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The Present Status of Rainwater Harvesting for Agricultural and Domestic Use in Uromi, Edo State

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ABSTRACT

The largest environmental challenge that Uromi is facing today is inadequacy of public water systems and the ineffective functioning of the water facilities. Lot of methods has been suggested to increase the sources of water supply; and one of this is Rainwater harvesting. Sometimes ground water may be available for domestic and agricultural use. Nevertheless, rainwater harvesting which falls on the ground and percolates into the soil which is not usually sufficient to meet the need of the rural and urban dwellers in the state. Although rooftop rainwater harvesting is a practice of most household in Uromi .The study is carried out to determine the current status of Rain water harvesting in Uromi, Edo State. Rainfall data for 5 years was used with supply side Approach (SSA) to calculate the potential Rainwater harvesting mean monthly rainfall ranged between 0 – 0.42.12mm.

The month of July had the highest potential yield (2,258.91 litres) with an actual yield of 642.20litres followed by the month of August which had a potential yield of 2,240.20 litres and with actual yield of (615.43litres).This indicates the status of rainwater in Uromi is still on the search for effective method. This can be addressed by using larger storage facilities and possibly the entire rooftop that will yield 100% water harvesting with a loss of less than 0.5%.

Keywords: Rainwater harvesting (RWH), Water scarcity, and supply side approach (SSA).

INTRODUCTION

The scarcity of water in Uromi Edo State has become a major challenge.

Water is the most precious natural resource that man cannot do without for his day to day living. A recent report by World Health Organization/UNICEF shows that about seven hundred and eighty million people in the developing world lack access to portable water which is majorly as a result of microbiological and chemical contamination (WHO/UNICEF, 2012).Man has seek different ways to mitigate the global challenge of water shortage. (Eletta and Oyeyipo).Of which rain water harvesting is an affordable method to address the global scarcity of water challenge (*Igbadun, 2012*)

Rainwater harvesting is a deliberate collection of storing rainwater from rooftops, catchment using simple storage utensils such as GP-tanks, and more complex options such as underground check dams. Rainwater is of great value to humans, it provides affordable water to meet the water use requirements for household, agriculture, environmental usage.*(Brooks and Peters(1988)*. Its usefulness has called for plants to strive under irrigation with stored rain water in tanks.

In the study carried out on water provided for 1.2million people in California, an average of 11.5litres per day was used for cooking with another 15litres used for dish washing (*Rodrigo et al (2010)* of 5 to 15 litres per person per day.

The aim of this study is to determine the present status of rain water harvesting in Uromi.

Materials and Methods

Study Location

This study covers Uromi metropolis, which is located between latitude 7011′-7018′ North of the equator and longitude 6015′ and 6034, East of the Greenwich Meridian with an altitude of 205m.

This area is made up of several quarters, Ukoni, Ivue, Egbele, Eror, Amendokhian etc. Uromi experiences the humid tropical climate which is characterized by wet and dry seasons. The annual rainfall ranges between 752mm-802mm and spreads over 7-9 months.(***Onuoha et al,2012***),the topography is slightly undulating and it is steep sloppy from the North of the area to the South.

The type of soil in this location is the loose sandy soil, which makes it highly susceptible to erosion.

Sources/Scarcity of water in Uromi

Although there exist a dam which was commissioned far years ago situated at Uromi, but presently not working due to poor improper management and maintenance. As a result of this, the majority of water supply in Uromi comes from vendors. They fetch water from the streams and rivers with automobile tankers and supply to their customers who resides in the community as shown in figure 1.Others comprises of plastic bottled water, sealed nylon, with NAFDAC registration number and a few without, there are few boreholes in the communities but can only serve about 18% of the teeming population residing in Uromi (HARRISON A..)found that the average water supply from Uromi metropolis for the month of April – September which was used to determine the water supply index for the community were 72%, sachet water 15%, Rain harvesting 7.4% and boreholes 5.6%.Having a face to face interview with a Vendor Mr HARRISON a major supplier said that a tanker load of water with capacity of 8000 litres delivers its

content at between 6000 -8000 depending on the source of water.

4000 LITRES..... 2500 Naira

3000 Litres.....2000 Naira

150 Litres.....150 Naira

25 Litres Jerry can.....20 Naira

20 Litres jerry can.....15 Naira

10 Litres jerry can.....10 Naira

Rainwater Harvesting in Uromi

The scarcity of water in Uromi is a well known fact .In spite of the average annual rainfall in Edo State; Uromi is experiencing shortage of water for their day to day use.

Most part of the rural and urban dwellers in Uromi experience lack of water supply for Domestic and Agricultural uses.

Components of Rainwater Harvesting

This comprises of the transportation of water through drains, filtration and storage tanks.

The most commonly used rainwater harvesting system includes roads, packing lots, and roofs to increase water supply for domestic and Agricultural use.

a) **Coarse mesh**: This is situated at the roof to prevent the passage of debris.
b) **Catchments**: This refers to as the surface area which directly receives the rainfall and provides water to the storage system. A roof made of galvanized iron can also be used for harvesting.
c) **Gutters**: This are channels provided all around the edge of a sloping roof which is used to collect water and transport to the positioned storage tanks' locally made galvanized iron sheet can be folded to the required shape and used for harvesting of rainwater. 50-125 diameters can be considered.

Advantages of Rainwater Harvesting

This provides self sufficiency for water supply and to supplement domestic water, irrigation water supply which is required during summer and drought condition.

- The construction and installation of rain water harvesting is less expensive, and easy to construct by rural dwellers.
- It reduces soil erosion in urban areas
- It reduces runoff which chokes storm drains thereby eschewing flooding of roads.
- In areas of low rainfall such as the deserts, rainwater provides relief to the people.
- Reduces the rate of power consumption for pumping of groundwater
- Provides water for human basic needs and other small scale productive activities.

Data Collection Techniques

Rainfall data for 5 years as an historic data ranging from 2011-2015 was obtained.

Based on this, cumulative monthly rainfall was calculated and the average for each month for the five years under usage as shown in Table 1.

In order to access the potential rainwater in the study area, five quarters within Uromi were considered namely (Ukoni, Ivue, Egbele, Eror and Amendokhian)

Were visited using five houses from each section which sum up a total of fifty houses from the entire study area .

The total area of the roof top was measured and the portion area where the water harvesting covered was also measured, the average from each quarter was calculated and the average for the whole study area was considered to calculate the yield of water per month in the study area. The potential of the water was calculated using the supply side approach (SSA) Proposed by (*Gould &Nissan, 1999)*

Calculation and Evaluation of potential water Harvesting

The simple model based on the runoff using the coefficient of runoff (Cr) for catchment is the ratio of the volume of rain that falls on to the surface.(*Gould and Nissan,1999, Tripathi and Pandry,2015*).This was calculated by using the formula given by *Gould and Nissan* reflecting the supply side Approach9SSA) as follows:

Monthly yield (M3) = Monthly rainfall (m) x Catchment area (m2) x runoff coefficient…… …… ……. (1)

Where,

R = Monthly Rainfall in (m)

Cr = Coefficient of Runoff (0.9) for galvanized iron roofing sheet

A = Catchment area in m2

Table: 1: Mean monthly rainfall distribution for 5 years in mm.

JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEPT	OCT	NOV	DEC
0.00	6.40	13.62	31.41	35.79	38.40	51.69	49.20	37.99	37.41	7.53	0.00

RESULTS AND DISCUSSION

The average total area of the roof top and the area covered by the water harvesting component from the five quarters is shown in table two below.

Table 2: Average area of the roof top of the five quarters sampled

Quarters	Total area of Roof top (m2)	Area covered by water harvesting component
UKONI	40.24	14.18
IVUE	54.62	16.26
EGBELE	47.02	16.19
EROR	60.54	25.21
AMENDOKHIAN	44.61	14.77
	Mean= 49.41	**Mean= 17.32**

The mean of the entire study area was found to be 49.85 **m2** and the mean of the area covered by water harvesting component is 17.32 **m2.**

Table 3: Monthly Potential and actual rainfall yield

Month	Average Rainfall In (mm)	Average Rainfall In (mm)	Potential Yield in (m3)	Potential Yield in (Litres)	Actual Yield(m3)	Actual Yield (Litres)
Jan	0.00	0.0000	0.00	0.00	0.00	0.00
Feb	6.40	0.0064	0.33	328.01	0.10	104.30
Mar	13.62	0.0136	0.69	690.12	0.23	231.62
Apr	31.41	0.0314	1.51	1,511.31	0.43	434.37
May	35.79	0.0358	1.62	1,620.08	0.48	478.42
June	38.40	0.0384	1.72	1,715.51	0.56	560.58
July	51.69	0.0517	2.26	2,258.91	0.64	642.20
Aug	49.20	0.0492	2.24	2,240.40	0.62	615.43
Sept	37.99	0.0380	1.81	1,805.67	0.50	496.84
Oct	37.41	0.0374	1.72	1,724.29	0.48	481.10
Nov	7.53	0.0075	0.38	377.18	0.12	119.19
Dec	0.00	0.0000	0.00	0.00	0.00	0.00
TOTAL	**309.44**	**0.3094.**	**14.28**	**14,271.48**	**4.16**	**4,164.05**

Fig 1. **Status of Rainwater Harvesting in Uromi**

Table 3 and figure 1 indicates the variability of the harvested rainwater from the catchment for a period of five years in the month of January to December. From the figure above it was observed that there was no rainfall for the month of January and December. The month of July had the highest potential yield of (2,258.91 Litres) and with an actual yield of (642.20Litres) followed by the month of August which had a potential yield of (2,240.40) with an actual yield of (615,43Litres).The total potential yield for a period of one year is (14,271.48 Litres) with an actual yield of (4,164.05 Litres).

From the result gotten from this study ,it was observed that the rainfall data collected for the period of 5 years from (2008-2013) as a historical record has a mean monthly rainfall distribution in the study, range between minimum of 0 mm in January and rise to 51.69mm in the month of July.

From the result it was noticed that rainfall in the study area is under-utilized, a potential yield of (2,258.91 Litres) compared to the actual yield of (642.20 Litres) for the month of July which shows that the remaining rainwater is considered wasted as runoff which eventually leads to erosion which tends to increase the rate of demand of water from vendors.

CONCLUSION

Based on the findings in this study rainwater harvesting is of vital importance to the people living in this geographical area since there is inefficient water supply due to non availability of borehole system in place. More sources of portable water supply are needed to boost the amount of rainwater harvested.

This precarious situation need to be tackled by taking drastic measures in recharging the depleted aquifer (underground layer of the earth) which is situated at Ugboha in Esan South Local Government area of Edo State, should be re addressed. This will go a long way in solving the problem of water scarcity in Uromi thereby reducing the amount of money spent in purchasing water from vendors on a regular basis.

RECOMMENDATION

For effective harvesting of rainwater, the following recommendation should be effected to maximize rainwater harvesting; Policies that are laid down by the Federal Government agencies should be reviewed and properly harnessed to provide water for basic human needs and other small scale firms. More also, the rooftop such as roof sheets, asbestos, aluminum of the harvested areas should be cleaned at least twice (between between January to October) to disallow debris from running into the storage tanks provided.

Furthermore, there is a need to enlighten the general public of the risk involved in installing rain water harvesting system and consistent monitoring of structural and environmental status of rainwater harvesting is highly recommended to meet the needs of the 21st century.

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