III. WATER & MARINE ISSUES

Failure and Potential: Rainwater Harvesting in a Rural, Mountainous Haitian Village

Jessica Brooks, MESc 2014

Abstract

Access to safe water in rural Haiti is currently limited. In some rural mountainous areas, spring capping or rainwater harvesting systems (RWHS) may be the only feasible options for increasing water access toward the Millennium Development Goals. Previous studies have suggested that increasing at-house safe water access may provide more health benefits than improving a more distant source. A potential at-house water source, RWHSs, have been constructed in some rural areas of the Artibonite Department, Haiti, but the usage and acceptability of these systems have yet to be studied. This study assessed the use of rainwater collected at houses and rainwater harvesting systems intended for community use. Semi-structured interviews with RWHS managers and owners and surveys at systematically-sampled households were conducted in summer of 2013. RWHSs intended for community use face social and financial barriers, such as unwillingness to pay, ineffective delegation of management, and inequitable accessibility and allocation, and the preference for drinking rainwater varies within this case study village. The comparison of barriers encountered with the community-intended RWHSs to those of private RWHSs in this village suggests that rainwater is not wholly undesired, but that the maintenance experience and household-level need may determine the success of outcomes.

Introduction

For Target 7.C of the Millennium Development Goals, the proportion of the population with “access to safe drinking water” is measured by reported use of an improved drinking-water source. In Haiti, this indicator has decreased in both urban (88% to 77%) and rural (51% to 48%) areas since 1990 (JMP 2013). While these numbers reflect the disparity between urban and rural areas, access to an improved source also varies between Haiti’s departments.¹ A survey conducted by the U.S. Center for Disease Control in May 2012 determined that only 42.3% of households in rural areas of the Artibonite Department use an improved source—approximately 6% less than the national average (Patrick et al. 2013). The significance of this water and sanitation service deficiency has been made particularly appar-

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ent by Haiti’s cholera epidemic, which began in October 2010 in the Artibonite Department. More than 650,000 cases and 8,000 reported deaths have since occurred in Haiti (Patrick et al. 2013).

In some rural areas of the Artibonite Department, rainwater harvesting systems (RWHSs) have been constructed. However, they only narrowly appear in survey statistics on reported primary water sources (Patrick et al. 2013, Patrick et al. 2012). The usage and acceptability of these systems in comparison to other water sources has yet to be studied in the Artibonite Department. This case study assesses the current use of rainwater collected at households and in cisterns intended for community use in one rural village that is primarily reliant on an unprotected spring. Rainwater usage is compared to safety perceptions and drinking preferences held by the households selected by random sampling and households purposively sampled for ownership or management of a RWHS. The findings suggest RWHSs intended for community use are ineffective for improving drinking water access as implemented in this case. However, potential remains for rainwater to be more beneficial if better targeted and managed.

Theoretical Literature

A primary objective of the Five Year Plan (2011 – 2015) of DINEPA, Haiti’s national water and sanitation authority, is to increase rural water supply (Republic of Haiti: National Directorate for Water and Sanitation [2011] in Gelting et al. [2013: 669]). Geological, financial, technical, and infrastructural factors limit options for increasing safe water access in some rural areas to either capping a primary spring (i.e. constructing an impermeable barrier, typically concrete, at the point where spring water emerges from the ground) or building rainwater harvesting systems. Spring capping is shown to be ineffective for ensuring safe water quality in the Artibonite Department, contributed to by warm groundwater temperatures and poorer natural filtration due to the presence of shallow karst aquifers (Wampler and Sisson 2010, Patrick et al. 2013). Some primary springs may also not be suitable for capping due to the close proximity of a stream or river, which increases the potential for contamination of surface water and of the cap being washed out in a flooding event.

Furthermore, interventions that protect or treat water at the source (e.g., spring capping) may not be fully effective for improving health outcomes. Water can be re-contaminated during transportation and storage (Wright et al. 2004). A randomized control trial in Kenya demonstrated that spring improvement led to a 60% reduction of E. coli contamination at the source, but only a 24% contamination reduction in water being stored at the households (Kremer et al. 2011). Point-of-use water treatment and safe storage are thus necessary to ensure safe water consumption in places without clean and reliable piped water (Mintz et al. 2001).

Spring capping may not significantly improve the health of spring users due to the unchanged distance to households, maintaining the difficulty of obtaining adequate water quantity for hygiene practices. When the primary water source is 30 minutes away or more, water usage volume has also been shown to dramatically decrease (Cairncross 1987). Households with water access outside of their house plot are less likely to practice regular hand-washing compared to those with piped water to their plot (Curtis et al. 1995). Hygiene practices reduce diarrheal disease, the second leading cause of mortality of children under five years of age (Wardlaw
et al. 2010). In 26 countries in Sub-Saharan Africa, households with a 15-minute shorter walk, one-way, to the primary drinking water source had an average of a 41% relative reduction of diarrhea and 11% relative reduction of mortality for children under 5 years of age, controlling for education, wealth, employment in agriculture, and seasonality (Pickering and Davis 2012). RWHs, however, may serve as a feasible at-or near-household water supply to supplement existing sources.

**Background of Study Location**

The village selected for this case study sits along a mountain ridge top. At the bottom of this ridge is the spring that the residents of the village use for potable water. This uncapped spring resides very close to the river, which is used for laundry, bathing, and watering animals. The exposure of this spring and its proximity to the river was especially concerning in early August 2013 during a cholera epidemic in a nearby village. The village formerly had access to other springs along this river bank, but river flooding filled in the springs and washed out the one capped spring.

This village was selected as a case-study due to the existence of several RWHs. Two RWHs intended for community use collect rainwater at two local churches. Both systems were facilitated by the same Christianity-oriented NGO and built in 2001 and 2003, respectively. Further, two households have functioning small “jars” (smaller, round, concrete containers for above-ground storage of rainwater collected off of household roofs) that were built around 1986. Additionally, a neighbor of one of the churches had a RWHS constructed at his household by hiring a mason.

**Methodology**

Semi-structured interviews were conducted in the summer of 2013 with the NGO director responsible for facilitating construction of the RWHs at the churches, the local managers responsible for maintenance of these systems, and the households with private, professionally-built RWHs. These interviews provided detail on the rainwater harvesting systems’ construction procedures, financing, structural specifications, on-going cleaning and other maintenance, intended use and accessibility, and any existing problems. An oral survey allowing for open-ended answers was also conducted at 13 households selected by systematic random sampling to determine access to and use of RWHs, drinking water preferences, and treatment practices.

**Findings**

The findings of this case study include the maintenance, accessibility, and use of two rainwater harvesting systems intended for community use. The village’s varied usage of rainwater as a drinking water source is also presented.

**Management and Accessibility of the Community-Intended RWHs**

The community-intended RWHs in this case study were each built on church property (one Catholic, one Protestant). The churches are the two largest buildings in the area, and the Protestant church is beside a school. The intent was to provide domestic water access for everyone, regardless of church involvement. However, both RWHs’ accessibility is infrequent and unreliable. Both systems are within a fenced area, and the one at the Catholic church has an
additional locked structure around the spigot. The Protestant church cistern is primarily used by the pastor and his family, who live in the church, as well as a manager and the volunteer schoolteacher. The keys to the Catholic cistern are held by one man (“the manager”) who received the position by his previous involvement in the church. To provide keys to more than one person would be “a management problem,” according to him. Because of the limited water availability, there is a perceived need to monitor water extraction from the cistern to reduce waste and overuse. However, this is a burdensome responsibility for one person without compensation, as the Catholic cistern manager noted: “I would not be available to give them water every day since it is not a job.” Consequently, water access is limited to one day per week Sunday; when there is enough rain; and to specific large requests, such as for masonry work. “I don’t have time otherwise,” he said. People are unwilling to pay for cistern water, and the manager asserts this should not be mandated.

When accessible, the use of cistern water for drinking also varies. The manager and pastor’s daughter at the Protestant church use the cistern water for drinking. The Catholic church cistern manager, however, did not trust the water quality as he felt he was unable to clean the system often enough and did not treat it. He also tells users not to use the water for drinking. The distrust of the Catholic church cistern water quality was further observed in household interviews. In one interview, a man stated, “They don’t clean the basin. When it is clean, we can drink it.”

Perceptions of Rainwater for Drinking

This project found that rainwater is not a preferred drinking water source for most people in this village. Those who did not drink rainwater off their own roof or from a cistern typically complained of cleanliness problems or a bitter taste and some stated it causes stomachache. Some comments suggest spring water is seen as safer than rainwater. For example, one informant said, “I prefer the spring water since we would have to treat the cistern water from time to time.” Rainwater is not always seen as poor quality, however. According to one informant, rainwater is “the best water” because it comes “from above.” Despite this opinion, this informant retains a stronger preference for spring water: “Even when we have rainwater, we would go to the spring for drinking water.”

Though most households in the area do not use rainwater for drinking, notable exceptions were encountered. Two of the surveyed households consistently use rainwater for drinking, and both are composed of elderly household members, some of which are also physically disabled. All three private RWHS owners also drink their collected rainwater, yet they have household members who are physically able to collect water from the spring.

Analysis

The heterogeneous demand for rainwater and lack of social structures to support continuous access and adequate system cleaning are barriers against an effective maintenance and financing system for these community-intended RWHSs. The significance of the social, rather than technical, aspects for equitable, collective water management has previously been shown (Mosse 2004). Failing to recognize the current social structures has, in other cases, led to project failure (West 2006:150). Whether such barriers can be changed to facilitate community rainwater harvesting is worth questioning.
In this village, those involved in the church RWHS maintenance are all men. However, women and children bear the burden of water collection, and households comprised of elderly and disabled individuals rely on their grandchildren, family, and neighbors to bring or share water when in need. These individuals could most benefit from reduced effort in water collection for domestic use, yet they are not the most involved (if they are at all) in ensuring the continued functionality of the system.

The stated reasons against drinking rainwater is most often taste and cleanliness, though involvement in ensuring cleanliness of a RWHS seems to play a role that, for some, may overcome dissatisfaction with the taste. While elderly and disabled individuals have greater demand for at-home water, those with private RWHSs are young and have multiple able-bodied household members. One private RWHS owner and the Protestant church RWHS’s manager and pastor’s daughter cited personally managing the cleanliness of the system as a reason for trusting the RWHS water for drinking. Further research would be needed to assess if individuals who currently prefer not to drink rainwater would change this preference with personal management and protected rainwater storage, rather than collection in open buckets. As Agrawal (2005) argues, beliefs may be formed from experiences, rather than actions being determined by prior beliefs.

The private RWHSs cases provided in this study suggest the potential of at-home systems in providing a more appropriate system for rainwater harvesting and possible broader impact. Those with private systems reported sharing a bucket of water with those who needed it and came to borrow one, and this was confirmed in household surveys. In one interview, I was corrected by my wording choice for inquiring if the household had ever “borrowed” water from a neighbor: “We don’t borrow; we share as neighbors.”

**Conclusion & Recommendations**

This case study highlights social and financial barriers for two community-intended rainwater harvesting systems located at separate churches in a rural Haitian village. These barriers include unwillingness to pay for community cistern water, uncompensated and ineffective delegation of management, and inequitable accessibility and allocation. However, comparing the barriers encountered in the community-intended systems to the current use and maintenance of private rainwater harvesting systems in the same village suggests that rainwater is not entirely undesired, but that the social institutions and direct experience impact the outcome.

The NGO director that constructed the community-intended RWHSs expressed interest in providing tough tanks (large, plastic, enclosed drums) to households in this village in the future. Because some households may not be interested in at-home rainwater harvesting, however, specific consideration for groups the most in need may afford more appropriate and effective outcomes. Rather than simply providing the materials, such a program could provide technical assistance and improve access to materials for more extensive guttering to increase water quantity collected, as well as access to enclosed storage containers to protect water quality and reduce and prevent mosquito-breeding sites. The use of local materials, especially items that are easily repaired and replaced by the owner, as well as technical training are necessary — though likely not sufficient — components for long-term sustainability. Appropriate materials may be best discerned through assessment of self-constructed systems within this village,
as well as other similar villages.

Greater utility of RWHSs for community use in this village may be possible through an improved management structure that better considers the constraints and aims to address the greatest need. The greatest need includes the aforementioned groups of individuals, but also critical times in which water-related health risks are greatest and time-savings from reduced water collection is most needed. The rainy season, particularly May through July, is the busiest work period for agriculturalists and is also when water-related diseases (e.g., cholera, typhoid) are highest. If the cistern water cannot be a safe and acceptable drinking water source, it could be used for hand-washing to mitigate health risks. Tippy Taps are a cheap and efficient hand-washing device, which only need to be refilled every few days, depending on usage. Further educational programs that connect RWHSs to these uses and times would be needed.

Endnotes

1. Haiti’s administrative boundaries include 10 départements at the highest level, which are further broken into arrondissements and then communes.
2. Three households in two other villages also mentioned stomachaches.

Acknowledgements

My gratitude is especially to those who I interviewed for being so welcoming and patient. Thank you to Ron Bern Saint Armand and Vladimir Desulme for translating; Renold Estime, Dawn Johnson, Adriana LaMonte, Angel Hertslut, and many others at Hopital Albert Schweitzer Haiti for facilitating my research logistics and understanding of working in Haiti; and Professors Amity Doolittle, Gordon Geballe, Carol Carpenter, and Julie Zimmerman for supporting the development of my research. Thank you to the Tropical Resources Institute, Global Health Initiative Field Experience Award, and Latin America & Iberian Studies Travel Grant for supporting my research expenses. This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. 2012150097.

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