

Climate Change and Rain Water Harvesting

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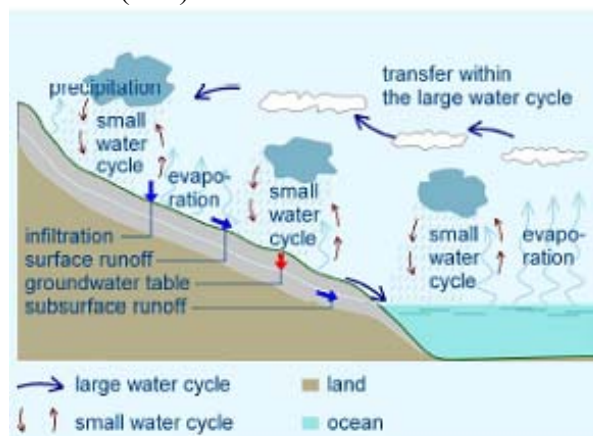
Climate Change and global warming has become the most concern of the 21st century. The IPCC or Inter government panel on Climate Change reports observations over last 150 years, rise in temperature, rise in global average sea level, reduction of northern hemisphere snow cover, . Associated with increasing temperatures of the atmosphere and the oceans is a proportionate increase in the content of water vapor in the atmosphere (for each degree Celsius of this increase, the air can theoretically absorb about 7% more water vapor). This causes numerous long-lasting climatic changes of regional and continental significance. . Higher air temperatures will increase evaporation from the world's oceans, intensifying the water cycle. They will also mean faster evaporation of water from land, so that less rainfall reaches rivers. These changes will be accompanied by new rainfall patterns and more extreme weather events, including floods and droughts (Human Development Report 2006).

Occurrence of extreme weather is been reported more frequently all around the world such as heat waves in Europe high intense cycle and floods in Asia. Serious dry spells (droughts) have affected vast regions of Europe, Asia, Canada, western and southern Africa and eastern Australia. It is been predicted that dry regions of the world will in the future be even drier and wet regions still wetter.

At present an estimated 700 million people in 43 countries around the world live in a state of water stress. These are particularly centered in the Middle East and in Sub-Saharan Africa. With the current tendency of cities to grow, a growth in both personal and industrial consumption of water can be anticipated. At the same time a growth in the need for water for the production of food in the poorest developing countries can also be anticipated. Those countries with high population growth and low financial capital, already using more than 80% of their water on agriculture, will be severely affected by the increase in extreme weather. We can expect a loss of livelihood for millions of small farmers and a growth in their dependence on food from developed countries. The need for water sources is growing because the number of such sources, their volume and their quality, are all getting lower. In the face of the growing demands of people, agriculture and industry, it is usually the environment which pays, and if no change occurs, the environment will continue to pay the biggest price. According to a UN report, the number of people living in a state of water stress will have probably increased by the year 2025 to more than 3 billion, with 14 countries having moved from the category of "water-stressed" to the category of "water insufficient" (ibid)

Change in the water cycle

The water is no longer a thought of as renewable source, water is a renewable source as long as the



water cycle exists. In the 20th century development activities has caused the water cycle to change to a unprecedented extent. Deforestation, and agriculture activities has lowered the ability of watersheds to retain water in nature, causing a decline in soil moisture and a fall in groundwater levels, as well as a warming of the whole local area. In mountains and foothill regions, fields without natural barriers to prevent the runoff of rainwater are an ideal setting for soil erosion and the occurrence of local flooding. Other negative results are the rapid aggradation of reservoirs, the lowering of groundwater reserves and increase in flooding incidences.

In the cities too water suffers the same fate as country side. Many open areas are covered by concrete and rain water falling on them and roof are carried away by to sewers to the nearest stream. Cities, whose locations were once selected with an eye on their rich sources of water, now go to extreme lengths to transport and purify water from great distances and at the same time as sluicing away all the rainwater that falls on their own heads.

New Paradigm for water management

The new paradigm, for water management has to be adopted, which attempt to balance water cycle and also offers a solution for making up the deficit. We can return the lost water back to the continents by keeping rainwater on a massive scale in the places where it falls, particularly in those areas where the influence of human activity is causing a drying out. Just as the impact of human activities (as their unplanned secondary effect) can lead to a breakdown in the water cycle, so concerted human activity can contribute to its renewal over land as well as to securing long-term stability in the water balance of a territory with sufficient water resources. If rainwater and surface water on land is conserved by increasing the water-holding ability of an entire watershed (which are often identical with anti-erosion measures); and if only the surplus surface water is sluiced away from an area, then with each turn of the cycle there will be recovery of the water cycle, the reserves of groundwater will gradually improve, the volume of precipitation will increase, and extreme weather events will decrease. Therefore the water balance at all levels—on the territory of individual communities, within cities, in forests, on agricultural land—is the central theme.

Dying wisdom of rain water harvesting

The conservation of rainwater on land is not a new idea. Human beings have collected and held atmospheric water throughout the millennia. India has a 4000-year-old tradition of harvesting rainwater for domestic consumption and agricultural use, while in China the tradition is even older (6000 years). The cisterns for the harvesting of rainwater mentioned in the Bible were spread throughout the entire Mediterranean. In semi-arid regions, such cisterns existed in every village and their demolition by enemies made the territory uninhabitable. The Phoenicians and Carthaginians practiced the harvesting of

rainwater from the roofs of homes 500 years before Christ, while the Venetians were long dependent on such technology for obtaining water, as were a number of other nations, too (Kleidon *etal* 2000). The famous quote of the Sri Lanka King, King Parakramabahu the Great (1153-86 AD) that "*Let's not allow a single drop of water to flow into the sea without being used for the benefit of mankind.* ", is an indication of the commitment of the ancient rulers and the people to conserve water and minimize the run off.

During the past 30 years, the ancient practices of rain water collection has under gone a major renaissance in many countries. Africa and South-east Asia, in particular have been at the heart of this revival during which tens of million of roof catchments systems have been constructed.

Today, Rainwater Harvesting is used in wet and dry countries, in poor and modern situations, for water supply and for sanitation in homes. It is utilized in addressing agricultural productivity and food security for poverty alleviation, even in places with 200 mm of rain. Rainwater Harvesting is employed in flood mitigation in rain-drenched countries, and in solving infiltration problems of sealed surfaces in urban areas and industrial complexes, or in avoiding polluted water and toxic ground water.

Since the early 1989s, there has been an important trend of growing international collaboration with regard to development and promotion of rainwater catchment systems world wide. Many countries have taken the initiative to promote and implement the technologies for eg. China, Thailand, Burma, Japan, Botswana, Kenya, India, Australia and Germany. Some of these country initiations were supported and presented at the International Rain water Catchment System Association Conference (www.ircsa.org).

Drought Mitigation and Poverty Elevation, China

Gansu Province, one of the driest areas in China, rain-fed agriculture land amounts to 90% (Qiang 2003). This is a typical dry farming area. The annual rainfall is 380mm while the potential evaporation is 1500-2000mm. The land is crisscrossed by numerous ravines, which make building of irrigation system very difficult. There are little surface and ground water available. The only water source for crop growth is rain. Owing to the unfavorable distribution of the rainfall, agriculture production has been kept at a low level. Drought happened frequently. There were 36 droughts reported in the past 40 years.

The provincial government introduced 1-2-1 project, which means each family in the area without availability of surface and ground water would get subsidy to build one hardened catchment yield, two under ground tanks and one piece of land for courtyard economy. Success of this project spread the concept and methodology to 15 provinces with area of 2.5 million km² and population of 200 million promoting RWH for domestic water supply and/or supplemental irrigation. In 2001 it has been recorded that about 12 million water cellars, tanks and small ponds were built with storage capacity of 6 billion m³, supplying water for domestic use of 36 million people and supplementary irrigation for 2.6 hm² of dry farming land, helping 30 million people to get relatively stable water

source and start to alleviate themselves from poverty. RWH system has enable the farmers to grow one harvest of rice and one harvest of irrigated corn instead of one harvest of rainfed corn before the RWH project. The yield has been increased by three folds and the cash by four folds. (Qiang 2003)

Flood mitigation in Taiwan

Taiwan is a country with frequent flood and drought problems (Lo, 2006). Torrential typhoon rains often lead to massive soil movement and landslides; concentrated runoff and large peak flow, causing significant damages downstream in the Hsichih area, Taipei. Small infiltration enhancement structures and retention ponds to collect storm water to reduce storm runoff and to control flood has been demonstrated in Taiwan. Also, computer models have been used to select the best sites to install such devices. Besides flood control benefits, the runoff storage increases the availability of water resources. Water stored in ponds may provide for non-potable uses such as irrigation, toilet flushing, landscaping, and groundwater recharge.

Groundwater Source Sustenance Through Recharge In India

The annual rainfall over India, is around 1170 mm. However, this rainfall occurs during short spells of high intensity. Because of this most of the rain falling on the surface either floods the area or flows away rapidly resulting in very little or no infiltration into the soil. This is all the more serious in coastal cities where it ends up in the sea and gets wasted.

Groundwater recharging (GWR) increase in the exploitable quantity of groundwater and is seen by the rise in groundwater level in places such as Chennai, India where such groundwater recharge has been taken up. In Chennai, the residents had implemented GWR in 2004 in order to comply with the law enacted by the government. This resulted in the groundwater level rising in the entire city by almost 6 to 8 metres. (Raghavan, 2006). GWR also improves the quality of groundwater. In areas where the groundwater contains metals like iron and arsenic and injurious salts like Fluoride, GWR will dilute them and even leech them out. This was exhibited in a few areas in Chennai, which are close to the sea and where groundwater had become saline. After the monsoons, the Total Dissolved Salts (TDS) has came down to less than 500 ppm and the groundwater has even became potable. Recent years Chennai city has reported a reduction in flood incidences in spite of the excess rainfall that it received.

Watershed management and Ecology

Successful community based watershed management projects are reported in the Philippines (Salas J , 2003), where people played a significant role as user and protector and conservation agent of the resources within the watershed. Rain water harvesting in the watershed will retain more water on land and will assist in tree planting, help maintain biodiversity and recharge ground water resources.

Many European countries too use rain water harvesting to protect the environment, ground water recharge, reduce storm water flow, irrigation and to supplement non potable use. Many of these innovative projects are explained in the Arch Klaus Kong Book Rain water technology Handbook.

Similar concepts are promoted and used in Taiwan, Japan and Korea. Rain water harvesting system in National Kaohsiung First University of Science and Technology (NKFUST) is used by the entire campus for toilet flushing and gardening. This system serve as environment conservation measure as well as flood mitigation measure, as the campus is prone to flooding

Energy Efficient and Carbon reduction

Study conducted in 3 cities in Australia (Coombes and Barry, 2007), Brisbane Sydney and Melbourne has indicated that roof catchment systems supplying rain water tanks were significantly more resilient to natural variation in climate and expected climate change than water supply catchment supplying dams. This study shows Decentralised rain water harvesting from roof catchments in cities has the potential to supplement centralised water supply strategies to create and overall more resilient urban water supply.

Study conducted in New Zealand shown that introducing concrete rainwater tanks to residence of Auckland will reduce cost and energy use than the conventional water supply schemes (Mithraratne and Vale 2007). Thus supporting the reduction of CO₂ emissions.

Conclusion

To carefully protect the fragile equilibrium of our water cycle, we need to develop, utilize and support overland rainwater harvesting and conserving rainwater in watersheds so that ecosystems can "produce" enough good quality water for humanity, food and nature, can purify polluted water, can reduce the risk of natural disasters like floods, droughts and fires, can stabilize the climate and strengthen biodiversity and can become a component of economically sustainable development programs. Practice of rain water harvesting will bring sense of responsibility to conserve water in ones own region as well as bring a new dimension of solidarity and tolerance between people and communities in watersheds, between boundaries. .

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