

Water Resources, Management and Human Beings: An Integrative Review

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ABSTRACT

On earth all life is critically dependent upon water – the origin and evolution of life became possible on earth because of the presence of liquid water. Animals and plants consist mostly of water. Water is only one of the several parameters that have a bearing on the industrial and agricultural productivity of a country. The quality of life of a community or family is closely linked to the quality and quantity of water available for drinking, cooking, washing, bathing, sanitation of a country. Since ancient times, man has settled along the rivers water, has moved along the river to unknown parts, and has eaten the fish caught in the rivers. This review research paper focuses on the managing the multiple uses and reuses of the natural resources optimally, sustainably through an understanding of the linkages and dynamics of interaction involving water. The attempt made by the community to protect the natural resources play important role for the future, we have to preserve natural resources and provide a pollution free environment which is not only concern with only policy makers, legislatures or the Judiciary. This work adopts an integrated socio-economic approach for water resources management.

Keywords: water resources, environment, policy, water management, conservation.

INTRODUCTION

On Earth water is crucial for human survival, productive processes, and the ecosystem. It constitutes between 50 to 90 percent of the structure of living organisms. Owing to its appearance from outer space, the Earth is of its surface is covered by water, although hydrologic sources only represent 0.07 percent of its mass and 0.4 percent of its volume (Oswald, 1999). The total amount of water in the hydrosphere out of this saline, waters constitute 97.5 percent and fresh water 2.5 percent. The great portion of ice and permanent snow cover in the Antarctic and the Arctic, and high mountain chains, like Himalayas and Alps. Ground water constitutes 29.9 percent of freshwater, 0.9 percent fresh water exists in the form of soil moisture, swamp water. Surface water in the form rivers, reservoirs and

lakes account for 0.26 percent of freshwater, which alone is renewable (Shiklomanov, 1998). Water has an important role in the maintenance of biodiversity. The rivers deliver not only water but also nutrients of the coastal oceans, and are thus linked to coastal fisheries, and so on. We should understand how these linkages operate at a watershed level, in order to integrate the biophysical and socioeconomic approaches of the use and reuse of water. In an International Conference on water and Environment, Dublin 1992, enunciated two crucially important guiding principles, namely, that all human beings have a basic right to have access to clean water and sanitation at an affordable price, and that water has an economic value in all its competing uses and should be recognized as economic good.

India receives annual precipitation of about 4000 Km³ including snowfall. Out of this, monsoon rainfall is of the order of 3000 Km³. Rainfall in India is relying on the southwest and northeast monsoons, on shallow cyclonic depressions and disturbances and on local storms (Bhattacharyya *et al.*, 2015). There are four main sources of water: Surface water, Underground water, Atmospheric water and Oceanic water. Due to uncontrolled activities including deforestation, rampant construction and unregulated flow of *pollutants* in the water causes problems to the natural habitat of aquatic organisms. In India, since ancient times, man has settled along the rivers, water have moved along the river to unknown parts, and has eaten the fish caught in the rivers. The *worship* of gods and goddesses, the religious practices, and the whole tenor of life of the people living on the bank of the rivers are inextricably linked with the *rhythm* of the river. Traditionally, water had and continues to have, a central role in the rituals, worship and prayers of *Hindus*. *Hindus* believe that all water in India- surface and underground is ultimately connected to the *Ganga*. In India water scarcity and pollution is acquiring a serious dimensions as almost 70 percent of its surface water resources and a large proportion of groundwater reserves are contaminated by biological, toxic organic and inorganic pollutants. The availability of water has been rendered unsafe for domestic consumption, irrigation, and industrial needs due to improper management. Degradation of quality, turn leads to water scarcity as it limit water availability for human use. Nowadays it is important to maintain integrated water resources management which involves the management of surface and subsurface water resources to maintain its quality, quantity and

ecology which is the need of society at large. This revived paper focus on the multiple uses and reuses of water optimally, sustainably through an understanding of the linkages and dynamics of interaction involving water and its proper management. The aim of this paper overview the best practice for the management of our natural water resources.

METHOD

An integrative review of the literature was undertaken to determine what the role of water resources on this planet is. This integrative review method was chosen because it provides the information about natural resource, how they play an important role in different ways, findings from numerous independent peer-viewed studies to determine the current knowledge in a particular area. The conclusion of this analysis provides the available evidence about water policy, management and role of human beings in the conservation of natural resources.

RESULTS AND DISCUSSIONS

Every human being on earth is a stake holder in water resources managements. And, so far that matter, is every animal, domesticated and wild – only, they do not have constituency. We need to protect water and living thing not for any altruistic reasons, but in our own self interest. We should realize that our well-being is inseparable from the well-being of the ecosystem. If frogs are dying, we would surely next in the line (Aswathanarayana, 2001). Berrien Moore (1999) explains how water couples the terrestrial biogeochemical system to the climatic system. As well known the plant productivity and the sustainability of natural ecosystems are critically dependent upon the availability of water. If the water use data are viewed on a global scale, more than 3,240 km³ of fresh water are used annually. There is considerable variation in sector wise water use throughout the world. Agriculture is the primary user in Asia, while municipal and industrial sectors are major users in India. The use of water for various purposes has significantly risen during the last century and the trend continues. This has led focus the attention on sustainable use of water resources and maintenance of environmental quality. Water and agriculture sectors

in India are largely depend on monsoon rainfall. There have been considerable spatial and temporal variations in rainwater availability in recent years as a result of continuity and withdrawal patterns of monsoon. The monsoons serve not only as a sole provider of water to recharge the groundwater resources of the country (Murari, 2001). Water has a key role in sustaining ecological balance. The widespread scarcity gradual destruction and aggravated pollution of the water resources also lead to degradation of ecology. In India water quality issues are gaining recognition as river waters are getting heavily polluted at many places and ground water quality at many places beginning to deteriorate (Sharad *et al.*, 2007).

Hydrological cycle and man's influence

Water is different from other natural resources is being mobile. In this cycle water moves and changes in the water cycle. A cycle has no beginning and no end. Most of the water on earth is involved in continuous movement called water cycle. Water evaporates from the surface of the oceans, seas, lakes, rivers etc., forms clouds and moves inland. Part of the precipitates, on land forms surface runoff, and part percolates downward forming groundwater. The force of gravity moves surface water and groundwater into depressions (river valleys) and forms rivers which feed the oceans. The water cycle describes the storage and movement of water on, above and below the surface of the Earth. Through countless interactions within the Earth system, the water cycle plays a crucial role in the physical, biological, and chemical processes of the planet. The terrestrial water cycle is of paramount importance because it continuously renews water supply for societal and ecological well beings. Associated with this water cycle, energy, salt within the oceans, and nutrients and minerals overland are all transported and redistributed within the Earth climate system (Kevin and Ghassem, 2014). The movement of water in the hydrological cycle extends through the four parts of the total Earth system – atmosphere, hydrosphere, lithosphere, and biosphere – and strongly depends on the local peculiarities of these systems.

Surface water resources in India

In India only a small proportion of surface fresh water is available for human use. The most accessible surface fresh water resources are in the form of lakes, reservoirs, streams, springs and rivers. These fresh

water bodies contribute only 0.60 percent of the total of amount of fresh water which is renewable and actually available for the human use on a sustainable form (Chatterjee, 2008). India is gifted with a river system comprising more than 20 major rivers with several tributaries. Many of these rivers are perennial and some of these are seasonal. As many as classified as Major River whose total catchment area is 252.8 million hectares and an average annual potential in rivers is 1570.98 BCM (Bhattacharya, 2015). Another 48 rivers are classified as minor (Rangarajan, 2000) rivers whose total catchment area is 24.9 million hectare (Engleman & Roy, 1993) (Pachauri & Sridharan, 1998). The rivers like Ganges, Brahmaputra and Indus originates from the Himalayas and carries water throughout year. Lal (2001) mentioned that 50 percent of water resources of India are located in various tributaries of these river systems. The mean annual flow of all the Indian river is estimated at 1869 BCM of which 690 BCM or 36.92 percent is available for use, from this only 3 percent of the country's population contributes 29 percent of the country's water resources and 45 percent of the hydroelectric potential (Chatterjee, 2008). Bhatt and Mall (2015) mentioned that rainfall is the main source of surface water resources, due to anticipated climate change and temporal pattern of rainfall in different regions of the country will be change and there will be increase in intensity of rainfall greater monsoon variability. Agrawal *et al.*, (2014) noted that Western Himalayan watersheds are rich in natural surface water resources and provides fundamental basis in the form of natural streams and springs which are surface runoff derived from seepage water turning from perennial to seasonal and have been ignored, even though they secure source behind domestic surface water availability. In India there is enough scope for storing runoff water for irrigation and power generation purpose.

Ground water resources

Groundwater comprises near about 97 percent of the worlds readily accessible freshwater and it provides the rural, urban, industries and agriculture water supply needs of 2 million peoples around the globe. The rainfall is the primary water source of groundwater recharge, and topographical conditions across the country resulting in significant changes in the magnitude of recharge (Kittu, 1995). In India, due changes in climate from last few decades pressure has been evident through rapidly increasing the pumping

of groundwater. Dinesh Kumar (2007) mentioned that globally, India stands at the top in terms of groundwater withdrawal for human uses. The annual withdrawal in the country is around 231 m ha. From this much of the water is used up in 31.58 m ha of agriculture land. In India ground water has played a significant role in the maintenance of India's economy, environment and standard of living. As in the world India is the largest groundwater user, through construction of millions of wells and bore wells, there has been a phenomenal growth in the exploitation of groundwater in last five decades (Hector *et al.*, 2011). Hydro biologists believe that India is fast moving towards a water crisis of groundwater overuse and its contamination. India have an availability of surface water is greater than groundwater. In comparison with surface water the groundwater is easily accessible and forms the largest share in the agriculture and drinking water supply. It is noted that 89 percent of groundwater extracted is used in the irrigation purpose, use of groundwater for domestic purpose is 9 percent and for industrial purpose it is 2 percent. Now a day's 50 percent of urban water requirement and 85 percent of rural domestic water requirement are fulfilled by groundwater source. Groundwater contamination is the presences of certain pollutants are in excess of limits as prescribed for drinking water standards.

Management of water resources sites

Now a day's different regions are confronted with the urge to expand their water supply sources to deal with developing populace driven demand and concern of supply from water catchment areas, because climatic change and drought. The climatic changes forced to make the long term sustainability of water systems is increasing due to high demand for limited natural assets for all uses. This situation in India and other countries impels the requirement of re-configuration of current rural and urban water systems and developments towards more sustainable arrangements by incorporating the allocation and management of water (Mishra *et al.*, 2008). In India dealing with drought and scarcity requires local water resources in the most optimum manner, which requires that water users and communities themselves have a central role in the overall management of local and regional water resources (Kathapalia & Kapoor, 2002). Water management initiatives can be successful only if all categories of peoples in India accept responsibilities and interventions (Hooja, 2002).

Administrations responsible for developing and managing water resource infrastructure had to pay more attention to managing and protecting the resource (Muller & Lenton, 2002). If these natural resources cannot be managed properly without involving the rural and urban communities that derive their sustenance from the natural resources (Mishra & Bajpai, 2001). Many researchers have emphasized on the fact that the communities ought to organize and manage water resources.

Environmental policies in India

In India, growing environmental crises of today which have problems of many facets strongly warn us against different hazards of environmental pollution. All Indian citizens have an responsibility to protect our natural resources, we have to preserve natural resources and provide a pollution free environment which is not only concern with only policy makers, legislatures or the judiciary. Surendra Kumar (2012) noticed that an environmental policy in India does not imply total non-interference with nature. Only, it implies non-interference in spheres likely to jeopardize the environment as a whole comprising the man-made and natural environments. In our country NCEPC (National Committee Environment Planning and Co-ordination) was established as an apex advisory body in all matters relating to management of natural resources and protection of environment. Rajindra Verma (2016) in his book on natural resources mentioned that the Indian government has a framed national policy on environment protection for the better management of is natural resources, the proper protection and conservation of the environment for well being of future generations. In regard to the legal response to management of natural resources and environmental protection Indian Parliament has enacted certain very important legislations. The amendment article 48-A and 51-A (g) in the constitution which imposed a duty on the state and citizens of India to protect and improve the natural resources, environment safe-guard the forests and wildlife of the country. While expressing his views on management of natural resources policy P. Leelakrishnan (2005) mentioned that proper management of land and water resources is an important element of maintaining ecological balance, as well as economic growth without disturbing the resource base. Qazi and Navaid (2007) find out that all materials, which man obtains from the environment to satisfy his basic needs, the available natural resources

that are gift of nature and their utilization plays a vital role in socio-economic development of the people and nation.

Water conservation policy in India

As water is the very basis of life and is the foundation of human survival and development. India facing water scarcity/drought problem in the last few decades the consequences of population growth, urbanization, deforestation, industrialization have interfered with the natural hydrological cycle of rainfall, soil moisture, groundwater, surface water and storage of all sizes. Due to these all consequences has led to overuse, abuse and pollution of vital water resources and has disturbed the quality and the natural cleansing capacity of water. Kathpalia and Kapoor (2002) emphasized that minimize the negative impacts of water scarcity, it is necessary to adopt a water policy which recognizes and adequately addresses the challenges we face and also going to face in the 21st century. The earlier national water policy was adopted in September 1987 and a revised policy has been adopted by national water resources council in April 2002. But during the last few years a number of problems/challenges have emerged in the development and management of water resources. It was well known that during the ancient period the civilization of *Mohenjodaro* and *Indus valleys*, the structure of the city has water channels leading to dump the water for percolation (Majumber *et al.*, 1978). In our country the water sector must adopt to changing climate conditions by seeking alternative water resources and developing improved water management approaches that will reduce pressure on stressed systems. Narain (2000) discussed on some critical lacunae in the governance structure of India's water resources. He also argues that there is need to reforming the bureaucracy for greater accountability and improving co-ordination before making new policy. Whereas Aswathanaryana (2002) suggested some suggestions while making modern water policy that in a systematic and planned manner: (i) a nationwide monitoring programme should be developed (ii) new projects that influence climate (iii) improved methods for accounting climate-related uncertainty should be developed (iv) water availability and demands in all regions should be reassessed in the new climatic scenario (v) crop cultivation according to the availability of water (vi) re-examination of the water allocation policies and operating rules.

Impact of climate change on water resources

As in the previous discussions we have seen that how water is a precious natural resource which supporting human activities and ecosystems. The complexity in the natural water resources impacts due to global climate change. The hydrological cycle is a fundamental component of climate, is likely to be altered due to global climate change. According to Ratnayake and Herath (2005) due to climate change the rainfall intensity either increased/decreased, which results in floods/drought situation around the globe. The report of *IPCC*, 2001 assessed that climate change will lead to an intensification of the global hydrological cycle and can have major impacts on regional water resources, affecting both ground and surface water natural resources. Linsley (1982), Gosain (2008), focused on the impacts of climate change will depend on the baseline conditions and the ability of water resource managers to respond not only climate change, but also to population growth and changes in demands legislative conditions. SAARC (1992) report says that south-Asia and India in particular, are considered particularly vulnerable to climate change and it may show some adverse socio-economic effects. There are vast sectoral and regional variabilities in India that affect the adaptive capacity of the country to climate change (Bhatt & Sharma, 2002). Raneesh (2014) emphasized that planning and management to save natural water resources is an difficult task due to conflicting demands from various stakeholder groups, increasing population, rapid urbanization projected climate change and consequent changes expected in the hydrologic cycle, the use of toxic chemicals in various land use activities, and the incidence of natural disasters. The water resources and the hydrologic cycle is a very important link of climate change that caused by climate change (Yang *et al.*, 2011). Nemeč (1982) analyzed the sensitivity of water resource system to climate variation by performing simulations in a deterministic frame work, it also impact on stream flow in the arid and humid basins. Climate change is multi-scale, all-round; multi-level shows both positive and negative effects not only on hydrological cycle, but also on biological, ecological systems, economy and life (Ren, 2008). By 2025, almost two thirds of the world's population is projected to experience some kind of water related stress, and for one billion of them, the shortage will be severe and socially disruptive (WEDO, 2003). The IPCC also reported in the coming years there will be increase in the risk of child mortality in many regions

of the globe due to impacts of climate change on fresh water resources. Due to effects of climate change on fresh water resources already over one billion peoples live in water-scarce areas around the globe (Smaktim, 2004) it also affects livelihood security, induce risk and vulnerabilities in sectors such as health, agriculture and food scarcity.

Role of human beings in managing natural water resource

Water is perhaps most important natural resource used by human beings. It is used both in rural and urban areas of the country, the main uses of water are; (a) for drinking, domestic and washing (b) for irrigation (c) for animal consumption and (d) for industrial uses. Negi (2001) find out that management of various natural water resources on a sustainable basis is very important for natural resource management. For this purpose the strategies, which may be adapted for management of water, have been outlined: (i) the community must come forward to plan, develop and manage the water resources of the area (ii) an regular assessment of the natural water resources (iii) identification of natural water resources, needs for different purposes (iv) development of water resources (v) development of water resources includes; rain water harvesting, renovation of ponds, digging of ponds, harvesting of perennial water resources and development of underground sources of water (vi) constitution of user's groups, sharing and management of water and (vii) peoples and managers should protect forests, wetlands, and natural ecosystems to enhance the conservation of water. (viii) farmers should implement water-conserving irrigation practices, such as drip irrigation to reduce waste. Ognjen (2004) noticed that importance of water management is increasing because of the global growth of water needs and rise of water scarcity, which together causes greater risks and unreliability in water management. The integrated water management lie in the 1970 and 1880s, when the world was facing severe water crisis in the form of droughts, declining water quality, and competition in the for an ever scarer resources (Julia Martin *et al.*, 2015). The Nation Water Policy (1987), it promotes the prime natural resource which is basic need and a precious national asset, and gives priorities to water allocation process. Maharashtra government published white paper on 26 July, 1995 in order to comprehensive policy which is acceptable to all. As human populations and economics grow, global

freshwater demand has been increasing rapidly (Rosegrant *et al.*, 2002, Gleick 2004). Postel *et al.*, 1996, Pimentel *et al.*, 2004, findings mentioned that threatening human food supply, water shortages reduces biodiversity in both aquatic and terrestrial ecosystems.

CONCLUSION

Conservation and management process of natural resources to undertaken by various sections of the society by awaking them about different issues of water resources management, a participatory approach may be launched using the modern communication means for educating them about water conservation and efficient utilization of water. Policy decisions in any water resources project should be directed to improve knowledge, attitude and practices about the linkages between health and hygiene. It is important to know that water, as an environmental resource, needs to be further promoted and managed within the framework of a river basin and ecosystem approach. In India dealing with drought and scarcity requires that water users and communities have a central role in the overall management of local and regional water resources. The role that healthy ecosystem play in ensuring adequate quality and quantity of freshwater for basic human needs, for justifiable social, economic development and poverty alleviation. In India water pollution is acquiring a serious dimension as almost 70 percent of its surface water resources and large proportion of groundwater reserves are contaminated by biological, toxic organic and inorganic pollutants. The rights based approach, that this paper seeks to advance, is based on an essentially human centered as it promotes water as social resource.

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