ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIII, Issues– I/A Jan – Feb, 2024

OPEN ACCESS Original Research Article

SUSTAINABLE USE, DEVELOPMENT AND MANAGEMENT OF WATER

* Dr. Anil Dhimdhime

*Assistant Professor, Department of Environmental Studies, Ghanshyamdas Saraf College of Arts & commerce, Malad (W), Mumbai - 400 064.

Abstract

Water is indispensable for existence and survival of plants, animals and humans. The freshwater is the lifeline for agriculture, manufacturing, domestic and numerous other activities. In the recent past we witnessed the misuse and pollution of water all over the world. Water around the world is getting polluted due to human activities and the availability of potable water in nature is becoming rare day by day. If we do not take radical measures to conserve water, there will not be clean water left. Water demand in various sectors is increasing rapidly and this resource is no more an unlimited one. India is no exception to this trend. In view of the strong need to have judicious and sustainable development of water resources, we must undertake ecologically balanced strategies to tackle water scarcity situations. The sustainability of water resources is of the paramount importance for sound economic and social development of India. Therefore, in the present paper the author dealt with the scenario of water resources of India and their management for sustainable development.

Introduction:

Water is the most important of all resources as most living things are made up mostly of water. The planet we live in is covered by about 71% of water. This film of water helps to maintain the climate, dilutes the pollutants and is essential for all living things. Even though most of this water is saline, a fraction of fresh water is constantly recycled and purified by the hydrological cycle. This fresh water (3%) is the lifeline for agriculture, manufacturing and numerous other activities. Water is scarce resource and it is becoming more scarce as time passes. With increasing population and economic development, the demand for water has also increased in domestic, industry, agriculture and energy sector. In the international conference on water security at the Hague, Netherlands (March 2000), it was stressed that access to safe and sufficient water and sanitation are the basic human needs and are essential to help, wellbeing and empowerment of people. And estimated 1.1 billion people lack access to safe drinking water, 2.5 billion people has no access to proper sanitation. It is estimated that by the 2025 two thirds of the world's population is likely to live in countries with moderate or severe water shortages. Many scientists had identified water shortage and global warming as the two most worrying problems for the new millennium. Thus, keeping in view of the above facts, the main aim of this paper is to understand quantitative limits, temporal and spatial

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIII, Issues– I/A Jan – Feb, 2024

OPEN ACCESS Original Research Article

challenges of water and to assess the various water conservation techniques with special reference to India.

Sustainable Development and Water:

The UN Committee of World Environment and Development published "Our Common Future" in 1987. In 1992, the "Agenda 21" was approved by the assembly of Global Environment and Development. The main theme of these two historical events is sustainable development. The emphasis now is on sustainable water resources development as an integral part of national development programs. There are however, different opinions on what constitutes sustainable development. First the development and utilization of water resources should be continuous and sustainable. Second the development and utilization of water resources should be able to meet the requirements of social and economic development.

Integrated water planning and management based on a comprehensive ecosystem assessment, taking full account of the use of water in human activities is the main principle behind the sustainable development and management of water resources. Without the sustainable development of water resources, there will be no sustainable and stable development of society and its economy. Likewise, without the support of the water resources system, the requirements of social and economic development will put undue strain on the water resources which could eventually destroy the water resources system. Sustainable development can be ensured only when the rural areas received benefits of development. For these efforts to succeed rural people should be drawn into the process of decision making so that the decisions are better informed and more closely tailored to the needs of the local people.

It is well known that various human activities are dependent on water for survival. While man has helped himself to be benefit from water resources development, wastage water and overexploitation of the surface and ground water resources has leads to problems of droughts, water logging, depleting groundwater resources and water pollution. The decrease of the water quantity and the degradation of water quality have not only led to environmental degradation but also has jeopardized the sustainable development and utilization of water resources. There are four main problems of water resources management: (i) the disparity between water demand and water supply in the urban and rural areas, (ii) the recurring problem of floods and droughts, (iii) water logging and salinity resulting in loss of agricultural areas, and (iv) water quality related problems due to natural (arsenic, fluoride) and manmade causes (nitrates). There are other problems like loss of storage due to siltation of reservoirs, fall of groundwater levels, recession of glaciers, and salinity ingress in coastal areas. Harmonious development of water resources is therefore essential to manage the above water related problems to ensure sustainable development and utilization of water resources.

Quantitative and qualitative limits to water use

Water availability in India:

The two main sources of water in India are rainfall and the snow melt of glaciers in the Himalayas. It is estimated that some 5,000 glaciers cover about 43,000 sq. km in the Himalayas with a total volume of locked water estimated at 3,870 cub. km. Considering

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIII, Issues– I/A Jan – Feb, 2024

OPEN ACCESS Original Research Article

that about 10, 000 sq. km are located in the Indian territory, the total water yield from snow melt contributing to the river runoff in India may be of the order of 200 cub. meter per year. India receives an average annual precipitation of approximately 4,000 BCM in the form of rainfall and snow melt. After accounting for percolation, evaporation and other losses, less than 50% (1, 869 BCM) is the total surface flow. In view of the constraints of topography, uneven distribution over space and time, water storage technologies and interstate issues, the total utilizable quantity of water is estimated to be 1, 122 BCM per year of which 690 BCM and 430 BCM and utilizable surface and groundwater respectively.

Current and future water requirements:

Currently, more than 80% of the 750 BCM water used in India is for irrigation. The balance 20% is used to meet domestic, energy, industrial and other requirements. With the rapidly growing population and industrial and urbanization activities, the demand for water is expected to increase even faster. Estimates indicate that by the year 2025, the total water demand of 1, 050 BCM will be close to the total utilizable water resources of 1, 122 BCM in the country. Though projections are not available beyond 2025, it is evident that the country can face an acute water crisis unless clear and strategic measures are taken now.

Temporal challenge:

Almost 80% of rainfall occurs in the four monsoon months June-September. In peninsular rivers, where there is no contribution from snow melt, monsoon flow accounts for more than 90% of the annual flow. In this context, retention and storage of water becomes imperative.

Spatial Challenge:

Precipitation in India is not uniformly distributed and varies from less than 100 mm per annum in Rajasthan to more than 2, 500 mm in Assam. Against a national per capita annual availability of 2, 208 cub. m of water, the average availability in Brahmaputra and Barak Basin is as high as 16, 589 cub. m while it is as low as 360 cub. m in the Sabarmati basin. Water availability of less than 1, 000 cub. m per capita is considered by international agencies as scarcity conditions. The Cauvary, Pennar, Sabarmati, East flowing rivers and west flowing rivers are some of the basins with scarcity conditions. In majority of the river basins, present utilization is significantly high and is in the range of 50-95% of utilizable surface resources. In several basins there is also an over withdrawal of groundwater leading to lowering of groundwater tables and also salt water intrusions.

Development of water resources Rainwater harvesting - surface water conservation:

The infrequent rain, if harvested over a large area, yield considerable quantities of water. The examples of ancient rainwater harvesting involve water and moisture control at a very simple level. Often, these consist of rows of rocks placed along the contours of slopes. Contour terraces (also known as linear borders) have been found to be in use in various parts of India. Runoffs captured behind these barriers also allows for the retention of soil, thereby serving as an erosion control measure on gentle slopes.

Collection and storage of rainwater from roofs:

Another method of rainwater harvesting is collection of rainwater from rooftops. This method has advantage over others in which water is harvested from ground

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIII, Issues– I/A Jan – Feb, 2024

OPEN ACCESS Original Research Article

catchments in the sense that water remains without contaminants and is suitable for meeting most domestic requirements. Corrugated galvanized iron roofs have been used to harvest rainwater in many humid regions. For cost effective systems, the roofs can be made of tiles which can be produced on self-help basis. The runoff from rooftops is collected in different kinds of storage tanks which can be above or below ground. This kind of water harvesting system is especially suited for areas having rainfall of considerable intensity spread over a large part of the year.

Groundwater Conservation:

Due to frequent incidence of drought and overexploitation of groundwater, the water table has been declining in many parts of the country. To maintain the groundwater resource indefinitely, a hydrologic equilibrium must exist between all water entering and leaving the basin. The techniques available for maintaining this equilibrium are as follows:

Artificial Recharge:

As the main source of groundwater recharge is rainfall, in its absence the only alternative to replenish the groundwater is to do this by artificial means. Artificial recharge augments the natural infiltration of precipitation or surface water into underground formations. It can be done either by direct or indirect methods. In direct methods, surface water from a river or lake is conveyed to a suitable site , where it is made to enter the aquifer in one way or the other. Spreading of water can be achieved by: (i) flooding water in a relatively flat area, (ii) constructing basins by construction of dykes or small dams and spreading water on them and (iii) distributing water to a series of ditches or furrows. A common method of indirect recharge is based on locating a battery of wells at short distance (50 m) parallel to the bank of a river or lake. As the water is abstracted from the wells, more water joins the aquifer from the river banks.

Groundwater Sanctuary

Groundwater sanctuary in hard rock areas can be developed by impounding the flow of water by constructing dyke across the flow direction of groundwater. A subsurface dam across a valley will convert it into groundwater sanctuaries, and water from there can be drawn during periods of need. Materials like clay, bricks and concrete can be used to construct the dykes, depending upon the local conditions.

Reducing Evapotranspiration:

Evapotranspiration losses can be reduced by reducing evaporation from soil surface and transpiration by plants. The water loss can be prevented by placing water-tight moisture barriers or water retardant mulches on the soil surface. Non-porous materials such as paper, asphalt, latex, plastic film or metal foil could also be used for reducing evaporation from soil surface. Residues of the previous crops can also act as a moisture barrier which requires stringent weed control measures. Conservation of soil moisture is greatly improved by 5-10 mm thick gravel mulches.

Improving Irrigation Practices:

Drip irrigation in which only the adjoining portion of the plant is irrigated is a suitable method of irrigation in water scarce areas. This method is particularly suitable for row crops. Other methods of irrigation like sprinkler irrigation, subsurface irrigation is also suitable for water scarce areas. Use of gated pipes for irrigation can save seepage loss of water in field laterals. In this method, instead of laterals, gated pipes are used to carry water to the head end of the field and depending upon the requirement of

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIII, Issues– I/A Jan – Feb, 2024

OPEN ACCESS Original Research Article

water, the gates are opened.

Reduction of Seepage and Improving Irrigation Efficiency:

In water scarce regions, unlined ditches are used to convey water from its source to the field and a considerable quantity of water is lost by seepage before it is delivered to the field. The discharge capacity of the canal can be increased and the recurring cost of maintenance can also be reduced by lining of field channels.

Reuse of Water:

Reuse of water can significantly reduce the stress on water resources. Waste water after proper treatment can be used for irrigation, industry and even for municipal use. Proper biological treatment of sewage is required before it is put to agricultural use. Industrial waste water can also be used for irrigation after proper chemical treatment.

Inter-Basin and Intra-Basin Water Transfer:

Creation of storage and inter-basin transfer of water from surplus to deficit regions would be a better approach for achieving the objective of equitable distribution of water while ensuring its optimum utilization. If the water surplus rivers like Ganga and Brahmaputra could be linked with the water deficit rivers of peninsular A national perspective plan has been prepared which envisages two components as follows:

(i) the Himalayan river component comprising storage and canal linkages systems to transfer surplus water from Kosi, Gandak and Ghagra to the west; Brahmaputra-Ganga link to augment the lean season flows of Ganga; the Ganga-Yamuna link to serve the drought areas of Haryana, Rajasthan, Gujarat and parts of Uttar Pradesh and south Bihar.

(ii) the peninsular river component which envisages diversion of surplus waters of Mahanadi to the Godavari and the surplus there from to the Krishna, Pennar and Cauvery with terminal dams on Mahanadi and Godavari so that the drought prone areas in the south can be benefited.

Water within a basin can also be transported from surplus regions to regions of water deficit. These transfers have to be properly planned keeping in mind the interest of water users in both the receiving and supplying basins.

Watershed Development Programs:

Watershed development programs typically attempt at improving the water regime through engineering and vegetative measures to maximize the potential of natural resources and increase the income of inhabitants. While supply side measures include engineering interventions such as soil and water conservation measures, check dams, bunding, and other structures together with forestry practices which regulate or even increase water flows, demand sides measures include improved farming practices to reduce the requirements of water.

Traditional Water Harvesting Systems:

India is endowed with a diverse range of traditional water harvesting structures which have over centuries catered to community requirements. These systems are often highly effective, well adapted to local ecological and social conventions and often outperform methods based on modern agronomic knowledge. Some of the indigenous practices are as follows:

(i) In the western and central Himalayas, diversion channels called Kuhls or guhls were built to draw water from hill streams. The length

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIII, Issues– I/A Jan – Feb, 2024

OPEN ACCESS Original Research Article

of these channels varied from 1-15 km and carried a discharge of 15-100 litres per second.

(ii) In Meghalaya, a two hundred years old system of tapping stream water for irrigating plants by using bamboo pipes is prevalent. It is like a modern drip irrigation system.

(iii) The zabo system of cultivation in Kikruma village of Nagaland is combination of forestry, agriculture and animal care with soil erosion control.

(iv) the ahar-pyne system of irrigation is found in south Bihar. Ahars are rectangular catchment basins and pynes are channels constructed to utilize the water flowing through hilly rivers.

(v) Kunds found in the Thar dessert are covered underground tanks with an artificially prepared catchment area to increase runoff. It was developed to supply drinking water.

(vi) Karnataka has been a forerunner in managing traditional water harvesting structures like arakere, volakere, devikere, katte, kunte and kola. The maximum number where 40, 000 tanks still exist today.

(vii) Khatri is a unique way of water storage in various parts of Himachal Pradesh. These are hand-hewn caves located on both sides of the road beneath huge rocks.

(viii) A special water harvesting structure in Kasaragod district of Northern Malabar is called surangam, a tunnel dug through a laterite hillock from the periphery of which water seeps out.

Changes in Water Pricing Structures:

An effective tool for achieving water conservation is to work out an imaginative pricing policy. The higher rates can be proposed for water use beyond a base line amount. Some economic incentives for using small quantities of water may be given to consumers for encouraging water conservation.

Changes in Water use Patterns:

The changing water-oriented lifestyles, habits and uses include taking short shower, reducing bathing frequency, fewer toilet flushing, reuse of residential waste water. Other measures include curbing the habit of leaving taps open when not required, restricting the use of water for watering lawns and gardens etc. Planned water allocation and distribution measures may include proper and regular checks on water distribution system.

Educating People on Water Conservation:

The water conservation education and information to convince the water users about the seriousness of water scarcity or shortage are the vital components of any water conservation program. To do so, water manager should also give sufficient background information and training on water conservation program. There is a need to include such education system at different levels in schools and colleges, so that students are made aware of water conservation practices and are educated to learn to live with water scarcity.

Conclusion:

It is recognized that water is going to be one of the major issues confronting India in the new millennium. It has emphasized that proper water administration is a critical component of sustainable development. The environmental challenges of water resource development and management can be addressed through following approaches:

1. By pursuing decentralization and community water management initiatives,
2. By fostering local institutional development and capacity building,

ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XIII, Issues– I/A Jan – Feb, 2024

OPEN ACCESS Original Research Article

By promoting economic instruments for efficient and sustainable water resources management

3. By supporting innovative approaches to water resource management with the use of appropriate technologies by integrating traditional and modern techniques,
4. by abatement and treatment of water pollution.

In this way, we can both consume less water and reap greater benefits of water conservation. The required strategies take not only money and political will, but time as well. Everyone has a stake in seizing these opportunities to chart a decisive course of action for meeting goal of sustainable water management

References:

Sustainable Development - A. K. Shrivastava; APH Publication Corp. (2004)

Water Resources Development and Management - H. Chandrasekharan, R. K. Sharma, and K. V. Sundaram; Mittal Publication, New Delhi (2004)

Water Harvesting: Ecological and Economic Appraisal - Archana Misra; Author Press Publ. (2006)

Oxford handbook of water resources in India - edited by John Briscoe and R. P. S. Malik; The World Bank (2007).

Agarwal, A., de los Angeles, M. S., Bhatia, R., Chéret, I., Davila-Poblete, S., Falkenmark, M., Gonzalez-Villarreal, F., Jønch-Clausen, T., Aït Kadi, M., Kindler, J., Rees, J., Roberts, P., Rogers, P., Solanes, M. & Wright, A. (2000): Integrated Water Resources Management. GWP-TAC Background Papers no. 4. 43 pp.

ACS Distance Education (Ed.) (2009): SSWM Toolbox. Soil Degradation http://www.sswm.info/category/background/agricultural-issues/land-degradation 27.06.2016).

Bahri, A. (2009): Managing the other side of the water cycle: Making wastewater an asset. GWP-TAC Background Papers no. 13. Stockholm. 62 pp.

Bundesministerium für Bildung und Forschung (2011): Integrated Water Resources Management: From Research to Implementation. Leipzig. 54 pp.

Brown, A. & Matlock M.D. (2011): A Review of Water Scarcity Indices and Methodologies. FOOD, BEVERAGE & AGRICULTURE. The Sustainability Consortium University of Arkansas. White Paper 106. 19 pp.

Burt, C.M. (Ed.) (2000): Selection of Irrigation Methods for Agriculture. American Society of Civil Engineers. 129 pp.

Cite This Article:

Dr. Dhimdhime A. (2024). *Sustainable Use, Development and Management of Water*. *In Aarhat Multidisciplinary International Education Research Journal: Vol. XIII (Number I, pp. 93–99).*

AMIERJ. *https://doi.org/10.5281/zenodo.10565993*