Bringing Clean Water to Rural Communities in Developing Countries: A Well for the Community in Agrippa Todzi, Togo

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Abstract

This paper presents a summary of a student funded project for the construction of a community water well in Agrippa Todzi, a small farming village in Togo. A survey was conducted to quantify daily water usage and investigate access to improved latrines in the village. Sixty eight percent of the survey participants reported having access to a clean water source. Based on estimates, the daily average water consumption per capita was near 17 L. Only 13% of respondents reported having access to an improved latrine. The completion of the project is a valuable contribution to the local water supply. The project provided a unique opportunity for international experience and service learning to the students involved.

Keywords: Drinking water, well, sanitation, Togo, rural community

1.0 Introduction

Water is a vital resource for human survival, the most basic and accessible element of life (Specter, 2005). Each person on Earth needs an estimated 5 to 13 gallons (between 19 and 50 liters) of fresh, contaminant-free water every day to satisfy basic needs (Keenan, 2008). When scarcity occurs, women and children, in developing countries, are often the first victims. Although 1.6 billion people have gained access to safe and potable water since 1990 (Wright, 2009), an estimated 1.1 billion people still do not have reliable access to drinking water, with the

majority of these people living in Africa and Asia (Keenan, 2008). In Africa alone, the United Nations has recommended that $20 billion must be invested each year for the next 20 years to achieve universal access to water; however, there has often been a lack of investment in this area. Research showed that even though Africa has 5 trillion cubic meters of fresh water resources available annually, only 3.8% of this supply has been developed, leaving 300 million African people without access to safe drinking water (Ford, 2008).

Togo, a country in the Sub-Saharan Africa, shares the same realities and difficulties. Like in almost all developing countries, the majority of public health problems in Togo is somehow related to unsafe drinking water. In March 2010, the Minister of Water, Sanitation and Village Hydraulics acknowledged the problem when he declared that more than 60% of people living in urban areas in Togo do not have access to safe drinking water (http://www.etiame.com/etiame1112.htm). This percentage increases when moving from cities to suburbs and to rural areas.

This paper is a summary of a student-funded project for the construction of a community well and survey of water usage habits in a rural village of Togo. A community well is a valuable asset to any rural community in developing nations. Shared by all members of the village, the presence of such a well in a community reinforces the sense of cooperation and togetherness enjoyed by the local population. Access to a community well reduces the risk of exposure to waterborne disease by providing a convenient and reliable alternative to surface waters. Water accessibility from improved sources has been shown to help dramatically reduce rates of morbidity and disability due to ascariasis, diarrhea, guinea worm disease, hookworm infection, schistosomiasis, and trachoma (Esrey, Potash, Roberts, & Shiff, 1991). A near-complete eradication of guinea worm disease has reportedly been achieved between 1960 and 1990 through improvement of community water sources and education in an African country (Hunter, 1997; Diamenu & Nyaku, 1998).

Depending on their location, wells can also greatly reduce the amount of time and energy involved in fetching water for daily household use. In developing countries, it is the responsibility of women and children to fetch the household's daily water. The lack of a centralized water source often means trekking several kilometers through potentially hazardous areas, only to wait in lines before accessing the water supply. They must then carry the water back to the household in heavy containers on their head. This process is time consuming and physically demanding. Having a community well generally creates a ripple effect on productivity and impacts quality of life in many other areas. For example, in a study comparing the daily time budgets of women in a village with a centralized water source to women with a distantly located water source, it was found that the former spent fewer minutes fetching water each day (Rosen & Vincent, 1999). Family members can spend the extra time available on activities that promote their own well-being, such as farming, regular school and church attendance, petty trading, and recreation (Arku, 2010). The main beneficiaries of reduced water-collection time, women, may also increase their daily amount of time assigned for household cottage production of goods (Asare, 2004).

The specific objectives of this paper were to (1) describe the narratives of the financing and construction of a large-diameter community water well for safe drinking water; (2) conduct a survey to estimate domestic water usage and access to improved latrines in a rural community; and (3) present undergraduate student experience about service learning through an international project.

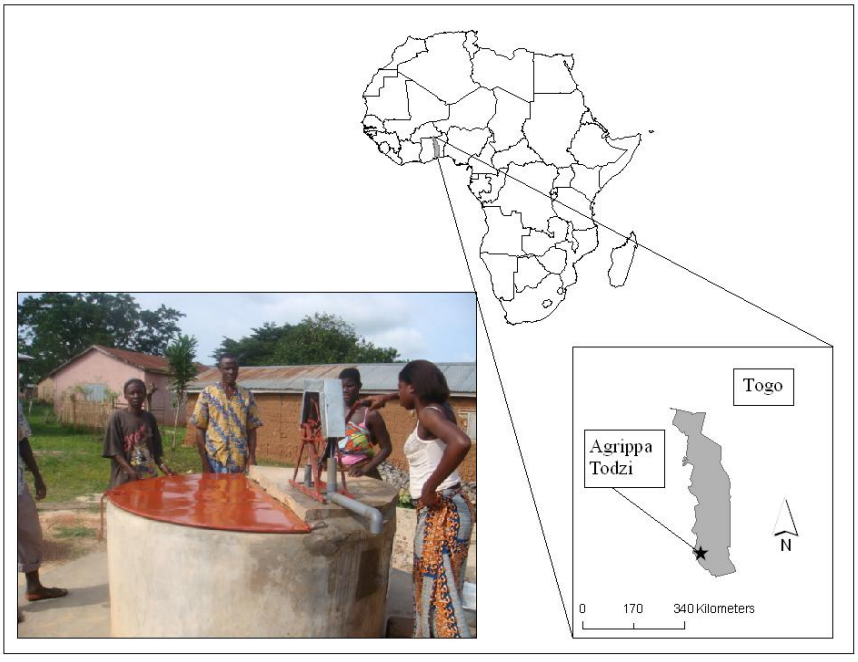
2.0 Methods

2.1 Project Location

This project was conducted to serve the water needs of Agrippa Todzi, a rural Togolese village of 2,500 inhabitants, situated 6.5 km east of the Ghanaian border, 12 km west of the regional capital of Kpalimé, and 113 km north of the Atlantic coast (Fig. 1). Togo is bordered by Burkina Faso to the north, Benin to the east, and Ghana to the west. Its southern border is the Gulf of Guinea in the Atlantic Ocean. The capital of Togo is Lomé, located along the southern coast. The climate of Togo ranges from tropical forest to temperate savannah. In April of 1960, the Togolese Republic ceased to be a United Nations trusteeship and became its own nation.

Although the residents of Agrippa Todzi are expert farmers and maintain large plantations of both commercial and subsistence crops, poverty is widespread in the village due to lack of employment and suitable markets for local agricultural products. In the last ten years, international aid organizations have improved upon four preexisting sources of water for public use in the village. Of these four, one is permanently unusable. The remaining wells are subject to frequent mechanical breakdowns, leading to severe water stress during dry seasons. Due to inadequate funding to maintain the existing water sources or to finance new ones, many households in the village resort to using unsafe sources for drinking water, creating a high risk of exposure to waterborne diseases.

Figure 1. Location of Agrippa Todzi



2.2 Project Conception and Completion

This project had its inception when a team of five students sought to bring water-related aid work to rural communities in developing countries. In partnership with the Association Togolaise de Volontaires au Travail (ASTOVOT), a non-government organization (NGO) based in Kpalimé, Agrippa Todzi was identified

as the beneficiary of a large-diameter community well. Contractors were located to perform preliminary studies and the technical work. ASTOVOT and the Purdue University team maintained routine communication for the exchange of comments, critiques, and suggestions. Once volunteers from Purdue University and ASTOVOT arrived in Agrippa Todzi in May 2010, the two teams worked closely with one another in assisting the contractors at the well site, collecting information on water usage within the village, and reaching out to the local population. The ASTOVOT volunteers served as linguistic and cultural guides, translating and helping the Purdue students learn local customs and practices.

The cost for the project was slightly over $14,000. This number includes the construction cost of the well and travel arrangements for the students involved including vaccinations, lodging expenses, and airfare. Under the sponsorship of a faculty member, a team of five students submitted a proposal to a grant program called Hydrologists Helping Others (H2O). This program was sponsored by the Earth and Atmospheric Sciences (EAS) Department at Purdue University. The proposed project was approved for the amount of $10,000. Additional funding was raised from local businesses and other sources, which allowed students to successfully achieve the completion of the project.

2.3 Survey

A survey was conducted through one-time face-to-face interviews with various households in May 2010 to quantify daily water usage and investigate access to improved latrines in the village. The survey was 10 minutes in length and 38 household participants for the survey were randomly selected from different socio-geo-economic backgrounds in Agrippa Todzi (see Table 1). Typical household size varied between 5 and 10 residents on average, with a range of 1-25 people. This was to ensure that different opinions on the subject matter are captured during the survey. Specific demographic characteristics of participants was purposely not recorded during the survey because the goal of this study was to approximate domestic water usage and access to potable water of the average rural dweller in the village regardless of age. This will also ensure a general comparison of domestic water usage in other parts of the world. Before conducting the survey, the chief informed the residents of the village through public announcement to assure their consent. This is a common practice in a community such as Agrippa Todzi. The participants voluntarily participated in the survey and gave inputs regarding their water use and sanitation practices, as well as future needs for the village. A survey of the conditions of all potable water sources and latrines in the village was also conducted with site visits. The data recorded were summarized and presented to the village chief and important elders during an educational session.

During the survey, the subject matter was first explained to each participant to ensure understanding of the goals of the study and to ensure objective response from participants. Participants were then asked sequentially six questions as follows:

1. How many people live in your household?
2. Do you have enough clean water to use?
3. How far is the travel from your home to the nearest water source?
4. How much water does your household use daily?
5. Do you have access to a good latrine?
6. What do you think the village needs most?

Table 1. *Geographic Location of Household Participants in Agrippa Todzi*

Quarter	Range of People in Household	Employment
Abloganme	1-17	Farming
Fiakome	1-25	Farming
Kpodzi	1-4	Farming
Lomnava	3-10	Farming

3.0 Results

3.1 The Finished Well as a Clean Water Source

The finished well provides easy-access to a safe drinking water source for the community of Agrippa Todzi. This is mainly due to the fact that the well is constructed at a strategic location within the village. The shaft of the well is 2.2 m in diameter and lined with curved concrete bricks that were mixed, poured, and dried at the well site using local materials. Types of well and construction methods vary depending upon location, geological conditions, budget, and equipment available. This design is commonly used in the region to increase durability of such structures. Coated in a smooth layer of concrete, the well head extends 1.5 m above ground level and is topped by a removable aluminum cover. To reduce work for manual drawing of the water, a simple pulley mechanism was installed at the well head to draw water to the surface (see Figure 1). Because the water table depth in Agrippa Todzi is around 16 m prior to any rainfall events, the well was dug to a depth of 20 m in order to ensure year-round usability. The design implemented in this project offers both greater ease of use and superior taste for the consumers. It is also free from corrosion that tends to occur in pipes, and entails fewer maintenance demands. Based on these advantages, the well is preferred over existing water sources. Although residents from some remote areas of the village must travel quite far to fetch safe water from the well, the added convenience of this well would eventually improve productivity and living standards through the greater Agrippa Todzi area.

3.2 Assessment of Water Usage and Sanitation

Every participant surveyed was very cooperative and tried to give helpful answers. Based on the survey results, 68% of respondents indicated that they have access to adequate clean water when the existing pumps were functional; however, frequent breakdowns forced many to resort to drinking standing water from shallow pits in the ground. Seventy five percent of the respondents reported a short walk (10 minutes or less) and 25% reported walking more than 10 minutes to the nearest water source, although it was apparent that some households needed to make the trip more than once daily. Because no accurate means of water volume measurement was available at the time of the survey, respondents estimated their daily household water usage in either common metal basins or barrels; a barrel was believed to be equivalent to roughly 2 basins, and a basin thought equivalent to 15 L. Based on these estimates, the daily average per capita water consumption was nearly 17 L. Most families reported a water consumption that fell below the World Health Organization (WHO) reasonable access standard (2008) of 20 L/person/day (see Figure 2). Estimates of daily water usage per capita in Agrippa Todzi compared well with reported values. For example, research

(Kärkkäinen, 2000) conducted at Helsinki University of Technology reported that daily water usage per capita in 1995 in Benin was 18 L, 48 L in Cameroon, 20 L in Burkina Faso, 34 L Ghana, 34.7 L in West Africa, and 148 L for the world as a whole.

Survey results also suggested that access to improved latrines is limited in Agrippa Todzi. Only 13% of residents interviewed reported having access to an improved latrine system. When asked what improvements were most urgently needed in Agrippa Todzi, 32% gave "public latrine" as their first response, while "better schools", "electricity", and "a market for selling agricultural goods" were each mentioned first by 13% of the respondents. Eight percent indicated that improved drinking water quality or quantity was the most pressing needs; while miscellaneous other needs expressed included jobs, a hospital with improved access to medicines (see Figure 3).

Since all water for the day must be hauled from the nearest well to the house, water is conserved and treated with care. In comparison with developed countries such as the United States, there is a tendency to take potable water for granted. Obtaining water for use is as simple as turning on a faucet, and there is usually no risk of contracting waterborne diseases from the tap. Overall water consumption in developed countries is much greater because of the convenience of water sources and infrastructures such that the average person does not realize the amount of water that they consume per day. Consumptive use of water in the United States was 578 L/person/day in 1997, 334 L/person/day in United Kingdom, 85 L/person/day in Asia, and 47 L/person/day in Africa as a whole (PIP-CCP, 1998). Seeing the care that the residents of Agrippa Todzi have shown toward water, it appears that sustainability in water use can be achieved through smart use of water for daily needs. In many cases, water consumption in developed countries is not sustainable for an extended period of time.

During the presentation session with the chief and the elders of the village, particular attention was given to the maintenance of the new well and to minimize at-risk practices for water quality protection. Major recommendations include the encouragement to start a community garden as a source of income to maintain the well and construction of public latrines.

Figure 2. Comparison of Daily per Capita Water Usage in Agrippa Todzi with the World Health Organization Standard

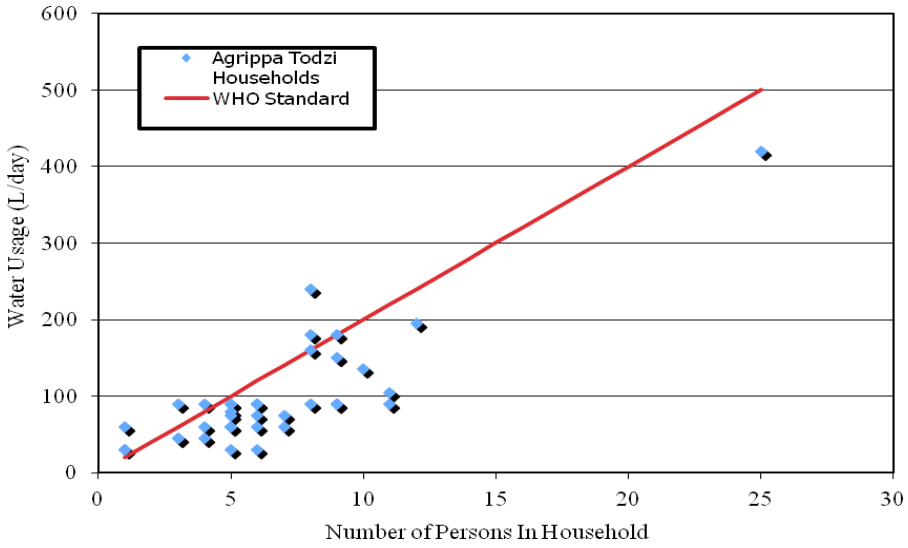
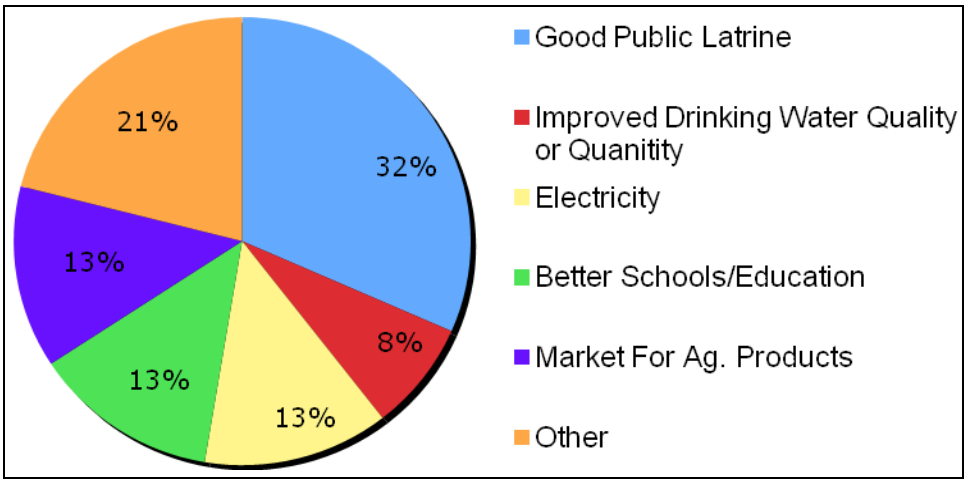


Figure 3. Resident Opinions on the Needs for Agrippa Todzi



3.3 Student Experience and Feedback

The visit to Agrippa Todzi provided valuable opportunities for cultural exchange and service learning. Whether poor or wealthy, every member of the community proudly shared their finest hospitality with us, at every turn, offering us locally-grown fruits and products. The students were given tours of profitable cacao plantations, and many opportunities to partake in traditional food, music and dancing with residents of the village. Students observed firsthand the manufacturing of local products such as kente (colorful local cloth) and palm oil. Students also experienced full immersion in Ewe, the local spoken language. The residents, in turn, particularly children and youth, expressed fascination with the Americans and their belongings. Many residents seized upon every opportunity to talk to us as few westerners come to the village, and occasions for them to practice their English language skills with native English speakers are particularly rare.

The students greatly benefited from their experience working on this project. Prior to the visit to Agrippa Todzi, none of the students had spent time in a rural, developing nation. The weeklong immersion in a community that lacks adequate sanitation systems and drinking water was truly an eye-opening experience. Moreover, students gained an appreciation for the ongoing work done by NGOs in at-risk communities, as well as a profound understanding of how much effort is still needed to improve public health and living standards in these communities. Students were also exposed to different worldviews and cultural backgrounds through cohabitation and side-by-side work with ASTOVOT volunteers. The great wealth of experience of the ASTOVOT staff in overseeing foreign volunteers in rural settings left the students with a sincere interest in participating in similar projects in the future.

4.0 Commonalities of Human Impact on Water Quality

Surface waters are largely impacted from a number of human activities, whether point sources or nonpoint sources. In the United States, agriculture has been identified as a major contributor of nonpoint source pollution of surface waters (USEPA, 1990). Fertilizers used in crop production, as well as other agricultural chemicals are often washed into water bodies during rain events when runoff occurs. Animal wastes are also sources of contaminants to streams and lakes.

These contaminants include nutrients and pathogens from effluent such as phosphorus, nitrogen, fecal coliform, trace levels of antibiotics and pesticides (Copeland, 2010). Family crop production in developing countries is most of the time organic with reduced risk of contamination of waters; however, other forms of pollution are more prevalent. Animal wastes are indeed a considerable source due to the lack of adequate resources and policies to regulate animal discharge into waterways (Yacoubou, 2010). Moreover, nearly 2.6 billion people globally lack improved sanitation facilities and must resort to open defecation, oftentimes in surface waters, which similarly contribute a number of pathogen, organic, and nutrient contaminants. For example, in India, less than 30% of the populations have a bathroom where they reside, and only 250 of 4,000 cities in India have sewer systems (Cooper, 1997). As a result most people defecate in the open or directly in surface waters, which are then often left to flow downstream untreated (Cooper, 1997). In Agrippa Todzi of the 38 households surveyed, only 5 reported having access to an improved latrine, with the remainder defecating likely in bushes or in holes near the village.

Industrial wastes are also a major contributor to surface water contamination. As the industrial sector continues to grow in developed nations, loose regulations and crude processes may result in elevated pollutant disposal. For example, the Swiss firm Trafigura was involved in a scandal in which toxic waste was illegally exported and dumped in the coastal waters of the Ivory Coast. The resulting water contamination killed 17 people and poisoned thousands more (RFI, 2010). Mining operations across the globe are sources of heavy metals such as arsenic, which may contribute to contamination through runoff (USEPA, 2000). They may generate drainage water of high acidity when in contact with oxygen or sulfide minerals. Roadways and parking lots are also sources of pollution when chemicals left by road salts, vehicular fluids, and exhaust are washed into surface waters (Gratton, 2010). Municipal solid wastes, common house debris such as plastics and food scraps, are other sources of toxins and contaminants in both industrialized and developing countries. Developing countries often lack waste management systems, increasing their susceptibility as they undergo urban growth (Tsiho, 2007).

5.0 Concluding Remarks

The community well project in Agrippa Todzi was a valuable contribution to the local water supply. The well was completed in mid-June 2010 and has been in use since then. However, many pressing issues, such as crumbling school facilities and the demand for public latrines, remain in the village. The construction of the new well is certainly a major step; but many residents still live distant from a safe drinking water source.

Community wells serve a vital role in the well-being and productivity of a rural village. Water is a part of any activity, from cooking, sanitation, to irrigation. For a human community to survive, there must be enough water serving the community's drinking, washing, and hygienic needs. In most cases, water itself is available in abundant amounts; however, this water may not be potable or easily accessible. When this happens, local residents will turn to the nearest water source, including unsafe standing water directly from the ground. Water in the United States and most developed nations is taken for granted as it is always available and safe. It is difficult for most residents in developed regions to imagine fetching water in large buckets from a well, waiting in line, or even being entirely without access to clean water. However, the gift of a single well, owned and cared for by

those who need it, can result in a profound improvement in living standards of any community struggling with such difficulties. The world's population must be educated on the reality of water misuses, shortage, stress, and pollution as the result of human behavior, and that this behavior, regardless of region or nation, influences water resources and water quality across the globe.

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