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SUBTAINABLE WATER RESOURCE THROUGH RAIN WATER HARVESTING (RWH) MANAGEMENT

Dr. T. Ramanathan
Assistant Professor, Department of Environmental Economics, MK University, Madurai

P. Prabu
Research Scholar, School of Economics, M.K. University

Abstract

In recent years, the uses of natural resources such as land water and forests have become absolutely unsustainable. Currently 30 percent of the rural population lack accesses to drinking water and, out of the 35 states in India, only 7 have full availability of drinking water for rural inhabitants. Most of the people who live in rural areas demand less water for day to-day living than people living in cities, and the majority of their water demand comes from agricultural needs. Fresh and potable water is a rare commodity and is threatened due to misuse, over exploitation and pollution. Water harvesting is a method of collection and storage of rainwater that can be used to meet out the household, agricultural and navigational requirements. Rain water replenishes ground water and improves its quality too, by softening it. It alleviates flooding significantly. The paper concluded that Private and public participation on RWH management will offer suitable development on socio, economic and environment.

Key Words: *Natural Resources, Rural Inhabitants, Misuse, Over Exploitation and Pollution.*

Introduction

Natural resources occur naturally within environments that exist relatively undisturbed by humanity, in a natural form. A natural resource is often characterized by amounts of biodiversity and geo-diversity existent in various ecosystems. Natural resources are deri0076ed from the environment. Some of them are essential for our survival while most are used for satisfying our wants. Natural resources may be further classified in different ways.

Natural resources are materials and components (something that can be used) that can be found within the environment. Every man-made product is composed of natural resources (at its fundamental level). A natural resource may exist as a separate entity such as fresh water, and air, as well as a living organism such as a fish, or it may exist in an alternate form which must be processed to obtain the resource such as metal ores, oil, and most forms of energy. There is much debate worldwide over natural resource allocations; this is partly due to increasing scarcity (depletion of resources) but also because the exportation of natural resources is the basis for many economies (particularly for developed nations such as Australia). Some natural resources such as sunlight and air can be found everywhere, and are known as ubiquitous resources. However, most resources only occur in small sporadic areas, and are referred to as localized resources. There are very few

resources that are considered inexhaustible (will not run out in foreseeable future) – these are solar radiation, geothermal energy, and air (though access to clean air may not be). The vast majority of resources are exhaustible, which means they have a finite quantity, and can be depleted if managed improperly.

Water Resources

Water resources are sources of water that are useful or potentially useful. Uses of water include agricultural, industrial,household, recreational and environmental activities. The majority of human uses require fresh water. 97 percent of the water on the Earth is salt water and only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is found mainly as groundwater, with only a small fraction present above ground or in the air.Fresh water is a renewable resource, yet the world's supply of groundwater is steadily decreasing, with depletion occurring most prominently in Asia and North America, although it is still unclear how much natural renewal balances this usage, and whether ecosystems are threatened. The framework for allocating water resources to water users (where such a framework exists) is known as water rights.

Sources of Water

Surface Water

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation, evapotranspiration and sub-surface seepage. Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates. All of these factors also affect the proportions of water loss. Human activities can have a large and sometimes devastating impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans often increase runoff quantities and velocities by paving areas and channelizing stream flow. The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill

in when average stream flow is below the power plant's need. Nevertheless, over the long term the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed. Natural surface water can be augmented by importing surface water from another watershed through a canal or pipeline. It can also be artificially augmented from any of the other sources listed here, however in practice the quantities are negligible. Humans can also cause surface water to be "lost" (i.e. become unusable) through pollution.

Under River Flow

Throughout the course of a river, the total volume of water transported downstream will often be a combination of the visible free water flow together with a substantial contribution flowing through sub-surface rocks and gravels that underlie the river and its floodplain called the hyporheic zone. For many rivers in large valleys, this unseen component of flow may greatly exceed the visible flow. The hyporheic zone often forms a dynamic interface between surface water and true ground-water receiving water from the ground water when aquifers are fully charged and contributing water to ground-water when ground waters are depleted. This is especially significant in karst areas where pot-holes and underground rivers are common.

Ground Water

Sub-surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between sub-surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called "fossil water"). Sub-surface water can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that due to its slow rate of turnover, sub-surface water storage is generally much larger compared to inputs than it is for surface water. This difference makes it easy for humans to use sub-surface water unsustainably for a long time without severe consequences. Nevertheless, over the long term the average rate of seepage above a sub-surface water source is the upper bound for average consumption of water from that source. The natural input to sub-surface water is seepage from surface water. The natural outputs from sub-surface water are springs and seepage to the oceans. If the surface water source is also subject to substantial evaporation, a sub-surface water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a sub-surface water source may cause the direction of seepage to ocean to reverse which can also cause soil erosion. Humans can also cause sub-surface water to be "lost" (i.e. become unusable) through pollution. Humans can increase the input to a sub-surface water source by building reservoirs or detention ponds.

Desalination

Desalination is an artificial process by which saline water (generally sea water) is converted to fresh water. The most common desalination processes are distillation and reverse osmosis. Desalination is currently expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf.

Frozen Water

Several schemes have been proposed to make use of icebergs as a water source, however to date this has only been done for novelty purposes. Glacier runoff is considered to be surface water. The Himalayas, which are often called "The Roof of the World", contain some of the most extensive and rough high altitude areas on Earth as well as the greatest area of glaciers and permafrost outside of the poles. Ten of Asia's largest rivers flow from there and more than a billion people's livelihoods depends on them. To complicate matters, temperatures are rising more rapidly here than the global average. In Nepal the temperature has risen with 0.6 degree over the last decade, whereas the global warming has been around 0.7 over the last hundred years.

Rain Water

Rainisliquidwaterin the form of droplets that have condensed from atmospheric water vapor and then precipitated—that is, become heavy enough to fall under gravity. Rain is a major component of the water cycle and is responsible for depositing most of the fresh water on the Earth. It provides suitable conditions for many types of ecosystem, as well as water for hydroelectric power plants and crop irrigation. The major cause of rain production is moisture moving along three-dimensional zones of temperature and moisture contrasts known as weather. If enough moisture and upward motion is present, precipitation falls from convective clouds (those with strong upward vertical motion) such as cumulonimbus (thunder clouds) which can organize into narrow rain bands. In mountainous areas, heavy precipitation is possible where upslope flow is maximized within windward sides of the terrain at elevation which forces moist air to condense and fall out as rainfall along the sides of mountains. On the leeward side of mountains, desert climates can exist due to the dry air caused by down slope flow which causes heating and drying of the air mass. The movement of the monsoon trough, orintertropical convergence zone, brings rainy seasons to savannah climes.

The urban heat island effect leads to increased rainfall, both in amounts and intensity, downwind of cities. Global warming is also causing changes in the precipitation pattern globally, including wetter conditions across eastern North America and drier

conditions in the tropics.[*citation needed*] Antarctica is the driest continent. The globally averaged annual precipitation over land is 715 mm (28.1 in), but over the whole Earth it is much higher at 990 mm (39 in). Climate classification systems such as the classification system use average annual rainfall to help differentiate between differing climates regimes. Rainfall is measured using rain gauges. Rainfall amounts can be estimated by weather radar. Rain is also known or suspected on other planets, where it may be composed of methane, neon, sulfuric acid or even iron rather than water.

Rain Water Harvesting

Rainwater harvesting is the accumulation and deposition of rainwater for reuse before it reaches the aquifer. Uses include water for garden, water for livestock, water for irrigation, 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. An old technology is gaining popularity in a new way. Rain water harvesting is enjoying a renaissance of sorts in the world, but it traces its history to biblical times. Extensive rain water harvesting apparatus existed 4000 years ago in the Palestine and Greece. In ancient Rome, residences were built with individual cisterns and paved courtyards to capture rain water to augment water from city's aqueducts. As early as the third millennium BC, farming communities in Baluchistan and Kutch impounded rain water and used it for irrigation dams.In the present scenario management and distribution of water has become centralized. People depend on government system, which has resulted in disruption of community participation in water management and collapse of traditional water harvesting system. As the water crisis continues to become severe, there is a dire need of reform in water management system and revival of traditional systems. Scientific and technological studies need to be carried out to assess present status so as to suggest suitable mitigative measures for the revival to traditional system/wisdom. Revival process should necessarily be backed by people's initiative and active public participation.

Living creatures of the universe are made of five basic elements, viz., Earth, Water, Fire, Air and Sky, Obviously, water is one of the most important elements and no creature can survive without it. Despite having a great regard for water, we seem to have failed to address this sector seriously. Human being could not save and conserve water and it sources, probably because of its availability in abundance. But this irresponsible attitude resulted in deterioration of water bodies with respect to quantity and quality both. Now, situation has arrived when even a single drop of water matters. However "better late than never". The people have not realized the seriousness of this issue and initiated efforts to overcome those problems.

Why Harvest Rainwater?

This is perhaps one of the most frequently asked questions, as to why one should harvest rainwater. There are many reasons but following are some of the important ones.

- To arrest ground water decline and augment ground water table
- To beneficiate water quality in aquifers
- To conserve surface water runoff during monsoon
- To reduce soil erosion
- To inculcate a culture of water conservation

Different Methods of Rainwater Harvesting

Rainwater Harvesting in Different type of Buildings

Normally, debris, dirt and dust get deposited on the roof during non-rainy periods. When the first rains arrive, this unwanted material will be washed into the storage tank. This may cause contamination of water collected in the storage tank thereby rendering it unfit for drinking and cooking purposes. Therefore, a first flush system can be incorporated in the Roof top Rainwater Harvesting Systems (RRHS) to dispose of the first flush so that it does not enter the tank. There are two such simple systems. One is based on a simple manually operated arrangement whereby, the down pipe is moved away from the tank inlet and replaced again once the first flush water has been disposed. In another simple and semi automatic system, separate vertical pipe is fixed to the down pipe with a valve provided below the T junction. After the first rain is washed out through the first flush pipe the valve is closed to allow the water to enter the down pipe and reach the storage tank.

Sloping roofs

Roofs made of corrugated iron sheet, asbestos sheet or tiles can be utilised for harvesting the rainwater. Gutters and channels can be fixed on the edges of roof all around to collect and transport the rain water from the roof to the storage tank. Gutters can be prepared in semi-circular and rectangular shapes. Locally available material such as plain Galvanized Iron sheets can be easily folded to required shapes to prepare semi-circular and rectangular gutters. Semi-circular gutters of PVC material can be readily prepared by cutting the PVC pipes into two equal semi-circular channels. Bamboo poles can also be used for making gutters if they are locally available in sufficient quantity. Uses of such locally available materials reduce the overall cost of the system.

Catchment

Any surface or the paved areas can be treated as catchment. Even the footpaths and roads can act as the catchment, as these areas to receive the direct rainfall. Rooftops are the best among them because of the large coefficient of runoff generated from them and there are less chances of contamination of water.

Conveyance

Conveyance system basically includes rain gutters and down pipes which collects the rain water from catchment to the storage tank. These rain gutters are usually built during the time of construction. They need to be designed appropriately as to avoid the loss of water during the conveyance process.

Storage

The most important part of the rain water harvesting is the storage system. The storage system is designed according to the amount of water that is to be stored. The design and site (location) of the storage or the recharge system should be properly chosen. The areas which receive the rainfall frequently, there a simple storage system could be constructed, to meet the daily water requirements. Otherwise the areas which receive the lesser rainfall, there the storage systems are quite essential. Rain barrels, underground or open slumps are mostly used to collect rain water. Neither makes sure that the storage system is properly sealed and does nor leak. Use Chlorine from time to time to keep the water clean.

Sustainable Water Resources

Issues

- Water scarcity from limited water quantity and degraded water quality
- increasing demand for expanding global population
- irrigated crop production primary consumer of water resources
- water demand for bio-fuel production
- Biogeochemical cycling
- natural and anthropogenic contaminants
- sustainable production in context of land use and climate change

The Center for Sustainable Water Resources conducts studies related to water quantity and quality aspects of water resources at local scales using field studies and regional scales using remote sensing and at annual to millennial timescales. Impacts of land use change and climate variability/change are important drivers considered in these studies. The results of these studies will have important implications for development of sustainable water resource programs in different regions.

Sustainable Water Management – Local to Global

Water is life. Growing pressure on water resources from population and economic growth, climate change, pollution, and other challenges has major impacts on our social, economic, and environmental well-being. Many of our most important aquifers are being over-pumped, causing widespread declines in groundwater levels. Major rivers including the

Colorado River in the western United States and the Yellow River in China no longer reach the sea in most years. Half of the world's wetlands have been lost to development. The world's water is increasingly becoming degraded in quality, threatening the health of people and ecosystems and increasing the cost of treatment. Some 780 million people around the globe still lack access to clean water and thousands perish daily for lack of it.

The world's water problems stem from our failure to meet basic human needs, ineffective or inappropriate institutions and management, and our inability to balance human needs with the needs of the natural world. These maladies are rooted in a wasteful use of water, characterized by poor management systems, improper economic incentives, underinvestment, failure to apply existing technologies, and an antiquated mindset focused almost exclusively on developing new supplies to the exclusion of "soft path" conservation and efficiency measures.

Since 1987, the Pacific Institute has worked to identify challenges facing our water resources and find solutions that promote the sustainable management of water resources, in California and around the world. Our research brings attention to key issues that have often been overlooked: the impact of climate change on water, water as a basic human right, the importance of conservation and efficiency, the role of water in conflict, the globalization and privatization of water, threats to the world's water, and more.

Benefits of Rain Water Harvesting

Rainwater harvesting first of all increases water security. It is the perfect solution to meet water requirements especially in the areas which do not have sufficient water resources. It helps in improving the quality of the ground water and increasing the level of the ground level. It also helps in improving the overall floral system. It reduces the loss of top layer of the soil. If we capture the water directly we need not to depend much on the water storage dams. It is the good solution to the increasing water crises. Rain water harvesting reduces the flooding on roads and further prevents it from contamination. And in the last it decreases the menace of floods on regional scale.

Conclusion

Government is constructing new buildings, and or maintains the old buildings for public usage i.e., hospital, school, colony, anganwadi, primary health centre, goodowns and so on. But there is no appropriate rain water harvesting connecting on those buildings. It will not support development of the society an indirect manners. It express that, not only the individual but also government should be a role model for the society. Private and public participation on RWH management will offer suitable development on socio, economic and environment.

We have to save every drops of water for our present as well as future requirements while consuming water we should think about others and save it for our future generations.

Reference

1. *Arvind Kumar, "Need for New Water Policy", Third Concept, November 2010, pp.7-12.*
2. *Arvind Kumar, "Water, Conflict and Cooperation", Third Concept, September 2008, pp.13-15.*
3. *Arvind Kumar, "Need for Regional Water Hub", Third Concept, April 2010, pp.7-11.*
4. *Elangovan. G, "Rainwater Harvesting & Impact on Ground Water Chennai City – A case study, March 2009, ENVIS centre, department of Environment, Government of Tamil Nadu, Chennai-15, pp 1-7.*
5. *JayawantBharadwaj, "Water Consciousness in a Community" Eternal Bhoomi, April – June 2010, pp.48-51.*
6. *Kailash Chandra and AnuragSrivastava, "Water & Rural Development in Uttrakhand: A Case-Study on Manila Hill Station", Third Concept, November 2009, pp.30-35.*
7. *Rajeev R Shrivastava, "Water Harvesting in India", Third Concept, December 2010, pp.34-37.*
8. *Selvaraj A. "River Pollution: Who's Concern?" Third Concept, January 2012, pp.43-44.*
9. *Subramanian .K, "Water Pollution and Health Status", Third Concept, Febraruy 2010, pp.45-49.*
10. *http://www.tn.gov.in/dtp/rainwater.html*