EDUZONE: International Peer Reviewed/Refereed Multidisciplinary Journal (EIPRMJ), ISSN: 2319-5045
Volume 12, Issue 1, January-June, 2023, Available online at: www.eduzonejournal.com

Water Resources: Its Demand, Degradation and Management

Wazir Singh[1], Prof. (Dr.) Inder Singh[2]

[1]Research Scholar, Department of Geography, Baba Mastnath University, Asthal Bohar, Rohtak-124021
[2]Professor, Department of Geography, Baba Mastnath University, Asthal Bohar, Rohtak-124021

INTRODUCTION

The country's population has already passed one billion and is expected to reach 1.64 billion by 2050. Cities and villages expand rapidly, new villages appear and old villages are transformed into villages. Everyone needs and needs drinking water to sustain life. India's economy has traditionally been based on agriculture. Therefore, the development of irrigation to increase crop production, ensure the country's self-sufficiency and reduce poverty was critical to planners. According to currently available water demand statistics, the agriculture sector is the largest user of water in India. About 83% of usable water is used exclusively for agriculture. The amount of water needed for agriculture has gradually increased over the years as more and more areas have been irrigated. Since 1947, the area of irrigated land in India has increased from 22.6 million hectares by June 1997 to 80.76 million hectares. The use of surface water and groundwater resources for irrigation has played an important role in India's past achievement of self-sufficiency in food production. Thirty years, but this will become even more important in the future in the context of national food security.

Keywords:-agriculture based economy, water demand, agriculture sector, water resources, consumer

Growing Demand:-

India's population is increasing day by day. A number of agencies have estimated the projected population of India by 2025 and 2050. According to NCIWRD, India's population is projected to reach 1.333 billion and 1.581 billion by 2025 and 2050, respectively, in a rapid growth scenario. Taking into account consumption levels, losses during storage and transportation, and the need for seed and buffer stocks, projected demand for grain and feed in 2025 and 2050 will be 320 million tonnes and 494 million tonnes, respectively (high demand scenario). . Hence, there is an annual demand for water for irrigation, domestic demand, hydropower, industry and other purposes. Most of future demand will have to be met by groundwater resources. Rainwater seeps into the surface and becomes groundwater. Leakage also occurs in surface water. Both of these methods collect large amounts of water from beneath the earth's surface. This is the so-called groundwater. According to the Central Groundwater Board, renewable groundwater capacity in India (1994-95) was about 431 billion cubic meters per year. Of this, about 396 billion cubic meters of water is usable. The distribution of groundwater is not the same everywhere. The availability of groundwater depends on the amount of precipitation, the nature of the precipitation, the nature and slope of the land. Water seeps through easily in areas with heavy rainfall, where the ground is mostly flat and has porous rocks. Therefore, groundwater is abundant at shallow depths in this area. In regions such as Rajasthan, where the land is flat and has porous sandy soils, less groundwater is available at greater depths due to lack of rainfall. In the northeastern region, where the land is loose, water infiltration conditions are not good even though there is a lot of precipitation. As a result, groundwater is available in smaller amounts even at greater depths in these areas.

The Ganges-Brahmaputra plains and coastal plains contain large reserves of groundwater. The availability of groundwater is less in the highlands, Himalayan and desert areas of the peninsula. Utilization of Groundwater Capacity Groundwater is widely used in areas with relatively low rainfall. Groundwater is used on a large scale in Punjab, Haryana, Rajasthan, Tamil Nadu, Gujarat and Uttar Pradesh, while Andhra Pradesh, Madhya Pradesh, Maharashtra, Karnataka and Chhattisgarh are states with limited groundwater use despite low rainfall. The need for groundwater resource development is great.

Water Budget:-

The water budget fund is the balance between available water and used water in a country. The distribution of water resources varies greatly in space and time. Sufficient water is available during the rainy season. With the onset of the dry season, water is scarce. The reserves of surface water and groundwater are approximately 23.84 trillion cubic meters. Of that, only 10.86 trillion cubic meters of water is needed for use. The unit for measuring the amount of water is the cubic meter or hectare meter. If a perfectly flat area of 1m2 contains water 1m deep, then the total volume of all this water is 1m3.

In the same way, if water is 1 meter deep in a perfectly flat area of 1 hectare, the total volume of water will be 1 hectare meter.

Table 1: Annual Surface water requirement for different uses27 (in km3)

Sl. No	**Use(Surface water)**	**Year 2010**	**Year 2025**	**Year 2050**
1.	Irrigation	339	366	463
2.	Domestic	24	36	65
3.	Industries	26	47	57
4.	Power	15	26	56
5.	Inland navigation	7	10	15
6.	Environment-Ecology	5	10	20
7.	Evaporation Losses	42	50	76
	Total	458	545	752
Use (Ground water)				
8	Irrigation	218	245	344
9	Domestic	19	26	46
10.	Industries	11	20	24
11.	Power	4	7	14
Total		252	298	428
Grand Total		710	843	1180

In India, 90% of the precipitation falls in a short three-month period from June to August. The number of rainy days in India varies greatly. The average number of wet days on the West Coast is 137. In Rajasthan, the average number of rainy days has fallen to less than 10 days. Precipitation patterns also vary. In areas with high rainfall, rainfall can be heavy and constant, and in areas with low rainfall, rainfall can be light and intermittent. Therefore, there are large differences in the distribution of precipitation by region. About 8% of the country's regions receive more than 200 cm of precipitation, and 20% of the regions receive between 125 and 200 cm. The remaining 30% of the territory receives less than 75 cm of precipitation. The uneven distribution of precipitation causes uneven distribution of surface water and groundwater. Average annual rainfall in India is 4000 km3, of which 700 km3 is immediately lost to the atmosphere, 2150 km3 is absorbed by the soil and 1150 km3 remains as runoff. The country's total water resources are estimated at 1953 km3. Almost 62% or 1202 km3 of all water resources are in the Ganges-Brahmaputra- Meghna basin. The total water resources of the remaining 23 basins are 751 km3. In terms of available water resources in India, annual water availability is 1122 km3. It will also receive an additional return flow of 123 km3 to 169 km3 through increased use for irrigation, domestic and industrial purposes by 2050.

Table 2: Per Capita Availability of Water

Year	**1951**	**1991**	**2010**	**2025**	**2050**
Population (10^6)	**361**	**846.3**	**1,157**	**1,333**	**1,581**
Average WaterResources (m^3/person/year)	**3,008**	**128.3**	**938**	**814**	**687**

The per capita availability of utilizable water, which was about 3,000 m3 in the year 1951, has been reduced to 1,100 m3 in 1998 and is expected to be 687 m3 by the year 2050.

Water Resources at A Glance:-

The total volume of water in the hydrosphere is estimated to be about 1.36x109km3, of which 97.3% is locked up in the oceans as sea water, and another 2.1% in ice caps and glaciers. Freshwater, essential for sustenance of terrestrial life (plants, animals, and humans) constitutes about 0.6% of the total water inventory. A bulk of this freshwater occurs as ground water and as soil water, which can be extracted only by plants. Freshwater in lakes streams and the atmosphere constitutes less than 0.05% of all water on the Earth. Atmosphere alone contains only 13000km3 or 0.001% of Earths water inventory.

Table 3: Water resources in India

Sl. No	Water resources	Quantity
1	Annual Precipitation	4000 BCM
2	Available water resources	1869
3	Utilizable a)Surface water (Storage and diversion)b)Groundwater (Replenishable)	1122 690 432
4	Present utilization(Surface water 63%,groundwater37%	605
5	Irrigation	501
6	Domestic	30
7	Industry, energy and other uses	74

In most studies, India's water resources are estimated at 188 billion cubic meters. m, the total available water resources vary considerably. NCA has estimated total usage at 1.5 trillion cubic meters. According to CWC, India's total available water resources are 1110 bcm, whereas NCIWRDP estimates 1086 bcm plus an additional return flow (123 bcm) for low demand scenarios or 169 bcm for high demand scenarios. Thus, according to NCIWRDP, the total available water resource of 1,086 bcm will further increase to 1,209 bcm or 1,255 bcm depending on the low or high demand scenario.

Water Quality Deterioration:-

Groundwater accounts for more than 80% of the rural domestic water supply in India. Data collected in 1998 for the 54th round of the National Sample Survey showed that 50% of rural households were served by a tubewell, 26% by a well, and 19% tap. In most parts of the country, however, the water supplied through groundwater is beset with problems of quality. The over dependency on groundwater has led to 66 million people in 22 states at risk due to excessive fluoride and around 10million at risk due to arsenic in six states. India's Tenth Five Year Plan lists excess fluoride concentration as one of the major hurdles to the sustainable supply of safe water for domestic use. Twenty Indian states have excess fluorides in the ground water. Nearly six million children below the age of 14 suffer from dental, skeletal and non-skeletal fluorosis.

The presence of arsenic in water is geogenic. The entire gangetic delta plain, which consists of alluvial soil, contains arsenic in the deeper aquifers. Bacteriological contamination, especially fecal coliform, is the most widespread groundwater problem in India. Groundwater itself doesn't inherently contain fecal coliform. Most of the ground water coli forms come from the leaching of solid (human and animal) and liquid waste. In addition, there are problems due to excessive salinity, especially in coastal areas, iron, nitrates and others. Around 195,813 habitations are affected by poor water quality due to chemical parameters.

Table 4: Water quality problem in rural areas

Nature of Problem	No. of habitation affected
Excess fluoride	36988
Excess arsenic	3553
Excess salinity	32597
Excess iron	138670
Excess nitrate	40003
Other reasons	1400
Total	217221

Management of Water:-

India covers over 3 million square kilometers and has a diverse climate, landscape, geology, flora and fauna. Here, water played a crucial role in the last part of the last century and promises to play an even more important role in India's future. Thus, India's water situation after 60 years of independence is characterized by water scarcity and lack of coordinated planning. Much of India is vulnerable to changing floods and droughts. In many parts of the country, the water table continues to decline due to overdraft. Assured clean water supplies are lacking in urban centers and in rural villages. Currently, two major themes are receiving attention to overcome India's woes; rain-harvesting and interlinking of major rivers. In Indian conditions, the availability of water is highly uneven in both space and time. The total average annual flow per year for Indian rivers is estimated as 1953km3.The total annual replenishable ground water resources are assessed as 432km3.The annual utilizable surface water and ground water in India are estimated at 690 km3 per year respectively26.With rapid increase in population and improved living standards, the pressure on our water resources is also increasing, while availability of water resources is declining day by day. Production of food grains has increased from around 50 million tons (mt) in 1950s to about 208 mt in the period (1999-2000).This will have to be raised to around 350 mt by the year 2025.The drinking water needs of people and livestock also have to be met. In these hot conditions, it is important to manage water resources in all areas. Water management is no longer just about moving water. Water management practices can be based on increasing water supply and managing water demand under water supply stress. Monitoring, processing, storage, retrieval and dissemination of data are critical aspects of water management.

Draught Management:-

The planning and management of the effects of draught appear to have a least priority due to associated randomness and uncertainty in defining the start and end of draught. Presently, the draught prone area assessed in our country is of the order of 51.12 Mha. Most of the draught planning and management schemes are generally launched after persisting draught conditions. Food fodder agriculture inputs and water banks may be established in vulnerable zones instead of their storage in surplus regions to avoid transport bottlenecks during draught. Robust and rainfall independent off-farm livelihood opportunities may be targeted in the draught mitigation strategy. For draught management there is a need for development of decision support system (DSS) for the monitoring and management of draught on basin scale utilizing the advanced capabilities of remote sensing, geographical information system and knowledge based systems.

Flood Management:-

As per the report of Central Water Commission (CWC) under the Ministry of Water Resources, Government of India, the annual average area affected by floods is 7.563Mha.This observation is based on the data for the period 1953-2000 published by Indian Water Resources Society (IWRS).Thirty three million people have affected during this period. The main causes of floods in India are river bank erosion, silting of silver beds and inadequate capacity of river banks to contain high flows. Sometimes landslides often obstruct the river to flow and make its diversion in course. Poor natural drainage in flood prone areas, heavy rainfall, cyclonic effects, snow melt and glacial outburst also responsible for flood. As stated by Mahapatra and Singh, Flood management programme were launched at the nation level by the Government of India after the devastating flood of 1954. After 1954, the Government of India established many commissions and received some important recommendations from the commissions on flood control issues. Various types of structural and non-structural measures have been taken to reduce floodplain damage. As a structural measure, some states have implemented the construction of dams, dams, and spurs. Currently, 16.8 thousand km of dams and 32.5 thousand km of drainage channels have been built. Currently, 1040 cities and 4760 villages are protected from flooding. Non-structural measures such as flood forecasting and warnings are also being taken. CWC has established a flood forecasting system covering 62 major rivers and has more than 157 flood forecasting stations covering nearly all flood prone states. In 1999, the Department of Water Resources organized satellite remote sensing of flood risk areas to spur floodplain zoning action.

Groundwater Management:-

According to National Water policy, the detrimental environmental consequences of over exploitation of ground water need to be effectively prevented by the Central and State Governments. Over exploitation of groundwater should be avoided, especially near the coasts to prevent ingress of seawater to freshwater aquifers. In critically over exploited areas, borewell drilling should be regulated till the water table attains the desired elevation. Artificial recharge measures need to be urgently implemented in these areas. Amongst the various recharge techniques percolation tanks are least expensive in terms of initial construction costs. Many such reservoirs already exist, but most of these structures are submerged. In this case, cleaning the bottom of the tank will allow it to be reused.

Water Conservation:-

Water conservation implies improving the availability of water through augmentation by means of storage of water in surface reservoirs, tanks, soil, and groundwater zone. It emphasizes the need to modify the space and time availability of water to meet the demands.

There is a great potential for better conservation and management of water resources in its various uses. On demand side, a variety of economic, administrative and community-based measures can help conserve water. Also it is necessary to control the growth of population since large population since large population is putting massive stress on all natural resources.

Since agriculture accounts for about 69% of all waters are withdrawn, the greatest potential for conservation lies in increasing irrigation efficiencies. Just 10% improvement in irrigation efficiency could conserve enough water to double the amount available for drinking.

Watershed Management:-
Watershed is the unit of management in Integrated Water Resources Management (IWRM), where surface water and groundwater are inextricably linked and related to land use and management. Watershed management aims to establish a workable and efficient framework for integrated use, regulation and development of land and water resources in a watershed for socio economic growth.

Local communities play a central role in the planning, implementation and funding of activities within participatory watershed development programmes. In these initiatives, people use their traditional knowledge, available resources, imagination and creativity to develop watershed and implement community centred programme.

Rainwater Harvesting:-
Rainwater harvesting is the collection, diversion, and storage of rainwater for a variety of purposes, including but not limited to landscape irrigation. Rainwater harvesting may also include above-ground systems with man-made landscaping to direct and concentrate rainwater into storage tanks or crop areas. Old techniques are gaining popularity in new ways. This is rainwater harvesting. Catchments need to replenish aquifers and store rainwater. Even in ancient days, people were familiar with the methods of conservation of rainwater and had practice them with success. Different methods of rainwater harvesting were developing to suit the geographical and meteorological conditions of the region in various parts of the country. Those are capturing runoff from rooftops, capturing runoff from local catchments, capturing seasonal floodwaters from local streams, conserving water through watershed management etc. These techniques can serve the following the following purposes: provide drinking water, provide irrigation water ,increase groundwater recharge ,reduce storm water discharges, urban floods and overloading of sewage treatment plants, Reduce seawater ingress in coastal areas. Traditional rainwater harvesting; which is still prevalent in rural areas, is done by using surface storage bodies like lake, ponds, irrigation tanks, etc. The Kul (diversion canal) irrigation system is an example of this type. The system carries water from the glacier to the village. In urban areas, rainwater must be collected from rooftops and open spaces. Rainwater harvesting not only reduces the likelihood of flooding, but also reduces society's dependence on groundwater for household needs. In addition to filling the gap between supply and demand, refilling also improves the quality of groundwater, increases the level of groundwater in wells, wells, and prevents flooding and clogging of drains. Rainwater harvesting generally means collecting and storing rainwater. Its special significance is the technology of recharging groundwater. This method collects rainwater locally without polluting it and then goes down to the ground. In this way, water can be supplied while local domestic demand is short. Now the question arises. Why do I need to collect water? The three main reasons contributing to this are: 1. Shortage of surface water; 2. Increased dependence on groundwater; 3. Growing urbanization.

Recycle and Reuse of Water:-
Due to population pressure demand of water is gradually increasing in India. The water demand could be reduced through the practices which require less water and reduce wastage of water and misuse of water. First of all there should be a balance between water demand and water supply. Economic incentives or penalties to be applicable to the users for ideal water management. Water rationing system may also be introduced. These may be based on strategies that include legal restrictions, economic incentives and issuance of public appeals.

Desalinization of water:-
About 70% of Earth's water resources are seawater. Since the 1970s, various desalination technologies have been developed, including distillation, reverse osmosis, and electrolysis. These technologies are particularly suited to coastal areas where drinking water is low and brackish water is high. Desalination costs are currently declining and around Rs 50/m3 so the above technology can be widely applied in coastal.

CONCLUSION

Water is life on Earth. It is one of the most important natural resources to sustain life, and is likely to become very scarce in the coming decades due to rising demand, rapid population growth, and national economic expansion. The in homogeneity of climate characteristics both in time and space determines the distribution of precipitation in India. This presents a challenge to existing water resources and those responsible for water management. Hydrological studies are needed to assess water resources under changing climate scenarios. To obtain safe drinking water, it is important to obtain reliable and accurate information about water quality. Water in its natural habitat must be carefully managed if life on Earth is to be fully maintained.

REFERENCES

[1] Central Pollution Control Board, Water quality in India:Status and trend(1990-2001),New Delhi1999.
[2] Central Statistical Organization, 1999. Compendium of Environmental Statistics, Ministry of Planning and Programme Implementation, New Delh i,
[3] Central water Commission Report, 1993. Reassessment of water resources potential of India, CWC, New Delhi.
[4] Garg N. K. & Hassan Q. 2007. Alarming scarcity of water in India.,Curr.Sci.,93(7),932-941.
[5] Ghosh A. 2007. Current knowledge on the distribution of arsenic in groundwater in fivestates in India.J.Environ.Health Part A, 42,1-12.
[6] Gupta SK and Deshpande RD. 2004. Water for India 2050, First order assessment of available options.Curr.Sci.86(9):1216-1224.
[7] Mahapatra,PK and Singh,RD. 2003. Flood Management in India, J. Natural Hazards, (28):131-143.
[8] Mall,R.K., Gupta,A.,Singh,R.,Singh,R.S.,and Rathore,L.S.,Water resources and climate change: An Indian Perspective,2006,vol.90(12).,1610-1626.
[9] Montgomery AM. and Elimelech M. 2007. Water and environmental sanitation in developing countries: including health and education, 41, 17– 24.
[10] National Water Policy, 2002. Government of India, Ministry of Water Resources. New Delhi, April, 2002.
[11] Oaksford ET. 1995. Artificial recharge: Methods, hydraulics and monitoring: In Artificial Recharge of Ground water (ed, Asamo T), Butterworth Publishers, Boston.
[12] Rao S. M. and Mamatha P. 2004. Water quality in sustainable water management. Curr. Sci., , 87: 942–945.
[13] Rashtriya Barh Ayog, 1980. Report Vol.I, Ministry of Energy and Irrigation, New Delhi.
[14] Srikanth,R.2009. Challenges of sustainable water quality management in rural India; 97(3).,317-325.
[15] Wani SP, Sreedevi TK, Reddy TSV, Venkateswarlu B and Prasad CS. 2008. Community watersheds for improved livelihoods through consortium approach in drought prone rain-fed areas. Journal of Hydrological Research and Development. 23:55-77.
[16] World Bank, 1998. India: Water resources management sector review. Ground water regulation and management report,Washington D C., ,P.98.