The impacts of increasing water scarcity and the potential for water-related conflict in Lamu, Kenya

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ABSTRACT

In the age of climate change, the efficient allocation, distribution and use of water raises complex issues for water management, with far-reaching and often contentious consequences. As water becomes scarcer, water-related tensions are imminent on different scales. It is the interplay of these tensions with a number of socioeconomic, political, environmental and cultural factors that determine the probability of conflict. Lamu, found in the coastal part of Kenya, is a unique location in that access to water is already a major challenge. Combined with the negative impacts of climate change, and the ongoing large infrastructural development in the region, Lamu is on the verge of a water crisis. As such, there is a need for research into the context-specific factors that play a part in heightening the potential for water-related conflict amidst increasing water scarcity. The focus of this study was to identify and evaluate the context-specific factors that will amplify the potential for water-related conflict in Lamu. The findings suggest religion, migration, and poverty are factors that would heighten the potential for water-related conflict in the region amidst increasing water scarcity. The study recommends that these factors need to be addressed urgently and should be part of any water management mechanism in Lamu, in order to avoid water-related conflicts. Additionally, the findings imply that anticipating the stressors for water-related conflict in Lamu will play a significant role in managing conflict and facilitating negotiations over the region’s water resources.

Key words: climate change, adaptation, Lamu, LAPSSET, water

HIGHLIGHTS

- The study identifies ways through which water scarcity can be managed to avoid water-related conflict.
- The findings provide an indication of factors that should be considered, in context, for any water governance mechanism to effectively manage water.
- The findings are useful in the field of climate change adaptation in Africa, as water scarcity will likely be increased as a result of the impacts of climate change.

INTRODUCTION

Water scarcity has been a persistent issue in Kenya for decades (Ogendi & Ong’o 2009; Marshall 2011; Gedo & Morshed 2013; Mwihaki 2018; Wakhungu 2019). This is for a number of reasons. Firstly, there is inequitable delivery of water to various regions in the country. Secondly, the country’s freshwater basins are not well distributed around the country, leaving a large part of the population without potable water (Ogendi & Ong’o 2009; Marshall 2011). Out of a population of 50 million, about 20.5 million Kenyans lack access to safe and clean drinking water (Ogendi & Ong’o 2009; Marshall 2011; Gedo & Morshed 2013; Wakhungu 2019). The status of water in Kenya remains critical and climate change will only serve to exacerbate the current water scarcity (Bates et al. 2008; Ngaira 2009; Urama & Ozor 2010).

Globally, the water cycle is expected to undergo significant change as a result of the impacts of climate change (Bates et al. 2008; Hosterman et al. 2012; Jeuland et al. 2013; Arnell & Hughes 2014; Tabari 2020). The global pattern of warming is consistent with climate model estimates that account for anthropogenic effects, supporting human-induced climate change as the cause (Padrón et al. 2020). The observational records and current climate predictions provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change (Bates et al. 2008; Hosterman et al. 2012; Arnell & Hughes 2014). Further, there is regional evidence of drier dry seasons predominantly in

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extratropical latitudes including eastern Africa (Padrón et al. 2020), which in turn will impact water resources. As greenhouse gases progressively warm the atmosphere, altering the hydrological cycle, changes to the amount, timing, form and intensity of precipitation will continue (Bates et al. 2008; Hosterman et al. 2012; Arnell & Hughes 2014; Doell et al. 2015; Tabari 2020).

In addition, other expected changes include the flow of water in watersheds, as well as the quality of aquatic and marine environments (Urich et al. 2014; Doell et al. 2015). In tandem with current water challenges, these impacts are likely to affect the programmes designed to protect water quality, public health and safety. This in turn will have wide-ranging consequences for human societies and ecosystems (Gleick 1993; Arnell & Hughes 2014; Urich et al. 2014; Doell et al. 2015). Moreover, the direct impact of human activities on the water cycle through water abstraction, irrigation, and land use change is already a significant component of regional water cycle change and is expected to further increase in importance as water demand grows with global population (Allan et al. 2020). Water plays a significant part in driving climate, rather than just being affected by climate as commonly thought (Koutsoyiannis 2021). This requires a more a more active role of hydrologists in climate research, who have traditionally taken a more passive role in studying climate impacts (Koutsoyiannis 2021).

Ever since analysts began to consider the impact of global warming on security, water has been viewed as an especially critical factor. In many parts of the developing world, water supplies are already insufficient to meet societal requirements. Climate change will cause widespread hardship, unrest, and conflict when water supplies shrink even further (Klare 2020). Competing demands for scarce water supplies are the most obvious cause of water-related conflict (Gleick 1993; Ravnborg et al. 2012; Devlin & Hendrix 2014; Lautenberger & Norris 2016). Studies (Patrick 2020; Zubaidi et al. 2020) show that continuous variation in climate patterns has an adverse effect on local communities. The vulnerability of rural communities to climate change impacts on water availability is intensified by their weak coping capacity in terms of poverty, lack of infrastructure, as well as overdependence on climate-sensitive resources. Communities are more likely to resort to conflict when climate-induced water shortages continue to rise, as they will channel their frustrations over the negligence of their immediate water needs (Patrick 2020). Conflict will only decline when proactive rather than reactive measures are taken to manage water scarcity and vulnerability in rural areas (Patrick 2020; Zubaidi et al. 2020).

The longer water scarcity and variability in supply persists, the more likely conflict will occur in a region (Devlin & Hendrix 2014). The conflicts are further aggravated by high social inequality, economic marginalisation and the reliance on water-dependent livelihoods (Ashton 2002; Jury & Vaux 2007; Robins & Ferguson 2014; Patrick 2020). Further, studies have shown that serious water shortages are more likely to marginalize already disenfranchised members of the affected community (Zwarteveen & Meinzen-Dick 2001; Denton 2002; De & Nag 2016; Ženko & Menga 2019), as well as cause violent conflict (Barnett & Adger 2007; Reuveny 2007; Rai et al. 2017). Numerous links between water and conflict play a part in complicating water management efforts. Inherent to all of these are the competing interests in water sources from a wide range of water users (Ashton 2002; Jury & Vaux 2007; Boelée et al. 2017). Understanding these interests, from a contextual point of view, is essential in developing cooperative and cohesive water management structures that can manage conflict in the face of increasing water scarcity (Ashton 2002; Jury & Vaux 2007; Robins & Ferguson 2014). However, existing studies tend to focus on the physical aspects of climate change or discuss the social ones (Schilling et al. 2020; Uexkull & Buhaug 2021). The role that water plays in influencing the indirect causal pathways between climatic conditions and a wide set of conflict-related outcomes needs greater consideration by the academic community (Abrahams 2020; Schilling et al. 2020; Uexkull & Buhaug 2021).

Arguably, coastal communities are even more vulnerable to climate change, particularly in relation to their water (Hoanh et al. 2003; Ferguson & Gleeson 2012; Ballinger 2015). As the climate becomes warmer and the sea level rises, coastal communities are at risk of salt-water intrusion into aquifers (Ferguson & Gleeson 2012; Werner et al. 2012; Ballinger 2015). They are also faced with flooding of coastal wetlands and marshes, lower oxygen levels in wetlands, ocean acidification due to higher concentrations of carbon dioxide in the atmosphere and the associated impacts of more severe coastal storms (Werner et al. 2012). These have significant implications on coastal water systems and, as such, impact on water availability and quality (Ferguson & Gleeson 2012; Ballinger 2015). These impacts may occur concurrently with other existing stressors such as infrastructural development and coastal population growth, presenting new and different challenges to coastal communities (Massoud et al. 2004; Werner et al. 2012).

Coastal communities are even more at risk where current water systems are underdeveloped (Ferguson & Gleeson 2012; Werner et al. 2012; Gedo & Morshed 2013). For some time now, the coastal region of Lamu has been experiencing a critical shortage of freshwater (Ochiewo 2001; Biamah 2012; Gedo & Morshed 2013; Okello et al. 2015a, 2015b). A surging
population, underdeveloped water infrastructure and over-dependence on declining groundwater sources are the predominant reasons behind the current water crisis (Okello et al. 2015a, 2015b). Lamu is also the site of major infrastructural development, in the form of the Lamu-Southern Sudan-Ethiopia Transport Corridor (LAPSSET). The project is expected to stimulate a further rise in Lamu’s population by at least 1.25 million people – twelve times Lamu’s current population by the year 2050 (Government of Kenya 2015; Okello et al. 2015a, 2015b). This will put additional strain on current freshwater sources that are already under significant stress (Gedo & Morshed 2013; Okello et al. 2015a, 2015b). The national government has proposed certain measures to combat the water issues in Lamu including a proposal to create a desalination plant (Government of Kenya 2015). However, this is a long-term, controversial measure that is yet to be operationalised. As such, Lamu remains on the verge of a freshwater crisis.

Lamu is likely to suffer intensified water shortages as a result of climate change and the LAPSSET development (Okello et al. 2015a, 2015b), which in turn could eventually give rise to water-related conflict (Devlin & Hendrix 2014). There is some research that has been done depicting the state of declining water sources in Lamu (Gedo & Morshed 2013; Okello et al. 2015a, 2015b). However, there is a gap in our knowledge on how Lamu’s water scarcity interacts with other social, cultural and economic factors in the region; factors that in tandem with increasing water scarcity could amplify the risk of water-related conflict in the region. For example, Lamu is a predominantly Muslim region (Ghaidan 1974) that is already experiencing tension between the Muslim and non-Muslim communities (Nyongesa 2017). These tensions are largely believed to be the result of a series of terror attacks that occurred in Mpeketoni (a town in Lamu) in 2014 where more than 60 people were killed (Anderson 2014; Nyongesa 2017). The Somalia based Al-Shabaab militant group claimed responsibility for the attacks but it was also suggested that the attacks were locally organized, and motivated by ethnic or religious hatred, or revenge for land grabbing (Anderson 2014; Nyongesa 2017). The attacks have since caused a significant divide between the Christian community living in Lamu and the Muslim majority. How would this existing tension between the Christian and Muslim communities relate to increasing water shortages in Lamu? This is an important question to answer, as Lamu continues to be water insecure and the potential for conflict remains. Lamu is grappling with declining water supplies and this could ultimately lead to conflict if not managed properly. This paper argues that there are additional factors including religion, migration and poverty that could play an amplifying role in increasing the risk of water-related conflict in the region. The purpose of this paper is to characterise these factors, arguing that carefully managing these factors as part of a water governance mechanism, is essential in mitigating against the potential for water-related conflict. Further this paper contends that managing these factors in the face of increasing water scarcity will promote cooperative water resources management in the region.

STUDY AREA

The study area is Lamu, one of the 47 counties of Kenya. Lamu County is located on the north-eastern coast of Kenya. The study was not limited to one particular area in Lamu County; rather it was determined by the location of the research sites identified (Figure 1). The possible research sites are households in densely populated parts of Lamu (as identified in the Lamu County Integrated Development Plan 2013). Households are specifically targeted, as household water use is a significant use of freshwater in the region.

METHODS

To identify and evaluate the factors that heighten the risk of water-related conflict in the region, we applied a mixed methods approach. This involved a household survey and key informant interviews. The household survey was distributed to 552 households around Lamu, through random sampling. Among the respondents, 51.4% were male and 48.6% were female. Due to the low and scattered population in Lamu (County Government of Lamu 2018), the household survey was administered in the more densely populated parts of Lamu, namely: Lamu Island (including Shella, Manda, and Lamu Town), Mpeketoni, Pate Island, Pandanguo, Mkunumbi, Hindi Area, Mokowe Area and Witu. A structured questionnaire using the KoboToolBox (an Android-enabled platform) was used to gather detailed information on people’s observations of water availability, sourcing and access. Both open-ended and close-ended questions were included in the questionnaire. The statistical techniques utilised in the data analysis are descriptive and inferential to examine the differences and relationships between the population.
Key informant interviews (KIIs) were then conducted between 2016 and 2017 with 25 respondents, selected through purposive sampling. The respondents included local community leaders, members of the community, local government and local water authority employees, the National Drought Management Authority (NDMA) officials, and water experts in the region. The KIIs took on a semi-structured format whereby an interview guide was utilized. Data was collected on variables including access and availability of water, uses of water, relationship to water and the responsibility for water sourcing. The data generated was analysed using SPSS descriptive statistics as well as thematic content analysis for the quantitative and qualitative data, respectively.

RESULTS AND DISCUSSION

Results are reported and discussed in three sections. The first section contains insights on the present state of water in the region, including context on current water scarcity. The second section presents a discussion on the factors identified for their potential to amplify the risk of water-related conflict in Lamu. These factors are pivotal in anticipating water-related conflict in Lamu and, as such, dealing with them will be fundamental to circumventing water-related conflict and facilitating negotiations over Lamu’s dwindling water resources. The third and final section suggests an integrated water resources management approach as a suitable option for avoiding conflict in Lamu in the face of growing demand for water, and declining supply.

The state of water in Lamu

Sources of water and history of access to water in Lamu

The main sources of potable water for households in Lamu include wells, boreholes and rainwater harvesting (Table 1). Other sources of water (Table 1) include purchased water from local water kiosks. This is significantly more expensive, but is the chosen option for households that do not have access to a well or borehole. All the respondents who listed ‘other sources’ are located in Lamu Island, where the cost of living is higher than any other part of Lamu. Some parts of Lamu are also supplied with piped water through the Water Resources Authority (WRA). The specific water service provider responsible for
supplying water to Lamu County is the Lamu Water and Sewerage Company (LAWASCO). According to LAWASCO officials, they serve an area that is approximately 124 km², with a population mandate of 150,000. However, the actual population served by LAWASCO is 50,000 and as such, the current water demands are currently not met. Access to piped water remains limited to the urban centres of Lamu. Results from the household survey (Table 1) showed that only 6.9% of the respondents were dependent on LAWASCO as a main source of water, indicating that it is possible that far less of the total population are actually served by LAWASCO in spite of their claim that they serve 33% of Lamu’s total population.

The method of rainwater harvesting used in Lamu is through traditional ‘djubias’ scattered throughout the city and residential areas. Djubias are masonry structures for harvesting rainwater that are prevalent in this area. Each ‘djubia’ can hold approximately 200 m³ of water supply for 150–180 people. Lamu has no permanent rivers. However, there are a few seasonal rivers, which flow from the west towards the southeast. A small percentage (1.3%) of the respondents rely on such seasonal rivers as a source of water. Lamu Island (including Manda, and Shella) is entirely dependent on the Shella-Kipungani catchment zone or Shella aquifer for freshwater. The Shella aquifer is a water catchment area consisting of sand dunes that collect water during the rainy season. The rainwater seeps underground and water wells are dug to collect the clean water. Across Lamu, other studies have shown similar results in terms of water sourcing. For example, Saidi et al. (2019) showed that 91% of residents in Mokowe (see map – Figure 1) are entirely dependent on well water while the other 9%, classified as middle class, purchase water for household use.

With the exception of wells and seasonal rivers, all other sources of water in Lamu have some cost implication to them. For example, the fees and duties associated with piped water, purchasing water directly or the infrastructure development costs linked to boreholes and rainwater harvesting. As a result, the livelihood of respondents plays a role in their source of water (Figure 2). The unemployed source largely from wells (free access) and scarcely from other sources (purchased water).

Table 1 | Sources of water in Lamu

| Source of water                        | Number of respondents | Percentage of sample |
|---------------------------------------|-----------------------|----------------------|
| Borehole                              | 240                   | 43.5%                |
| Well                                  | 229                   | 41.5%                |
| Water Service Provider (LAWASCO)     | 38                    | 6.9%                 |
| Rainwater harvesting                  | 32                    | 5.8%                 |
| River                                 | 7                     | 1.3%                 |
| Other sources (purchased water)       | 6                     | 1.0%                 |
| Total                                 | 552                   | 100%                 |

Figure 2 | Sources of water in Lamu by livelihood.
they also source from boreholes, it is important to note that these tend to be community owned in Lamu. Therefore the cost of a borehole is shared amongst community members. Furthermore, water-reliant livelihoods including farming and pastoralism are most dependent on boreholes and wells as their main source of water (Figure 2). This indicates that a decline in freshwater availability at these sources would have dire consequences for these livelihoods.

Gender plays a role in how residents source water in Lamu. From the survey, 83% of women source water from boreholes and wells, whereas piped water and purchased water is largely attributable to men (more than 90%). Most of the women surveyed were unemployed (76%), and possibly unable to meet the cost of paying for water. The majority of the respondents (86.21%) cover less than two kilometers to their source of water. Of these 51.37% are women while 48.63% are men. There is no discernable relationship between distance travelled and type of water sources accessed.

The Shella region of Lamu Island is entirely dependent on water from wells. This is confirmed by other studies (Okello et al. 2015a, 2015b). Elders interviewed in the Shella region revealed that Shella’s ownership of wells has deep historical significance. According to the elders, in the past, Lamu was made up of three villages: Lamu town, Takwa and Manda. There was a lot of competition for trade amongst the people within these villages. The Takwa and Manda regions produced the best millet and, as a result, there was a lot of jealousy amongst these villages. Jealousy turned into hostility, until eventually the people of Takwa, Manda and Lamu could no longer pray together. A deal was struck by the Sultan who resided in Lamu, to expel the Takwa people to Shella. White sandy beaches, and not much fertile farming land covers Shella. The people of Lamu thought they had overcome their adversaries by giving them a useless piece of land; however, the people of Takwa (which means ‘honoured people’ in Arabic) were only concerned with having freedom to pray. The elders claim that their desire to pray pleased Allah, and he blessed them with abundant, clean, pure water from the sand dunes to conduct their prayers. To date, the Shella region has access to the best quality water in Lamu, directly supplied by the Shella aquifer.

The main uses of water in Lamu

Freshwater in Lamu has a variety of different uses for the community. The major uses of water for respondents include carrying out ‘household other’ (chores which include household cleaning and cooking), ‘household drinking’, commercial and subsistence farming (Table 2). Table 2 also indicates the difference in uses of water listed by men and women. Gender plays a significant part in determining the roles, rights and responsibilities associated with water sourcing, access and availability. This data was important in helping to understand the inequalities that would be intensified by water scarcity. The differences and inequalities between men and women influence how individuals respond to changes in water resources management. As indicated in Table 2, both women and men listed ‘household drinking’ and ‘household other’ as their predominant use of water. Upon further investigation, there were significant water collection disparities noted between the Muslim and non-Muslim respondents. In the Muslim communities, water collection is a responsibility of the men. They are responsible for collecting water, ensuring maintenance of pipes and finding water from additional sources when there is a shortage. Conversely, in the non-Muslim communities it is the women who are responsible for water issues in the household. They fetch water and find water from additional sources when there is a shortage. They generally manage all water concerns within the household. Increasingly, school-going children in non-Muslim communities are being made responsible for fetching water. This is because the women are overwhelmed with other household duties and opt to send

| Primary use of water                                | Female | Male | Total (%) |
|------------------------------------------------------|--------|------|-----------|
| Cash crop farming                                    | 12     | 14   | 4.7       |
| Subsistence farming                                 | 1      | 3    | 0.7       |
| Household Drinking                                  | 127    | 134  | 47.4      |
| Household Drinking + Cash crop farming              | 4      | 6    | 1.8       |
| Household Drinking + Subsistence farming            | 12     | 16   | 5.1       |
| Household Drinking + Subsistence farming + Cash crop farming | 0 | 3 | 0.5 |
| Household Other (recreational & religious purposes) | 103    | 87   | 34.4      |
| Other uses                                           | 8      | 22   | 5.4       |
| **Total**                                            | 267    | 284  | 100       |
out their children instead. In most of the households interviewed, it is the girls who take up this responsibility, as they are the ones who are tasked with helping their mothers with most chores around the house. Table 2 also shows that Lamu has an active farming community, with 12.8% of respondents engaging in either subsistence or commercial farming. Commercial farmers in the region grow a range of crops for cash including coconut, mangoes, cotton and cashew nuts, while subsistence farmers grow maize, sorghum and cassava.

Respondents who indicated ‘household other’ as a main use of water, described recreational and religious purposes as alternative uses of water in their homes. Water is designated for religious purposes in 34.4% of the surveyed households. These households also listed Muslim as their religion. Muslims require clean pure water to meet Islamic prayer needs. During prayer rituals, Muslims carry out cleansing practices before they begin praying. These cleansing practices involve washing themselves with clean water in order to ‘prepare’ them to go before Allah. A mosque worker explained that poor water quality would have a detrimental effect on Allah’s response to their prayers, as they would not be completely clean and pure.

As far as recreational uses of water are concerned, hoteliers (particularly in Shella and Lamu town) noted that freshwater was used to fill swimming pools. This was a major concern for Shella residents, and in particular the elders of Shella. Shella is where most of the hotels and tourist houses are located. Every new house and hotel has a swimming pool, which requires large amounts of water. However, because tourists are seasonal visitors, swimming pools are emptied and filled according to the season when tourists are visiting. One elder noted:

‘They build swimming pools and then completely empty the same pools once they are done with their holidays. Such a waste of our water!’

It would appear from the views of residents that the use of freshwater from wells and boreholes for swimming pools is wasteful and uncontrolled.

Evidence of increasing water scarcity

As part of evaluating the impact of increasing water scarcity, it was necessary to confirm that water is indeed becoming more difficult to access. As such, households were asked to list their sources of water (Table 1) and state if this source was a reliable one. They were also asked to confirm if they had been forced to make any changes to their main source of water in the past decade (1996–2016). Nearly half (47.8%) of the respondents reported that their main source of water had become unreliable or inaccessible. The same respondents (47.8%) also reported that they have had to change to alternative sources of water to meet their daily household water needs as their previous source of water has become insufficient, or unreliable in supply.

The qualitative results indicate that the prevalence of commercial farms has reduced over the years, with farmers opting to focus on subsistence farming to support their families, due to increasing scarcity of water in the region. Farmers claimed that there is simply not enough water to support commercial farming any more. Furthermore, farmers specified that they now had more than one source of income (other than farming), as the income from farming was inadequate as well as unreliable. Some farmers (54.3%) reported uncertainty in predicting the onset and cessation of the rainy season, which makes it difficult for them to plan as well as have any sustainable commercial interests dependent on rainfall. Additionally, 86% of respondents who were dependent on rivers as a water source have had to change their immediate source of water. Key informants revealed that seasonal rivers were becoming more difficult to access for a number of different reasons, including the fact that seasonal rivers have long dried up. They also indicated that the seasonal rivers had become more difficult to access, owing to an increase in the population dependent on this water source.

For respondents who depended on the water service provider as a source of water, there were complaints about the continuous occurrence of pipe bursts on the mainland. Instances of damaged pipes, resulting in a breakdown in piped water supply, are becoming more frequent on Lamu Island. Residents indicate that the pipes are not well maintained and are in poor condition. In several instances, burst pipes have not been attended to for many days at a time, leaving residents without water. Lamu’s water infrastructure is outdated and heavily dependent on groundwater sources (wells and boreholes) as indicated in Table 1 (85% of respondents listed wells and boreholes as their main source of water). From the survey, respondents depend on these water sources for both household use and for commercial interests, including farming and pastoralism. In light of the surging population in Lamu, key informants believed that their rainwater harvesting systems were in dire need of an upgrade to enable them to improve their water supply. They cited the lack of financial resources and the lack of political
will as the challenges to improving their rainwater harvesting systems. They claimed that the County Government would rather supply them with water from water service providers and keep increasing the price instead of building innovative water technologies.

The availability of financial resources to upgrade water infrastructure is a challenge in Lamu. According to key informants, the national government receives additional financial support in the form of grants and donor funds earmarked for improving water provision nationally. However, Lamu’s budget for water is exceptionally low. Comparatively to other Counties, Lamu receives little additional support from supplementary financial allocation from the national budget. This is due to the fact that Lamu is a tourist site and, as such, is perceived to be a ‘rich’ County that does not require as much financial support. Thus, Lamu receives a relatively low supplementary financial allocation from the national budget in relation to the County’s water needs. This results in poor service delivery, and frequent shortages in water supply. At the same time, Okello et al. (2015a, 2015b) identified the mismanagement of available water sources as an amplifier of the current water shortages.

The findings suggest that there exists an opportunity for residents in Lamu to plan and implement more efficient and sophisticated methods of water infrastructure as well as develop better tools to facilitate the prediction of aquifer behaviour under climate change conditions and human interference (Okello et al. 2015a, 2015b). This will enable residents to meet their water demands and needs, especially in between the rainy seasons. Persistent water problems will make it more difficult for water-dependent livelihoods in Lamu to survive and may result in a higher rate of rural-urban migration in the region. This will add to the already significant urbanization trend in the region.

Factors to consider for equitable and efficient water management in Lamu

Religion

Water plays a major role in households in Lamu for the purposes of cleansing and purification rituals associated with Islamic prayers. As such, Islamic elders and leaders play a significant role in the management of water in Lamu. This is a potential trigger for water-related conflict for two key reasons. One, while Lamu is a predominantly Muslim region, it is also made up of other religious groups and cultures. This means that earmarking local water for religious purposes would be to the detriment of other cultures and religions that do not follow the same practices. It means that an already limited water supply in the region is preferentially supplied to one group, and the other smaller groups in the region may have a hard time finding water. In the Shella region, for instance, local elders (Muslim) have assumed a leadership role over the Shella aquifer. They determine who can put up a borehole or well for private use. While the Shella community is predominantly Muslim, there are Christians living in the area who are subjected to the same rules. As water scarcity persists, unequal distribution and access between the Christians and Muslims in the region could potentially be a cause for conflict. Secondly, it is also important to consider the existing tension between the Christians and Muslims as a result of the series of terror attacks in Mpeketoni in 2014 (Nyongesa 2017). Relations are already on edge in this region and it is likely that persistent water scarcity can escalate existing tensions. Declining water supplies, with limited access (to the detriment of the non-Muslims who are not in control of local water supplies) could ultimately lead to conflict among the communities with religion playing an amplifying role.

Migration (cross-border and rural/urban)

Water-reliant livelihoods, including farming and pastoralism, rely on boreholes and wells as their main sources of water. This indicates a decline in freshwater availability at these sources would have dire consequences for these livelihoods. Key informants from the National Drought Management Authority (NDMA) raised concerns that the number of pastoralists coming into Lamu from the Garissa region has increased. Garissa County borders the northern part of Lamu. Garissa is also going through a major water crisis, forcing several pastoralists to move to Lamu in search of water for their animals. These nomads are taking jobs as security guards/watchmen at night, while grazing their flocks during the day. Pastoralists from Garissa are migrating to Lamu as they believe that there is more water available in Lamu due to the abundant boreholes and wells, with free/open access. With the exception of Shella, on Lamu Island, wells and boreholes in Lamu tend to be completely open access, with little to no regulation. This is significant for pastoralists as they do not have to seek permission or own land in Lamu in order to access water. Elders in Shella, on the other hand, assumed control over their wells and boreholes in order to conserve water. This also ensured that Shella residents were less exposed to water shortages.

Officials of the NDMA are concerned that the relocation of pastoralists to Lamu in search of water is becoming a huge security concern for Lamu residents, as they are becoming increasingly protective of their water. They are protective as
water is already in decline in the area, with residents complaining that the available supply is inadequate to meet their needs. This makes the local residents less inclined to share with pastoralists from Garissa. As such, there is increasing tension between Lamu residents and pastoralists over the use and access to local water sources. This is perhaps heightened by the fact that there are no existing efforts to bring together residents and pastoralists to discuss these issues and explore water-sharing options. It would be beneficial to the Lamu community to address these tensions to ameliorate the chance of potential conflict between Lamu residents and pastoralists.

Also, Lamu is experiencing a surge in water demand resulting in current pressure on local water supplies. This is predominantly due to the major LAPSSSET infrastructural development in the region. The project is attracting people into the County from different parts of Kenya, as well as encouraging rural to urban migration within the County borders with the promise of new opportunities and jobs. County government officials confirmed that since the start of the project, they have noticed a surge in population of the youth in the region. They stated that the former Kenyan President, Mwai Kibaki, instituted an initiative in the region under the LAPSSSET project mandate, to give the youth educational scholarships so that they can be better equipped to get employment on the project, once it is complete and fully functional. This has encouraged widespread rural to urban migration within the Lamu region and from neighbouring counties. Resultantly, there is an increase in demand for water with no corresponding increase in supply. The issues raised by rural – urban migration and migration across county borders in Lamu should be considered as part of any water management scheme in the region.

Poverty

The household survey found that 32.2% of respondents are unemployed. According to the county government, unemployment is a persistent concern in Lamu. Consequently, the ability of residents to buy water to supplement their dwindling sources is low. Residents stated that water prices in Lamu are on the increase and that these costs will continue to go up with the development of the LAPSSSET project. Following from this, it is envisioned that there will be a biased distribution of clean water in favour of higher-income families that can afford to keep up with the increasing cost of water.

Drinking water is expensive to buy and as a result only certain parts of Lamu and residents with higher incomes are able to access clean, quality drinking water. While piped water is available in some parts of Lamu, distribution is sporadic and during water shortages, residents are forced to buy water from water kiosks. Furthermore, while digging up of new wells or boreholes is relatively cheaper than consistently buying water, it still has an associated initial cost that is considerably high. Digging up a new well or borehole also requires that residents have access to land to be able to do so, which is not the case for most of the Lamu residents.

For residents without sufficient means, the high cost of water is undermining their human right to safe and clean drinking water. Water is at the core of community development, and is critical in ensuring socio-economic development, food production, health and sanitation. For this reason, residents believe that Lamu is in dire need of affordable alternatives to their current sources of water. They also recommend that water infrastructure in Lamu should be upgraded and made more efficient to ensure that the local community has better access. Further, with the LAPSSSET project placing additional demands on local water supplies, they recommend that the LAPSSSET project should be responsible for investing in better water provision services.

How can factors for conflict be addressed and managed?

There is no clear integrated approach to water management in Lamu. An integrated water resources management (IWRM) approach draws on an understanding of water use and management, equitable considerations (participation of all relevant stakeholders) and principles of sustainability (Mitchell 2005). One of the main challenges observed in Lamu is the conflicting viewpoints of the different residents. This includes differing approaches to water use, sourcing and management. In addition, there is no clear effort to build relationships between residents around shared water resources through an approach that considers the different viewpoints, and navigates equitably amongst them. This is particularly noticeable amongst residents of different religions, and socio-economic backgrounds. As each stakeholder has a different perception, there is a clear need for appropriate mechanisms to reach a consensus in decision-making. IWRM focuses on equity in that it seeks to consider the participation of all relevant stakeholders in the process.

Furthermore, results indicate that only 15.8% of respondents were actually aware, or had an understanding of the term climate change. Current research shows that knowledge of climate change can be useful in supporting the right adaptation practices, especially when scientific knowledge is supplemented with local, indigenous knowledge (Eriksen et al. 2011).
Community adaptive capacity involves complex relationships among political, socio-economic and cultural elements that vary across a range of temporal and spatial scales. Capacity building needs to be grounded at the community level and involve local knowledge systems. Okello et al. (2015a, 2015b) argue that the proper management of groundwater in Lamu, in the face of a changing climate and land use, will require a reliable knowledge of the availability, recharge and demand of groundwater (Okello et al. 2015a, 2015b). This knowledge can be made available through an IWRM approach, giving residents the necessary information they need for cooperative decision-making.

CONCLUSIONS

There are crucial concerns around the potential for conflict in water-scarce Lamu. These concerns will be intensified by the complex religious tensions in the area, the rampant unemployment, poverty and high cost of water, as well as the rise in rural-urban and cross-border migration. The study shows how context-specific factors have the ability to increase the chance of water-related conflict, suggesting that identifying such amplifying factors should precede any water management approaches or efforts in any region. By identifying these factors, it is possible to anticipate water-related conflict and as such, improve negotiations on Lamu’s dwindling water resources, applying an integrated water resources management approach.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

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