away, I mean turned away. They have nowhere they can go". The key informant further argues that this increased vulnerability is double-sided as many poor non-nationals are furthermore not be able to protect themselves from water borne disease outbreaks compared to

[5] Source for this claim is an article published by The Sunday Standard on the 25th of October 2018 (The Sunday Standard, 2018)

the Batswana. This, as they often cannot afford to buy potable water, leaving them with only boiling as a viable risk reducing measure.

When discussing differentiated vulnerabilities among different communities, a key informant working primarily with people living with HIV/AIDS points to the community's vulnerability. In an effort to combat the prevalent HIV/AIDS pandemic, Botswana provides free antiretroviral therapy for all Batswana. This medication requires water and the key informant explains how being exposed to water shortage without means to access water may potentially endanger the health of this community:

> "People can't take their meds if there is no water. Water rationing, it affects the times that people take their medication. It means sometimes if you didn't keep water, you have to wait for the time that the water comes back. That's when you take your medication, by then. And then it affects your health and the treatment and how it will work in your body."

Furthermore, being prevented in taking the medicine may have rippling effects. As the key informant in the healthcare sector proclaimed in relation to being HIV/AIDS positive and the potential transmission to babies through breastfeeding: "So with breastfeeding, if your parents are undetectable, in other words, they take their medicine properly, it should be safe to feed their baby." From this quote it can be interpreted that if a mother is unable to take the medicine properly, it may not only affect her own health but potentially also that of her baby. Again, the notion of the added disadvantage for less affluent non-nationals is brought up, as they are not provided free antiretroviral therapy by the government (see Figure 6 for visualization of intersecting identity markers). In addition, HIV/AIDS positive non-national mothers are also not provided formula if they themselves cannot afford the medicine to avoid transmission to their babies. Formula that requires either milk or water which in turn further increases the vulnerability to contaminated water.

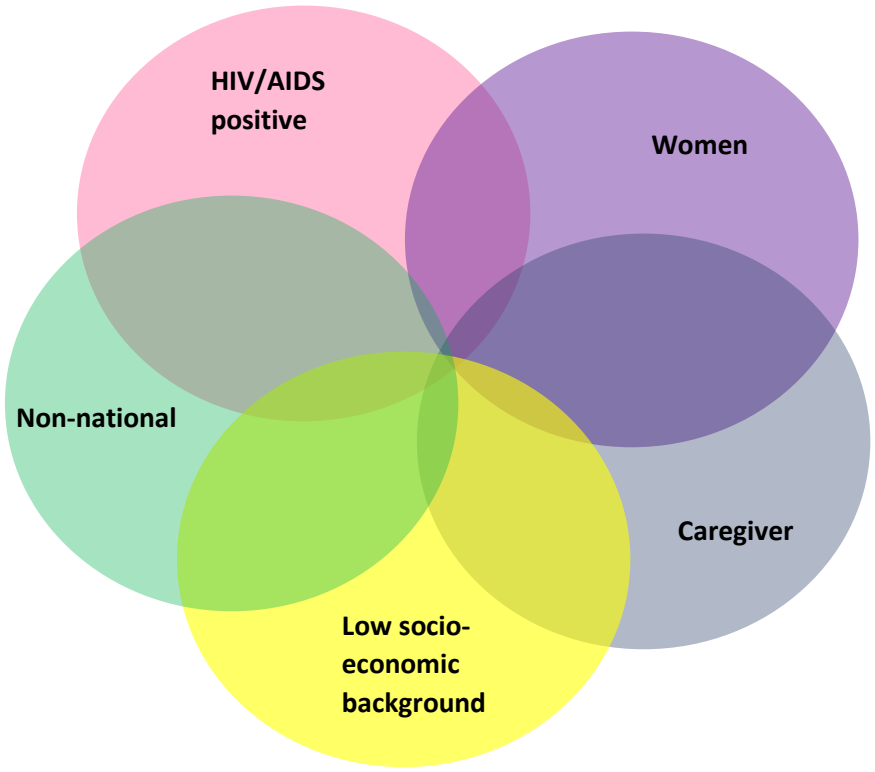

Figure 6: Intersection of HIV/AIDS positive, Women, Caregiver, Low Socio-economic Background and Non-national

5.5. Social exclusion and embarrassment

Water shortage results, among other things, in lack of hygienic practices. When asked about how water shortage affects their household routines, 18 participants explicitly stated that they deprioritized laundry; several respondents would wait up to several weeks during periods of severe water shortage. All but two were women. Similarly, 25 participants said that they had to change bathing routines with regards to the form (switching from showers or tubs to buckets), volume (using significantly less water), frequency, reusing or sharing water with other family members, or skipping showers altogether. A mother explained how, in an effort to save water, she would prioritize buying sturdy clothes as well as limit her children's playtime outside:

> "You see my kids are playing inside the house. I am avoiding [having them] to go outside, to play outside, because if they get dirty, I am going to use a lot of water (…) If they break the cup, I can buy a cup, but you can't, I can't provide water"

While the majority of the participants felt frustrated with the necessity to implement such changes, a few young participants furthermore stated that having to make these changes made

them “feel embarrassed to go out”, and as another participant puts it*:* “you can’t go out without having bathed”, ultimately potentially leading them to social exclusion due to the prospect of embarrassment and ridicule. A key informant working in the health sector stresses that for the Batswana, body odor is “quite unacceptable” and that smelling will affect daily interactions as well as e.g. the chance at getting a job if unemployed.

Another challenge noted by several participants of middle socio-economic background is the social consequences of investing in risk reducing structural equipment such as large JoJo tanks. While these households had the means to invest in such equipment, the investments came at a cost, most notably to their social life. One household had bought a big JoJo tank in response to the big 2015/2016 drought as “part of the preparation” for the future. A JoJo tank costs approximately 3000 pula[6] (excluding the additional approximately 3000 pula needed for connecting it to the municipal water system), which is more than the average monthly salary for many households. Thus, for the household to invest only in the tank, sacrifices had to be made:

> “we had to cut certain things, for us to buy those things. Like, we used to go out, have fun, run around and stuff like that, right? But ever since we thought of buying this [points to the JoJo tank] we had to cut certain things (…) because we felt that having fun while you have no water makes no sense. So, we had to cut that.”

Similar sentiments are found in other interviewed households of similar socio-economic background and means. In addition, many Batswana living in Gaborone continues to have strong linkages to their home village and their respective communities. A relationship that is increasingly strained due to the impact of water shortage. A woman expresses it as follows:

> “Basically we are just living to survive (..) We had to cut everything that we do not need to survive with. The first thing we had to cut was the travel (…) So you literally change your social life. Which means you change your social stand within your own community. Because we come from Kgatleng, Kgatleng still has, especially in smaller areas, they still have this [traditional kgotla events and meetings] and now if you are not there, ultimately you don’t belong. So you find yourself having to work overtime to remind the community that ‘I am still a member of this community’. And if you have come in like me from somewhere else, it’s even more taxing for me. Like if there is a funeral in his place, he would not have to stay but if I don't stay, then I am not… you know what I mean? So there is quite a lot that we have to cut.”

This quote illustrates how the impact of water shortage is felt not only within the individual household but also on a broader scale within communities. Traditional social norms and customs are potentially threatened, which in turn adds pressure on the household to uphold these. The

[6] In time of writing, 3000 Pula is approximately US $279.

quote further illustrates intra-community asymmetrical power relations, in that people from the same household, who are having to make the same choices, are affected differently on the basis of what is expected of them within the community on the basis of their gender and whether they were born into the community or married into it.

An issue mentioned only by mothers and grandmothers of low socio-economic background is the social pressure to wash the children's and grandchildren's school uniforms during periods of severe water shortage. Although laundry typically is mentioned as being the last priority when experiencing extended periods of water shortage, some families with school aged children felt they had to prioritize differently because, as a mother explains*:* "we had to clean up the uniforms so that the kids can go to school clean. Uniforms have to be cleaned every day". The reason for having to prioritize washing of school uniforms on a daily or semi-daily basis is because "if the uniforms are not clean, the kids will be sent home. Or the school will call the mother and have her come and pick up her child, both of which is very embarrassing and socially not good". Due to the gendered societal norms pertaining to house chore responsibility, this added social pressure, which in addition can potentially impede the children's education, is experienced only by women as they are the primary caretakers and furthermore responsible for household chores such as ensuring that there is water for laundry. A mother in a household comprised of several male and female adults recounts a situation that sums up the consequences of such gendered social norms: "There was this other time where I wasn't around to put the water in the buckets, and then we ended up washing the school uniform late". This quote illustrates how in some households, the gendered division of domestic labor can have negative consequences during times of water shortage as the responsibility to reduce exposure often falls on the women.

5.6. Intersecting barriers to adaptation

Access to economic resources is an instrumental part of engaging in long-term sustainable adaptation strategies to decrease vulnerability. As the previous sections have outlined, the ability to purchase water and invest in movement, supplies and equipment is essential for all participants irrespectively of socio-economic background. As a wealthy male participant argues: "I need my family to survive climate change. And the best way to do that, unfortunately, is to not be poor. That's the cold-blooded truth". On a similar note but argued from the point of less affluent households, not having enough money "is a problem" and if you cannot find money to invest in adaptive strategies such as storage tanks, it means that "you are doomed". For all but a few participants, monetary constraints is a significant factor as to why many of the participants of middle and lower socio-economic backgrounds struggle to adapt to water shortage. While almost all the participants had given thought to what they would need to adapt to water shortage as mentioned in subsection 5.2, not everyone is in a position that allows them to invest in such measures. Upon a closer analysis of the narratives of the participants who stated that they were

unable to invest in adaptive strategies due to monetary constraints it became clear, that this issue is not merely socio-economic in nature. As outlined in section 5.3 nationality greatly influences a person's ability to diversify income and in turn increase their adaptive capacity. This is however not the only factor influencing vulnerability. The inability of certain participants to improve their socio-economic situation is further rooted in issues of gender, age as well as unemployment and housing tenure.

That having children influences a household's vulnerability during water shortage is outlined above. In relation to this, among the 24 households who have children age five and younger, only women participants mention how young children are impeding their ability to improve their financial situation. In Botswana, childcare is predominantly a woman's responsibility, which can help explain why it was only women who articulated being affected by the burden of childcare. In lower socio-economic households, the cost of outsourcing childcare to institutions is for many not a possibility, consequently leaving a woman in the family to take care of the child (see Figure 7 for visualization of intersecting identity markers).

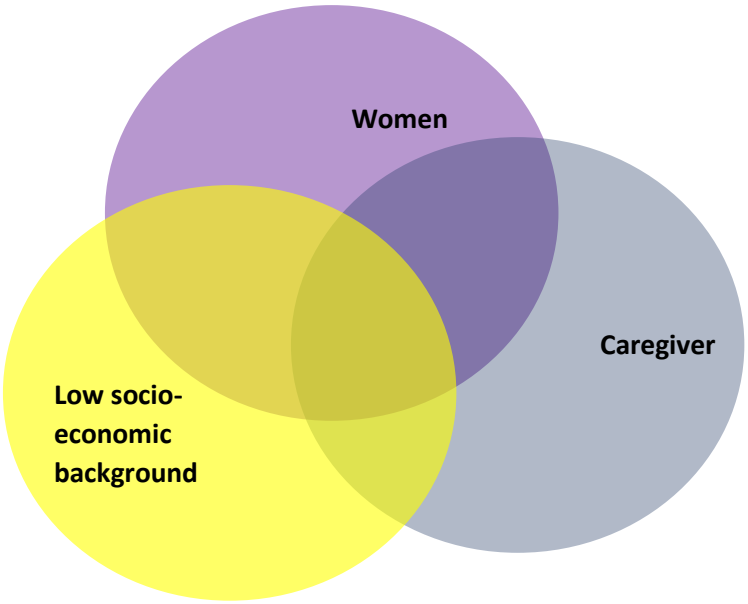

Figure 7: Intersection of Women, Caregiver and Low Socio-economic Background

An example of this is a grandmother who explained that she stopped making an income as a seamstress after she was left with the responsibility of taking care of her grandson. A young single mother of low socio-economic background further explained how children may impede your ability to invest the little money that you do have due to shifting priorities, she explains: "I am not comfortable. I would buy a bigger tank to store water, but it is not something I am prioritizing to

save up for yet. There are other priorities with the baby". She further explains that she spends her extra money on potable water for the baby and his formula as "it is better than the tap water". Thus, the money that she has is spent on coping due to fear of contaminated water through purchasing potable water which in turn impedes her ability to engage in measures of long-term adaptation through investment in better equipment. That gender is influencing an individual's adaptive capacity is stressed by a key informant working on climate change adaptation in Botswana. In addition, the key informant further points to age as an influencing factor, more specifically the key informant states that being young is negatively influencing a person's adaptive capacity as young people have no arable land or savings that can catalyst the household's adaptation to water shortage. The interviews of the young participants under the age of 30, living alone, with a friend or a partner reflects this sentiment. The seven households of this description from both low- and middle socio-economic backgrounds only use 5-25L buckets for water storage and all are renting their houses. In general, they have significantly fewer resources to reduce vulnerability against water shortage. Furthermore, over half are currently unable to improve their financial situation, as they are either students or unemployed, consequently leaving them with no steady income. The unemployment rate in Gaborone is especially high amongst the younger part of the population and several participants expressed a desire to invest in equipment once they have a job and subsequent secure income (see Figure 8 for visualization of intersecting identity markers).

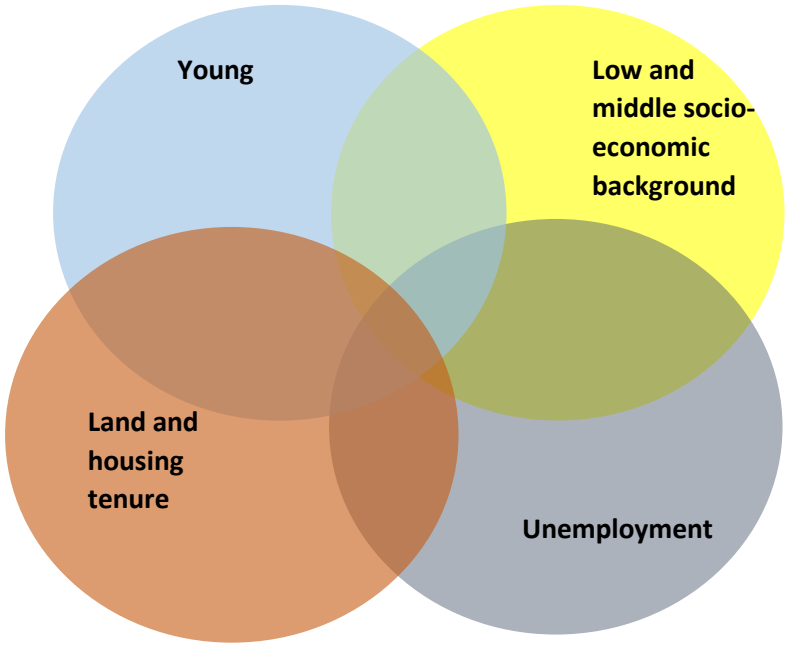

Figure 8: Intersection of Young, Low and Middle Socio-economic Background, Unemployment and Land and Housing Tenure

While unemployment rates are higher among the younger population, unemployment is an issue for older people as well. An unemployed middle-aged man from a poor neighborhood summed up his position to the future and his inability to improve his financial situation and in turn engage in measures of adaptation and preparedness in his statement: “If it’s time to die it’s time to die man”. Although this particular quote is worded harshly, it is a common sentiment among many of the participants that they feel that they have little agency to improve their situation and that they instead are resorted to simply praying and subsequently wait for their situation to improve.

Lastly, housing tenure is found to be an important influencer with regards to engaging in adaptive strategies. Since most adaptive strategies requires either land or structural changes to the house, many households who are renting are unwilling to engage in these measures. For the two participants living in apartments, options for adaptation are limited with no access to land and no direct control over the building structure. For households renting a house on a plot of land, a common barrier to adaptation through investment in structural equipment is that “it is not my house (…) so for that fact, I am not even considering doing that” or “because I don't own the property it wouldn't like, it would be a really big optional extra”. Housing tenure thus acts as an obstacle to adaptation as renting one’s housing makes households unwilling to invest in structural equipment and thus long-term adaptation.

5.7. Water shortage and heat

Water shortage is not a phenomenon that occurs in a vacuum. Instead, water shortage is the center of a nexus interconnected to several other things including heat. This, as the dry season where water shortage tends to be most pervasive is simultaneously also the warmest period of the year. When studying the narratives of the participants, a frequent theme is how excessive heat and heatwaves are negatively affecting the households. In total, 31 participants made comments about how excessive heat, by many described as “unbearable”, affects them negatively through for example health issues such as heat rash and headaches, decreased productivity due to tiredness and interruption of sleep. A woman summarizes its interconnectedness to water: “It’s too hot. The sun. Ah, it affects me because we have to drink lots of water. Bathing more times a day. When it’s hot it’s almost 3-4 times a day cause it’s very hot”. During times of excessive heat, hydration and body cooling through bathing become a priority for households. This conflicts with another household priority during water shortage, namely water conservation. In addition, to keep hydrated households must have access to more water than would normally be necessary, an added challenge during times of water shortage.

Moreover, for many poorer households, housing is made without ceilings whereby the house is a simple construction of walls and corrugated iron as roofing (see Appendix D for a photo), which is problematic when it is hot. A woman explains*:*

> “The household has been affected with this heatwave because during the day you can't sleep and the nights are very worse because you can't sleep outside because of the security. And then inside the house, if you don't have fans or air-conditions you can’t survive it”.

Many households therefore see it necessary to invest in fans and a few in air-conditioners in an effort to combat the beforementioned negative side effects of the heat. For most households of both low- and middle socio-economic backgrounds, this need competes with the needs posed by water shortage. With a limited disposable income many households are forced to choose between either engaging in measures for coping with the heat or adapting to water shortage.

6. DISCUSSION

The aim of this research is to examine the implications water shortage has on households in Gaborone; their responses to this as well as the underlying factors that are influencing how they are affected, their adaptive capacity and vulnerability. The previous chapter outlined the findings derived from the analysis of the interviews, and this chapter is therefore dedicated to a discussion of these. This chapter will thus engage in a broader discussion of the implications of some of the key findings, contextualize these and moreover recommend areas for further research.

6.1. Water shortage, access and WASH

97% of the population of Botswana has access to an improved water source (WHO & UNICEF, 2015). This figure could lead to the misconception that water shortage, therefore, is not an issue in Botswana or in Gaborone, where water supply supposedly is the best within the country. However, the findings show that the two are not mutually exclusive. All studied households have access to an improved water source, and all but one have, at least at one point of time, been affected by water shortage. The findings thereby support the view that access to an improved water source does not equate to reliable water supply nor acceptable quality of water and that such statistics therefore inadequately describes reality (Adams, 2017; Guardiola, González-Gómez, Grajales, & Grajales, 2010; Kujinga, Mmopelwa, et al., 2014). It is a "statistical illusion", as it is referred to by Guardiola and colleagues (2010), which only emphasizes the necessity to understand these realities empirically.

Access to improved water, sanitation and hygiene (WASH) facilities is a key component to healthy living and quality of life. The study finds that many of the studied households are negatively affected by poor water quality, manifesting itself through health-related issues such as stomachache and diarrhea. These health challenges are especially present among the households with children aged five or younger. While some households have already experienced their children getting ill from the water, others expressed awareness of the increased risk to their children's health leading them to proactively engage in measures of risk reduction as a precaution. The finding of an increased vulnerability to poor water quality among the studied households with small children is supported by existing literature. According to Prüss and colleagues (2002), about 90% of the disease burden related to water borne diarrheal disease occurs in children younger than five years of age. This phenomenon has furthermore been well established in other case studies related to water shortage and water quality (e.g. Arnold et al., 2013; He et al., 2018; Neelim, 2011).

The study further finds that one of the main coping strategies among the participants is water conservation through among other things altered hygienic practices such as changes in laundry and bathing routines. While research on urban adaptation to water shortage frequently outline changing routines such as hygienic practices as a commonly employed response strategy (e.g. Smiley, 2016; Thompson et al., 2000; Wutich, 2009), these studies does however not mention associated health challenges with water shortage. Another main coping and adaptation strategy employed by the participants is household storage of water in various size containers. With that in mind, while the affected participants all attribute their health challenges to poor quality of the water provided by the Water Utilities Corporation (WUC), other potential sources of contamination cannot be excluded. This, because scholars have in some instances found that household storage of water can influence the quality of water including the presence of bacteria leading to water borne diseases (Boateng, Tia-Adjei, & Adams, 2013; Feleke, Medhin, Kloos, Gangathulasi, & Asrat, 2018). Consequently, a case can be made for the importance of an exploration of the interplay and relationship between the coping strategy of decreased hygienic practices, the coping and adaptive strategy of water storing and water related health challenges in future research on adaptation to water shortage. Understanding whether household water storage may inadvertently influence a household negatively can generate important insights in analyses of households' vulnerability to water shortage. The results of such research may furthermore challenge the current perspective of this research of anticipatory water storage as an adaptive strategy.

Related to issues of WASH, the findings indicate that caregivers, especially when intersecting with lower socio-economic status, and young people are subject to social exclusion and stigma if unable to engage in regular hygienic practices, such as bathing and washing of children's school uniforms. Such increased pressure on caregivers to maintain hygienic practices during water shortage is supported by a study of hygienic practices in urban India (Reddy & Snehalatha, 2011), suggesting that women and in particular mothers are more likely to endure social embarrassment and blame when their children fail to meet the social standards pertaining to cleanliness and washing. In review of 11 studies from around the world, Curtis and colleagues (2009) found that unwashed bodies are associated with disgust, shame and ultimately social exclusion as they found that "one cannot be dirty and disgusting and still be acceptable or respected in society" (p. 660). This review did however not attribute set feelings towards unwashed bodies to any social identity marker, and given the relatively small number of young participants who expressed similar sentiment in this study, further research remains to explore possible generalizations pertaining to age and feelings of social embarrassment and exclusion.

6.2. The potential of intersectionality to facilitate a multidimensional analysis

Understanding the intricacies of vulnerability and adaptive capacity to water shortage can be challenging. The complex nature of water shortage could be one of the underlying reasons why research often is focusing solely on certain aspects such as e.g. employed coping and adaptation strategies (Kujinga, Mmopelwa, et al., 2014; Lilian Chaminuka, 2013; Manzungu & Chioreso, 2012; Thompson et al., 2000), implications of poor water quality (Boateng et al., 2013; He et al., 2018; Sarpong Boakye-Ansah, Ferrero, Rusca, & Van Der Zaag, 2016) or gender differentiations pertaining to exposure, impact coping and adaptation (Chipeta, 2009; Kujinga, Vanderpost, et al., 2014; Mason, 2012; Tsai et al., 2016; Wutich, 2009). This research however is an attempt to bridge some of these aspects of water shortage into one analysis as they arguably are interrelated. It is therefore necessary and important to understand the interplay of all these factors in a multidimensional analysis to facilitate a holistic understanding of adaptation to urban water shortage. To this end, an intersectional framework is employed.

According to Kaijser and Kronsell (2014), understanding how identity markers and other factors intersects and influences adaptive capacity and vulnerability is instrumental if societies are to engage in sustainable, equitable, and just climate change adaptation strategies and further formulate relevant vulnerability reducing policy frameworks. A key finding of this study is that the properties of adaptive capacity and vulnerability are not uniformly distributed – neither between nor within social categories. The findings show that the studied men and women are affected differently by water shortage – even when they live within the same household. This is among other things due to societal norms generating a gendered division of labor where women often bear the responsibility of ensuring access to water and many of the water intensive household activities such as cleaning and laundry as well as differentiated societal expectations. However, vulnerability within these gendered social categories is not homogeneous either, but is influenced by a variety of other identity markers and contextual factors. For example, the study finds that both vulnerability and adaptive capacity is different for female caregivers to young children compared to women without such responsibilities. Irrespectively of socio-economic background, being a primary caregiver affects the women both with respect to enhanced pressure to find sustainable solutions to poor water quality and the societal pressure to uphold norms of cleanliness and hygiene. When intersecting with lower socio-economic status it further limits the women's mobility to engage in employment which in turn limits their access to financial resources needed to engage in risk reducing measures of coping and adaptation. In addition, being HIV/AIDS positive further influences the implications water shortage can have for people in general, both men and women, due to reliance on water for medication purposes. Notwithstanding, it is highlighted how mothers are particularly vulnerable, as e.g. HIV/AIDS positive breastfeeding mothers who are exposed to water shortage need water not only to maintain their own health, but also the health of their baby. Within this social group of HIV/AIDS positive mothers, poor non-nationals are furthermore increasingly disadvantaged due to limited access to antiretroviral

therapy, baby formula and healthcare in general. Moreover, the study also highlights that, when intersecting with middle and lower socio-economic status, age plays a role in the capacity to adopt adaptive strategies. For example, young men and women from both middle and lower socio-economic backgrounds are unable to engage in risk reducing measures due to limited financial savings, limited opportunities for secure income due to high youth unemployment and being a student as well as limited access to assets such as ownership over land and housing tenure, in itself an issue identified as being influenced by nationality. Similarly, elderly Motswana men and women from lower socio-economic backgrounds who are outside the formal employment sector, either due to retirement or illness are impacted by limited yields from their arable land plots, an activity that serves as either the only household income or as basis for the household's subsistence farming.

In existing vulnerability and adaptation literature, poverty is often outlined as the primary driver of vulnerability and lack of adaptive capacity, a sentiment exemplified in the following quote from Smit and Pilifosova (2001, p. 895): "Whether it is expressed as the economic assets, capital resources, financial means, wealth, or poverty, the economic condition of nations and groups clearly is a determinant of adaptive capacity (…) It is also recognized that poverty is directly related to vulnerability". While the findings of this study have shown that access to resources is instrumental for adaptation, the intersectional lens enabled the analysis to further look at other underlying societal structures and factors that serve as a barrier for adaptation and influences vulnerability. The study therefore moves beyond simply accepting the common understanding of socio-economic factors and especially poverty as the primary influencing factor on vulnerability and adaptive capacity to water shortage. Instead the research, through intersectionality, illustrates the multidimensionality and intricacies of water shortage. As suggested by Buckle (1998) and Djoudi and colleagues (2016), stereotyping entire social groups as inherently vulnerable, overlooks inter- and intra-group differential vulnerability as neither vulnerability nor social categories are homogenous as has been outlined above. Furthermore, while access to financial resources is undeniably an important factor influencing a person's adaptive capacity, labeling all less affluent households within this study as inherently vulnerable based solely on their socio-economic position in society would be misleading. Doing so would ignore the finding that socio-economic status is one out of many crosscutting identity markers and contextual factors that comprise an individual and shapes their opportunities and constraints. Moreover, such an assumption would ignore the finding that some of the poorer households that are renting housing without indoor water tap connections are in fact less vulnerable to shorter unwarned water cuts due to their household's pre-established practice of water storing not as a risk reducing measure to water shortage but as a time saving practice. The perception that poverty and vulnerability is intrinsically linked could also explain why most climate change and vulnerability literature set in developing countries focuses exclusively on poorer communities and households, although exceptions can be found (e.g. Manzungu & Chioreso, 2012; Mason, 2012). The findings

of this study demonstrate that households from all socio-economic backgrounds are impacted by water shortage albeit in different ways – which in itself is a reason to broadening the perspective in future water shortage research to include non-poor communities and households in the analysis. Moreover, the findings illustrate that people from middle socio-economic backgrounds are vulnerable to the effects of water shortage through e.g. social exclusion and vulnerability to water contamination. Further, when intersecting with gender, women from middle socio-economic backgrounds are additionally subject to asymmetrical intra-household and community power relations exacerbating the impact for them compared to their male spouses.

By helping represent complex realities, an intersectional approach to research on water shortage, can potentially improve our understanding on the relationship between an individual and how his or hers adaptive capacity and vulnerability are crosscut by gender, nationality, age, socio-economic structures, and furthermore also shaped by contextual factors such as health, parenting and caregiving, unemployment and land- and housing tenure – ultimately influencing the ability to improve their situation and undertake adaptive measures. Moreover, intersectionality allows for the analysis to illustrate how asymmetrical power relations are present at multiple levels. These constraining power relations are for example found in corporate hiring policies and in state provided healthcare favoring nationals over non-national residents when intersecting with lower socio-economic background, such as for example poorer Zimbabwean migrants. Literature has previously noted how citizenship and especially access to employment opportunities among poorer migrants, and especially Zimbabweans, is a primary source of political and social tension in Botswana as rising xenophobic tendencies is becoming more apparent within society (Marr, 2012a, 2012b; Morapedi, 2007). The findings further shows asymmetrical intra-community and household disparities with respect to the differentiated sensitivity to water shortage experienced by men and women within the same household due to differentiated roles, responsibilities and expectations.

In summary, the study suggests that employing an intersectional lens can help an analysis of water shortage in different ways. First, it can help in the assessment and analysis of household vulnerability to illustrate that some households are more vulnerable than others to the impacts of water shortage. Secondly, it can help to uncover why households engage – or does not engage – in certain coping and adaptation activities based their adaptive capacities which also is influenced by the interplay of their identity markup and other contextual factors. Lastly it allows for a deeper multilevel understanding of why these patterns of vulnerabilities and adaptive capacities exist. This, as it can help disentangle how multiple and fragmented dimensions of identity intersect, revealing systems of power that creates differentiated opportunity and constraint which subsequently either enable or delimit individual agency vis-à-vis water shortage. This research thus argues, that to fully understand household adaptive capacity and vulnerability to water shortage, it is thus necessary to examine the complex interplay and interdependence of

existing and unequal context specific multiple identities, contextual factors and socio-economic structures that shape these.

6.3. Unexpected findings

The study yielded a few unexpected findings. In much intersectionality literature, 'ethnicity' is often exemplified as a likely identity marker governing an individual's relationship to power (Kaijser & Kronsell, 2014; McCall, 2005; Osborne, 2013). The possible influence of ethnicity is however not reflected in the findings of this study. Aside from the ethnic groups not native to Botswana and thus categorized as non-nationals, the narratives of the different ethnic groups represented in this study – primarily Tswana and Kalanga – did not show any difference in terms of implications, responses or vulnerability and adaptive capacity. It is however important to note that just because ethnicity does not seem to influence the adaptive capacity or vulnerability of the participants of this study, it does not necessarily mean that asymmetrical power structures pertaining to ethnicity is not present in society. Nor that these does not intersect with other identity markers that together influence an individual's adaptive capacity and vulnerability. In an exploration of ethnicity in Botswana, Wilmsen and Vossen (1990) argue that ethnic divisions is closely associated with class domination in which "subordinate 'groups' are kept in conflict with each other" (p. 7). This notion of ethnicity as an identifier for class status of individuals in Botswana is supported elsewhere in existing literature (e.g. Mompati & Prinsen, 2000; Werbner, 2002; Wilmsen, 2002). The findings of this research can possibly be explained by the interplay of several factors; the majority of participants are Tswana and Kalanga, the former being the dominant ethnic group in Gaborone, and Botswana, and the latter is, as explained by Werbner (2002), a minority elite with relative educational and entrepreneurial success. This coupled with an underrepresentation of smaller ethnic groups and divisions among the participants could conceivably create the illusion that ethnicity does not influence adaptive capacity or vulnerability in Gaborone. Further research into how ethnicity is affecting adaptation to water shortage in Gaborone is therefore recommended to fully understand the extent to which ethnicity may or may not influence vulnerability and adaptive capacity among residents in Gaborone.

Another unexpected finding derived from the analysis is the water shortage-heat nexus. Most participants expressed struggling with heat, for many resulting in health challenges and disruption of lives. The health-related issues that the participants expressed have been documented in literature as a consequence of increased urban temperatures due to climate change (Harlan, Brazel, Prashad, Stefanov, & Larsen, 2006; Kjellstrom & Weaver, 2009) and urban heat islands (Oke 1982 and loads others). Health challenges are furthermore often unequally distributed among urban dwellers due to socio-economic position, ethnicity, living standards and unequal opportunity for improvement (Harlan et al., 2006; Kjellstrom et al., 2007). Literature on the interplay between adaptation to water shortage as well as other climate change induced changes

such as excessive heat is however scarce. With the projected rise in temperature between 0,5 degrees to over 2 degrees Celsius by 2030 (The World Bank, 2010), the climatic relationship between temperature (heat) and water shortage, and the finding of this research highlighting how the two phenomena are competing for same funds in households of middle and low socio-economic status whereby many households are forced to choose between coping to either excessive heat or water shortage, it is recommended that further research is done on the water shortage-heat nexus.

6.4. The future of Gaborone

For arid and semi-arid regions, climate scholars have for decades projected that climate change will result in decreased and altered precipitation patterns coupled with an increase in temperatures which in turn increases evaporation rates. Such changes in climate can for these regions exacerbate periodic and chronic shortfalls of water, especially for areas dependent on single-point water resource systems that by nature are vulnerable due to lack of redundancy in the system (Arab Water Council, 2009; Falkenmark, 1989; IPCC, 1997). Looking especially at southern Botswana, a region encompassing Gaborone, Masike and Urich (2008) projects a seasonal decrease in rainfall by as much as 11% as well as a possible shortened drought return period from two years to 1.6 years by 2050. Such changes will have profound impacts on society, as droughts may intensify due to the decline in rainfall. For urban areas, it is further recognized that the effect of drought is primarily manifested by lack of water for daily activities, including rationing of drinking water (Manthe-Tsuaneng, 2014). In addition, official population projections estimate that just under 314.000 people will reside in Gaborone by 2026, which in itself is expected to stress the provision of services, including freshwater (Statistics Botswana, 2015). The findings of this study show that water shortage is a phenomenon experienced by almost all participants across socio-economic strata, gender, age and other identity markers. With regards to the future of Gaborone, it is not unreasonable to assume that the conglomerate effect of the anticipated climatic changes, outside the scope of regular climate variability, and projections for urbanization will create a severe challenge for Gaborone to supply its residents with adequate access and quality of freshwater. It is therefore not unlikely that Gaborone will face periods of severe water shortage in the future, unless sustainable solutions pertaining to water supply vis-à-vis demand, infrastructure and management are found.

With this in mind, it is increasingly important that research such as this is undertaken to sufficiently understand the implications of water shortage at the local level. To create sustainable and resilient societies it is paramount that policy makers gain insights into how people are differently exposed and subjected to differentiated adaptive capacities and vulnerabilities based on factors that at times are outside of their own control and agency. While this study cannot be statistically generalized to other study sites, or Gaborone, it has shown the importance of

understanding the intricacies of water shortage and vulnerability that is necessary to develop sustainable equitable cities.

7. CONCLUSION

Arguably one of the biggest development failures of this century is the inability to provide clean and safe freshwater to all. A failure whose impendent success is further challenged by climate change. This study is conducted to explore the implications of and responses to water shortage among households in Gaborone. The case study pays special attention to the differentiated adaptive capacities and vulnerabilities of the studied households and seeks to furthermore explore the underlying factors enabling or constraining individual agency.

The study finds that water shortage is not experienced similarly among all the participants, with significant differences pertaining to both the experienced extent and duration of water shortage. Nor does participants express a similar understanding of what constitutes adaptation to water shortage. Instead this seems to be informed by current means of coping and adaptation within a hierachical order further inlfuenced by their socio-economic background. It is further established that water shortage has numerous implications for the participants such as; disruption of daily life both with regards to household chores and time spend on fetching water and queuing times, livelihood disruption for subsistence households and people with water intense jobs, social exclusion and embarrassment, changing routines, water use and water source as well as health challenges both as a direct result of poor water quality as well as the potential to disrupt established health care routines such as intake of medicine. To reduce the risk of water shortage and the subsequent implications hereof, it is illustrated how participants employs numerous strategies to minimize exposure and sensitivity. These are for the most part coping rather than adaptive in nature.

With the use of intersectionality as a heuristic device, a key finding of this study is that the properties of adaptive capacity and vulnerability are not uniformly distributed between or within social categories. Hence, the implications of water shortage and how the participants are affected by this phenomenon is influenced by the intersection and interplay of several underlying factors such as the identity markers pertaining to gender, age, nationality, socio-economic structures in conjunction with the contextual factors of health, caregiving, unemployment and land- and housing tenure. Together these form power structures that can enable or delimit the participants in engaging in risk reducing adaptive measures as well as inform their vulnerability.

By employing an intersectional lens, this research attempts to bridge the gap in current adaptation and vulnerability literature on water shortage that often focuses solely on a single dimension of this phenomenon. As such this research seeks to better understand the intricacies of water shortage by looking at the interdependent and interrelated aspects of implications, coping and adaptation strategies as well as the underlying societal power structures influencing these.

It is shown how inherent power structures both within the individual households as well as within society at large can contribute either positively or negatively to individuals' experiences with and vulnerabilities to water shortage. It is further shown that it is not only less affluent households that are negatively impacted by, or vulnerable to water shortage but that e.g. households of middle socio-economic status struggles with issues pertaining to health, social exclusion and intra-household and community asymmetrical power relations that disproportionally affects women compared to men. The research thus moves beyond the emphasis on access to financial resources and poverty as the primary determining factor for vulnerability and instead highlights how also e.g. gendered societal roles and nationality can impede an individual in pursuing a better financial and socio-economic position within society. Similarly, the study reveals how preestablished practices pertaining to water storing in some poorer households is actually decreasing these households' vulnerability to shorter unwarned water cuts. An important insight to the existing notion in literature where properties of poverty and limited access to financial assets often categorize the unit of analysis as vulnerable by default.

It is recommended that future research explores the relationship between health implications, coping mechanisms related to decreased hygienic practices as well as water storing as an adaptive strategy, as this might potentially challenge the finding of water storing being an adaptive capacity. Similarly, more research into the role of ethnicity vis-à-vis vulnerability and adaptation to water shortage in Gaborone is proposed to provide a broader perspective of this dimension as well as on the water shortage heat nexus.

Concludingly, this research hopes to inspire future research to employ intersectionality within the realm of water shortage and climate change adaptation, as it has been demonstrated how this analytical framework can contribute positively with invaluable insights to further the understanding of these phenomena and ultimately help the development of sustainable, equitable and resilient cities.

8. REFERENCES

Ackerly, B., & True, J. (2013). Methods and Methodologies: Oxford Handbooks Online. https://doi.org/10.1093/oxfordhb/9780199751457.013.0005

Acquah, B., Kapunda, S., & Legwegoh, A. (2014). The dimensions of urban food insecurity in Gaborone, Botswana. *Urban Forum*, *25*(2), 217–226. https://doi.org/10.1007/s12132-014-9222-8

Adams, E. A. (2017). Thirsty slums in African cities: household water insecurity in urban informal settlements of Lilongwe, Malawi. *International Journal of Water Resources Development*, *34*(6), 869–887. https://doi.org/10.1080/07900627.2017.1322941

Adger, W. N. (1996). *Approaches to Vulnerability to Climate Change*. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.662.5892&rep=rep1&type=pdf

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change*, *15*(2), 77–86. https://doi.org/10.1016/j.gloenvcha.2004.12.005

Adger, W. N., & Kelly, P. M. (1999). Social vulnerability to climate change and the architecture of entitlements. *Mitigation and Adaptation Strategies for Global Change*, *4*(3–4), 253–266. https://doi.org/10.7287/peerj.preprints.3090v2

Alcamo, J., Kaspar, F., Wetterdienst, D., Siebert, S., & Döll, P. (1997). *Global change and global scenarios of water use and availability: An Application of WaterGAP1.0*. Retrieved from https://www.researchgate.net/publication/251427736

Arab Water Council. (2009). *Vulnerability of arid and semi-arid regions to climate change-Impacts and adaptive strategies Perspectives on water and climate change adaptation*. The Hague. Retrieved from https://www.preventionweb.net/files/12914_PersPap09.AridandSemiAridRegions1.pdf

Arnold, B. F., Null, C., Luby, S. P., Unicomb, L., Stewart, C. P., Dewey, K. G., … Colford, J. M. (2013). Cluster-randomised controlled trials of individual and combined water, sanitation, hygiene and nutritional interventions in rural Bangladesh and Kenya: the WASH Benefits study design and rationale. *BM JOpen*, *3*(8), 3476. https://doi.org/10.1136/bmjopen-2013

Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change*, *21*(2), 744–751. https://doi.org/10.1016/j.gloenvcha.2011.01.005

Berkes, F., & Jolly, D. (2001). Adapting to climate change: Social-ecological resilience in a Canadian western arctic community. *Conservation Ecology*, *5*(2), 1–18. Retrieved from http://www.consecol.org/vol5/iss2/art18

Boateng, D., Tia-Adjei, M., & Adams, E. A. (2013). Determinants of household water quality in the Tamale metropolis, Ghana. *Journal of Environment and Earth Science*, *3*(7), 70–78. Retrieved from www.iiste.org

Bryman, A. (2012). *Social Research Methods* (4th ed.). Oxford: Oxford University Press.

Buckle, P. (1998). Re-defining community and vulnerability in the context of emergency management. *Australian Journal of Emergency Management*, *13*(4), 21–26. Retrieved from

http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.456.3020&rep=rep1&type=pdf

Burton, I., & May, E. (2004). The adaptation deficit in water resource management. *IDS Bulletin*, *35*(3), 31–37.

Central Statistics Office. (2008). *Botswana Demographic Survey 2006*. Gaborone. Retrieved from www.cso.gov.bw

Chaminuka, L. (2013). An assessment of water shortages and coping mechanisms of Harare residents: A case of Msasa Park and Dzivaresekwa Extension. *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, *4*(3), 21–35. https://doi.org/10.1177/09526950022120629

Charmaz, K. (1996). The Search for Meanings - Grounded Theory. In J. A. Smith, R. Harré, & L. Van Langenhove (Eds.), *Rethinking Methods in Psychology* (pp. 27–49). London: Sage Publications. https://doi.org/10.1016/B978-0-08-044894-7.01581-5

Chipeta, L. (2009). The water crisis in Blantyre city and its impact on women: The cases of Mabyani and Ntopwa, Malawi. *Journal of International Women's Studies*, *10*(4), 17–33. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-68349102054&partnerID=40&md5=ff29da5d246937504109e806b0fc4e4d

Cho, S., Crenshaw, K. W., & McCall, L. (2013). Toward a field of intersectionality studies: theory, applications, and praxis. *Signs: Journal of Women in Culture and Society*, *38*(4), 785–810. https://doi.org/10.1086/669608

Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory, and antiracist politics. *University of Chicago Legal Forum*, 139–167. Retrieved from https://philpapers.org/archive/CREDTI.pdf?ncid=txtlnkusaolp00000603

Curtis, V. A., Danquah, L. O., & Aunger, R. V. (2009). Planned, motivated and habitual hygiene behaviour: an eleven country review. *Health Education Research*, *24*(4), 655–673. Retrieved from https://watermark.silverchair.com/cyp002.pdf?token=AQECAHi208BE49Ooan9kkhW_Ercy7Dm3ZL_9Cf3qfKAc485ysgAAAjYwgglyBgkqhkiG9w0BBwagggIjMIICHwIBADCCAhgGCSqGSIb3DQEHATAeBglghkgBZQMEAS4wEQQM1XCnFr0fHEIbz3lRAgEQgIIB6WkiJ6nTVIoHfxJeZkpGwPsgeJebKekx0hUrmxiRPPYXUgbe

Davies, S. (1993). Are coping strategies a cop out? *IDS Bulletin*, *24*(4), 60–72. https://doi.org/10.1111/j.1759-5436.1993.mp24004007.x

Davis, K. (2008). Intersectionality as Buzzword: A Sociology of Science Perspective on What Makes a Feminist Theory Successful. In H. Lutz, M. Herrera Vivar, & L. Supik (Eds.), *Framing Intersectionality: Debates on a Multi-Faceted Concept in Gender Studies* (pp. 43–52). Farnham : Ashgate.

Djoudi, H., Locatelli, B., Vaast, C., Asher, K., Brockhaus, M., & Sijapati, B. B. (2016). Beyond dichotomies: Gender and intersecting inequalities in climate change studies. *Ambio*, *45*(3), 248–262. https://doi.org/10.1007/s13280-016-0825-2

Downing, T. E., Ringius, L., Hulme, M., & Waughray, D. (1997). Adapting to Climate Change in Africa. *Mitigation and Adaptation Strategies for Global Change*, *2*(1), 19–44.

Engle, N. L. (2011). Adaptive capacity and its assessment. *Global Environmental Change*, *21*, 647–656. https://doi.org/10.1016/j.gloenvcha.2011.01.019

Eriksen, S. H., Brown, K., & Kelly, P. M. (2005). The dynamic of vulnerability; locating coping strategies in Kenya and Tanzania. *The Geographical Journal*, *171*(4), 287–305.

ESCAP, & UNISDR. (2012). *Reducing Vulnerability and Exposure to Disasters: The Asia-Pacific Disaster Report 2012*. Bangkok. Retrieved from https://www.unisdr.org/files/29288_apdr2012finallowres.pdf

Falkenmark, M. (1989). The massive water scarcity now threatening Africa - why isn't it being addressed ? *Ambio*, *18*(2), 112–118. Retrieved from https://about.jstor.org/terms

Falkenmark, M. (1990). Rapid population growth and water scarcity: The predicament of tomorrow's Africa. *Population and Development Review*, *16*, 81–94. Retrieved from https://www-jstor-org.ludwig.lub.lu.se/stable/pdf/2808065.pdf?refreqid=excelsior%3A470a072d5906a8feb0a2d6c83d511f38

FAO. (2012). *Coping with water scarcity : an action framework for agriculture and food security*. Rome. Retrieved from http://www.fao.org

Feleke, H., Medhin, G., Kloos, H., Gangathulasi, J., & Asrat, D. (2018). Household-stored drinking water quality among households of under-five children with and without acute diarrhea in towns of Wegera District, in North Gondar, Northwest Ethiopia. *Environ Monit Assess*, *190*(11), 669. https://doi.org/10.1007/s10661-018-7033-4

Ganesan, C. T. (2001). Water resources development and management: A challenging task for Botswana. *Water International*, *26*(1), 80–85. Retrieved from https://www.tandfonline.com/doi/pdf/10.1080/02508060108686888?casa_token=oVBAumVxkm8AAAAA:1lcM1PeZnqWd83XW9MbTinJb3a6DhpByqcYf4ilFFuCbOHfNrpC5fCTUwrQpnSwgT4qAm8BsD8Ex

Government of Botswana. (2013). *Botswana Integrated Water Resources Management & Water Efficiency Plan*. Gaborone. Retrieved from https://www.gwp.org/globalassets/global/activities/impact-stories/further-reading/iwrm-we-plan.pdf

Guardiola, J., González-Gómez, F., Grajales, Á. L., & Grajales, L. (2010). Is access to water as good as the data Claim? Case study of Yucatan. *International Journal of Water Resources Development*, *26*(2), 219–233. https://doi.org/10.1080/07900621003655692

Hahn, C. (2008). *Doing Qualitative Research Using Your Computer: A Practical Guide*. Sage Pubilcations.

Hambira, W. L., Moalafhi, D. B., & Mulale, K. (2011). *Water Demand Management in Botswana : Reflections on the latest review of Botswana National Water Master Plan*. Gaborone, Botswana.

Harlan, S. L., Brazel, A. J., Prashad, L., Stefanov, W. L., & Larsen, L. (2006). Neighborhood microclimates and vulnerability to heat stress. *Social Science & Medicine*, *63*, 2847–2863. https://doi.org/10.1016/j.socscimed.2006.07.030

He, Z., Bishwajit, G., Zou, D., Yaya, S., Cheng, Z., & Zhou, Y. (2018). Burden of common childhood diseases in relation to improved water, sanitation, and hygiene (WASH) among Nigerian children. *International Journal of Environmental Research and Public Health*, *15*(6). https://doi.org/10.3390/ijerph15061241

Hearn, J. (2012). *Theorizing Power*. Macmillan International Higher Education.

Hillsburg, H. (2013). Towards a methodology of intersectionality: An axiom-based approach. *Studies in Gender, Culture & Social Justice*, *36*(1), 3–11. Retrieved from http://journals.msvu.ca/index.php/atlantis/article/viewFile/3054/2447

Hoegh-Guldberg, O., Jacob, D., Taylor, M., Bindi, M., Brown, S., Camilloni, I., … Zhou, G. (2018). Impacts of 1.5^{o} C global warming on natural and human systems. In V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, … T. Waterfield (Eds.), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change,* (pp. 175–311). In Press. https://doi.org/10.1002/ejoc.201200111

IPCC. (1997). *IPCC: Regional impact of climate change*. Retrieved from https://www.ipcc.ch/pdf/special-reports/spm/region-en.pdf

IPCC. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. (M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, & C. E. Hanson, Eds.). Cambridge, UK: Cambridge University Press.

IPCC. (2018). Annex I: Glossary. In V. Masson-Delmotte, P. Zhai, H. . Pörtner, D. Roberts, J. Skea, P. . Shukla, … T. Waterfield (Eds.), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change,* (pp. 541–562). In Press.

Jiménez Cisneros, B. E., Oki, T., Arnell, N. W., Benito, G., Cogley, J. G., Döll, P., … Mwakalila, S. S. (2014). Freshwater Resources WGII in AR5. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Billir, … L. L. White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 229–269). Cambridge, UK: Cambridge University Press. https://doi.org/10.2134/jeq2008.0015br

Juana, J. S. (2014). *WIDER Working Paper 2014/007 Aid and the environment: The case of Botswana*. Retrieved from https://www.wider.unu.edu/sites/default/files/wp2014-007.pdf

Kaijser, A., & Kronsell, A. (2014). Climate change through the lens of intersectionality. *Environmental Politics*, *23*(3), 417–433. https://doi.org/10.1080/09644016.2013.835203

Keiner, M., & Cavric, B. I. (2004). *Managing the development of a fast growing city a case of Gaborone, Botswana*. Zürich. https://doi.org/10.3929/ethz-a-004644558

Kjellstrom, T., Friel, S., Dixon, J., Corvalan, C., Rehfuess, E., Campbell-Lendrum, D., … Bartram, J. (2007). Urban Environmental Health Hazards and Health Equity. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, *84*(1). https://doi.org/10.1007/s11524-007-9171-9

Kjellstrom, T., & Weaver, H. J. (2009). Climate change and health: impacts, vulnerability, adaptation and mitigation. *New South Wales Public Health Bulletin*, *20*(2), 5–9. https://doi.org/10.1071/NB08068

Kujinga, K., Mmopelwa, G., Vanderpost, C., & Masamba, W. R. (2014). Short and long term strategies for household water insecurity in Ngamiland, Botswana. *Journal of Sustainable Development*, *7*(3). https://doi.org/10.5539/jsd.v7n3p96

Kujinga, K., Vanderpost, C., Mmopelwa, G., & Masamba, W. R. . (2014). Analysis of gender and other

social dimensions of household water insecurity in Ngamiland, Botswana. *Journal of Management and Sustainability*, *4*(4). https://doi.org/10.5539/jms.v4n4p86

Legwegoh, A. F., & Hovorka, A. J. (2013). Assessing food insecurity in Botswana: the case of Gaborone. *Development in Practice*, *23*(3), 346–358. https://doi.org/10.1080/09614524.2013.781128

Ludwig, F., van Slobbe, E., & Cofino, W. (2014). Climate change adaptation and Integrated Water Resource Management in the water sector. *Journal of Hydrology*, *518*, 235–242. https://doi.org/10.1016/j.jhydrol.2013.08.010

Luers, A. L. (2005). The surface of vulnerability: An analytical framework for examining environmental change. *Global Environmental Change*, *15*, 214–223. https://doi.org/10.1016/j.gloenvcha.2005.04.003

Manthe-Tsuaneng, M. (2014). *Drought Conditions and Management Strategies in Botswana*. Retrieved from http://www.droughtmanagement.info/literature/UNW-DPC_NDMP_Country_Report_Botswana_2014.pdf

Manzungu, E., & Chioreso, R. (2012). Internalising a crisis? Household level response to water scarcity in the City of Harare, Zimbabwe. *Journal of Social Development in Africa*, *27*(1), 111–136. Retrieved from http://eds.b.ebscohost.com/eds/detail/detail?sid=f4557abe-ad5c-4dda-a1c7-3bc4fe3fafaa%40sessionmgr198&vid=0&hid=112&bdata=JnNpdGU9ZWRzLWxpdmU%3D#db=edo&AN=86160085

Marr, S. (2012a). “If you are with ten, only two will be Batswana”: nation-making and the public discourse of paranoia in Botswana. *Canadian Journal of African Studies*, *46*(1), 65–86. https://doi.org/10.1080/00083968.2012.659579

Marr, S. (2012b). “They Treat Us Like Dogs”: Demographic claustrophobia and the Zimbabwean struggle for space on the streets of Gaborone. *African Historical Review*, *44*(1), 80–108. https://doi.org/10.1080/17532523.2012.714161

Masike, S., & Urich, P. (2008). Vulnerability of traditional beef sector to drought and the challenges of climate change: the case of Kgatleng District, Botswana. *Journal of Geography and Regional Planning*, *1*(1), 12–18. Retrieved from http://ithuteng.ub.bw/bitstream/handle/10311/542/Masike_JGRP_2008.pdf?sequence=1&isAllowed=y

Mason, L. R. (2012). Gender and asset dimensions of seasonal water insecurity in urban Philippines. *Weather, Climate, and Society*, *4*(1), 20–33. https://doi.org/10.1175/WCAS-D-11-00037.1

Matandare, M. A. (2018). Botswana unemployment rate trends by gender: Relative analysis with upper middle income Southern African countries (2000-2016). *Dutch Journal of Finance and Management*, *2018*(2), 4. https://doi.org/10.20897/djfm/3837

McCall, L. (2005). The complexity of intersectionality. *Signs: Journal of Women in Culture and Society*, *30*(3), 1771–1800. https://doi.org/10.1086/426800

McDonald, R. I., Green, P., Balk, D., Fekete, B. M., Revenga, C., Todd, M., & Montgomery, M. (2011). Urban growth, climate change, and freshwater availability. *Proceedings of the National Academy of Sciences*, *108*(15), 6312–6317. https://doi.org/10.1073/pnas.1011615108

Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. *Science*

Advances, *2*(2), 1–6. https://doi.org/10.1126/sciadv.1500323

Mimura, N., Pulwarty, D. ., Elshinnawy, I., Redsteer, M. ., Huang, H. ., Nkem, J. ., & Sanchez Rodriguez, R. . (2014). Adaptation Planning and Implementation. In V. . Barros, D. J. Dokken, K. . Mach, M. . Mastrandrea, T. . Billir, M. Chatterjee, … L. . White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 869–898). Cambridge, UK and New York, USA: Cambridge University Press.

Ministry of Health & Wellness. (2018). Press Release -Heat Wave Alert. Gaborone, Botswana: Ministry of Health & Wellness. Retrieved from https://www.moh.gov.bw/press release/heat_wave_alrt.pdf?fbclid=IwAR0q9Iaj8_mPMp1sh9GrHF9o1ZFOGXusUdqlNOWHpvDYhUO1k8Qkm5c3RU8

Mompati, T., & Prinsen, G. (2000). Ethnicity and participatory development methods in Botswana: some participants are to be seen and not heard. *Development in Practice*, *10*(5), 625–637. https://doi.org/10.1080/09614520020008805

Morapedi, W. G. (2007). Post-Liberation Xenophobia in Southern Africa: The Case of the Influx of Undocumented Zimbabwean Immigrants into Botswana, c. 1995-2004. *Journal of Contemporary African Studies*, *25*(2), 229–250. https://doi.org/10.1080/02589000701396330

Morrow, B. H. (1999). Identifying and mapping community vulnerability. *Disasters*, *23*(1), 1–18. Retrieved from http://www.geo.mtu.edu/rs4hazards/links/Social-KateG/Attachments Used/IdMapComVulnerability.pdf

Neelim, A. (2011). The impact of safe sanitation facilities in reducing the prevalence of waterborne diseases in rural Bangladesh. *Waterlines*, *30*(4), 328–343. https://doi.org/10.3362/1756-3488.2011.042

New, M., & Bosworth, B. (2018, October). OPINION: What global warming of 1.5 ℃ and higher means for Botswana and Namibia. https://doi.org/10.1002/2017EF000680

Nkemelang, T., New, M., & Zaroug, M. (2018). Temperature and precipitation extremes under current, 1.5 °C and 2.0 °C global warming above pre-industrial levels over Botswana, and implications for climate change vulnerability. *Environmental Research Letters*, *13*. https://doi.org/10.1088/1748-9326/aac2f8

OECD. (2012). *OECD Environmental Outlook to 2050*. Retrieved from https://www.naturvardsverket.se/upload/miljoarbete-i-samhallet/internationellt-miljoarbete/multilateralt/oecd/outolook-2050-oecd.pdf

Osborne, N. (2013). Intersectionality and kyriarchy: A framework for approaching power and social justice in planning and climate change adaptation. *Planning Theory*, *14*(2), 1–34. https://doi.org/10.1177/1473095213516443

Padowski, J. C., Carrera, L., & Jawitz, J. W. (2016). Overcoming urban water insecurity with infrastructure and institutions. *Water Resources Management*, *30*(13), 4913–4926. https://doi.org/10.1007/s11269-016-1461-0

Poste, S. L. (2000). Entering an era of water scarcity: The challenges ahead. *Ecological Applications*, *10*(4), 941–948.

Pritchard, B., & Thielemans, R. (2014). “Rising Waters Don’t Lift All Boats”: a sustainable livelihood analysis of recursive cycles of vulnerability and maladaptation to flood risk in rural Bihar, India. *Australian Geographer*, *45*(3), 325–339. https://doi.org/10.1080/00049182.2014.930001

Prüss, A., Kay, D., Fewtrell, L., & Bartram, J. (2002). Estimating the burden of disease from water, sanitation, and hygiene at a global level. *Environmental Health Perspectives*, *110*(5), 537–542. Retrieved from http://ehpnet1.niehs.nih.gov/docs/2002/110p537-542pr

Quinn, C. H., Ziervogel, G., Taylor, A., Takama, T., & Thomalla, F. (2011). Coping with multiple stresses in rural South Africa. *Ecology and Society*, *16*(3), 10. https://doi.org/10.5751/ES-04216-160302

Rankokwane, B., & Gwebu, T. D. (2006). Characteristics, threats and opportunities of landfill scavenging: The case of Gaborone-Botswana. *GeoJournal*, *65*(3), 151–163. https://doi.org/10.1007/s10708-005-3122-3

Reddy, B. S., & Snehalatha, M. (2011). Sanitation and personal hygiene: What does it mean to poor and vulnerable women? *Indian Journal of Gender Studies*, *18*(3), 381–404. https://doi.org/10.1177/097152151101800305

Ribot, J. (2010). Vulnerability Does Not Fall from the Sky: Towards multiscale, Pro-Poor Climate Policy. In R. Mearns & A. Norton (Eds.), *Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World* (pp. 47–74). Washington: The World Bank. Retrieved from http://documents.worldbank.org/curated/en/970361468324546268/pdf/520970PUB0EPI11C010disclosed0Dec091.pdf#page=73

Ritsema, M. S. (2008). Gaborone is growing like a baby: Life expectancies and death expectations in Urban Botswana. *Africa Development*, *33*(3), 81–108.

Sarpong Boakye-Ansah, A., Ferrero, G., Rusca, M., & Van Der Zaag, P. (2016). Inequalities in microbial contamination of drinking water supplies in urban areas: the case of Lilongwe, Malawi. *Journal of Water and Health*, *14*(5), 851–863. https://doi.org/10.2166/wh.2016.258

Schaer, C. (2015). Condemned to live with one’s feet in water? A case study of community based strategies and urban maladaptation in flood prone Pikine/Dakar, Senegal. *International Journal of Climate Change Strategies and Management*, *6*(4), 442–476. https://doi.org/10.1093/brain/awg239

Sebego, R. J., & Gwebu, T. D. (2013). Patterns, determinants, impacts and policy implications of the spatial expansion of an African capital city: The Greater Gaborone example. *International Journal of Sustainable Built Environment*, *2*, 193–208. Retrieved from https://pdf.sciencedirectassets.com/282138/1-s2.0-S2212609014X00038/1-s2.0-S2212609013000307/main.pdf?x-amz-security-token=AgoJb3JpZ2luX2VjEL7%2F%2F%2F%2F%2F%2F%2F%2F%2F%2FwEaCXVzLWVhc3QtMSJHMEUCIQD2oHYq2xEUKunGll7LrGeGdGMoGNSxe79yLAnJtavucgIgLBpx2QyFARKi

Segosebe, E., & Parida, B. P. (2006). Water demand management in Botswana: Challenges of a diminishing resource. *International Journal of Sustainable Development and Planning*, *1*(3), 317–325. https://doi.org/10.2495/SDP-V1-N3-317-325

Selolwane, O. (2012). From National to People’s Poverty in Changing Policy Regimes. In O. Selolwane (Ed.), *Poverty Reduction and Changing Policy Regimes in Botswana* (1st ed., pp. 1–11). Palgrave Macmillan. Retrieved from https://link-springer-com.ludwig.lub.lu.se/content/pdf/10.1057%2F9781137270177.pdf

Shandas, V., Lehman, R., Larson, K. L., Bunn, J., & Chang, H. (2015). Stressors and strategies for managing urban water scarcity: Perspectives from the field. *Water*, *7*(12), 6775–6787. https://doi.org/10.3390/w7126659

Showers, K. B. (2002). Water scarcity and urban Africa: An overview of urban-rural water linkages. *World Development*, *30*(4), 621–648. https://doi.org/10.1016/S0305-750X(01)00132-2

Siderius, C., Gannon, K. E., Ndiyoi, M., Opere, A., Batisani, N., Olago, D., … Conway, D. (2018). Hydrological response and complex impact pathways of the 2015 / 2016 El Niño in Eastern and Southern Africa. *Earth's Future*, *6*, 2–22. https://doi.org/10.1002/eft2.268

Singh, C. (2014). *Understanding water scarcity and climate variability : an exploration of farmer vulnerability and response strategies in northwest India*. University of Reading.

Smiley, S. L. (2016). Water availability and reliability in Dar es Salaam, Tanzania. *The Journal of Development Studies*, *52*(9), 1320–1334. https://doi.org/10.1080/00220388.2016.1146699

Smit, B., Burton, I., Klein, R. J. T., & Wandel, J. (2000). An anatomy of adaptation to climate change and variability. *Climatic Change*, *45*, 223–251.

Smit, B., & Pilifosova, O. (2001). Adaptation to Climate Change in the Context of Sustainable Development and Equity. In J. J. McCarthy, O. F. Canziani, N. A. Leary, D. A. Dokken, & K. S. White (Eds.), *Climate change 2001: impacts, adaptation and vulnerability* (pp. 880–912). Cambridge: Cambridge University Press. https://doi.org/10.1167/iovs.12-11207

Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, *16*(3), 282–292. https://doi.org/10.1016/j.gloenvcha.2006.03.008

Srinivasan, V., Seto, K. C., Emerson, R., & Gorelick, S. M. (2013). The impact of urbanization on water vulnerability: A coupled human-environment system approach for Chennai, India. *Global Environmental Change*, *23*(1), 229–239. https://doi.org/10.1016/j.gloenvcha.2012.10.002

Statistics Botswana. (2015). *Botswana Population Projections: 2011-2026*. Gaborone. Retrieved from http://www.statsbots.org.bw/sites/default/files/publications/population_projection.pdf

Statistics Botswana. (2016). *Selected Statistical Indicators 1966-2016:* Gaborone. Retrieved from http://www.statsbots.org.bw/sites/default/files/publications/Selected Statistical Indicators 1966-2016- Sept 2016.pdf

Statistics Botswana. (2017). *Botswana Environment Statistics Water and Climate Digest 2017*. Gaborone. Retrieved from www.statsbots.org.bw

Statistics Botswana. (2018). *2017 Botswana Demographic Survey Report*. Gaborone. Retrieved from www.statsbots.org.bw

The Sunday Standard. (2018). WHO, UNICEF joins hands with Botswana as diarrhoea outbreak death toll continues to rise. Retrieved April 28, 2019, from http://www.sundaystandard.info/who-unicef-joins-hands-botswana-diarrhoea-outbreak-death-toll-continues-rise

The World Bank. (2010). *Botswana Climate Variability and Change: Understanding the Risks: Draft Policy Note*. Retrieved from https://www.car.org.bw/wp-content/uploads/2016/06/Botswana-Climate-Change-Policy-Note.pdf

The World Bank. (2019). Botswana | Data. Retrieved April 27, 2019, from

https://data.worldbank.org/country/botswana?view=chart

Thompson-Hall, M., Carr, E. R., & Pascual, U. (2016). Enhancing and expanding intersectional research for climate change adaptation in agrarian settings. *Ambio*, *45*, 373–382. https://doi.org/10.1007/s13280-016-0827-0

Thompson, J., Porras, I. T., Wood, E., Tumwine, J. K., Mujwahuzi, M. R., Katui-Katua, M., & Johnstone, N. (2000). Waiting at the tap: Changes in urban water use in East Africa over three decades. *Environment and Urbanization*, *12*(2), 37–52. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/095624780001200204

Tsai, A. C., Kakuhikire, B., Mushavi, R., Vořechovská, D., Perkins, J. M., Mcdonough, A. Q., & Bangsberg, D. R. (2016). Population-based study of intra-household gender differences in water insecurity: Reliability and validity of a survey instrument for use in rural uganda, *14*(2), 280–292. https://doi.org/10.2166/wh.2015.165.Population-Based

Turner, B. L., Kasperson, R. E., Matson, P. A., Mccarthy, J. J., Corell, R. W., Christensen, L., … Schiller, A. (2003). A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences*, *100*(14), 8074–8079. Retrieved from www.pnas.orgcgidoi10.1073pnas.1231335100

United Nations. (2018). *World Urbanization Prospects: The 2018 Revision. Key facts. New York, United*. https://doi.org/10.4054/DemRes.2005.12.9

Vairavamoorthy, K., Gorantiwar, S. D., & Pathirana, A. (2008). Managing urban water supplies in developing countries - climate change and water scarcity scenarios. *Physics and Chemistry of the Earth*, *33*(5), 330–339. https://doi.org/10.1016/j.pce.2008.02.008

Vörösmarty, C. J., Green, P., Salisbury, J., & Lammers, R. B. (2000). Global water resources: Vulnerability from climate change and population growth. *Science*, *289*(5477), 284–288.

Werbner, R. (2002). Cosmopolitan ethnicity, entrepreneurship and the nation: Minority elites in Botswana. *Journal of Southern African Studies*, *28*(4), 731–753. https://doi.org/10.1080/0305707022000043494

WHO, & UNICEF. (2015). Joint Monitoring Programme: Botswana. Retrieved May 2, 2019, from https://washdata.org/data/household#!/bwa

WHO, & UNICEF. (2017). *Progress on Drinking Water, Sanitation and Hygiene: 2017, Update and SDG Baselines*. Geneva. Retrieved from http://apps.who.int/bookorders.

Wilmsen, E. N. (2002). Mutable identities: Moving beyond ethnicity in Botswana. *Journal of Southern African Studies*, *28*(4), 825–841. https://doi.org/10.1080/0305707022000043539

Wilmsen, E. N., & Vossen, R. (1990). Labour, language and power in the construction of ethnicity in Botswana. *Critique of Anthropology*, *10*(1), 7–37. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/0308275X9001000102?casa_token=-RO9MY4xYtUAAAAA:qkGiOsI3gqiojcJVkvjB1pFR6BnoHti7i90TjrK8pqLhvUNlKQ3hAVhilaXQbPU17y_AWd7kBt0n

Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). *At Risk: Natural hazards, people's vulnerability and disasters* (Second). London and New York: Routledge. https://doi.org/10.4324/9780203428764

WUC. (2012). Water Utilities Corporation - Posts. Retrieved April 27, 2019, from

https://www.facebook.com/waterutilities/posts/497320766952892

Wutich, A. (2009). Intrahousehold disparities in women and men's experiences of water insecurity and emotional distress in urban Bolivia. *Medical Anthropology Quarterly*, *23*(4), 436–454. https://doi.org/ed. DOI: 10.HH/j.1548-1387.2009.01

Yin, R. K. (2011). *Qualitative Research from Start to Finish*. New York: The Guilford Press.

9. APPENDICES

9.1. Appendix A

Below is Table 3, displaying the different areas represented in this research.

Table 3: Location of Participants' Households

Block 3
Block 6
Block 8
Bontleng
Extension 8
Extension 10
Extension 11
Extension 12
Kgale
New Stance
Old Naledi
Village

9.2. Appendix B

Below are Table 4 showing the themes of the demographic part of the interview, Table 5 displaying the interview themes of the primary interviews and lastly, Table 6 displaying the interview themes of the key informant interviews.

Table 4: Themes for Demographic Questions

1	Self-identified Gender
2	Age
3	Marital Status
4	Nationality and Ethnicity
5	Household Level of Education
6	Employment / Livelihood
7	Family Structure
8	Housing Tenure

Table 5: Interview Themes for Primary Interviews

Theme 1: **Climate Change**	*Purpose*: To hear about the participant's perceptions of climate change, if/how it is manifesting itself in Botswana and Gaborone as well as potential experiences related to if/how it has affected their household.
Theme 2: **Household Water System**	*Purpose*: To get an understanding of the participant's access to water, their primary and secondary water sources as well as how they use water within the household.
Theme 3: **Water Shortage**	*Purpose*: To get an understanding of the participant's; experiences with water shortage, response to this, prioritizations and struggles during times of water shortage as well as own perceptions of preparedness and future needs in relation to water shortage.

Table 6: Interview Themes for Key Informant Interviews

Theme 1: **Effect on Organization/Work Activities**	*Purpose*: To get an understanding of whether and how water shortage is affecting their work organization, activities as well as if/how it is influencing their work.
Theme 2: **Effect on Local Community**	*Purpose*: To get their view on whether and how water shortage is affecting the local community with whom they work and in what way.
Theme 3: **Vulnerability and adaptive capacity**	*Purpose*: To get an understanding of who they regard vulnerable to water shortage among the people/communities with whom they work with as well as how they perceive their adaptive capacity.

9.3. Appendix C

Examples of buckets, typical volume capacity ranging between 20-25L.

Figure 9: Different Types of Buckets for Water Storing

Source: *Author's own photos, taken February 18th 2019*

Examples of a drums, typical capacity 100-250L

Figure 10: Different Types of Drums for Water Storing

Source: *Author's own photos, taken February 22nd 2019 (L) and February 18th 2019 (R)*

Examples of JoJo tanks, typical capacity 2.200-5.000L

Figure 11 (L): JoJo Tank for Rainwater Harvesting

Figure 12 (R): JoJo Tank for Storing Municipal Water

Source: *Author's own photos, taken February 22nd (L) and February 18th 2019*

9.4. Appendix D

Example of a house without ceiling but only corrugated iron as roof.

Figure 13: A Participant's House Without Ceiling

Source: *Author's own photo, taken February 18th 2019*