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Access to Drinking Water and Community Development in Northwestern Haiti

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Abstract

There are approximately 700,000 inhabitants in Northwestern Haiti. Only a fraction of this population has regular daily access to water and its cleanliness is questionnable. Prolonged political instability and a lack of financial resources for water infrastructure results in more than 50% of inhabitants having no access to safe drinking water at all. Bombardopolis is a commune center in the Northwest region of Haiti. Only two thirds of the commune is inhabited. One of the main reasons that it is not fully inhabited is the inaccessibility to water. In 2012, a Czech NGO drilled a well close to the settlement in this area. The research is showing a case study of access to drinking water in Bombardopolis. It is investigating the impact of such a well on its surroundings. Time saved as a result of a closer water source allows for social and economic individual or community development and this model can be duplicated in other areas. The quantitative part of the research focuses on microbiological and chemical quality tests as an inseparable component for measuring quality of water sources.

Key words: Haiti, safe drinking water, well drilling, quality of water sources, community development

Introduction

It has been proven that contaminated or insufficient water supply increases deprivation of people (Zakria Zakar, Zakar and Fischer 2012), child mortality, reduces life expectancy and causes diseases that can lead to death if there is insufficient treatment (Hunter, MacDonald and Carter 2010). Along with its negative impacts on human health, water affects crop cultivation, livestock breeding and has an overall effect on the whole economy of the country (Thomas, Rosenberger and Pawlovski 2014). As a result, Haiti fell into a vicious cycle generating chronic and deep-rooted poverty.

Haiti, thanks to its waterfalls, rivers, rugged coastline and rice fields, creates the impression of a place which is rich in water resources. In fact, Haiti ranks last in an International Water Poverty Index. Haiti shows the lowest values in all the measured components - resources, access, capacity, use and environment (Lawrence, Meigh and Sullivan 2002).

Constant population growth is causing ever greater pressure on land and water resources in the already densely populated country (Smith 2001). Despite the efforts to build a better infrastructure, only 58% of the population has access to potable water and 45% to sanitation (WHO/JMP 2014). The disparities are not only between urbanized and rural areas, but also between the cities themselves.

According to WHO/JMP (2014) 73% of the urban population has access to drinking water compared to 47% of the population in rural areas. The capital and its surrounding areas have the advantage of the construction of new water sources or of water tank deliveries because of good infrastructure conditions. In contrast, areas far away from the capital suffer not only from the lack of investment in water infrastructure, but also the lack of interest from international organizations and authorities (Botton, Brailowsky and Matthieussent 2005). Only 28 of 133 Haitian communes have provided satisfactory access to drinking water (Sommer et al. 2012). Unfortunately, the situation with access to drinking water has not improved even with the large flow of international organizations providing help after the devastating earthquake of 2010. Since 2010, the number of people with access to safe drinking water has decreased by 22% (MINUSTAH 2013).

Haiti has an average annual precipitation rate of 40 milliards cubic meters of water per year. Of this rainfall, 60% evaporates, 30% flows into freshwater estuaries and only 10% filtrates into subterranean aquafers because of high temperatures and deforestation (Toussaint 2010). This inefficient water management reflects the poor Haitian infrastructure, the low level of institutional leadership, socio-economic underdevelopment and also the lack of technical equipment for acquiring new water sources, especially groundwater sources (Toussaint 2010). Groundwater reserves have not yet been sufficiently explored but their supplies are estimated at 56 milliards cubic meters (Saade 2005). Falkenmark and Widstrand (1992) in their analysis indicate that 100 liters per person per day (36.5 m^3/year) is the minimum amount for the preservation of good health and hygiene. If all water sources were used effectively, people would have enough water for both consumption and daily activities.

The Haitien Institute of Statistics and Information (ISHI) focused in its research on actual life conditions in Haiti in 2001. One area of the research dealt with the resources used for obtaining drinking water and the differences between the capital, other cities and rural areas.

We must focus not only on the quality of the water source but also on the distance to that source. In urban areas, people should not have to travel further than 200 meters from their place of residence for high-quality drinking water (UN 1992). The distance for rural areas has not been determined.

According to OECD (2003), the amount of water should be enough to satisfy metabolic, hygienic and domestic human needs. This amounts to 20 liters of water per person per day. The characteristics of the climate should be reflected in the assessment of the amount of sufficient water.

Table 1. Types of sources utilized for obtaining drinking water in Haiti

Water source	Capital	Other cities	Rural areas	Total
Duct	5.8	2.1	0.5	2
Garden tap	9.5	8.1	2.7	5.2
Garden well	1.3	2.8	1.8	1.9
Neighbourhood well	4.1	13.9	11.2	10
Public fountain	7.8	29.4	22.8	20.5
Purchased water tank	0.7	0.1	0	0.2
Purchased water bucket	59.7	11.9	5.3	19
Purchased treated water	9.9	2.2	0.4	2.9
Rainwater	0.6	0.1	3.1	2
Natural springs and rivers	0.1	27.1	50.5	34.7
Other	0.5	2.3	1.7	1.6
Total	100	100	100	100
Sample	1,002	1,541	4,641	7,184

(IHSI 2003)

Objectives of the study

The study was carried out with the following specific objectives:

- To describe how the construction of a new well in the town center changed the life of people who previously had to walk for water to natural sources which were a few hours away.
- To test the water quality of selected water sources for chemical and biological contaminants.

Methods

The study utilized both quantitative and qualitative methods. The main quatitative research question was: How the new well changed people´s lives in the village/town? A non-experimental design was used for the research. The results were not compared with a control group. The impacts of the new well were monitored only for the group that received the intervention. The research included other sub-questions: What are the positive impacts of the new well in the village/town? Has the well brought some negative impacts on people´s lives? What is the utility of a new water source?

Research methods included semi-structured observation, structured questionnaires, standardized interviews and document analysis. Observations around the well were conducted during a public holiday from 8 in the morning until 5 o‘clock in the afternoon. Children were not in school and traders were selling their goods at the market during that selected day.

Quantitative research was mainly focused on microbiological and chemical water tests of not only well water, but also of other formerly used drinking water sources in the commune. The water was tested for presence of E.coli, Coliforms and Enterococci and also for pH, conductivity, presence of ammonia, metals (cadmium, chromium, copper, nickel, lead, zinc), magnesium and calcium.

Biological water testing was conducted using a simple method of Presence-Absence (PA) which does not show numbers of colonies. There were used commercially available tests, Readicult Coliforms 100 and Readicult Enterococci 100, for the measurements. If coliform bacteria is detected, a test allowed to analyze the sample for the presence of E.coli by UV lamp. Samples were tested 6 hours latest after its abstraction from the source. Samples had to be incubated for 18 to24 hours at 35-37°C for having correct results.

The pH and conductivity testing was carried out using a hand-held tester with a measuring range from 0.00 to 14.00 pH; 0-3,999 µS /cm. The presence of ammonia was tested using Ammonia Test Kit - Model NI-8, manufactured by HACH, based on the reaction of ammonium ions with the Nessler reagent. The intensity of the color is directly proportional to the concentration of ammonium ions in the sample – it is compared with the color standards (included in the kit). Other quantities were tested by external experts in the laboratories of Palacky University in Olomouc after returning from Haiti.

Sample

Qualitative research included a sampling of 90 people from three different groups - women, children (6-15 years) and men. People were interviewed with structured questionnaires on questions concerning their walking distance to obtain drinking water, how they spent their new-found leisure time that access to the new well provided since they no longer had to spend so many hours seeking water. The data sample was collected from September to December 2013 as a part of the work on diploma thesis.

A total of five water sources were selected for the qualitative research. The first of them was a well drilled by the Czech NGO called Fidcon who is active in Haiti since 2011. The second well was drilled by different organisation and the rest were natural springs where people used to take water before constructing the new well.

Study limitations

Data collection was influenced by several limiting factors. Language barriers, an illiterate population and the disinclination to communicate with the white people conducting the research were the main limiting factors in the qualitative research. The factors were eliminated by the presence of a local interpreter who was not only able to translate from Creole to French, but who also encouraged the people to answer the questions.

Measuring the biological and chemical quality of selected water sources in Haiti was difficult due to the fact that the only laboratory was located in the capital. Another limiting factor in measuring was the lack of electrical energy.

Electricity was available only among people owning solar panels or generators. Simple tools and tests were used for the measuring of water quality in the well and other water sources because of the lack of electricity and the difficult conditions.

Study Area

A well drilled in October 2012 by the Czech organisation Fidcon in the capital of the Bombardopolis commune, which is situated in the Nothwestern region of Haiti, was chosen for the qualitative research. The well is located 800 meters northwest of the town centre between the pitch and the marketplace. This one-year old well was specifically chosen because it was assumed that the researchers would be able to compare the situation before and after the drilling of the well.

The northwest region has enough groundwater thanks to its limestone bedrock, but the water is found at great depths, often reaching more than 100 meters. The depth of the wells depends on the altitude and soil quality. The average depth of wells in the region is 41 meters. The requirements for technical equipment and financial demands increase with the drilling depth. Very deep boreholes often mean economical inefficiency. The danger of biological contamination decreases with the increasing depth of the borehole. The selected well, with a depth of 46 meters, is ranked as medium-depth and with medium protection against biological contamination. The water well is equipped with a Vergnet foot pump and the water resource yield meets the demand of the population. In the vicinity there are no other sources of drinking water (average distance to other sources of drinking water - 1.1 km).

Bombardopolis, the oldest Haitian commune is located in the poorest region of Northwestern Haiti. The region suffers from long droughts, which cause a shortage of food and water, low level of education, lack of health facilities and a lack of interest from the central government. Inadequate infrastructure isolates the region from the rest of the country. Unpaved roads impede trade and tourism development. The Northwestern region stays on the periphery of national and foreign organisations interests.

Table 2. Basic characteristic of Bombardopolis commune in comparison with the country

	Bombardopolis	Haiti
Number of inhabitants	34,382	10,413,211
Rural population (%)	90.8%	50.49%
Population under 18 years (%)	57.49%	57.9%
Number of men per 100 women	105	98
Area (km^2)	196.5	27,065
Density (people/km^2)	175	385
Average number of people in household	4.5	4.6

(IHSI 2012)

Bombardopolis commune is located in the heart of the Northwest region and it borders on two communes - Baie de Henne and Mole St. Nicolas. It is situated on a plateau with an average altitude of 400-450 meters above sea level. The flat terrain is sloped towards the South and Southwest into the mountains reaching 700 meters (Woodring 1924). Although the Bombardopolis commune includes agricultural regions, the commune faces the problem of soil salinization caused by dry climate and mountain barriers on the South. Soil salinity is increasing, especially in the coastal area, where vegetation less tolerant of salty soils is dissapearing (Commune de Bombardopolis 2011).

The whole of the commune territory is located in a semi-arid tropical zone with an annual average rainfall of 500-800 mm. The annual evaporation rate reaches 1,100 mm with the loss of water being 300 to 600 mm. The region has two seasons: the rainy season from April to October and the dry season during the other months. The rainy season begins irregularly. More often there are massive droughts alternating with torrential rains that cause flooding (MARNDR 2011).

Surface water does not meet the basic needs of the population and the agricultural sector due to the lack of rainfall. There is no great river that flows through the region and river beds, rivulets and streams remain dry throughout the year, filling only during the rainy season. If people do not have access to wells or water tanks, they must walk to natural springs, of which there are only 54 in the entire region. This number of springs is insufficient for more than 34,000 inhabitants, especially when they are located in difficul terrain. Almost 2/3 of the commune is uninhabited, mainly due to the lack of water resources (Commune de Bombardopolis 2011).

The lack of drinking water is one of the most serious problems of the town and the area. Irregular rainfalls cause drying of surface flows. There was no well or rainwater cistern until 1978 (Leach, 2013). Currently, people use four wells in the town center and smaller tanks for rainwater, but many of them still take water from the natural springs (Boukot, Palermo) and from a pond called Corossol.

Results

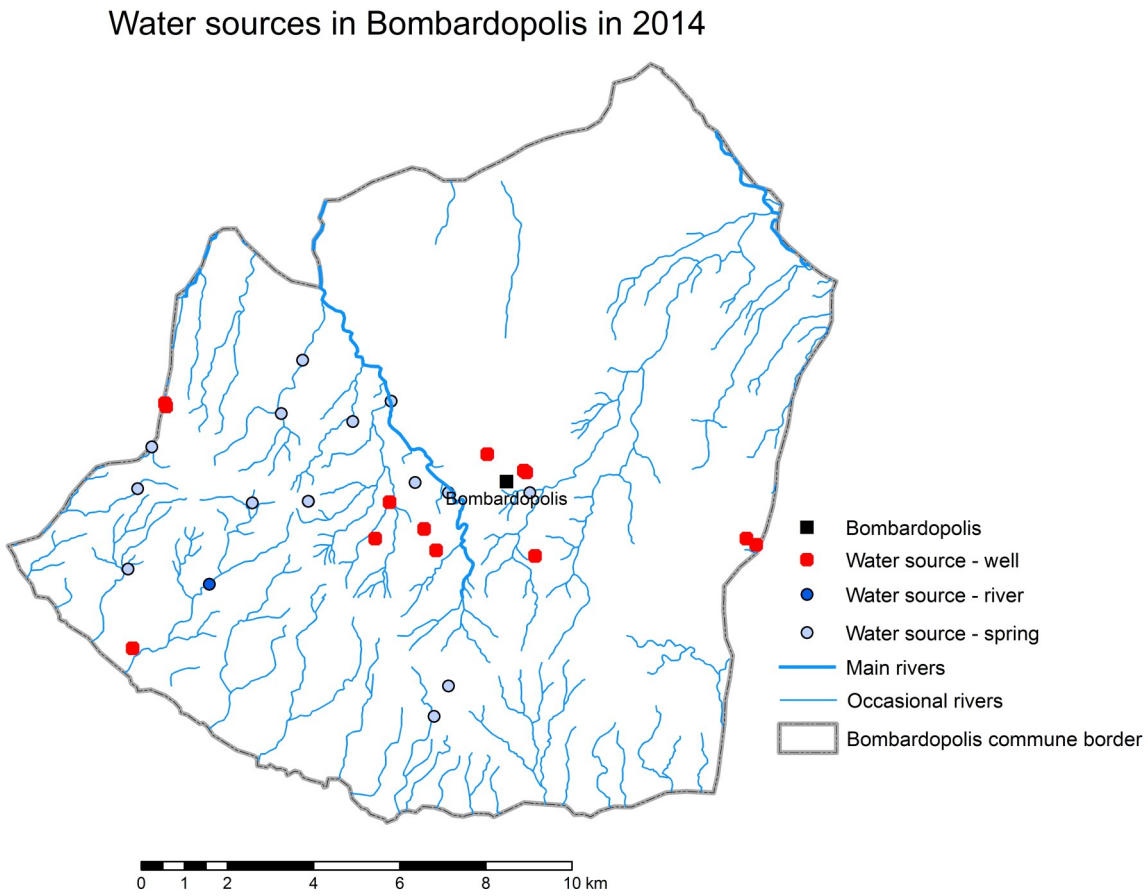
Microbiological and chemical water quality in the well

Water chemical analysis demonstrated its safety. Increased salt content is minimal, so the burden on the body is not great. Generally, water in Haiti due to its proximity to the sea has a higher salt content. The Haitians consume water up to 1,400 μS/cm. Their bodies have

become accustomed to the salt levels so people do not notice a change in taste and the water does not cause them health problems. The tested water exhibits slightly increased chromium content, but at levels that are not considered toxic nor carcinogenic. The values of the other elements are normal or below the detected limit of the measuring device.

Calcium and magnesium in water are considered desirable because they are beneficial to the human body. The tested water has the optimum amount of calcium, with its magnesium content less so.

Map 1. All water sources in Bombardopolis commune



(Jiří Pánek in collaboration with the author 2014)

Only coliform bacterias were positive from the indicators of microbiological contamination. The method of measurement indicates the presence of bacterias, but does not provide data on their number. The pump itself could be one of the sources of the coliform bacteria contamination because people touch the pump with their mouth and dirty hands. The pump has never been purified. It is assumed that if the pump were disinfected, the water would not be positive for coliform bacterias. Tests for enterococci and E. coli bacteria were negative.

Water attendance analysis

The people of Bombardopolis have limited sources of drinking water. The majority own a cistern for rainwater so they can meet their own personal water needs during

the rainy season. For drinking water, people must go to the natural water springs or pools in the village or surroundings areas. Long distances, along with a lack of transportation and the tropical climate make acquiring water a physically difficult and time-consuming activity.

Organization Fidcon drilled a well in a public place in a densely populated area near the town center. The new marketplace was built just after the well was drilled. There is a large trading market that takes place once a month next to the marketplace. Thus, the well serves not only the needs of people living in the immediate area, but the water is also used by people going to the market, traveling traders and passers-by.

Table 3. Water quality of the well

	Well	Limit of detection
Microbiological indicators		
Coliform bacterias	yes	0 CFU
E.coli	no	0 CFU
Enterococci	no	0 CFU
Chemical indicators		
pH	7	
Conductivity (µS/ cm)	606	500
Ammonia (ppm)	0	0.5
Cadmium (mg/l)	<0.010	0.003
Chromium (mg/l)	0.078	0.05
Copper (mg/l)	0.026	2
Nickel (mg/l)	<0.028	0.07
Lead (mg/l)	<0.05	0.01
Zinc (mg/l)	0.026	3
Calcium (mg/l)	108.462	100 (optimum)
Magnesium (mg/l)	5.015	10 (minimum)

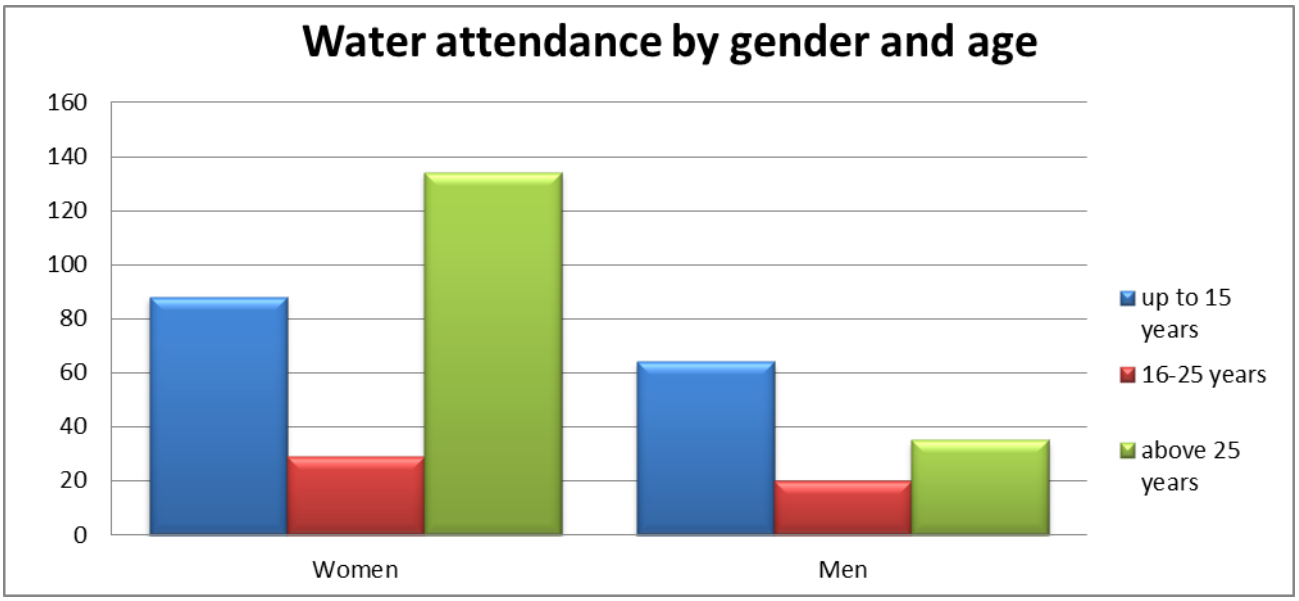
(Hekera, Lungová 2013)

Almost four hundred people (370) came to the well during the observed period. Almost 70% of them were women. Some women simply passed through filling the well with a small flask for a maximum of 2 liters. The majority of them came with containers and took water for their households. Men came to the well with their cattle, fetched water in containers and left for further work. Only a small number of men came to the well to take water for their households. This role is predominantly for women.

Detailed analysis of the water acquisition, which includes gender and age, also shows that the main water supply for the household is provided by women over 25 years of age (Graph 1). They are mothers responsible for their own typical Haitian households. Water acquisition by women varies during the day. Single women usually go to the well on average two times a day and especially in the morning until 9am and after lunch between

12:30pm and 13:30pm (Graph 2). Although only twice a day, women can take home up to 43 liters one bucket of 20 liters on their head, another in one hand and still another container with a volume of 3 to 4 liters. Women oftentimes use carts or donkeys for loading goods. In these cases, the volume of the taken water increases (Table 4).

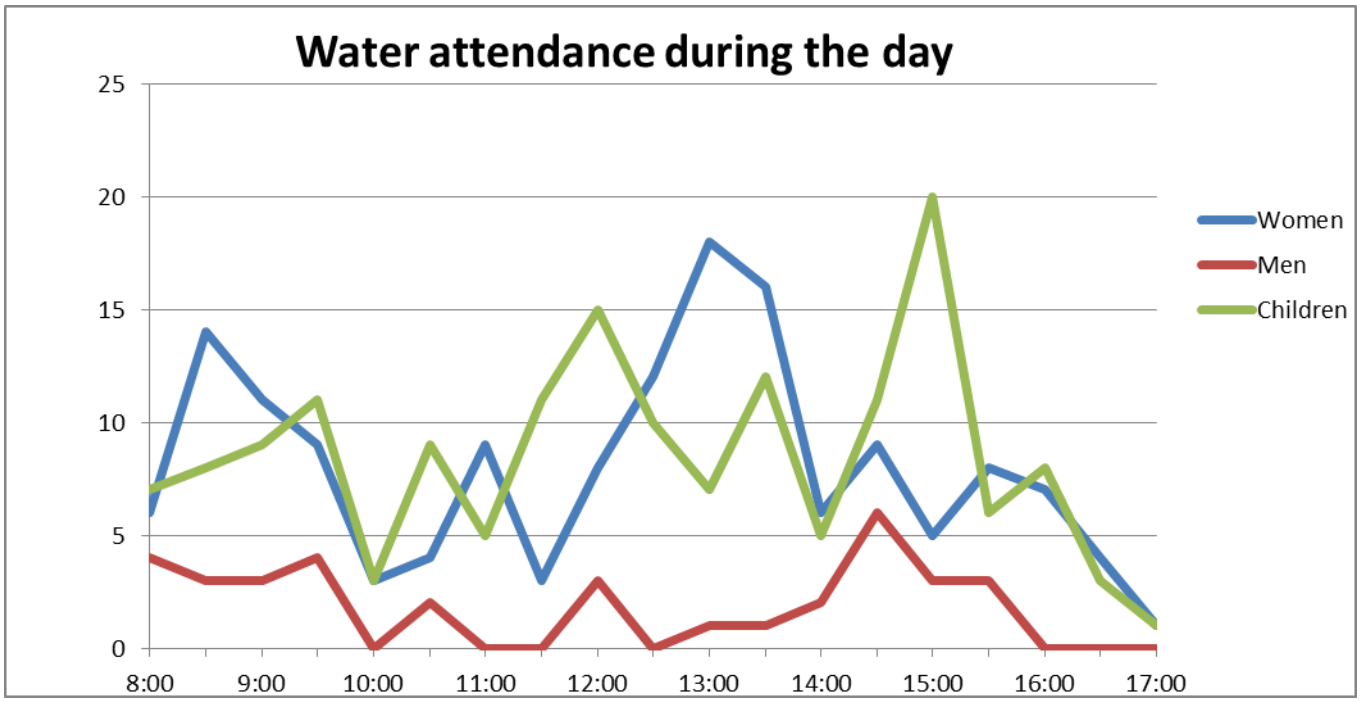
Graph 1. Water attendance by gender and age



(Lungová 2014)

Children, both boys and girls up to 15 years of age, fetch water three times a day – in the morning, at noon and in the afternoon at around 3pm. The amount of water fetched depends on the child's age and physical fitness. Most of the children can take one bucket of 20 liters of water (Table 4). Although children fetch water more often than women, they take smaller amounts. Thus their acquisition serves as a supplement to the water brought home by women. Water taken around 3pm is intended for the evening hygiene, because of the earlier sunset just after 5pm, or 7pm in the summer time (Sunrise and Sunset 2014). In the evening hours, children and women do not often go outside due to security reasons. Males over 16 years of age do not play an important role in water acquisition for the households. They mostly go to the water source for drinking, washing up, and sometimes to help with pumping.

Graph 2. Water attendance during the day



(Lungová 2014)

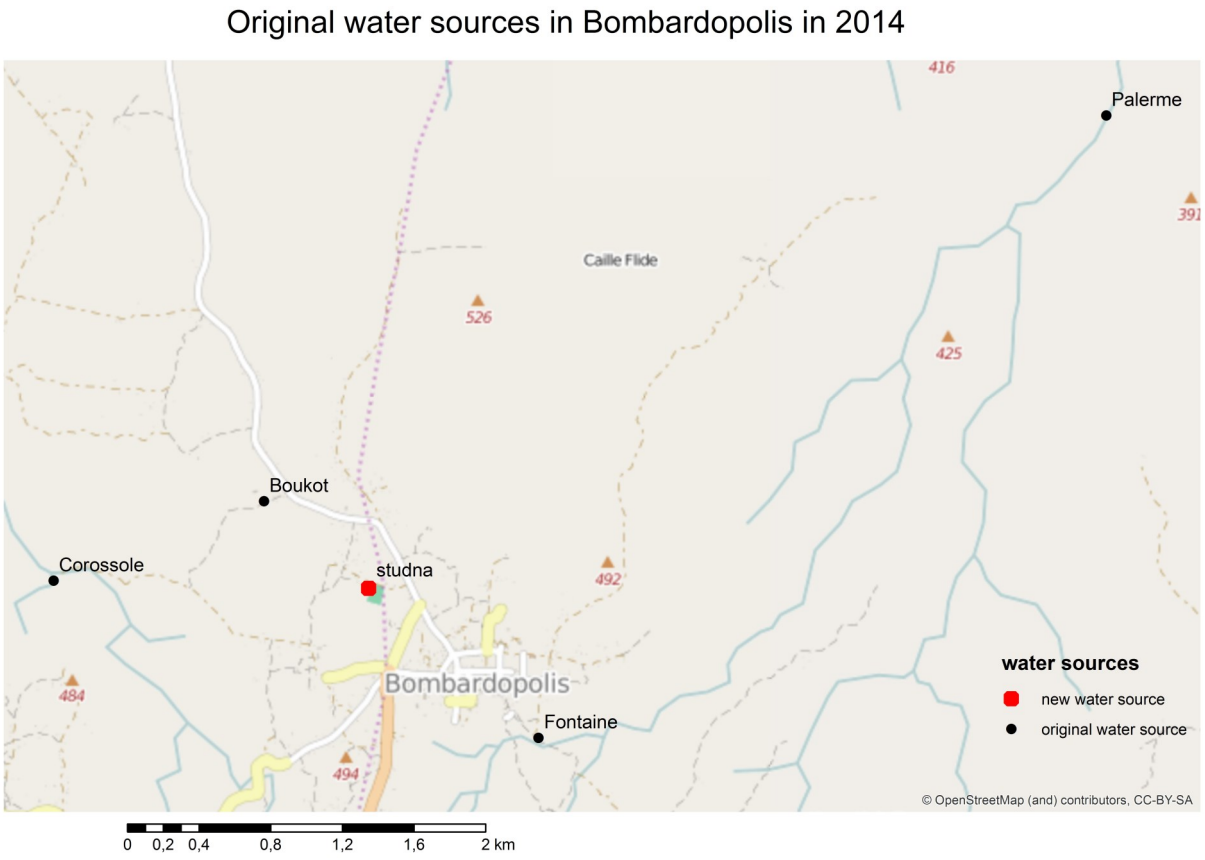
Table 4. Attendance, frequency and amount of water

Frequency of water acquisition	**median**	**2 times/day**
	average	**2-3 times/day**
	women	**2 times/day**
	children	**3 times/day**
Time for fetching the water	**8am-10am**	**26.20%**
	10:01am-12:00pm	**14%**
	12:01pm-2pm	**29.40%**
	2pm-5pm	**30.40%**
Pumping time	**1 gallon (3.78 liters)**	**30 sec**
	20 liters	**3 min**
Water quantity	**1 woman**	**43 liters on average**
	child	**20 liters**

(Lungová 2014)

Water acquisition compared to the original and new sources

Map 2. Original water sources in Bombardopolis in 2014



(Jiří Pánek in collaboration with the author 2014)

The average distance people are traveling to fetch water cannot be measured. The selection of a water source depends on several factors. The two most important are distance and water quality. People choose water quality over distance. Diarrhea is one of the most common diseases among children and adults. Even though there are long distances involved, people are much more willing to fetch better quality water from remote areas to prevent this illness. Before drilling the well (before 2012) people of Bombardopolis used four sources of water in distant villages (two natural resources – Boukot, Palerme), one pond and a water well near the city center. According to research, before the drilling of the well in 2012, the inhabitants of another part of Bombardopolis used four water sources far removed from the village (Map 2). These were two natural springs – Boukot and Palermo; one pond – Corossole; and a well near the center of the village, which people refer to as Fontaine.

Both of the natural springs, Boukot and Palermo, are located in a valley surrounded by rocks. To secure drinking water, people must travel 2.9 km (Boukot) and 5.2 kilometers (Palermo) through difficult, rocky terrain. Distance and terrain did not allow people to take enough water for their personal use.

Both of these natural water sources now have concrete structures with taps. Those who visit do not merely go there to take water in containers. Despite a ban, they wash clothes or bathe themselves there. Despite the concrete structure, the natural spring becomes more susceptible to contamination. Rainwater also affects the water quality, bringing in many impurities.

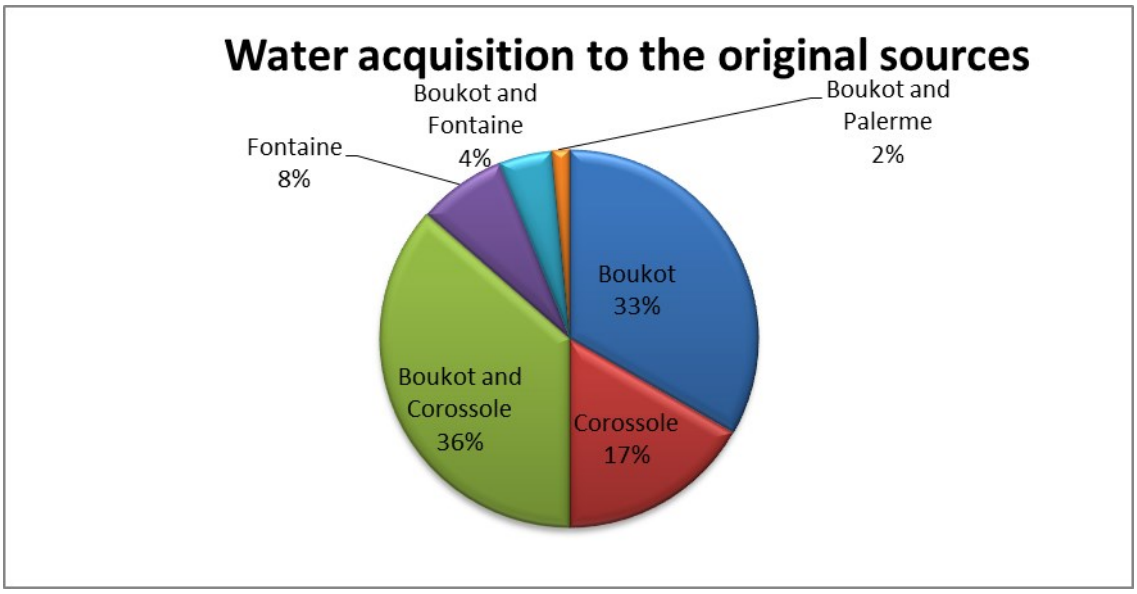
Tests for biological contamination were carried out only at the Boukot spring. The results for the detection of coliforms, E. coli and enterococci were negative. Water from this source is very good and does not cause any health problems to the population. Considerably less people are fetching their water from this spring now. Because of the drilling of the new well, the water quality of the spring has improved and water acquisition decreased.

Pump Fontaine is located 400 meters from the town center, but 1.4 km from the location of the new well. Microbiological tests revealed the presence of enterococci in the water. Chemical tests revealed unsatisfactory results: conductivity (809 μS/cm) and the content of chromium (0.103 mg/l). Water with high salinity levels is not suitable for regular use. The water may have an unpleasant taste and may cause health problems such as diarrhea. The presence of chromium in the water also affects the flavor and color. Higher concentrations may be toxic and carcinogenic. The water quality of the pump, compared with other water sources, is very low. People use Fontaine very little, although the pump is the closest to their homes. People in this area prefer to walk several hours to acquire good quality water rather than use this low quality local water.

Pond Corossole is located 3.2 km from the selected well. Using only a sensory evaluation, this pond has the worst water quality, and because of the red soil the water has a reddish tint. The pond has no drainage so the water stinks and biological plant material accumulates there. Tests for coliforms, enterococci, E. coli, were found to be positive. People do not use water from this pond for drinking but they utilize it for personal hygiene and washing. This water source may cause health problem, especially of the gastrointestinal tract. People who use water from Corossole often complain of abdominal pain and digestive problems.

According to the surveys, most people (36%) walked to Boukot and Corossole to obtain drinking water before the drilling of the new well (Graph 3). Almost a third of the respondents obtained water from the Boukot spring which is 2.9 km away. A more significant finding was that 17% of the people used Corossole as their only source of drinking water. Fewer people used water from Fontaine (8%) or from Palerme in combination with Boukot (2%). Only the natural spring Boukot is considered to be of good drinking water quality because the tests showed negative results for microbiological contaminants. According to the survey results, 75% of residents living in the area were using safe drinking water before the drilling of the well.

Graph 3. Water acquisition to the original sources



(Lungová 2014)

Water is a necessary part of everyday life, and because of this people spend most of their day searching for appropriate water sources. Before the new well, people spent several hours a day walking to obtain water, the time spent walking depending on the distance to the water source. According to surveys, people spent the most time (an average of 142 minutes to and from) obtaining water from the Corossole pond which has the poorest quality water; people spent 30 minutes less walking to Boukot and Palerme natural springs, but the quickest walk (55 minutes) to obtain water was from the Fontaine pump (Table 5).

Table 5. Duration of walk to previous water sources

	median (walking to and from)	average (walking to and from)
Walk to Corossole	120 minutes	142 minutes
Walk to Boukot	120 minutes	109 minutes
Walk to Fontaine	60 minutes	55 minutes
Walk to Palerme	120 minutes	120 minutes

(Lungová 2014)

The construction of new the well radically changed the distance people had to travel to obtain drinking water. A well drilled close to human habitation or in the town centre is an unprecedented reality in Haiti. Today, it takes people on average 15 minutes (median of 5 minutes) to get to the new well. This new well saves people on average 138 minutes for one water trip. Therefore, if women walk 2 times a day for water, the new well has saved them at least 276 minutes per day (4 hours 36 minutes).

Use of time resulting from shorter distances to water sources

The use of leisure time resulting from the close proximity to the new wells varies according to gender and age. Women in Haiti play a key role in the family. They not only care for the individual members and run the household (acquiring water being an important part of this), but they often contribute financially. The women are limited to the daylight hours to get their work done. There is no electricity In Bombardopolis and people do not have enough money to buy candles or gas lamps which would allow them to work in the dark during the evening hours. People can work only from sunrise to sunset. The longest days in Haiti are 13 hours and 14 minutes in the second half of June while the shortest days are an average of 11 hours in December. At this time the sun sets at 5pm. The amount of time saved because of the closer water source plays a very important role in the potential development of the community. The newly acquired free time for women significantly affects the functioning of the household, children's health and the economic activity of the city.

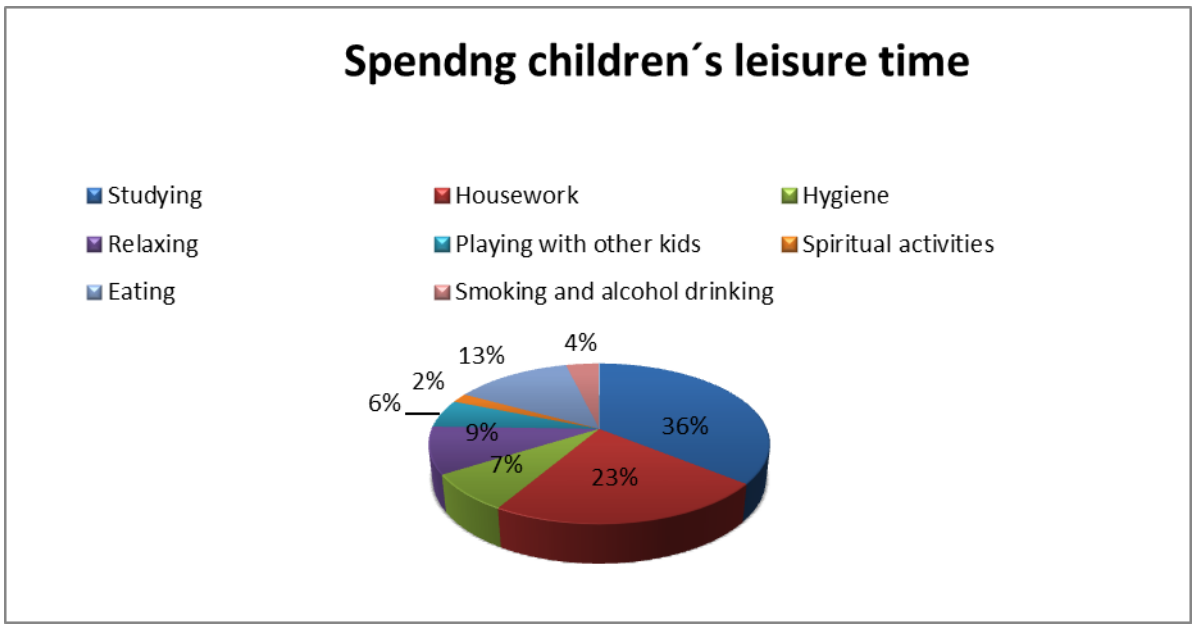
Children´s leisure time

The use of leisure time due to the closer drinking water source is most significant in the area of education. 37% of respondents said that because of the new well, they have more time to do homework and study (Graph 4). Previously, immediately after school children had to walk to remote sources to obtain water. The walk took them most of the afternoon when it was daylight. Due to the lack of electricity, they could not study in the evenings. Thus the acquisition of water affected children’s education.

How children spend their free time now depends on the needs of the family. The second most common use of free time was in helping parents in the household (23%). Most children now had time to help with small chores like sweeping, washing dishes, taking care of cattle or helping in the garden. 14% of the children did not feel a significant change with the new well in giving them more leisure time but they did recognise a better quality of life and more hot food at home on a regular basis because their mothers now had more time to cook . If children do not go to private schools that have a dining room, a hot meal for them is a luxury to which they were not accustomed. According to the surveys, children use their free time on personal hygiene, resting and playing and attending church. All of the children interviewed had a significant change in the distribution of their activities during the day with the advent of the new well.

For children, especially the teenagers, there was one negative effect that came with their free time. Teenage boys around the age of 15 spent their free time smoking cigarettes and drinking alcohol. It is not clear whether the proximity of the new well leads teens to this behaviour or the phenomenon occurs regardless of whether the water source is close or if they must walk two hours.

Graph 4. Spending children´s leisure time



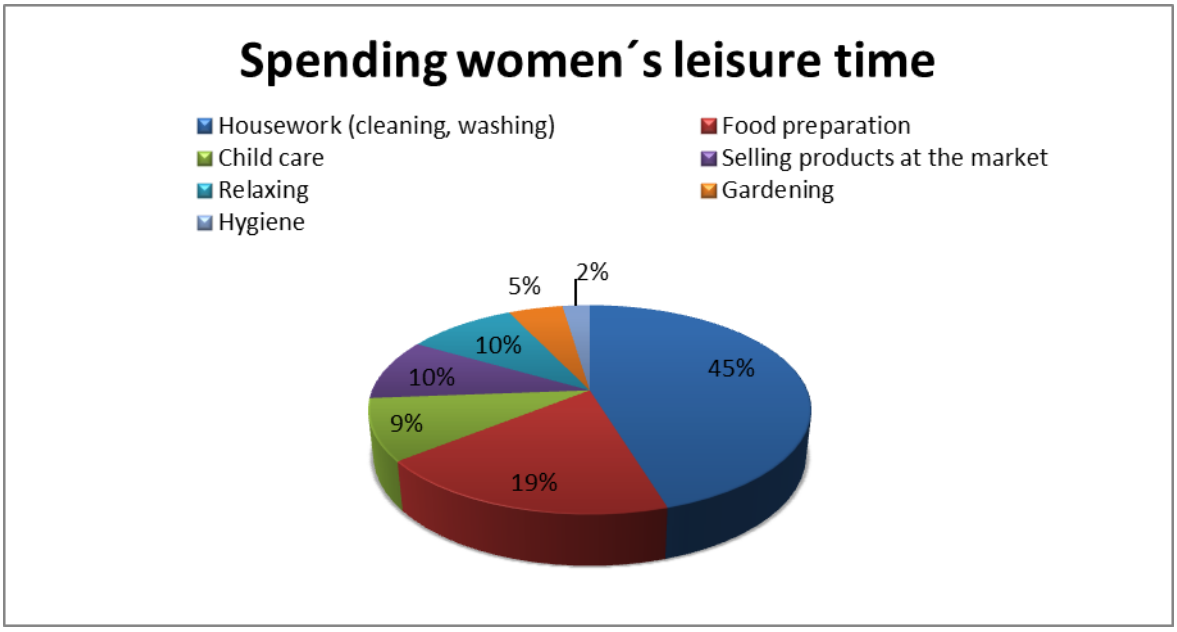
(Lungová 2014)

Women´s leisure time

According to the Haitian Constitution, women are equal to men in all spheres of human life. This fact, however, varies considerably especially in rural areas. Tradition and culture dictates that they assume the role of housewife, without influence on politics and public life. Women, however, occupy an irreplaceable role in the raising of children and the state's economy. Most Haitian women work as small merchants. More investment in women's education and their participation in public life would be a significant step towards the development of the entire country.

Women in the study in Bombardopolis spend most of their day in walking to obtain drinking water. The new well saved women at least four hours per day. This not only freed up a great amount of their time, but also provided enough quality water for all their activities. Almost half of the women in the research (45%) used this new found time in the care of their own household (cleaning, laundry) (Graph 5). A significant proportion of the women (19%) invested this new extra time to food preparation, which has a positive impact on the health of the children, who often suffer from malnutrition. Better and richer food affects children‘s health and performance in school. The proximity of water also increased the economic activity of women (10%) and allowed them the opportunity to relax (10%). Furthermore, women had more time for their childern (9%), they began to work in the garden (5%) and improved their personal hygiene (2%).

Graph 5. Spending women´s leisure time

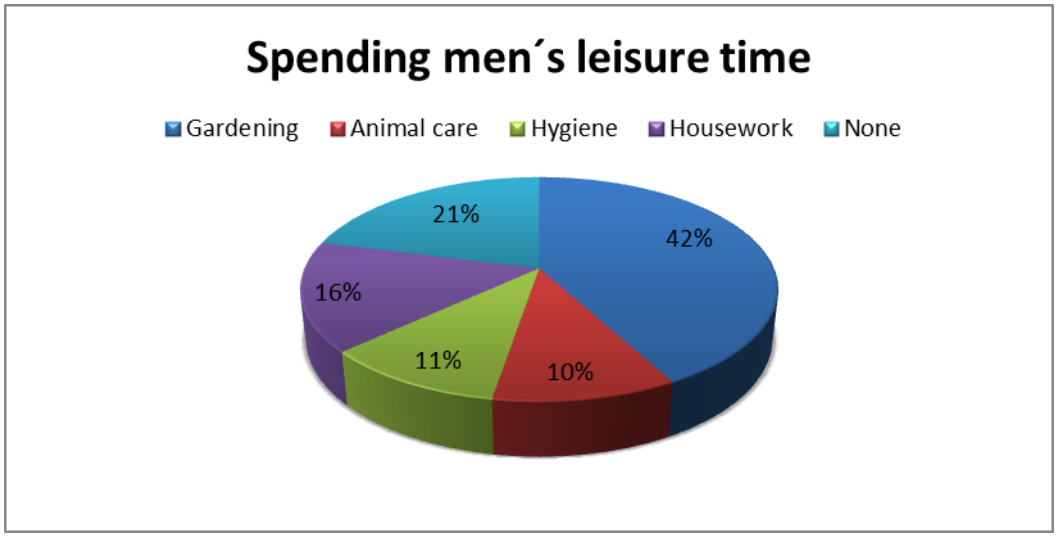


(Lungová 2014)

Men´s leisure time

Men play a marginal role in the obtaining of drinking water. They pass by the well with their livestock or on their way to work. Only a minority of them provide water for the functioning of the household. Most respondents (42%) said that their leisure time was devoted to working in the garden (Graph 6). For 21% of the respondents, the new well did not cause any change nor did they start any new activities. No significant changes were noted in their time invested participating in the work at home, the improvement of their personal hygiene and care of their animals. Due to the fact that men take water from the well in small PET bottles, apparently for personal use, it is not possible to tell whether the new well influenced the implementation of any new activities or whether the men were already engaging in these activities even before it was drilled. Undoubtedly, the quality of the men‘s drinking regimen improved.

Graph 6. Spending men´s leisure time



(Lungová 2014)

Conclusion

The research has shown that water plays an important role in community development. With the new water source built near the established community comes fundamental changes in the distribution of activities during the day for women and children. By reducing the time spent collecting water, there is time for starting new activities and improving health and eating habits. Reducing the distance, and improved water quality showed that the well is one of the instruments contributing to improved health and thereby increasing life expectancy. The expanding range of water sources together with investment in education and health care should be a potential engine for development in the Northwest region of Haiti.

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