



A study of identifying the potential for improving rainwater harvesting systems in a village tank cascade system- a Case study of Kappiriggama Village tank system in Anuradhapura District

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විවිධ ජල අවශ්‍යතාවන් සපුරා ගැනීම සඳහා ශ්‍රී ලංකාව ඇතුළු ලොව පුරා බොහෝ රටවල් වැසි ජලය රැස් කිරීම සිදුකරනු ලබයි. කපිරිගම එල්ලංගා වැව් ගම්මානය ඇසුරෙන් මෙම අධ්‍යයනය සිදු කරන ලදී. කපිරිගම ගම්වැසියන් බොහෝමයක් ජල හිඟයකින් පෙළෙනු ලබන අතර ජනතාව ඒ සඳහා පිළියමක් ලෙස වැසි ජලය එකතු කිරීම හා එය භාවිතයට ගැනීමට පෙලඹී ඇත. එල්ලංගා වැව් ගම්මාන පද්ධතියක් තුළ වැසි ජලය රැස් කිරීමේ පද්ධති වැඩි දියුණු කිරීම සඳහා ඇති හැකියාව හඳුනා ගැනීම ප්‍රධාන අරමුණ කරගනිමින් මෙම අධ්‍යයනය සිදු කරන ලදී. වර්තමාන වැසි ජල ටැංකි භාවිතයන් හඳුනා ගැනීම, එසේ භාවිතයට හේතු හඳුනා ගැනීම, මිනිසුන් වැසි ජලය රැස් කිරීමේ ටැංකි භාවිතා කිරීමට මැලිවෙන්නේ ඇයි ද යන්න අධ්‍යයනය කිරීම මෙම අධ්‍යයනයේ සුවිශේෂිත අරමුණු විය. අධ්‍යයන ප්‍රදේශය ලෙස රඹැව ප්‍රාදේශීය ලේකම් කොට්ඨාශයේ කපිරිගම, පිනාගම, සහ කෝනකුඹුක්වැව යන ග්‍රාම නිලධාරී කොට්ඨාශ යොදා ගන්නා ලදී. මෙම

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අධ්‍යයනය සඳහා ප්‍රාථමික හා ද්විතියික දත්ත භාවිතා කරන අතර, ලබාගත් දත්ත සහ තොරතුරු විශ්ලේෂණය කිරීමේ දී (MS Excel) භාවිතා කරමින් ප්‍රමාණාත්මකව හා ගුණාත්මකව විශ්ලේෂණය කරන ලදී. නිරීක්ෂණයට අනුව මෙම ප්‍රදේශයේ ජනයාගේ දිනපතා අවශ්‍යතාවයන් සහ වෙනත් ප්‍රයෝජන සඳහා වැඩි වශයෙන් ගෘහ ආශ්‍රිත ළිං ජලය භාවිතා කරන බව හඳුනාගත හැකිය. එහෙත් බොහෝමයක් ජනයා පානීය ජලය සහ මුළුතැන්ගෙයි අවශ්‍යතාවයන් සඳහා වැසි ජලය රැස් කිරීමේ ක්‍රමය යොදා ගැනේ. අධ්‍යයන ප්‍රදේශයේ ඇතැම් අය වැසි ජල ටැංකි භාවිතා කිරීම අත්හැර දමා ඇති බව හඳුනා ගත හැකි අතර අධ්‍යයන ප්‍රදේශය තුළ වැසි ජලය රැස් කිරීමේ පද්ධතීන් වැඩිදියුණු කිරීමේ හැකියාව හඳුනා ගැනීමට හැකි බව නිරීක්ෂණය කළ හැකිය.

මුඛ්‍ය පද: කප්පිරිග්ගම, වැසි ජල ටැංකි, දියුණු කිරීමට හැකි විභවතාවය, භාවිත ජලයේ හිඟ බව,

Introduction

Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. It provides water when there is a drought, and reduces demand on wells which may enable groundwater levels to be sustained. It also helps in the availability of potable water as rainwater is substantially free of salinity and other salts.

The stored rainwater may need to be analyzed properly before use in a way appropriate to ensure its safe use. Sri Lanka has used rainwater for both domestic and agricultural use for many centuries. (Tanuja Ariyananda, 2010). Traditionally rainwater is collected for domestic use from tree trunks using banana or coconut leaves and from rooftops into barrels, domestic containers and small brick tanks. In recent years there has been revival of rainwater harvesting and much research has been conducted to improve the technology.

Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. The concentration of contaminants if any is reduced significantly by diverting the initial flow of runoff water received from first rains to the waste disposal

system. Improved water quality can also be obtained by using a floating draw off mechanism and by using a series of tanks, withdraw from the last in series. The quality of collected rainwater is generally better than that of surface water (Wikipedia, 2014). Contamination is always possible by airborne dust and mists, bird feces, and other debris, so some treatment may be necessary, depending on how the water will be used.

Rainwater harvesting systems can be installed with minimal skills. The system should be sized to meet the water demand throughout the dry season since it must be big enough to support daily water consumption. The water storage tank size should be large enough to contain the captured water. The lowest annual rainfall is received by the low country dry zone, in which the study area is found. Due to this situation most of the villagers in Kappriggama are suffering from usable water scarcity. Therefore people are used to collect the rain water for their drinking and other domestic purposes.

Objectives of the study

The study was carried out in order to identify the potential for improving rainwater harvesting systems in a village tank cascade system.

Also the specific objectives of the study are

- To assess the availability of rain water harvesting tanks in the study area
- To identify the present usage of rain water tanks,
- To identify the reasons, why people are reluctant to use rainwater harvesting tanks.

Literature review

Rainwater harvesting is the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to runoff (Wikipedia, 2014). Uses include water for garden, livestock, irrigation, domestic use with proper treatment, and

indoor heating for houses etc. In many places the water collected is just redirected to a deep pit with percolation. The harvested water can be used as drinking water as well as for storage and other purpose like irrigation.

Where there is no surface water, where groundwater is deep or inaccessible due to hard ground conditions, or where it is too salty, acidic or otherwise unpleasant or unfit to drink, another source must be sought. In areas that have regular rainfall, the most appropriate alternative is the collection of rainwater, called 'rainwater harvesting'.

Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. It provides water when there is a drought, can help mitigate flooding of low-lying areas, and reduces demand on wells which may enable groundwater levels to be sustained. It also helps in the availability of potable water as rainwater is substantially free of salinity and other salts.

The term 'rainwater harvesting' is usually taken to mean the immediate collection of rainwater running off surfaces upon which it has fallen directly. This definition excludes run-off from land watersheds into streams, rivers, lakes, etc. Water Aid is concerned primarily with the provision of clean drinking water; therefore, the rainwater harvesting projects we support are mainly those where rainwater is collected from roofs, and only to a lesser extent where it is collected from small ground, or rock, catchments.

The concentration of contaminants if any is reduced significantly by diverting the initial flow of runoff water received from first rains to the waste disposal system. Improved water quality can also be obtained by using a floating draw off mechanism and by using a series of tanks, withdraw from the last in series. The stored rainwater may need to be analyzed properly before use in a way appropriate to ensure its safe use

Rain Water Harvesting in Sri Lanka

Sri Lanka has used rainwater for both domestic and agricultural use for many centuries (Tanuja Ariyananda, 2010). Traditionally rainwater is collected for domestic use from tree trunks using banana or coconut leaves and from rooftops into barrels, domestic containers and small brick tanks. In recent years there has been revival of rainwater harvesting and much research has been conducted to improve the technology. According to Tanuja Ariyananda (2010) today there are more than 23 institutions and organization implementing rainwater projects and there are more than 31,000 systems constructed throughout the country.

Rainwater Harvesting Policy and Legislation in Sri Lanka

In 2005 the Government of Sri Lanka realizing the importance of rainwater harvesting as a solution to overcome the water scarcity in the country passed a national policy on rainwater harvesting (Tanuja Ariyananda, 2010). The policy objective is aimed at encouraging communities to control water near its source by harvesting rainwater. The policy was followed by necessary legislation, which was gazetted on April 17, 2009 to amend the Urban Development Authority by laws on drainage, which makes rainwater harvesting mandatory in certain categories of new buildings in areas under municipal and urban council jurisdiction (Tanuja Ariyananda, 2010).

Many of the research done related to rainwater harvesting system. The research namely as "Rainwater harvesting - a review " done by JR.Julius , Dr.R.angeline prabhavathy , Dr. G.ravikumar. They reviewed that as the world population increases, the demand increases for quality drinking water. Surface and groundwater resources are being utilized faster than they can be recharged. Rainwater harvesting is an old practice that is being adopted by many nations as a viable decentralized water source. The paper reviews the methods, design of rainwater harvesting systems, and its impacts adopted in all parts of the world.

"Rain Water Harvesting, Conservation and Management Strategies for Urban and Rural Sectors" done by Dr. R. K. Sivanappan. The paper reviewed that is very important to make water everybody's business. It means a role for everybody with respect to water. Every household and community has to become involved in the provision of water and in the protection of water resources. Make water the subject of a people's movement. It means the empowerment of our Urban and Rural community, i.e., to manage their own affairs with the state playing a critical supportive role. Further involving people will give the people greater ownership over the water project including watershed development, Soil and Water conservation and water harvesting will go a long way towards reducing misuse of government funds. It will also develop the ownership (own water supply systems), they will also take good care of them. In this way it is possible to solve water problems facing the county in the 21st century.

"Harvested Rainwater for Drinking" research done by Dr. N. Balasubramanya. He explained and reviewed it is clear from the World water quantity that out of total available water, only 0.3% is available for human consumption. But today even this is getting polluted due to human activities like mining, industrialization has created acute shortage of potable drinking water. Rain water harvesting is one of the most ancient and easy methods that can be adopted at urban and rural level efficiently. The aim of this study is to investigate the possibility of using harvested rainwater as a source of drinking water without causing any health risk. This can be achieved by adopting suitable storage technique efficient and economical treatment methods. Roof harvested rainwater samples were collected from five different places of Bangalore during October 2005. The water samples were collected and stored in good grade plastic containers and were subjected to periodical treatments (like chlorination, solar disinfections and use of silver nitrate) and tests for and use of silver nitrate and tests for physical chemical and Biological parameters up to May 2006 as per IS 10500:1991. All the above treatment methods suggested proved to be highly effective in reducing the colonies from an initial value of around 300 to zero.

Research Methodology

The study was conducted in three GN Divisions namely Kapiriggama, Peenagama and Konakumbukwewe in the Rambewa DS Division of Anuradhapura District. 292 sample collected within the survey area as totally. There are 146 sample collected in the Konakubukwewa village, 83 sample collected in the Peenagama village and 63 sample collected in the Kappiriggama village area. This research mainly depended on the primary data. In addition used the secondary data. The main data analysis tool was MS excel. The data presented as the graphs, charts and text.

Primary data collection through varies ways as follows.

1. Interviews
2. Field observation
3. By Questionnaire

Results and findings

People in the study area, use water for several activities. Such as drinking, kitchen use, toilet use, cloth washing, bathing, plantation and cattle drinking or livestock. People are using several of water sources, such as tank, domestic well, agro well and rainwater harvesting tank system to fulfill their water needs.

The usage of water resources to fulfill their needs in the research area can be indicated as follows. It could be identified people mostly use domestic well water for their day today activities and other purposes. But, rain water harvesting system mostly used for the drinking and the kitchen use purposes. The drinking water sources and amount of users are as follows.

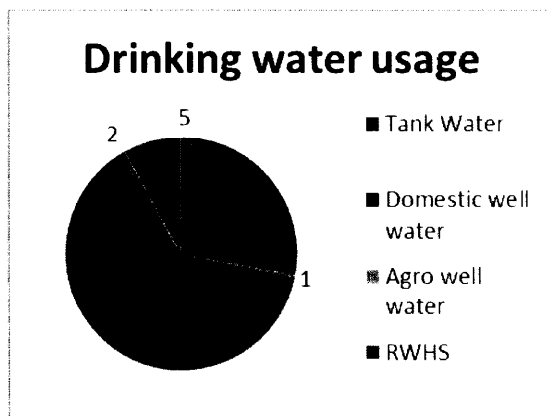


Figure 01: Drinking water usage

(Source: Field survey data 2014)

According to results that 188 households are using rainwater harvesting tank system for their drinking water purposes. And 78 households use domestic well water and 24 households use other sources like plastic shells and mineral water taken from the market for drinking water purpose in addition to rainwater harvesting tank systems. Therefore it could be identified majority used the rain water for their drinking water purpose. Domestic wells are used by 176 households for their kitchen usage. Also 87 households in the study area use rainwater harvesting tank system for the kitchen usage.

There are 292 rain water harvesting tanks were available in the research area. Some of the rain water harvesting systems is with good conditions and some of them are with bad conditions. Although due to this situation people who are living in the research area use the rain water harvesting tanks mostly for drinking and kitchen usage purposes.

And also it could be identified some people in the study area have discontinued the use of rainwater harvesting tank system.

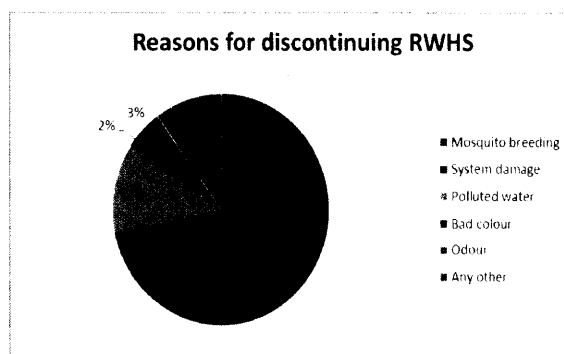


Figure 02: Reasons for discontinuing RWHS

(Source: Field survey data 2014)

The results show that 69% of the systems have been abandoned due to system damage. Further, 12% of people have discontinued the system due to polluted water. Also some other reasons were reported as bad colour, odor and any other reasons.

Conclusions

The rural people should be provided with rainwater harvesting tank systems and they must be made aware the importance of it, as the rainwater harvesting tank system is a better solution for usable water requirement of the North Central Province. Also many of people request new rain water harvesting tanks in study area. Therefore, it would be better to constructed new rainwater harvesting tanks adopting modern technology. The reason is that most of unusable rainwater harvesting tanks is affected by some technological problems or design defects. It would be better to increase the capacity of the rainwater tanks.

The construction process should be observed or supervised when new rainwater harvesting tanks are constructed in the research area. Most of people were abandoned the usage of rain water harvesting tanks because of the system failures. Therefore it

should be reconstruct the rain water harvesting systems in research area. Some of rain water harvesting tanks has not fully damaged. So the householders request the materials for maintain it and some of them request best level filtering system for the rain water harvesting systems. Therefore it should be supplied some materials for maintain rain water harvesting tanks. As well as it should be established a best level filtering system for rain water harvesting tanks.

There are 292 rain water harvesting tanks were available in the research area. Some of the rain water harvesting systems is with good conditions and some of them are with bad conditions. Although due to this situation people who are living in the research area use the rain water harvesting tanks mostly for drinking and kitchen usage purposes. According to the results, most of the people use rainwater harvesting tanks for drinking purposes. Also some of them use for kitchen usage purposes. Some of the people in the research area have discontinued the usage of the rainwater harvesting tanks. It revealed that discontinued rainwater harvesting tank system due to system failure, water pollution in the rainwater tank system. Mosquito breeding, color, bad smell of the water and any other reasons have also led to discontinue the usage of rainwater harvesting tank system. Some people have wrong attitude about the rainwater harvesting tank system. And some people who stopped usage of rainwater harvesting tanks in the research area like to restart because they believe water of the rain water harvesting tank is best solution for CKDu problem in the North Central Province. Rainwater harvesting system is a better solution for the kidney disease and water scarcity problem in the North Central Province of Sri Lanka. Thus, it is very important to look for avenues to offer rainwater harvesting tank systems and to make them aware the importance of rainwater collection.

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