Household Water In Northern Trinidad: Source, Collection, Storage, And Socioeconomics

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Introduction

Consistent access to safe water is essential for human health, yet for many people throughout the world this basic need is unmet. In its Millennium Declaration, the United Nations (U.N.) set 2015 as a target date for halving the proportion of people without sustainable access to safe water and sanitation. Significant progress has been made towards this goal, but the U.N. estimates that nearly one billion people, most of them in developing countries, are still without a reliable source of safe water (U.N. 2009). Water-related diseases, although preventable, are a significant health risk in many parts of the world. Diarrhea kills an estimated 5,000 children a day, and millions of other children and adults are suffering from other water- and sanitation-related diseases, such as cholera, malaria, schistosomiasis, and guinea worm. Water-borne diseases can aggravate malnutrition, retard physical development, keep children home from school, lead to a loss of labor productivity, and create high health care costs (UNICEF 2009). Where delivery of improved water is either not available or not affordable, families assign a strong member (often male) to collect water. In doing so, an able body capable of earning income is tied up collecting water instead of obtaining financial resources for the family (McCormick 1997, Aiga & Umenai 2002). Therefore, improvements in water supply are essential for reducing illnesses, reducing poverty, improving education, and developing sustainable communities (UNICEF 2009).

Population growth and rapid urbanization pose significant challenges to improving access to safe water. More than half of the people on earth live in urban areas, and shanty towns, and slums are proliferating in the urban fringes. These settlements of urban poor are often excluded from statistics on basic services and lack the infrastructure necessary for reliable delivery of safe water. "Since every

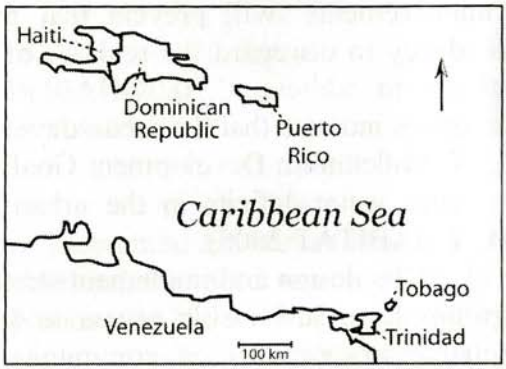
municipality would prefer its slums go away, and officials fear that 'improvements' will prevent that from happening, there has been a tendency to disregard the realities of urban squalor and under-invest in efforts to address it" (UN-HABITAT 2008, p. 5). Although official statistics indicate that the urban developing world is close to meeting the U.N. Millennium Development Goal for safe water, this is far from true because water-deficits in the urban slums are greatly underestimated (UN-HABITAT 2008).

To design and implement strategies that insure all socioeconomic groups have sustainable access to safe water, it is important to have reliable assessments of community needs, resources, infrastructure, water collection, water storage, and water use practices. Such assessments aid in identifying areas where the status-quo is inadequate and help interested parties tailor solutions to a community's specific circumstances rather than uniformly applying a single strategy to an entire region.

This paper presents results of household surveys conducted in Trinidad's Northern Range to assess 1) the source of household water, 2) the methods used for collecting and storing household water, and 3) the reliability of household water sources. This case study adds to the body of literature about household water in a part of the world and socioeconomic groups that are understudied. Most prior water accessibility studies have focused on the urban fringe in arid countries (Akbar et al. 2007, Bakker 2007, Bakker et al. 2008). In contrast, Trinidad is a relatively wet tropical nation, and this study focuses on households in both rural areas and the urban fringe. Existing literature provides an overview of water supply, water demand, and water resources management in Trinidad (Shrivastava 1999, Mycoo 2005, Mycoo 2007), but to our knowledge this is the first water accessibility study in Trinidad to include household surveys. The results of this study shed light on the availability of safe water in both the urban fringe and rural areas of Trinidad's Northern Range. The understanding gained from this preliminary study can lay the groundwork for further studies, identify information gaps, and guide the design of further studies. The results of this study may also be applicable to other developing nations,

particularly other Caribbean nations that are culturally and climatologically similar to Trinidad.

Figure 1: Location of Trinidad and Tobago

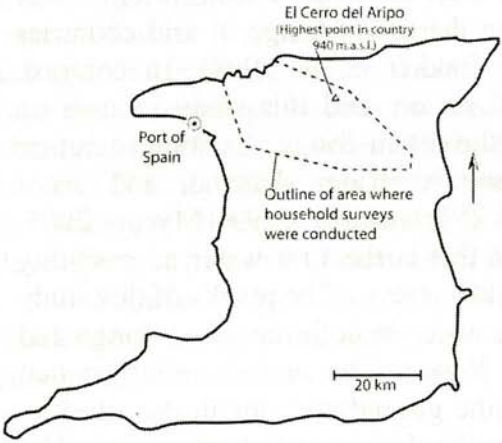


Source: Tara Root

Study Area

Trinidad is part of the twin island nation of the Republic of Trinidad and Tobago, and is the last island in the Caribbean archipelago located 16 km off the northeast coast of Venezuela (Done 1989) (Figure 1). Ninety-five percent of the nation's 1.3 million residents live on Trinidad, the larger of the two islands (Shrivastava 1999, Mycoo 2005). Trinidad is divided by three mountain ranges, the Northern, Central and Southern ranges. The majority of the population lives in urban and urban fringe areas in the foothills of the Northern Range. The highlands of the Northern Range are rural. The interviews for this study were conducted mainly in the urban fringe and rural areas of the Northern Range (Figure 2).

Figure 2: Location of the study area on the island of Trinidad



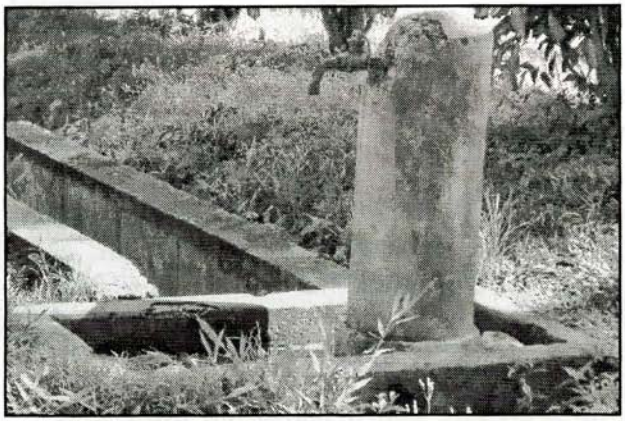
Source: Tara Root

The climate of Trinidad is tropical. The average annual temperature on the island is 26°C. There is very little (2°C – 3°C) seasonal fluctuation in temperature. Mean annual rainfall on the island is 2200 mm, but rainfall is spatially variable; average annual rainfall is greatest in the northeast (3300 mm) and least in the northwest and southwest (1500 mm)

(Mycoo, 2005). Two distinct seasons characterize the area. The dry season lasts from January-May. Up to eighty percent of the annual rainfall occurs during the wet season, which lasts from June–December.

The Water and Sewerage Authority (WASA) has been responsible for public water supply and sewage treatment since 1965. In urban areas, the majority of households have tap service. In areas where there is minimal water infrastructure WASA distributes water through community standpipes (Figure 3). Before more modern technology in water supply became available, standpipes were the primary source of water to many urban districts (James 1927). Currently, standpipes are located approximately every 5000 m in areas with adequate infrastructure, providing many towns with at least one location to obtain improved water. In the most rural areas, WASA might periodically truck in water and residents rely extensively on self-supplied water from rainwater, streams, or lakes. As with most developing countries, Trinidad suffers from unreliable water supply and low pressure in its water distribution system. In 2000 only 33% of the population in the capital region received 24-hr supply seven days week and 28% of the population received fewer than 48 hours of water supply per week (Mycoo 2007).

Figure 3: An example of a standpipe used by WASA for water distribution.



Source: Siana Lakhan

Methodology

Forty-four interviews were conducted between May and August 2006: 26 with rural households, 13 with urban fringe households, 5 with urban households, and one with a WASA employee. The majority of the

interviews were conducted with rural and urban fringe households because these are the areas with the most unreliable water supply and are thus of particular interest. Additionally the urban fringe and rural areas are often overlooked in official statistics. A few interviews were conducted with urban households for comparison purposes. The initial households chosen were those with whom the researchers had previous connections. Subsequent families were selected using the snowball method. Thus, selection was purposefully non-random.

All interviews were conducted with informed consent, and each discussion began by outlining the objectives and procedures of the interview, a method outlined by Fraser et al. (2006). Topics covered in the interviews included: 1) the source of the informant's household water, 2) the methods used by the informant to collect and store water, and 3) the reliability of the water source. Most interviews were conducted in the homes or at the family's water source. The interview with the WASA employee took place at WASA headquarters. The interviews were semi-structured with the researcher asking each informant a similar set of questions in a conversation format, without a set list of questions (Bernard 2006). Through discussion-oriented interviews, the researcher pursued the interests of the informant; each interview developed according to the particular experience of the informant (Fraser et al. 2006). Because interviewees are not all asked identical questions, this method is qualitative and does not lend itself to statistical analysis. However, through lengthy discussion collective views emerge from

which patterns and results can be understood. This is a method outlined by O' Brien (2006).

Results

Sources of household water

The primary source of household water varies with geographic region (urban fringe, rural, urban) (Table 1). Inhabitants in the urban

Table 1: The Percent of Informants in each Geographic Region Reliant upon a Specified Water Source.

Source of Household Water	Urban Fringe (% of 13 informants)	Rural (% of 26 informants)	Urban (% of 5 informants)
WASA supply to household	38	8	40
WASA supplied standpipe	8	12	40
Self supply from surface water and/or rainwater	23	54	20
Multiple sources (WASA and self-supply)	31	27	0

Source: Authors

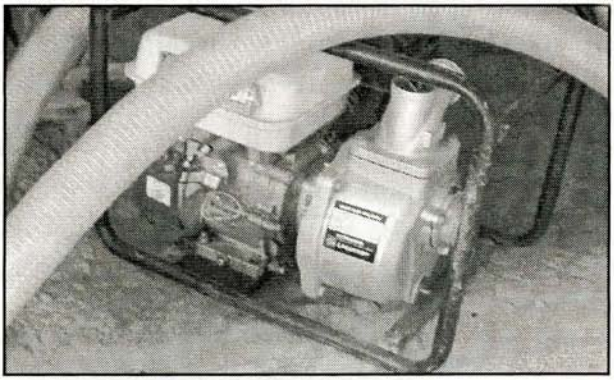
fringe and rural areas rely heavily on self-supplied water that they collect from rivers, springs, or rainwater. Fifty four percent of informants in the urban fringe and 81 percent of informants in rural areas relied on self-supplied water or a combination of self-supply and WASA supply. Standpipes appear to be used by relatively few people (around 10%) in both the urban fringe and rural areas. Thirty eight percent of urban fringe informants had a household tap, while only 8% of rural informants had a household tap. Among the small number of urban informants, the majority relied on WASA to supply their household water.

Methods of collecting water

The methods used to collect water depend on the type of source (standpipe, river, spring) and the household's proximity to the source. In order to bring river water to their homes, informants that lived close to a river carried water in buckets. However, those informants whose houses

were further from rivers often used pumps and hoses to convey river water to their home (Figure 4). Whether they utilized buckets or pumps, informants that relied on river water reported that they collect in the early morning or late at night because they feel the water is less polluted during these hours when fewer people are using the rivers for recreation and washing.

Figure 4: Pump used to obtain household water from river.



Source: Siana Lakhan

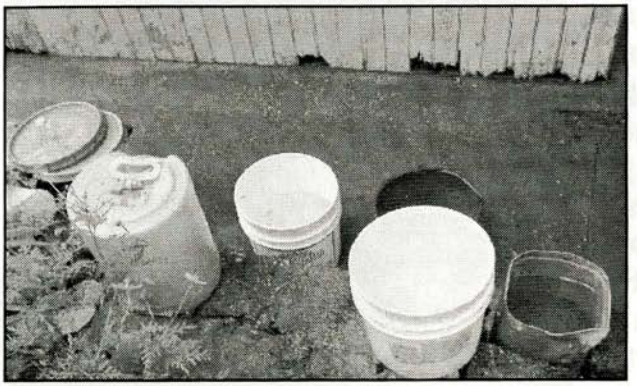
Many informants collected rainwater by attaching a spout to the roof gutter and channeling the rainwater into barrels and tanks (Figure 5). Many households in urban fringe and rural areas cannot afford tanks, pipes, and gutters and instead place buckets below the roof line to catch the rainwater that runs off (Figure 6). Rainwater is preferable to river water because it is relatively clean and does not have to be toted or pumped.

Figure 5: Rainwater collection from the roof to buckets and tanks.

Source: Siana Lakhan

The methods used to collect water from standpipes are similar to those used to collect water from rivers. Informants that obtained water from standpipes often hand-carried buckets or other water containers from the standpipe to their home. Those informants that had an automobile reported

Figure 6: Buckets aligning the roof line to catch rainwater.



Source: Siana Lakhan

using their vehicle to transport water containers from a standpipe to their homes. Some informants would run a hose from a standpipe to their house. The domination of a standpipe by one household often creates water disputes amongst villagers.

Methods of storing water

Most informants, even those in urban areas, stored water. Regardless of geographic region, water was typically stored for about a week. However, informants in one of the most rural areas where rugged terrain makes it particularly difficult to obtain water, reported storing water in tanks for up to three months. Methods of storing water varied depending on the water source, how the water was to be used, and, in some cases, on the season. Tanks are the most common form of storage in all geographic regions; however, many of the informants also used barrels, buckets, and various old plastic containers (Table 2). Most

Table 2: Percent of Informants in Each Geographic Region Using Specified Storage Methods.

Storage Method	Urban Fringe (% of 13 informants)	Rural (% of 26 informants)	Urban (% of 5 informants)
Tanks	46	46	40
Barrels	31	23	20
Various Containers	23	15	20
None	0	15	20

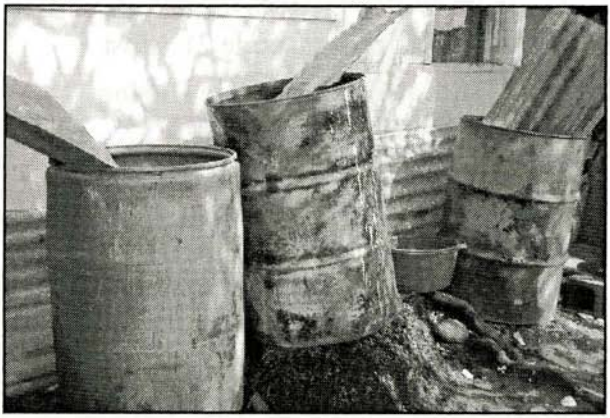
Source: Authors

informants reported storing cooking water inside the house in basins or buckets (Figure 7). However, water used for washing and cleaning was typically stored outside the house (Figure 8). Self-supplied water, such as river water or rainwater, was often stored outside in open containers, while WASA water, whether from a standpipe or truck delivery, was usually stored indoors in covered containers. Many informants used self-supplied water during the wet season, and this water was usually stored in small containers that were easy to carry from the river or spring. During the dry season when rivers and springs run low or are dry, people rely on WASA water from either a standpipe or truck delivery. This WASA water was typically stored for longer periods of time in large barrels or tanks. Most of the few urban residents interviewed kept tanks or barrels filled with WASA water for use during times when WASA mains are dry.

Figure 7: Inside Storage.

Source: Siana Lakhan

Figure 8: Outside Storage.



Source: Siana Lakhan

Discussion

As expected, we found that inhabitants in the urban areas had access to improved water from WASA. Usually, this water is delivered directly via household taps. However, as evidence of the inconsistency of

WASA supply, most urban residents also store a back-up supply of water in large tanks.

Because they are far from the urban centers and often high in the mountains, there is little water infrastructure in the rural areas. Additionally most rural inhabitants cannot afford to pay for public water supply. Despite not having access to an improved water source, most rural informants reported that by collecting and storing water from rivers, springs and rain, they had a consistent supply of water throughout the year. In fact, by relying on self-supplied water, rural inhabitants are not impacted by inconsistencies in WASA services. Without access to improved water, water quality is a significant concern for rural inhabitants. We found that rural informants clearly had some awareness of water quality and took water quality into account in their collection and storage practices. However, without long-term detailed water quality monitoring, it is not possible to determine whether the rural informants had access to safe water.

Similar to what other researchers have observed in other parts of the developing world (McCormick 1997, Aiga & Umenai 2002, Njoh 2003, UN-HABITAT 2008), we found that the urban fringe has the most inconsistent supply of water. The inadequate water supply in the urban fringe is due to a variety of factors including, population growth and socioeconomics. Many residents in the urban fringe areas of Trinidad work for government agencies or with government-sponsored programs (Tiatt 2003). The wages for such government programs are low, approximately TT$7 (US$1) per hour (Strobl & Walsh 2001). The initial fee to connect a household to a WASA mainline is approximately TT$200, and there is an additional cost of up to TT$800 dollars to run a pipeline from the main to a house. WASA's minimum billing rate for domestic water in 1991 was TT$80 per quarter (Mycoo 2007). For the typical low-income urban fringe household, publicly supplied water is clearly unaffordable.

Many urban fringe areas are located in the foothills, far from urban centers, and it is costly to expand water infrastructure to these areas, particularly when communities are located on steep slopes. Mycoo (2007) reports that WASA has consistently had revenue shortfalls due to its pricing policies, infrequent rate adjustments, and

large number of accounts receivable. These revenue shortfalls make it difficult for WASA to invest in expensive infrastructure expansion. In urban fringe areas where WASA has managed to build standpipes, they are often broken or dilapidated and thus subject to contamination.

Since publicly supplied water does not meet all of the needs of urban fringe inhabitants, people also rely on rivers, springs, and rainwater. However, many streams are depleted before reaching the urban fringe, and during the dry season, many households in the urban fringe run out of water.

Conclusions

It is universally crucial for all people to have access to safe water (Falkenmark & Lindh 1975). Although significant progress has been made toward achieving the U.N. Millennium Goal of halving the number of people without access to safe water by 2015, a significant number of people in the developing world and especially in urban slums, still do not have adequate water supplies. Assessing the magnitude and extent of water problems, allocating funding and implementing the proper solutions is often a long bureaucratic process. Studies that assess community-specific needs and resources are needed to develop solutions that address the unique circumstances of each community (Njoh 2003).

The household interviews that we conducted in Trinidad's Northern Range revealed that, although the majority of the urban areas have access to improved water, the service is not always reliable. Residents in the rural areas are able to secure a consistent supply of water, mainly from rivers, springs, and rain, but the quality of this water is uncertain. Residents in the urban fringe have the most difficulty obtaining water. There is room for improvements in water supply among all socioeconomic groups in the study area. Water infrastructure improvements are needed to insure consistent supply to urban areas. Expansion of water infrastructure is needed to make improved water available to more people. Extensive water quality monitoring and policies to protect water quality are needed to insure that self-supplied water is safe for use in rural and urban fringe households. Since the majority of people store water, public education programs should provide information about safe storage practices. Comprehensive

watershed management approaches will help insure that sufficient water supplies are available in all regions, even the urban fringe. Socioeconomics are central to all of these issues, and, in order for any nation to develop a sustainable and equitable water supply system, members of all socioeconomic groups need to be consulted and involved in implementing solutions.

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