

Status of Rainwater Harvesting (RWH) in Ghana

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Abstract

Potable water accessibility is an important criteria for improving health assessment of mankind. The demand for potable water in the world is growing fast compared to the growth in population. The increasing water demand globally has resulted into looking for alternative mechanism for water supply. Globally, harvesting of rainwater is classified as one of the best interventions to address water scarcity situations. In most of the developing countries including Ghana, rural communities lack the accessibility to clean drinking water. This paper presents rainwater harvesting as an alternative water supply system that needs to be adopted by the people of Ghana and is based on literatures associated with rainwater harvesting obtained from various studies both locally and internationally. This paper has identified the affordability and user ownership as the main factors influencing rainwater harvesting practices by rural communities in Ghana. Poor roofing materials, inappropriate harvesting facilities, housing occupancy, inaccurate land boundaries, quality of water and uneven rainfall pattern have been outlined as the constraining bottlenecks to this practice. Measures to curtail have been discussed as well. Moreover, a simple affordable rapid sand filter needs to be evolved and incorporated into the system in Ghana.



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Introduction

Undeniably, all water resources be it a surface water source or groundwater, originates from rainfall and constitute the main sources of water for domestic, industrial and agricultural usage. Water scarcity and pollution problems have generated public discussions and concerns by both policy makers and researchers. This has led to several studies on the

quality of groundwater and surface water in Ghana using conventional methods¹. Projections from United Nations, 2014, reveals that about 1.8 billion people of the world's population would be facing water availability problems by 2025. Increasing growth of populations, industrialization, intense irrigation coupled with global climate change is putting much pressure on available sources of water².

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Climate in Ghana is warm with a mean annual temperatures ranging 24°C to 36°C. In the southwest, the mean annual rainfall is maximum of about 2250 mm, 1000 mm in the north and 900mm in the southeast. Humidity on the coast is about 90% whilst during the dry season, humidity is about 20% in the north. Heavy rainfall occurs from about April through late June. The water scarcity condition occurs from November to January throughout the country³.

Rainwater harvesting is a technique used for the collection, conveying and storing of rainwater for domestic, industrial or agricultural use. This technology can either be direct collection or storage of the run-off rainwater for direct use in future. Rainwater harvesting is a technology that seeks to harness surface and groundwater, prevent evaporation and seepage losses. In semi-arid parts of East Africa (e.g. Tanzania and Kenya), and in Burkina Faso of West Africa, RWH systems are widely practiced, however in Ghana the practice is different. It is rarely practiced in the institutions, even though it is known that RWH has been incorporated in many missionary and government residences during the colonial era⁴.

Rainwater harvesting in households of Ghana, involves the use of a small water storage containers of an average volume of 16 litres which are placed below the tips of roofs to receive water whenever there is rainfall. These storage containers catch rains as they fell and are transferred into main storage containers in their various houses mainly by women and children as these buckets become full⁵. In other communities, residents rely on boreholes, unprotected streams, dams, rivers, dug-outs and impounded reservoirs for their domestic water demands. Few of these water sources serve as drinking places for animals as well, and the health risks posed by this are endless and far reaching. Harvesting of rainwater with roof-top has proven to be among the most growing domestic water resources⁶.

As of November 1, 2012, the Ghana WASH project initiated by USAID had provided several facilities including rainwater harvesting systems to various rural communities in Central, Western and the Greater Accra Regions⁷. Various facilities provided are outlined in Table 1.

Table 1: Ghana WASH initiatives

Facility	Proposed task	Completed task	Remained task
Institutional KVIP, WC	110	110	0
Wells	33	33	0
Small Town Pipe Systems	2	0	2
Rainwater Harvesting Systems	32	31	1
Boreholes	75	61	14

Rainwater harvesting technique has the capability to reduce dependency on public supply system, conserve water resources and subsequently save money for other developmental activities. To achieve these, this study seeks to present rainwater harvesting technique as an add-on to water supply in the Agona West Municipality specifically Agona Swedru.

Methodology

Description of Area of Research Work

The study area is Agona Swedru and is the capital of Agona West Municipality, one of the cocoa growing

areas in the country. The Agona West Municipality situated in the eastern corner of the Central Region of Ghana lies within latitudes 5°30' and 5°50'N and between longitudes 0°35' and 0°55'W⁸. As of 2013, the population of study area was 68,216 with a spanning area of 540 km². Swedru as simply called, can be located within the wet semi-equatorial climate zone. This area, having a bi-modal rainfall system, with maximum rainfall felt in May/June and September/October has an annual rainfall range of 1000 mm - 1400 mm. This situations puts this location into the forest zone, which allows for two main growing/wet seasons. The dry-seasons run

from December to March with the highest mean monthly temperature of 33.8°C being recorded between March/April. The lowest mean monthly temperature experienced often in the month of August is estimated as 29.4°C⁹.

Rainwater Harvesting

Rainwater harvesting is an act in which rainwater is harnessed, stored and utilized later for either domestic or agricultural purposes. The rainwater could be harvested from different locations, however the roof-top catchment systems are mostly adopted for supplies in homes.

Rainwater Studies in Ghana

An assessment on the current state of rainwater harvesting in the Northern Region of Ghana suggested a form of treatment to be done on water harvested before consumption. It also outlined measures on how rainwater harvesting could be used to address Pure Home Water's goal of reaching one million people in the coming years¹⁰. As per research work carried out on rainwater harvesting in the peri-urban areas of Accra such areas are suitable for the implementation of Domestic Rainwater Harvesting (DRWH), however it is only a complementary source to the water supplement in the area¹¹. A comprehensive research carried out on the chemical composition of rainwater in a mining community in Ghana (Obuasi) revealed the rain water in area was acidic i.e. (4.0 to 5.6). Anthropogenic activities in the area have strongly influenced the rainwater with Lead (Pb) found to be above the WHO permissible limit of 0.01 mg/l as a potable water¹². As per a case study of central Gonja district in the Northern part of Ghana, rainwater is suitable for the activities such as washing, bathing, cooking and drinking in the district⁶. A research on Rainwater Harvesting in the Coastal Savanna regions of Ghana recommended that government intensifies its programmes and activities, including awareness campaigns and training of artisans at the local level to create renewed interest in the activity. It was also recommended that the available water resources, especially the major rivers be harnessed for irrigation. The research again recommended that manufacturing industry in Ghana takes up the challenge to produce RWH components for sale to the public¹³. An assessment on physico-chemical and bacteriological parameters of rainwater in Adukrom-

Akwapim, where there is heavy rainfall during the rainy seasons was carried out. Direct rainfall, stored rainwater and roof catchment rainwater were sampled and studied. The result showed a significant increase in physico-chemical and bacteriological parameter from the direct rainfall to roof catchment and the stored rainwater. They suggested treatment of water ought to be done before drinking¹⁴. A research on chemical and isotopic composition of rainwater in the coastal, forest and mountainous parts of Volta region of Ghana recommended, harvesting of rainwater and storing for domestic use because it came to bear that the physico-chemical parameters of rainwater was satisfactory¹⁴. An assessment of rainwater harvesting as supplement to domestic water conducted in Kotei Ghana concluded that rainwater is suitable for either bathing or washing but not for drinking¹⁵.

In general, different kinds of rainwater harvesting systems are installed in Ghana. Small storage tanks are used to collect rainwater from different roof catchments. Some of the existing rainwater harvesting systems installed in Ghana are presented in Figures. 1 to 8. It can be seen that there is no understanding of filter presently. There are many important issues and challenges pertaining to rainwater harvesting in Ghana and have been discussed in this paper.

Results and Discussion

Rainwater Harvesting Techniques Common in Ghana

In Figure. 1, there is a 500 L galvanized steel tank that serves water to an unknown number of people in the Pong Tamale Health clinic. It could be seen that filter was not incorporated in the design which puts the quality of water being used questionable¹⁰. Figure. 2 presents a situation of the rainwater harvesting system being employed in a public school in Ghana. Again, filter is absent in the set up¹⁶. An initiative by Ghana WASH project under the USAID can also be seen in Figure. 3 where the rainwater harvesting system has been established in a basic school to provide water to the young students. Installation of filter over here cannot be found¹⁷. A household in a coastal area of the country where the storage tank of the rainwater harvesting system was made of concrete is shown in Figure. 4. The situation is not different from the already discussed. Filter was neglected in the design¹³.

Figure. 5 shows a latrine in *DobloGonno* in which rainwater harvesting system has been implemented, however the essence of filter was ignored in the set up¹⁸. Figure. 6 is a rainwater harvesting system in a public school in *Sefwi- Bonwire*. The system is not an exception of those with filters absent¹⁹. Intagrad also supported in the construction of a rainwater

harvesting system for hand washing in Tamale. The absence of filter can also be seen in Figure. 720. Figure. 8 also shows a rainwater harvesting system in Pong Tamale Vocational School Boys Correctional Center. It is clear here as well that filter has been neglected in the design¹⁰.



Fig. 1: RWH System in Health Clinic¹⁰



Fig. 2: RWH System in a public school¹⁶



Fig. 3: RWH system in a basic public school¹⁷



Fig. 4: RWH for household¹³



Fig. 5: Rainwater harvesting for hand washing¹⁸



Fig. 6: RWH system in a basic public school¹⁹



Fig. 7: RWH system for an office²⁰



Fig. 8: RWH system in vocational school¹⁰

Issues and Challenges

The present section provides a description on different parameters and issues related to rainwater harvesting in Ghana. For the implementation of this scheme, the challenges are hereby discussed below.

Poor Roofing Materials

The catchment of a RWH method first receives the rainfall directly from the sky hence adequate attention is needed with regards to its composition. "Slates" or asbestos sheets and aluminum sheets are the mostly used roofing in Southern part of Ghana, however, thatch dominates as one moves to the Northern part. Generally, any roofing form is acceptable provided it is able to collect rainwater but for drinking purposes, waters collected from roofs of thatched and asbestos need proper treatment. Therefore, the suitability and choice of such roof types have to be demonstrated by proper study⁵.

Inappropriate Harvesting Facilities

Few people use the poly-tank of reasonable sizes in their homes to store water due to the high cost incurred in the construction of bigger storage tanks. Most household use small containers to store harvest rainwater. Majority of these containers have small volumes to store sufficient water for longer days. Owing to this, substantial litres of rainwater gets lost to households and waste as run-off. In order to catch sufficient litres of water, provision of large underground or bigger storage tank on a raised platform ought to be made⁵.

Type of House Occupancy

Occupants in rented houses, however seem not ready to pump money in RWH facilities, since such disbursements may tie them to their current accommodation longer than their future situations may permit. They rather prefer acquiring smaller and mobile storage facilities, usually plastic containers for water storage⁵.

Inaccurate Land Boundaries

Having knowledge of one's land boundary is very essential to households having the power to engage in any constructional activities on their land without the fear troubles from land authorities and also encroachment. However, improper land demarcation is a major issue in some communities in Ghana.

This situation creates problems among land owners in a particular locality thereby making it uneasy to delineate areas where storage facilities should be sited. Proper land boundary demarcation is therefore a must to avoid land disputes and to expedite the process if large scale rainwater harvesting is to be adopted⁵.

Quality of Water

Recent developments reveals that rainwater in general rainwater is potable however, its quality usually gets affected by contaminations on the catchment and in the storage tank. Rainwater collects other contaminating materials that settle on the roofs. These include birds and lizards' excretions, falling plant debris from nearby trees, dust and any other foreign material found on roofs. Hence, installation of a filter is essential in RWH system⁵.

Uneven Rainfall Pattern

Unstable rainwater supply due to climatic change makes it difficult for one to initiate such project since he/she is unsure as to whether there would be regular rains during rainy days or not. Drying of spells coupled with droughts for longer periods could result serious problems in water supply⁵.

Conclusion and Recommendation

Rainwater harvesting widely is regarded as one of the best methods to harness water for future usage in this era of increasing water availability challenges, as per several studies. It is also evident from various research works that the use of filter in rainwater harvesting is absent in most communities in Ghana hence this paper seeks to come up with recommendation of a filter which should be cheap, easy to assemble and very effective to be adopted. It is also an undeniable fact that in adopting rainwater harvesting, some revenue could be saved as well. It is therefore concluded that rainwater could be harvested to supplement the water needs of residents of Agona west municipality and Ghana at large with respect to bathing and washing.

It is also recommended that the awareness of Rainwater harvesting be intensified to gain the acceptance and adoption of most people. Implementation of rainwater harvesting, will reduce the public water supply dependency and lessen the burden of utility bills which most people

complain about. Rapid sand filters should however be incorporated in the design in most communities in Ghana since there is correlation between water quality and the surrounding environment.

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