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A Review on Rain Water Harvesting in India

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Abstract

Water is a most essential source for living the human being. Water harvesting is the activity of direct collection of rainwater, which can be stored for direct use or can be recharged into the groundwater. Water harvesting is the collection of runoff for productive purposes.

As land pressure rises, cities are growing vertical and in countryside more forest areas are encroached and being used for agriculture. In India the small farmers depend on Monsoon where rainfall is from June to October and much of the precious water is soon lost as surface runoff. While irrigation may be the most obvious response to drought, it has proved costly and can only benefit a fortunate few. There is now increasing interest in the low cost alternative-generally referred to as 'Rain Water Harvesting' (RWH).

Keywords*- Rain water harvesting, portable and non-portable water, mass model, water balance, collection of rain water form roof top system.*

Rohitashw Kumar (2017) this study of low cost traditional water harvesting structures that helps in improving the socio-economic status of the poor farmers of the hill region. In the foothill region of North Western Himalayan region of India, the soil erosion has converted most of the fertile soils into barren, fallow and degraded lands. It is estimated that about 40 per cent of the total geographical area of Himachal Pradesh, Uttrakhand and Jammu and Kashmir is highly degraded. Soil loss through erosion is about 3.6 to 80 t ha-1. The farmers are not aware of rainwater management for storage and ground water recharge. The major constraints identified for conservation and management of water and soil in the area includes lack of technical knowledge and poor economic status of the farmers. Assessment of the area showed that if rainwater is conserved vis-à-vis managed properly and existing technologies are refined for specific land and pedospheric characteristics, it would rehabilitate the degraded lands and in turn increase the productivity in the area. Low cost farm ponds are a better option for collecting rainwater excess during monsoon periods for utilization for irrigation. The most efficient and cheapest way of conserving rainwater at the agricultural farm was found to be in- situ runoff management, which also reduces soil losses and increases the opportunity time for ground water recharging. The earthen embankment for rainwater harvesting has cost benefit ratio of 1.38:1.

N. Hatibu (2017) Rainwater harvesting (RWH) is a method of inducing, collecting, storing and conserving local surface runoff for agricultural production. This presents a brief treatise, of rainwater harvesting, and its historical perspectives. This reviews major techniques of RWH for crop production being practised. These fall into three broad categories namely: In-situ, Internal (Micro) and External

(Macro) catchment RWH. This finally gives specific examples of RWH techniques being practised in various Region and their extent of usage in that region. The paper concludes by looking at the past, current approaches and the role of RWH in various region and the appropriate techniques
and their relative viability.
Alberto Campisano (2017) the practice of rainwater harvesting (RWH) can be traced back millennia, the degree of its modern implementation varies greatly across the world, often with systems that do not maximize potential benefits. With a global focus, the pertinent practical, theoretical and social aspects of RWH are reviewed in order to ascertain the state of the art. Avenues for future research are also identified. A major finding is that the degree of RWH systems implementation and the technology selection are strongly influenced by economic constraints and local regulations. Moreover, despite design protocols having been set up in many countries, recommendations are still often organized only with the objective of conserving water without considering other potential benefits associated with the multiple-purpose nature of RWH. It is suggested that future work on RWH addresses three priority challenges. Firstly, more empirical data on system operation is needed to allow improved modelling by taking into account multiple objectives of RWH systems. Secondly, maintenance aspects and how they may impact the quality of collected rainwater should be explored in the future as a way to increase confidence on rainwater use. Research should be devoted to the understanding of how institutional and socio-political support can be best targeted to improve system efficacy and community acceptance.

Md Mahmudul Haque (2016) Water management is an important issue in urban design due to the growing concern of water scarcity.As a result, rainwater harvesting system has received notable attention as an alternative water source.Rainwater is one of purest form of waters and can easily be accessed via a rainwater harvesting system. In general, performance of a rainwater harvesting system is estimated based on historical rainfall data without the possible impacts of climate change on rainfall. However, rainfall pattern is likely to change in the future as a consequence of climate change that may affect the performance of a rainwater harvesting system. But research on climate change impacts on rainwater harvesting is limited. The objective of this study is to understand the plausible impacts of climate change on the performances (i.e. water savings, reliability and water security) of a residential rainwater harvesting system, based on the projected future rainfall conditions. A continuous daily simulation water balance model is developed based on behavioural analysis and yield-after-spillage criteria to simulate the performances of a rainwater harvesting system. The analysis is conducted at five locations in the Greater Sydney region, Australia. The results indicate that performances of a rainwater harvesting system will be impacted negatively due to climate change conditions in the future. It is found that a given tank size at the selected locations would not be able to supply expected volume of water under changing climate conditions in future. Water savings is going to be reduced from a rainwater harvesting system in future (reduction for 3 kL tank for indoor water demand). Moreover, number of days in a year to meet the water demand by a rainwater harvesting system (i.e. reliability) is likely to be reduced (reduction for 3 kL tank for indoor water demand).

Magnus (2016) Rainwater harvesting in residential homes is emerging as an important complement to centralized water supplies in urban centres around the world. Domestic rainwater harvesting systems provide a variety of benefits for water management and contribute to sustainable and integrated urban water management. There are however risks associated with rainwater harvesting that requires appropriate mitigation. One such risk is that systems can become breeding grounds for mosquitoes. This can constitute a significant health risk through the spread of mosquito-borne diseases (i.e. arbovirus and malaria). This deal explores the extent to which mosquitoes breed in rainwater harvesting systems as well as the effectiveness of different risk mitigation actions. Data were sourced from a large-scale domestic rainwater tank inspection survey undertaken in Melbourne and were analysed using simple Bayesian Network models. The observed rate of mosquito breeding was too high and was identified as a serious concern for health officials and water managers. The most common access routes into the tank system were found to be through the tank inlet or overflow. By exploring different system set-ups it was found that in order to mitigate the risk of mosquito breeding in tanks, all potential access routes must be adequately sealed. The complete eradication of mosquitos in rainwater tanks, however,, may need further investigation, as 4% of systems with adequate protection at the inlet and overflow were still found to have mosquitoes in them.

Lius F (2015) A rainwater harvesting system (RHS) was designed for a waste treatment facility located near the town of Mirandela (northern Portugal), to be used in the washing of vehicles and other equipment, the cleaning of outside concrete or asphalt floors, and thewatering of green areas.Water tank volumes representing 100% efficiency (Vr) were calculated by the Ripple method with different results depending on two consumption scenarios adopted for irrigation. The RHS design was based on a precipitation record spanning a rather long period (3 decades).The calculated storage capacities fulfilled the water demand even when prolonged droughts occurred during that timeframe. However, because the drought events have been rather scarce the (Vr) values were considered oversized and replaced by optimal volumes. Notwithstanding the new volumes were solely half of the original Vr values, the projected RHS efficiency remained very high (around 90%) while the probability of system failure (efficiency b 100%) stayed very low (in the order of 5%). In both scenarios, the economic savings related to the optimization of it were noteworthy, while the investment's return periods decreased substantially from the original to the optimized solutions. A high efficiency with a low storage capacity is typical of low demanding applications of rainwater harvesting,wherewater availability (Vw) largely exceeds water demand (Cw), that is to say where demand fractions (Cw/Vw) are very low. Based on the results of a literature review covering an ample geographic distribution and describing a very large number of demand fraction scenarios, a Cw/Vw = 0.8 was defined as the threshold to generally distinguish the low from the high demanding RHS applications.

Lala IP ray (2014) In XIth five year plan of India; water is given prime importance in all the developmental sectors. So,its conservation is given topmost importance. In addition to

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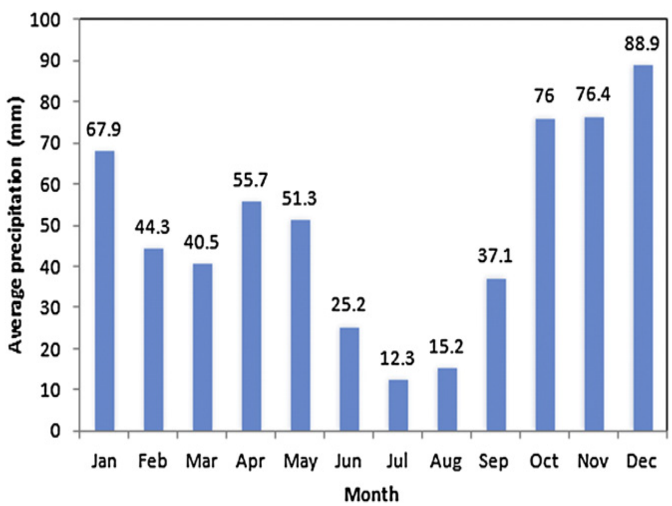
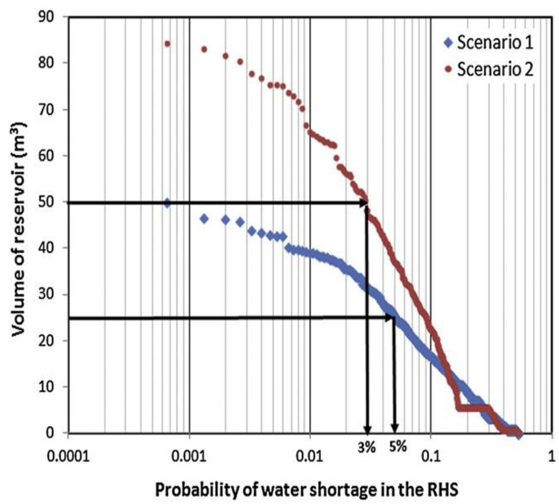
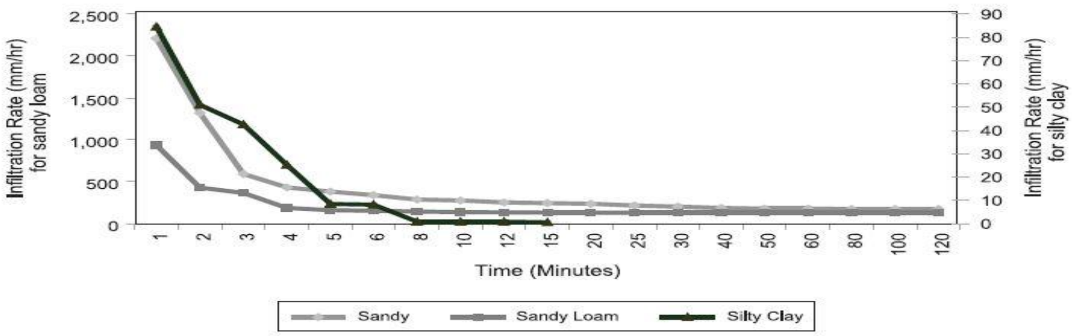
conservation, the management of conserved water is a matter of concern in order to overcome the fascinating problems on water scarcity. A structure was constructed along with all system components to collect rooftop rainwater through a net work of pipelines and its efficacy was monitored in meeting the portable and non-portable water demands for a projected roof surface area of 624 m2 at Soil and Water Conservation Engineering (SWCE) workshop building of Tamil Nadu Agricultural University (TNAU), Coimbatore. Weekly water balance reveals that 37th to 48th week got a surplus supply of rainwater after meeting all demands. It has been found that per annum a sizable amount i.e. 294.4 m3 of rain water can be harnessed from its rooftop during rain, which indicates a good potential for harvesting rooftop rainwater.





MD (2010) watershed level analysis to the river basin level analysis, and that basin level impacts are not always aggregates of local impacts. This study first discusses the critical issues in rainwater harvesting from micro and macro perspectives. The macro level analysis is strengthened by primary data on hydrological variables collected from two small river basins. It then goes on to make practical suggestions for effective rainwater harvesting.

Current studies would try and achieve the following: 1) present the major typologies in water harvesting in India; and to discuss the physical—hydrological and meteorological and socioeconomic and purely economic considerations that need to be involved in decision making with regard to water harvesting investments or analyzing the impact of RWH systems and how these considerations limit the scope of water harvesting; and make practical suggestions for improving the effectiveness of rainwater harvesting.



Maraina (2011) Garcia- This studies introduces an optimization formulation to design residential water systems that satisfy the water demands in a housing complex involving rainwater harvesting, storage and distribution as well as the simultaneous design of water networks for recycling, reusing, regenerating and storing reclaimed water. The design task is considered as a multi-objective optimization problem where one objective is the minimization of the fresh water consumption and the other objective is the minimization of the total annual cost. The proposed model accounts for the variability in the water demands through the different hours of the day and for the different seasons of the year. The seasonal dependence of the rainwater has also been considered in the optimization model. A case study for the city presented. It shows that significant reductions can be obtained in the total fresh water consumption and in the total cost. This work has presented an optimization formulation for synthesizing water networks in residential complexes. The approach involves the simultaneous harvesting of rainwater, the reuse of reclaimed greywater, and storage and distribution of managed water. The proposed model is based on a new superstructure thatinvolves segregating, recycling, treating, storing and recirculating wastewater.

Johan Rockstrom (2009) Rainfed agriculture plays and will continue to play a dominant role in providing food and livelihoods for an increasing world population. We describe the world's semi-arid and dry sub-humid savannah and steppe regions as global hotspots, in terms of water related constraints to food production, high prevalence of malnourishment and poverty, and rapidly increasing food demands. We argue that major water investments in agriculture are required. In these regions yield gaps are large, not due to lack of water per se, but rather due to inefficient management of water, soils, and crops. An assessment of management options indicates that knowledge exists regarding technologies,management systems, and planning methods. A key strategy is to minimise risk for dry spell induced crop failures, which requires an emphasis on water harvesting systems for supplemental irrigation. Large-scale adoption of water harvesting systems will require a paradigm shift in Integrated Water Resource Management (IWRM), in which rainfall is regarded as the entry point for the governance of freshwater, thus

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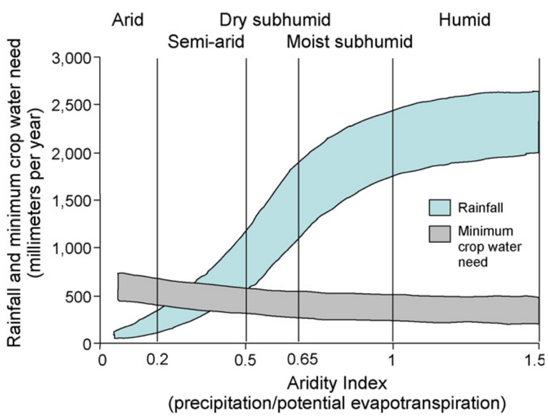
incorporating green water resources (sustaining rainfed agriculture and terrestrial ecosystems) and blue water resources (local runoff). The divide between rainfed and irrigated agriculture needs to be reconsidered in favor of a governance, investment, and management paradigm, which considers all water options in agricultural systems. A new focus is needed on the meso-catchment scale, as opposed to the current focus of IWRM on the basin level and the primary focus of agricultural improvements on the farmer's field. We argue that the catchment scale offers the best opportunities for water investments to build resilience in smallscale agricultural systems and to address trade-offs between water for food and other ecosystem functions and services.



Akil Amiraly (2008) The objective of the research was to evaluate to what extent this traditional system may constitute an additional source of water within the Old city of delhi and may locally reduce the pressure on water demand, assuming that the existing supply system does not fulfil the needs of the users. The results of an exploratory field study conducted in the Old city in 2006-07, which combined quantitative and qualitative aspects, give an outlook on people's opinions and behaviors regarding both systems. Finally, the rehabilitation of rainwater harvesting structures in the Old city of delhi suggests the necessity of empowering local structures of water management (households, non governmental association) in semi-arid urban areas to create the conditions for a sustainable implementation.

A. Jebamalar (2004) rainwater harvesting (RWH) is synonymous with many cities in developing countries as majority of them reel under severe groundwater exploitation. This is due to the increased demands of water for domestic and industrial uses and unplanned development works. The design of rainwater harvesting structures in any locality requires a thorough understanding of surface water (rainfall and runoff characteristics) hydrology and groundwater (movement and storage of water below the earth surface) hydrology of the area. Any lack of available or

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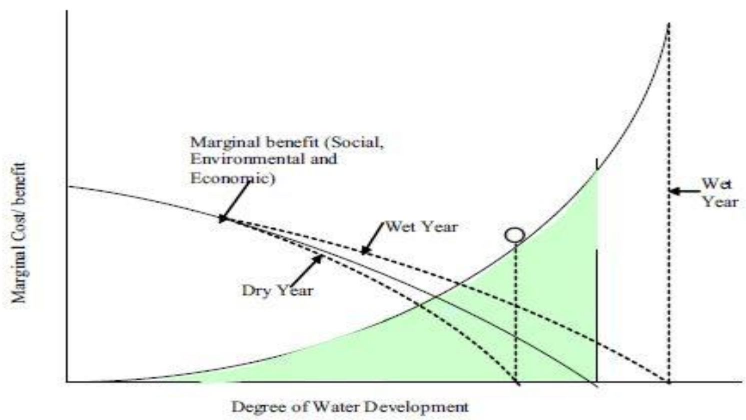
collected data in the above mentioned hydrologic aspects will reflect in the reduced response of the designed and implemented rainwater harvesting system. For example, any artificial recharge technique designed as a part of RWH has to match the intensity of rainfall with the infiltration rate and recharging is to be done to the location of the aquifer. This means that RWH has to be designed site-specific to get the desired response. This studies attempts to narrate a study made to investigate the RWH and its hydrologic responses (in terms of quantity and quality of water) in two hydro-geologically different localities of delhi city.



Conclusion:-

It is no denying that sustaining and recharging the groundwater along with judicious use of the limited fresh water resources is the need of the hour. If sufficient measures are not taken up immediately, we will face a crisis which will be detrimental to the very survival of mankind. Efficient management of water resources and education about judicious utilisation of water resources along with measures of harnessing, recharging and maintaining the quality of water and water bodies has to be taken up on war footing.

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