Water and Energy Supply, Access, and Management in the Drylands —Napak and Moroto Districts of Karamoja, Uganda

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Sustainable Development in Practice

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Introduction

Karamoja, a northeastern sub-region of Uganda, covers an estimated area of over 27,200km. It is characterized by Koppen Geiger Climate Zone as a tropical-savanna (Af), which confers high variability in climate, sporadic rainfall and high temperatures throughout the year. The annual rainfall ranges between 350-1000 mm. Major rivers include the Acolcol, Dopeth, Kitorosi, Moroto, and Okere, however many of these rivers dry up during the dry season, a typical characteristic of dry land ecosystems (Mugerwa et al. 2014).

Intermittence in rainfall often causes droughts, crop failure, decreased agricultural production, and food scarcity. Water scarcity also affects pastoralists and agro-pastoralists whose livelihood depends on the herding of livestock. In the past, people relocated in search of more fertile areas and fresh sources of water for herds and personal consumption, which resulted in inter-clan and ethnic conflicts.

In an endeavor to address the water scarcity problem, the Government of the republic Uganda and several partners introduced water development projects for Karamoja, which included drilling of boreholes and construction of valley dams, valley tanks and ponds. Some of these initiatives were a part of the Comprehensive Disarmament Programme for Karamoja.

Borehole technology includes hand pumps, which are primarily used for domestic consumption. Motorized systems, powered by windmills, solar panels, and diesel generators are reserved for production uses, and providing water access to schools and hospitals. Some of these systems are integrated into a piped water scheme.
While there has been a recent increase in initiatives, historically the central government marginalized the region in terms of infrastructure development. NGO partners who attempted to address the gaps took a short-term development approach, which perpetuated a culture of dependency by the community for food aid and water access. In response to these issues regarding water infrastructure and maintenance, the Ministry of Water devised a scheme of committees for the 252 villages. Furthermore, the government developed a training program for Borehole Maintenance Technicians (BMTs), more accurately called, Hand Pump Mechanics (HPT), who are assigned to each district.

Despite the interventions, communities still experience constrained water access and an apparent dysfunction in water management related to vandalism and lack of initiative to manage facilities. Therefore, we sought to examine existing water access and distribution technologies and assess management at local and governmental levels, in three sub-counties in Moroto, Nakapiripirit, and Napak. Our aim was to contribute to current efforts to improve water availability, utilization and management in Karamoja so that future practices will be more productive and sustainable.

Background Data

In 2015, through a loan with the Islamic Development Bank (IDB), the Government of Uganda launched the five year Dryland Integrated Development Project, aimed at addressing poverty challenges in 4 sub-counties in the Karamoja region of Loroo (Amudat District), Lorengedwat (Nakapiripirit), Lotome (Napak), and Nadunget (Moroto District). The Ministry of Karamoja Affairs through Millennium Promise Alliance, a non-profit organization aimed at achieving the Millennium Development Goals and creating self-sustainable communities, is implementing the project.

Prior to the official launch and start of implementation, between December 2014 and March 2015 the Karamoja Dryland Integrated Development Project (KDIDP) conducted a baseline assessment. In order to generate indicators for MDG 7: ensure environmental sustainability, researchers specifically looked at water facilities and access to clean water in the region. When the report was published the assessment for Looro County was not yet finished, and thus only included data from a total of 185 water points in the 3 other sub-counties. (KDIDP baseline report)

Of the 185 water points, 67.6% (125) were boreholes. The majority of boreholes incorporated a hand pump mechanism to access the water, while only 1 used a windmill pump. Only 1.6% of all the water points were connected to the main electricity grid and 11 water points used alternative power sources. Overall 41% (76) of water points were non-functional, and there were a number that had been outright abandoned.

131 water points were being used by 50-500 Households each, 36 were used by 10-50 Households each, and 6 were used by more than 500 households. The majority of water points (78.4%) were found to be in use year round regardless of season. Furthermore, 117 points were a source of water for livestock and 94 of these were used by 50-500 animals in a single day at a time of the year with maximum use, revealing the significance of pastoralism to the livelihood of the people. (KDIDP baseline report)

The report characterized a reachable distance to a water source to be 10 km from the furthest household in a settlement. Within this context most settlements had access to a permanent water source that ensured a regular supply of water all year round. The figure below (Figure 1) shows a map of settlements and drinking water sources in the KDIDP.

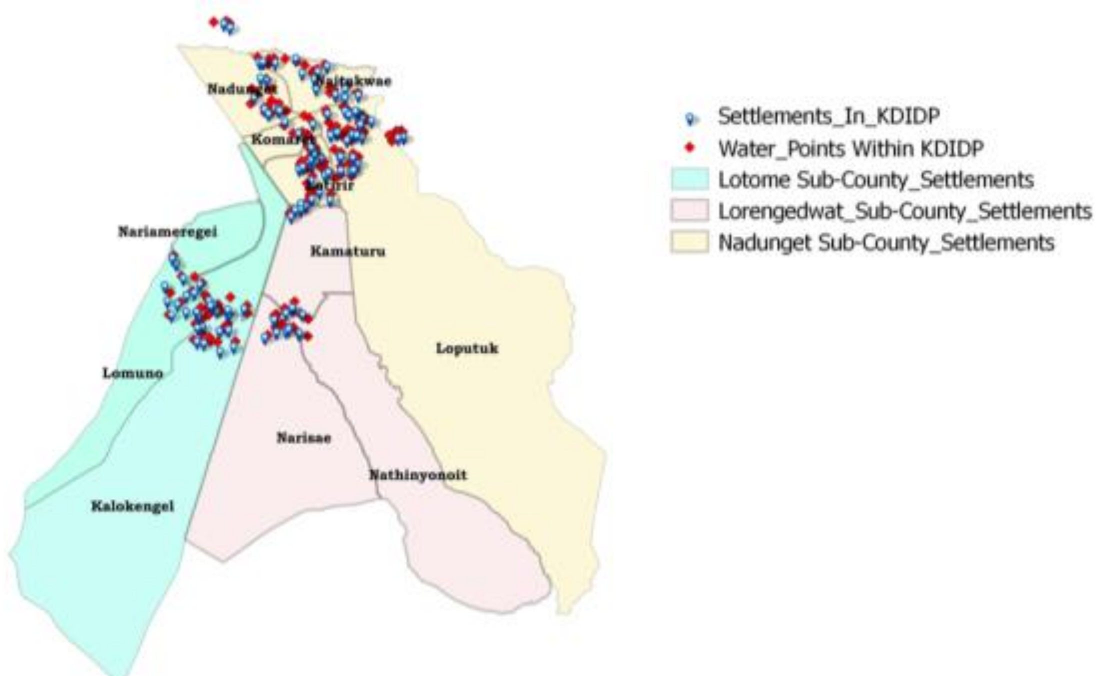


Figure 1. Map of Karamoja Settlements and Water Points. As illustrated by this map, the majority of water sources are located nearest to settlements. However, in a pastoralist community, settlement locations are subject to change.

In January of 2015, the Rural Water Supply and Sanitation Sector of the Napak Local Government published their most up to date progress report specifically for their district. The latest report was provided to us, however the data was not complete, which was acknowledged by the district officer prior to providing us with it. He stated that the missing data would be in the next quarterly report. However, a summary of the available water sources in Napak based on the published data is shown in the graph below (Figure 2). (A similar report was unavailable for Moroto district).

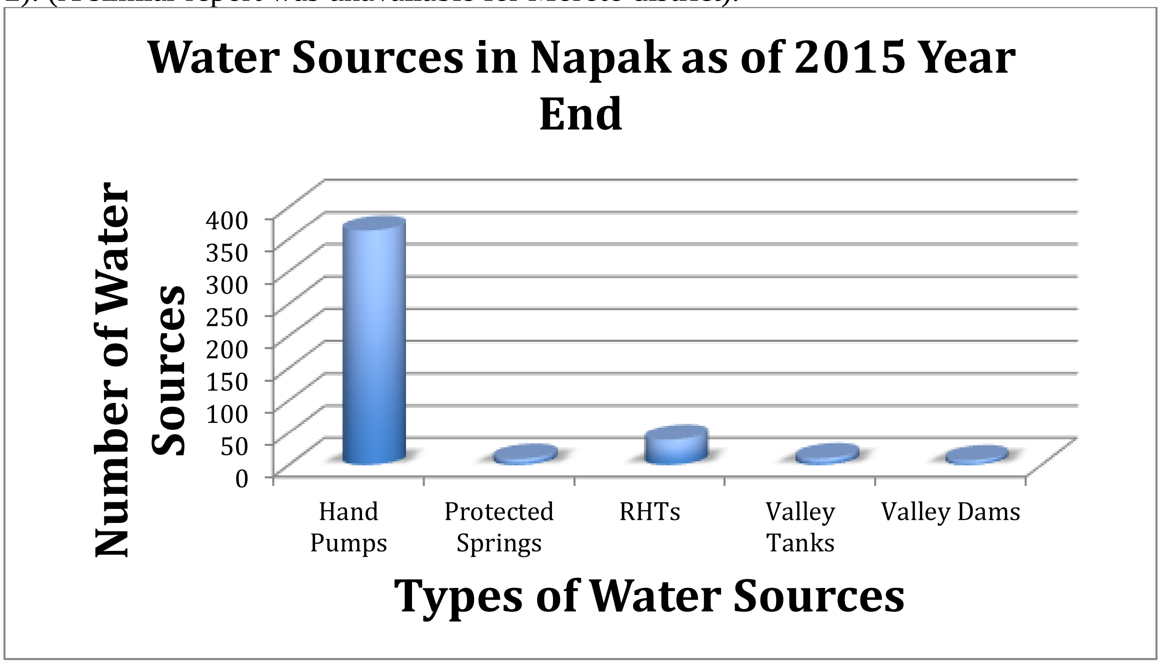


Figure 2. Types of Water Sources Found in Karamoja. At our time of visit, we only saw Hand, Wind, and Solar pumps, as well as Valley Tanks and Valley Dams, there are several other less prevalent methods used.

Problem

In Karamoja, Uganda there are multiple sources of energy used to pump water from boreholes, including solar, wind and manual hand pumps. The majority of boreholes, 122 of 125 are hand pumps (RIFA). Manual pumps are problematic due to the fact that they require frequent maintenance, only one person can use them at a time, and they do not have the ability to connect to the larger water distribution networks. As per RIFA data analysis, 41% of boreholes are non-functional. Furthermore, instead of rehabilitating existing boreholes, lack of coordination between NGO's and the local government results in the creation of new boreholes—a more expensive option.

The Ministry of Water attempted to use alternative energy methods to access and distribute water, but encountered many challenges, such as vandalism, lack of maintenance, and resistance from the local community. Therefore, the goal of this study is to determine the most sustainable methods of water access and distribution, and find ways to combat fragmentation and disorganization among developing partners.

Research Objectives

1. Analyze existing data on different water supply systems
2. Analyze existing data on distribution capacity of current water points
3. Assess the operational maintenance of each system or technology
4. Assess the suitability of each technology based on community capacity
5. Evaluate the reliability (percentage of time the system works in a year) of each system
6. Identify ways in which management and coordination between development partners can be improved.

Research Questions

1. Outside of boreholes, how prevalent are alternative methods of water collection, and how effective are they?
2. What are the factors that enhance or hinder sustainability of hand pumps, solar and wind energy as methods of accessing water?
3. What would be the impact of improved water distribution on the community?
4. How do NGO's and Government organizations affect water access and distribution? Is there adequate communication and coordination between them?

Hypothesis

The use of solar energy in concert with improved water collection techniques will result in a more sustainable and cost efficient water distribution system, and expand water access.

Improved management operations on local and central government levels will decrease barriers to water access, and enhance the ability to implement more sustainable practices.

Scope

The study concentrated on only one area of need in the community: water access. It was carried out in multiple districts in Karamoja, Uganda, a Millennium Promise Drylands Project site. Though Karamoja consists of 4 districts, the study was limited to Moroto, Napak and Nakapritprit. Karamoja is a pastoralist dryland, where water access can be limited, and is essential for both human consumption, as well as agriculture and livestock production. This study focused specifically on access via borehole technology, which consists of the use of hand, solar, and wind pumps. The findings of this study should be considered within a larger framework, as Millennium Promise (MP) interventions interconnect water access with energy and infrastructure.

The data was collected over the course of 2 days. Key informant discussions, short interviews, and observations took place in Moroto, Napak, and Nakapritprit. The discussions were carried out at the MP office in Moroto, as well as at the Moroto and Napak water district offices. Observations were made throughout traveling, which included stops various boreholes as well as a valley tank and a valley dam. At some of the stops, a translator was used to conduct brief interviews with local beneficiaries of the water sources.

Due to the rough terrain, our vehicle was unable to reach certain parts of the region. Additionally, there were tight time constraints, which hindered the ability to collect additional data. These limitations kept the researchers from being able to gather data from all 4 districts and compare them against one another.

Methods

We designed this study to produce quantitative as well as qualitative data. It was carried out in three sub-counties in the Moroto, Napak, and Nakapiripirit Districts, which are within the KDIDP site. Over the course of a week we executed three key informant interviews and visited multiple water points in order to make observations and conduct brief interviews with local beneficiaries. It is essential to note that a translator was used in order to conduct the interviews with the locals at the sites.

In order to make preliminary observations we first visited a Lorengedwat Primary School (Napak District), where there is a solar powered motorized borehole that connects to a piped water scheme. We also visited Lorengedwat Health Center III, where we observed the premises with a particular focus on the point source borehole that used a hand pump mechanism.

Key informant interviews were held with Mr. Abraham Lokawa, the infrastructure team leader of the KDIDP, Musa Lowot, District Water Officer of Moroto, and, District Water Officers of Napak. One list of preliminary questions was used to guide the interviews, which included those that were open-ended and those that were closed-ended. We added additional questions as we uncovered information in the field. (Appendix 1).

At a Kalokengel Primary School in Lotome, we examined a solar powered borehole and conducted a brief interview with a schoolteacher who was on the premises. Near the primary school, we made observations at a point source hand pumping station and briefly interviewed a man standing nearby, who other locals identified as an elder.

We also visited a wind mill powered borehole in Lokali, in the sub-county of Nadunget, in the Moroto District. We briefly interviewed multiple local beneficiaries at this location. Additionally, we surveyed a valley tank in Napak District and executed a brief interview with a water committee member on the premises. The final site of inspection was a Napak valley dam. No beneficiaries of this water source were interviewed.

In total, we assessed 2 solar powered boreholes, 2 windmill powered boreholes, 2 hand pumped boreholes, 1 valley tank, 1 valley dam and 1 piped water scheme.

Methodological Limitations

Researchers who designed study also facilitated the discussions, and this could introduce bias on several levels. There is the potential for interviewer bias, whereby the interviewer may subconsciously influence the responses of the interviewee. On the other hand, there is the potential for response bias, whereby the interviewee offers responses that they believe the interviewer wants to hear. Therefore, is an inability to validate whether or not the information provided in key informant discussions is wholly accurate.

A Focus group discussion with members of the community, water committees and Hand Pump Mechanics (HPM) could have been more conducive for obtaining both quantitative and qualitative data for information on the operational dynamics. However, there is no system in place to ensure that questioning from one group to the next is completely consistent.

Preliminary research questions were posed at the outset, but there wasn't strict adherence. This was further complicated by the fact that different researchers were sometimes responsible for asking questions of different groups, which can introduce bias on multiple levels.

Due, in part, to a language barrier, and time constraints, the preliminary questions were not always posed in a way that lent themselves to clear, interpretable, answers. Often times, responses resulted in multiple, and sometimes conflicting interpretations.

Findings

What are the factors that enhance or hinder sustainability of hand pumps, solar and wind energy as methods of accessing water?

Hand Pumps

We found that hand pumps are by far the most widely used method of accessing water from boreholes in Karamoja. They have both and positive and negative qualities. According to a key informant interview with Mr. Lokawa of Millennium Promise, maintenance is a major factor in the sustainability of hand pump technology. He stated that they require frequent maintenance, as often as every month, and many need major repairs every 2 to 3 years due to wearing of pipes and parts. According to a water district officer in Napak, only 68% of that districts hand pumps are currently functional, the national standard is 85%. That district officer cited poor workmanship, weak management, and a lack of skilled Hand Pump Mechanics (HPMs) as reasons as causes of non-functionality.

Hand Pump Mechanics who are tasked with repairing the hand pumps, and are supposed to be compensated through water management committees (WMCs), which are comprised of local residents, are in short supply. In regards to maintenance, Mr. Lokawa stated that there should be 2 to 3 HPMs stationed in each sub-county, however, they often lack knowledge and tools required to adequately troubleshoot technical difficulties. According to the Napak water district officer we spoke with, to create a WMC, the criterion includes 6 requirements from the community members. They must provide land, agree to a Memorandum of Understanding (MOU) with the sub-county, demonstrate that they are able to improve on issues of gender, provide a capital contribution of 200,000 shillings for installation and facility, maintain proper sanitation, and have a plan for operation and maintenance. The WMCs face challenges at times in paying the HPMs due to financial constraints amongst community members.

Mr. Lokawa advised that WMCs, which are comprised of local community members within a small area, should contribute to the payment of HPMs, who should receive 50,000 to 90,000 Ugandan shillings per repair. WMCs are responsible for paying for repairs up to 200,000 shillings. Above that, repair orders are to be submitted to the district water office. Other issues that face the community regarding hand pumps, is that water is only accessible at the point of the source, which results in long queues. Multiple pumps were also observed being used by animals and humans, which could result in the spread of zoonotic diseases. In spite of these challenges, had pumps are the most inexpensive form of water access, costing approximately 15 to 25 million shillings. Additionally, Mr. Lokawa stated that these boreholes could be productive for 50 years if sited well. (Charts and Graph Appendix 1)

Solar Pumps

We found that solar pumps are utilized far less than hand pump boreholes in Karamoja. Mr. Lokawa advised our team that there is much resistance from community in regards to the implementation of solar technology. Given that Karamoja is a pastoralist community, and rooted in traditional values, the residents are accustomed to hand pumps, and have vandalized solar pumps out of curiosity and a lack of knowledge. A key informant interview with a water district officer in Moroto revealed that a solar pump located in that district had been vandalized by community members and has been out of service for at least 1 year. Prior to the vandalism, the pump worked without interruption for 4 years. That officer did state however that they would like to upgrade to solar if possible due to both it's efficiency and ability to distribute water. Still, local residents are not the only issues that he stated plague the implementation of solar panels.

The Karamoja region has 2 long rainy seasons per year, during which sunlight is limited, thus inhibiting the ability of the solar panels to operate efficiently. This lack of sunlight resulted in the use of diesel fueled generators to supplement the solar systems during the rainy season. Furthermore, Mr. Lokawa advised us that the cost of solar panel systems complete with water collection and disbursement are prohibitive, as they can range anywhere from 6 to 8 billion shillings. HPMs also do not possess the knowledge to repair solar pump technology, which can prove frustrating to community members if the borehole goes out of service. The Napak water district officer also revealed that due to constant pumping, the system would need to somehow be switched off when not in use, otherwise they run the risk of not allowing the water in the borehole to recharge. Although there are many obstacles that hinder the implementation of solar powered pumps, we observed many potential benefits.

Solar appeared to be the most commonly used system to distribute water away from the immediate area of the borehole. From speaking with local community members, there appeared to be a consistent theme that the solar powered boreholes worked without, or with very few interruptions, prior to being vandalized.

Wind Pumps

We found wind pumps to be the least favorable form of alternative energy used for retrieving water from boreholes. Like hand and solar pumps, Mr. Lokawa stated maintenance of wind pumps can be troublesome. Due to the way in which windmills operate, they require a number of movable parts that necessitate constant upkeep, and spare parts can be hard to come by. The Napak water district officer stated that the mechanism located at the top of the windmill requires frequent lubrication, and accessing that area is difficult. Like the solar powered pumps, HPMs are not trained on how to repair windmills. In addition to mechanical issues, siting windmills was also revealed to be a problem.

Since wind is the sole agent in the powering of windmills, special attention needs to be paid to where a windmill borehole is placed. Not only does the area require a steady wind stream according to Mr. Lokawa, but the borehole must also possess a large water supply to avoid drying, which could result in mechanical issues. Ironically, Mr. Lokawa, as well as both water district officers we interviewed, stated that due to poor workmanship and quality of materials, many windmills installed could not withstand strong winds.

The water district officer in Moroto stated that when NGOs have installed windmills and they break, the local residents turn to the district office to repair them, however the office typically lacks the funds and resources to do so. We also observed that if a windmill was broken at the source (the area in which the water was retrieved from), and the windmill itself was otherwise functional, water would continue to be pumped and spilled out onto the ground.

What would be the impact of improved water distribution on the community?

Due to the overwhelming use of hand pumps in Karamoja, and their inability to connect to piped water schemes, water distribution is very limited. In our key informant interview with Mr. Lokawa, he propounded that a centralized tank or tanks, which could distribute water throughout an entire district, would be ideal. He said that this would certainly enhance water availability for both consumption and production by cutting down on the lengthy distances people must travel to obtain water. Furthermore, he stated that KDIDP would like to use a solar distribution method, although the community members are hesitant to allow them to convert their existing hand pump boreholes to solar pumped. The district water officer in Moroto said that he too would like to see a centralized distribution system powered by solar pumps implemented, but again cited both financial and cultural challenges as obstacles. He said that people in the region do not fully comprehend the value that a centralized solar system could bring to them. There is currently a piping system in place in Moroto, which distributes water to various municipalities, but it is expensive to connect to, at a cost of about 300,000 shillings. Customers would then pay monthly based on metered water use measurements.

The Napak water district officer stated that since the inception of the Napak district in 2010, piped water has increased from 47% to 59.83%. The national standard is 85%. This is illustrated in a graph below (Figure 3). He too would like to see a centralized solar distribution system, but stated that he felt that there needs to be an increase in the standard of living prior to such an implementation. Moreover, he sensed that if such a system were implemented, they would face additional costs, such as those for the maintenance of pipes and further water treatment ¾ water flowing through multiple channels increases the chances for contamination.

While in the field we also observed a deficiency in water supply at hand pumps and windmills, which seemed to affect livestock and irrigation. Thus, it appeared that an improvement in distribution could aid in agriculture and livestock production. On a similar note, many hand pumps had lengthy queues, which caused community members to stand around idle for long periods, waiting for their turn to retrieve water.

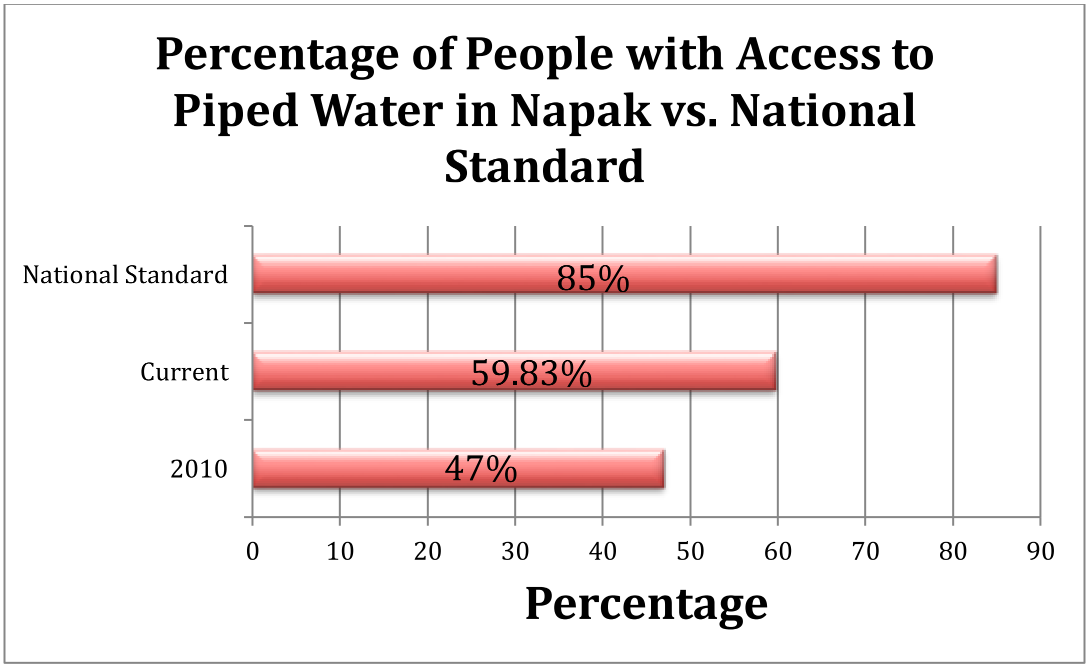


Figure 3. Piped Water in Napak from 2010 to Present versus the National Standard. The Napak water district officer stated that since the inception of the Napak district in 2010, piped water has increased from 47% to 59.83%. The national standard is 85%.

Outside of boreholes, what alternative methods of water collection exist, and how effective are they?

In addition to boreholes, there are other methods of water collection that exist in Karamoja, none of which are nearly as prevalent. In our key informant interview with Mr. Lokawa, we learned of valley dams, valley tanks, ponds, rainwater roof collection, and gravity flow schemes.

Valley Dam

According to Mr. Lokawa, valley dams are large collections of water that are created by building a wall across a section of a valley. They are very costly to implement, about 6 to 8 billion shillings each. Furthermore, the water is stagnant, untreated, and only collected during the rainy season. The water cannot be used for consumption, although some people do consume it. Mr. Lokawa felt that they were an underutilized alternative method. We did observe that despite the lack of rainfall recently, the water level seemed relatively high. However, the water appeared very brackish and not safe for consumption.

Valley Tanks

Valley tanks are essentially smaller scale versions of valley dams. At a cost of 300 to 500 million, tanks cost far less than dams. As per Mr. Lokawa, the tanks are between 10,000 to 20,000 cubic meters. The tanks are excavated in order to increase water retention, and are primarily used for livestock and some irrigation. While visiting a valley tank, we observed dogs and livestock in the water, which we were advised should not be occurring. Although there was a fence around the tank, and a designated entrance point, shepherds were allowing their animals to run freely through the fence, and approach the tank from all points. We did not have the opportunity to observe ponds, rainwater roof collection, or gravity scheme methods, but were informed that they are not very prevalent.

How do NGO's and Government organizations affect water access and distribution? Is there adequate communication and coordination between them?

Due to marginalization by the Ugandan government, the people of Karamoja have been forced to rely on NGOs for assistance in many sectors, including water access. When discussing the roles NGOs play with Mr. Lokawa at the Millennium Promise offices, we were advised that quarterly meetings are held and there are many NGOs active in the area, but not all attend. However, there has been a move towards centralized coordination. Similar sentiments were mentioned when speaking with the Moroto's water district officer. He asserted that NGOs do not always work with the district before starting on a plan. He said that often the only time they hear from the NGOs is if they have difficulty during the construction of a borehole. Furthermore, he acknowledged that NGOs often do not attend meetings with the district. While it seemed as though there was a trend emerging regarding the NGOs in the area, the water district officer in Napak spoke much differently about them.

According to the Napak office, they communicate well with the NGOs working in their district, and stated that NGOs are "very open for discussion." He also stated during our key informant interview in Napak that they attend all mandatory meetings, and that the NGOs fill the "gap" left by the government. They stated as an example, that if there was a need for 100 boreholes, and the government agreed to build 60, those NGOs would step up to close the gap and build the other 40. In addition to NGOs, the district officer stated that local councils are setup in communities as extensions of the government. Water management committees work with the council to resolve issues that arise with pumps and boreholes.

Discussion

Based upon the findings, the prediction that the use of solar energy in concert with improved water collection techniques will result in a more sustainable and cost efficient water distribution system, and expand water access, holds true. Additionally, our findings support the idea that improved management operations on both local and central governmental levels will decrease barriers to water access, and enhance the ability to implement more sustainable practices.

This research included the examination of many different water collection and distribution systems, which revealed the pros and cons of each. While valley tanks and dams hold a large amount of water, the water can only be used for production purposes, and they are extremely costly to build. Boreholes tend to last for decades and as far as quality, the water accessed is more often found to be at least potable. However, it is unclear as of now which pumping technology is the most suitable for the Karamoja population. The community recognizes and understands hand pump systems, but they are only point sources of water access. On the other hand, a solar pump system can connect to a larger distribution network, but is costly to implement and overall a more complex mechanism. Repairs are more difficult, and the traditional community can be resistant to change. Still, all methods of water collection and distribution necessitate at least a small amount of general operational maintenance. Thus, management and education play a crucial role in expanding access to water. If they were to be improved, many of the limitations of solar powered systems could be disregarded.

Deficiency in education is the likely cause of the high prevalence of vandalism to the solar and wind powered borehole pumps. Many community members throw stones or interfere in some other way with the function of the systems out of curiosity. Vandalism also occurs when the pump is not working at the optimum level. If there is any sort of slow down, residents have disconnected the system so that water flows directly out of the source, rather than to a collection tank and tap. Even boreholes that incorporate the hand pump mechanism are subject to misuse. Since the community views water extracted from the boreholes as a free and common resource to be consumed, there is no incentive for general responsible use. Throughout the study key informants all focused on this lack of ownership as a driving force for community members' mistreatment of all of the boreholes. Many were found non-functional or tampered with, with seemingly no one to take responsibility for their repair. Furthermore, many boreholes were abandoned when broken instead of being rehabilitated. We were advised that the rehabilitation of a borehole costs approximately 2 to 3 million shillings, as opposed to drilling a new borehole, which costs over 20 million shillings.

Regarding management, our research showed that a breakdown in coordination exists, stemming from an absence of effective communication and cooperation among development partners, and dysfunctional water management committees. In response to the need for borehole upkeep, the government formed local Water Management Committees (WMCs) and developed a training program for Hand Pump Mechanics (HPMs). The intention is that members will report malfunctioning or abused boreholes to the committee, who will gather funds and pay for the HPMs to do the repair. Yet, this doesn't always occur, as evidenced by the multitude of broken boreholes seen during data collection. There are many possibilities as to why this happens.

One of the most common explanations given in interviews was that the committee's roles isn't clearly expressed to the population, or their authority is unclear. Many beneficiaries noted that if there was a borehole in need of repair, they did not know where they should report the issue. Some assumed that the district government would come to examine the borehole eventually and fix it if necessary. Even still, when the committee has knowledge of an issue, they may be unable to pay a HPM to come. The committees do not normally collect funds from the community on a regular basis; rather they wait to collect when there is a need. Being an impoverished area, the people of the communities are not likely to have money readily available to give. The district government is responsible for repairs above 200,000 shillings, but failing to report the problem can leave broken boreholes unattended to. Moreover, the HPM presence is small.

A committee may lack an understanding of how to call for their service, or there is no technician available at the time of need. Additionally, the same lack of ownership that results in general misuse of all water sources, plagues the WMCs. They aren't motivated to ensure proper utilization and fail to disseminate their knowledge to the people. This was evidenced in the observation of the valley tank. The committee member we were talking to watched as a boy allowed his livestock to enter the area at the wrong point, and go in the water, contaminating it, in order to drink. The absence of an appreciation among the members of the Water Management committees for their importance to the community leaves the people open to the possibility of extortion.

At a higher level, poor communication and coordination still exists. The relationship between the district governments and NGOs is generally ineffective. While the presence of NGOs can be beneficial, as they are able to fill in the gaps not met by the government, they often disregard the proper governmental channels. The Moroto District water officer lamented the fact that NGOs frequently go through with their projects without approval, and many don't attend the monthly coordination meetings. This makes it more difficult for the government to keep track of community developments, which in turn hinders their ability to effectively manage the water sources. Furthermore, the NGO presence can create a culture of dependency, and the people don't feel the need to take ownership of their water sources.

Conclusion

Millennium Promise faces many challenges in the implementation of enhanced borehole technology as well as water access and distribution in Karamoja, Uganda. Community education, coupled with appropriate management and an increased sense of ownership will be pivotal in ensuring the success of these initiatives.

The objective of this short-term study was to evaluate if alternative methods (i.e. solar and wind pumps) would prove more sustainable than hand pumps for water access. Since hand pump boreholes were the most prevalent in the region, and limited in their ability to distribute water outside of their immediate area, this study looked at the best ways to improve the lives of Karamoja residence through improved water access and distribution. Additionally, the study aimed to determine what steps could be taken to improve management and development between partners.

It was predicted that the use of solar energy, in concert with improved water collection techniques, would result in a more sustainable and cost efficient water distribution system, and expand water access. It was also predicted that improved management operations on local and central government levels would decrease barriers to water access, and enhance the ability to implement more sustainable practices.

Key informant discussions, field observations, and reviews of primary and secondary source data revealed that solar technology is the best source for distribution of water from boreholes, yet the implementation of said technology faces many challenges.

Cultural barriers and a lack of management and education at the ground level is greatly hindering the ability to implement and sustain technological advancements that would improve the standard of living of the residents of Karamoja. While a push towards the use of more modern technologies on the part of NGOs is clearly evident, years of marginalization of the region by the centralized government has proven to be a difficult hurdle to circumvent.

This study concludes that even access to improved technology alone does not ensure an improvement in water access. Due to vandalism, financial constraints, and other limiting factors, it has been proven that community education and involvement, as well as an ethically sound management committee, and cooperation between all parties involved, are all crucial to the success of interventions that aim to enhance water access and distribution.

Recommendations

a) Future Development Projects

Given that we found that there was a lack of cooperation between development partners, the management and repair of existing boreholes should supersede the building of new boreholes. New borehole construction should be approved by the District Water Office to avoid poor planning and maintain high quality construction.

Since the water quality of many boreholes is not potable, quality analysis should be conducted. To improve efficiency, solar pumps could be added to high yielding boreholes with high water quality. To increase community support of implementation of newer technologies, like solar pumps, it would beneficial to develop motorized borehole pumps that have dual mechanisms and purposes, to both pump water at point sources and into piped water schemes.

While WMCs are fundamental in community involvement, it was discovered that they were not functioning properly. The WMCs need to be held accountable for the collection of funds, which can be done via verification in a multi-user platform, (ie. community, district offices, and HPMs). Encouraging a high percentage of women to be on the committee and retraining of WMCs to enhance operation and maintenance should be contemplated, and some form of oversight could be implemented to ensure that by-laws are upheld. One way to do this would be to consider changing borehole management to a co-op model. Under this scheme, the community could access borehole parts at wholesale prices, as well as safely pay into a centralized organization and decrease the cost of repairs. To test the effectiveness, a pilot water maintenance co-op could be tested within one district, and gradually implemented throughout the region. Additionally, creation of a centralized borehole repair center and/or number for community members to report non-functioning boreholes to would be constructive. Co-ops could engage the services of HPMs and expand their role to do site visits in each district and report boreholes in disrepair.

Since lack of knowledge about new technologies, leading to vandalism, was a recurring theme in our findings, educational programs about protecting and maintaining boreholes could be implemented to build capacity within the community. Furthermore, utilizing a monitoring and evaluation system to improve quantity and quality of data would provide information for studies, research, and planning at local and national levels.

In an effort to build capacity, partners should adhere to local laws, attend monthly coordination meetings, and disseminate data among development partners and government agencies.

Finally, improvements in water distribution could be beneficial for irrigation. For example the land adjacent to the Valley Dam could be potentially utilized for a communal farm due to the easy access to water for irrigation. This site could provide opportunity for a fish hatchery as well.

b) Policy Makers/Government

In light of how important education is in reducing vandalism, policy makers could increase awareness about the varying technologies and the need to protect them through community education initiatives. Additionally, capacity building sessions on how to do simple borehole repairs, or how to contact a centralized borehole co-op would increase the self-sufficiency of the community and inspire a sense of ownership over water resources.

Funding for infrastructural improvements, like piped water access and increased centralized water system should be increased. Government should utilize a monitoring and evaluation system to improve quantity and quality of data and openly share water resource data with development partners to provide information for studies, research, and planning at local and national levels. Further liability and sustainability must be a priority for development partners. More explicitly, project concepts must be responsible in their transitioning strategy and be suitable for what the region requires. Initiatives must encompass management, education and training, and not simply installation of boreholes.

c) Recommendations for Future Research

Since cooperation from the community is critical to the success of a maintenance program, a focus group discussion with community members and beneficiaries examining how much they are willing to pay for maintenance services, and what services and repairs would best enable quality of life, would be helpful. To further examine the dysfunction of the WMC a double blind study could be designed whereby the participants are unaware of the ultimate purpose of the study, and assistants are used to conduct research, so that they are also not likely to bias their questioning. Finally, additional research on regions nearby or regions that have had similar water issues (ie. Dertu, Sauri) would be helpful in identifying difficulties and opportunities in water maintenance and management.

Appendix 1

Questions for District Water Officer(s):

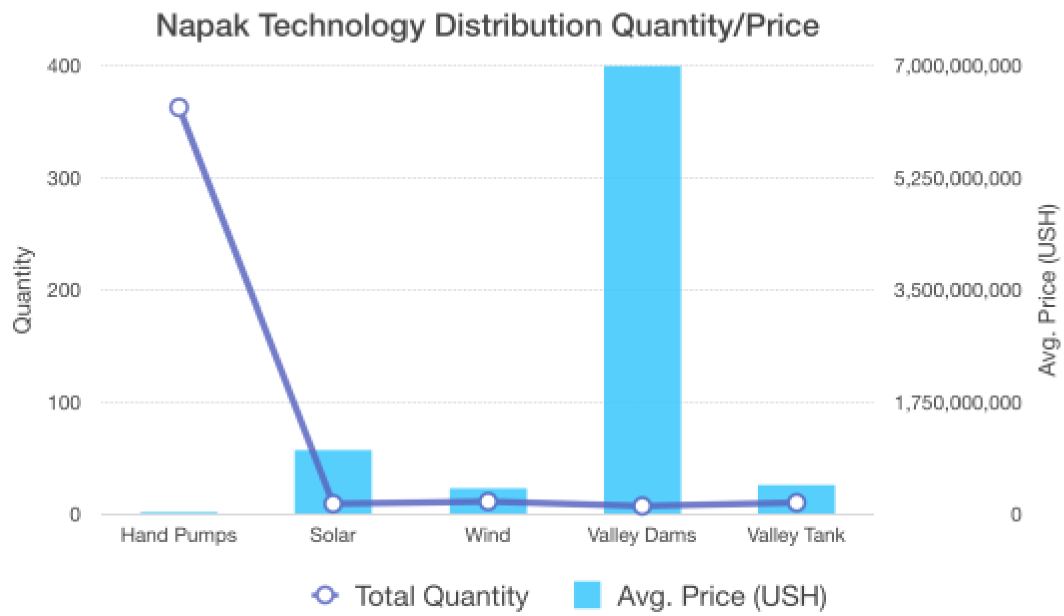
1. What are the average costs associated with installation and repairs (ie. Solar, Wind, Hand Pump, Grid)?
2. What is the frequency of maintenance (ie. Solar, Wind, Hand Pump, Grid)?
3. How many people are served by each technology (ie. Solar, Wind, Hand Pump, Grid)?
4. Which boreholes produce the most potable water?
5. Data on water quality and quantity for each borehole.
6. What is the existing network of water access points and piping systems?
7. How far do current systems reach? Are they reliable?
8. What is the districts policy on water access management?
9. What are the largest barriers facing the implementation of alternative (solar and wind) pumping methods?

Additional Questions posed specifically to the District Water Officer of Napak:

10. Are their future plans for improving water access?
11. How can coordination with NGOs be improved to facilitate maintenance?
12. What is the Districts Average Water Coverage?
13. What is the national average Water Coverage?
14. What are the causes of non-functionality and abandonment?
15. Do they have data on different water technologies?
    a. Which of these are the most utilized technologies?
    b. What is the best technology to focus future projects on?
    c. Why are some technologies used more than others?
    d. What is limiting the application of other technologies?
16. What is the districts policy on water access management?
17. What are the largest barriers facing the implementation of alternative (solar and wind) pumping methods?
18. What is their relationship with NGOs?
19. Do NGOs follow government regulation?
20. How many people does each technology serve?
21. Proximity (average distance) to travel for water.

Napak Technology Distribution Quantity/Price

TECHNOLOGY	TOTAL QUANTITY	AVG. PRICE (USH)
Hand Pumps	363	25,000,000
Solar	9	1,000,000,000
Wind	11	400,000,000
Valley Dams	7	7,000,000,000
Valley Tank	10	450,000,000



PHOTOS NEXT PAGE

PHOTOS

A) **Broken Windmill Pump (3 photos) –** This site revealed local people improvising to access water from the borehole. There was evidence of open defecation, which could have a negative impact on water quality.

B)

B) Valley Tank (3 photos) – cattle entering at wrong points while water committee member was present.

C) Valley Dam (2 photos) – The land adjacent to the Valley Dam had been slashed and burned. If the soil is fertile, the easy access to water for irrigation could be potentially utilized for a communal farm.

D) Broken Solar Pump. Entire scheme (Solar panel, tank, and tap) was enclosed behind a chain link fence. Could be beneficial to give tapped access outside of fence.

E) Cattle trough in disrepair (ie. Cracked basin, foundation washed away, tree fallen into trough) Brief interview with the man on site revealed that he would be willing to pay up to 500 USH a month for regular maintenance. He also indicated that he would ideally like to have the trough rebuilt in the opposite direction and/or gravel fill around the trough.

F) Cattle incorrectly drinking near hand pump

G) Long lines for hand pump

H) Broken Hand Pump

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