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A Study on the Challenges Regarding Conservation of Water Resources in Rajasthan

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ABSTRACT

Water can not be produced but conserving water is equivalent to production of water. Rajasthan has worked on two side water conservation theories. (i) Supply side (ii) Demand side water Supply Side Water Conservation Activities;- Harvesting the available surplus rainfall runoff by Efficient use of existing resources ,Water Harvesting, Artificial Ground water recharging,Increase in use of treated water,Demand Side Water Conservation Activities;- Various interventions taken for demand side water conservations are as under Diversification in cropping pattern,Micro irrigation system,IEC activities to use water optimally.

KEYWORDS: *conservation, water resources, Rajasthan, harvesting, recharging, micro-irrigation, cropping.*

Introduction

In Rajasthan, tTransformation of flow irrigation into pressurized irrigation system in 3.6 Lac ha. Command area of six IGNP lift scheme's Repair, Restoration and Renovation works to enhance the efficiency of the existing. irrigation systems, 137 major / medium and minor irrigation systems amounting to Rs 2576.86 crore funded by JICA are started in phased manner, in First phase work of 33 structures amounting to Rs 450.0 crore is in progress. Scheme will benefit about 4.70 Lac ha CCA. To enhance the efficiency of the existing irrigation systems, relining works of IGNP. stage Ist canal system in Rajasthan portion funded by NDB amounting to Rs 3291.0 crore and relining work of Rs IGF in Punjab portion amounting to Rs 1306.0 crore are sanctioned under Rajasthan Water Sector Restructuring Project in Desert. Phase Ist works of amounting to Rs 900 crore are in progress. It will benefit about 4.86 Lac ha CCA & reclamation of 22831 ha water logged area. The scheme will make possible diversion of surplus flood water flowing to Pakistan and utilisation of Ravi & Beas surplus water. Under CSS Repair, Restoration and Renovation of 36 MIW amounting to Rs 98.0,crore, benefitting CCA 5614.0 ha is in progress. Extension renovation and modernization work of 152 irrigation systems and, progress. Repair, Restoration and Renovation works of 8 medium irrigation projects funded, by world bank benefitting 1.1 lacs ha are in progress[1,2]

Rajasthan government has taken policy decision to create all new irrigation schemes on pressurized irrigation system WRD has taken up works of 10 new irrigation projects under pressurized, irrigation system in command area of 2.87 Lac ha area. 8 new medium irrigation projects benefitting 51717 ha area are in progress. 49 new minor irrigation works benefitting 10708 ha area are in progress. 394

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Micro Irrigation Tanks has been constructed for benefitting 10222.0ha CCA 36235 water harvesting structures constructed for ground water recharging 63693 works for catchment area treatment has been completed for water and soil conservation

- 23158 roof top rain water harvesting structures constructed
- 16948 Mini Percolation Tanks constructed
- 284 recharge shaft for aquifers constructed
- 1490 other MIT, de-silting, WHS deepening etc constructed[3,4]

Rajasthan is the Desert State and know the importance of the water¬ conservation measures. Rajasthan is trying hard to conserve water by all possible means. As per the report published by Niti Ayog 2018, on "Composite Water- Management Index" Rajasthan is placed at first rank in "Change in state-level performance over time-Non-Himalayan states and North-Eastern and Himalayan states Change in Composite Water Index scores" As per the above said report "Rajasthan has improved scores across the¬ indicator themes, including the provision of a greater role to Water User Associations (WUAs)38 in irrigation, and the restoration of surface water bodies. Building on this momentum, Rajasthan has received a $100 million loan from the New Development Bank (NDB) in 2018 to improve the Indira Gandhi Canal system, with WUA strengthening and water body restoration expected to be key activities in the proposed plan

Rajasthan is the largest state in India covering an area of 34.22 million hectares, i.e., 10.5 percent of the country's geographical area, but sharing only 1.15 percent of its water resources. The state is predominantly agrarian as the livelihood of 70 percent of its people depends on agriculture-based activities. Most of the state (60-75%) is arid or semiarid. In the last 50 years, a threefold increase in the human population and a doubling of the livestock populations have put tremendous pressure on the fragile water and land resources of Rajasthan. Recurring and prolonged droughts, particularly in the western arid part of the state, is a common phenomenon exacerbating water shortages. The estimated annual, per capita water availability in the state during 2001 was 840 m3 and it is expected to be 439 m3 by the year 2050, against the national average of 1,140 m3 by 2050. Groundwater is overexploited in many districts of the state. This study examines the potential for water harvesting and conservation against drought in the Indian state of Rajasthan. It indicates that despite water resources depletion, the state still has significant potential for harvesting and conserving water if an integrated water resources management approach is adopted, and proper policies and investment actions are implemented using recent technologies. The study suggests the following promising components of the water harvesting and conservation potential of the state. Rajasthan has about 50 million hectares of rocky/stony terrain. Over the existing storage, it offers the possibility of harvesting and conserving 90-145 million cubic meters (MCM) of runoff annually by developing suitable rainwater harvesting structures. Many additional sites have been identified for traditional water harvesting systems throughout the state and, when developed, they can satisfy the water requirements of large populations.[5,6] A case study in Jodhpur district has shown that with the existing and proposed rainwater harvesting structures, over 68 MCM of water will be available even during severe drought, which may suffice to meet nearly 69 percent of the drinking water requirement of villages. Multiple existing tanks/reservoirs for storage and conservation of runoff need urgent rehabilitation. Rehabilitation could lead to additional storage that could be utilized in dry years. The state has 216 cities, which generate 522 MCM of utilizable roof runoff annually. Excluding losses, a potential of 265 MCM of runoff from roof surfaces is available from urban catchments for harvesting and conservation in underground cisterns or for recharging groundwater aquifer through bore wells, to mitigate drought. This could meet the domestic water requirements of nearly 9 million people. High flash floods, though occurring once in about 10 years, can bring as much as 22.6- 54.8 billion cubic meters (BCM) of additional water in one year. This is comparable to

55.7 BCM of free underground storage, accumulated in the state during the last 20 years due to groundwater exploitation. Taming the excess flood water to rejuvenate the depleted aquifer is a major financial and technological challenge. Surplus water of the Indira Gandhi Canal may also be utilized to recharge the depleted aquifer. In-situ water conservation on vast arable lands, recharging of the soil profile, runoff harvesting and its efficient and economic utilization through drip, sprinkler or conservation irrigation are vital for drought mitigation. It is estimated that one year's drought-relief funds may be sufficient to develop rainwater harvesting structures to meet drinking water requirement in rural areas of western Rajasthan.[7,8]

The mean annual rainfall of the state is 490 mm with the local averages ranging from 100 mm in the northwestern part of Jaisalmer to over 1,000 mm in Jhalawar. Arid or semi-arid areas occupy 60-75 percent of the state. Droughts of varying intensity, particularly in the western part, are a recurring phenomenon. During 1901-2003, western Rajasthan experienced 20 moderate droughts (with 50% to 75% of the normal annual rainfall) and 10 severe droughts (rainfall below 50% of the normal) compared to 14 moderate and 5 severe droughts in eastern Rajasthan. During the last 50 years, the human population has increased threefold and currently stands at 58.20 million. The cultivated area is 20,798,311 hectares with a cropping intensity of 124 percent, which leads to an increasing demand for water in the same or in a higher proportion. All this calls for an exploration of the potential for water harvesting, its conservation and efficient utilization to withstand growing demand, especially during droughts. The objective of this study was to assess the traditional and innovative water harvesting and conservation technologies in the context of their potential for drought mitigation throughout the state of Rajasthan.[9,10]

Discussion

Problems: Water resource of Rajasthan is facing problems of over-exploitation, water logging, salinity, and fluoride and nitrate contamination in most of the districts of the state:

Over exploitation: There is a progressive increase in ground water draft in Rajasthan because of increasing population, urbanization and industrialisation. The limited availability and distribution of the surface water resources puts extra pressure on the groundwater resources and this has resulted in their over-exploitation. As per present groundwater resource estimates, out of total 295 blocks in the state, 184 blocks are categorized as Over-exploited, 34 blocks as Critical, 29 blocks as Semi Critical and 3 blocks as saline. Remaining 45 blocks, which have been categorized as Safe, have limitations for groundwater development due to its poor quality, deep water levels or falling in canal command area. Taranagar Block of Churu, Khajuwala Block of Bikaner and Rawatsar Block of Hanumangarh districts have not been assessed due to poor quality in the entire blocks. [11,12]

Arsenic in ground water: The arsenic concentration in groundwater of Rajasthan crossed the safety limit and is therefore unsafe for drinking purposes. As per the groundwater estimates, out of 33 district of Rajsthan, 4 districts (Churu, Sikar, Gangapur and Hanumangarh) are contaminated with arsenic above the WHO standard of 10 µg/L. Arsenic concentration is also reported in the mining areas of Rajasthan, especially around the mining areas of Khetri Copper Complex and Zawar mines in Jhunjhunu and Udaipur districts respectively.

Fluoride in ground water: Rajasthan is the only state in India where almost all the districts are affected by high fluoride. As per the estimates of CGWB, out of total 33 districts in the state, 30 districts are categorized as fluoride contaminated district. Of the 13,334 habitations affected by fluoride in the country, Rajasthan has 6,589 where more than 45 lakh people live, report said. Fluorosis, a disabling disease, is caused by drinking fluoride-contaminated water. The Thar Desert covers most of the area affected by fluoride. Ajmer, Nagur, Pali, Jalore, Jaipur, Jodhpur and Sirohi districts are worst affected by fluoride with average concentration of 2mg/l. Due to the higher level of fluoride in drinking water, several dental and skeletal diseases have been reported in the state. The

favourable factor which contributes to rise of fluoride in ground water is presence of fluoride rich rock system in the state. Fluoride enters into soil through weathering of rocks, precipitation and impure water, mainly from waste run-off and fertilizers. [13]

Nitrate in groundwater: Another contaminant which is commonly found in groundwater of Rajasthan is Nitrate. The contamination of groundwater from nitrate has become an environmental and health problem in the state. Nitrate pollution is caused by the intensive use of nitrogen fertilizers, irrigation with domestic wastewater and use of manure. The nitrate concentration in groundwater is influenced by rainfall. Where the amounts of rainfall are low, the concentration tends to be high because the diluting effect is reduced. Almost all of Rajasthan suffers from the problem of high nitrate concentrations. Ajmer, Sawai Madhopur, Jaisalmer, Jaipur, Bharatpur, Jalore, Nagaur, Sikar, Sirohi, Barmer, Jodhpur, Churu, Jhalawar, Tonk & Udaipur districts are worst affected with nitrate concentration where have nitrate values beyond permissible limit. High nitrate levels found in drinking water have been proven to be the cause for numerous health conditions across the world such as gastrointestinal cancers, methaemoglobinaemia, alzheimer's disease, vascular dementia, multiple sclerosis in human beings. Water Logging Water logging is a severe problem in outside basin and Chambal basin in the state. The causes are seepage from canals in the outside basin, and over irrigation in the Chambal basin. As a result of rise in water tables, 145,600 hectares has turned critical (water table within six meters of land surface). A far more serious problem is anticipated in stage-II of IGNP. Experts believe thousands of hectares of land will be submerged in 25 to 30 years.

Salinity: Rajasthan is the largest State of India having significant volume of saline groundwater especially in its western parts covering about 97673.13 Sq.Km. areas falling in 16 districts of state. The total saline groundwater available in the State has been assessed as 3053.38 MCM while the gross draft is 592.75 MCM.[14,15]

Results

In almost all parts of Rajasthan, different methods are used to conserve water. In the historic times, the kings had built many resources for water conservation. Ponds, lakes, wells, step-wells are found in different district of Rajasthan highlighting the importance the people of this state give to water conservation. The Jaisamad Lake which was built by Mewar's Maharana Jai Singh in the later half of the 17th century is the best example of water management system. This artificial lake built on Gomati river is one of the oldest example of water conservation by diverting and connecting rivers and lakes. The Jaisamad Lake which was built by Mewar's Maharana Jai Singh in the later half of the 17th century is the best example of water management system. This artificial lake built on Gomati river is one of the oldest example of water conservation by diverting and connecting rivers and lakes. Maharana Fatehsingh got a dam constructed on Ayad river near Udaipur city to divert excess rainwater to Fatehsagar.

Traditional storage structures

1. Tanka: Tanka is an old rain water harvesting structure of Rajasthan. These are available in different shape and sizes, round shaped and rectangle shaped Tanka are common in area. Size of Tanka is depend on available water harvesting area near by it. Tanka can be connected with RRWHS also but traditionally it is connected to "Aagor" (sloped nearby area of Tanka) from where rain water is collected to the storage. Tanka can be made by cement masonry or lime or stones. This should be non-water leakage structure so water can be stored for long time.

Basic characteristics of Tanka for better storage qualities: Š Tanka should not be located close to a source of contamination, such as a septic tank etc. Š Tanka must be located on a lower level than the roof to ensure that it fills completely. Š A rainwater system must include installation of an overflow pipe which empties into a nonflooding area. Š Excess water may also be used for recharging the aquifer through dug well or abandoned hand pump or tube well etc. Š A speed breaker plate must be provided below inlet pipe in the filter so as not to disturb the filtering material. Š Storage tanks

should be accessible for cleaning. Š The inlet into the Storage tank should be screened in such way that these can be cleaned regularly. Š Water may be disinfected regularly before using for drinking purpose by chlorination or boiling etc[13,14]

2. Nada/Nadi: These are pond sized structure with variable and high water storage capacity. Basically the share of Nada/Nadi is circular but it is changed by various weather activities and generally the shape will become irregular with time. These structures are multipurpose structures that can be used for drinking water for human and other livelihood, for bathing or other activities. In some villages it was found that the Nada and Nadi are separate for human and animal drinking purposes. Basic difference in Nada and Nadi is Nada is bigger than Nadi in size. Nada/Nadi should store the runoff from extreme events and it is well known that this runoff transports high loads of suspended sediment. In the storage, the water velocity decreases and as a result suspended particles settle As a result of the process of capturing sediment, retention ponds gradually become filled with sediment and thus their retention capacity diminishes. So, there is a need for regular evacuation of soil and other organic/inorganic material from Nada/Nadi to prevent the reduction in its storage capacity. The soil evacuate from storage is either used for social/religious purpose of village or sell by local government boards.

3. Roof rain water harvesting system: Rainwater harvesting is the accumulation and storage of rainwater for reuse on-site, rather than allowing it to run off. Rainwater can be collected from rivers or roofs, and in many places, the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation, or collected from dew or fog with nets or other tools. Its uses include water for livestock, irrigation, domestic use with proper treatment, indoor heating for houses, etc. The harvested water can also be used as drinking water, longer-term storage, and for other purposes such as groundwater recharge. The most useful rainwater harvesting technic is roof rain water harvesting system in arid and semi-arid area of Rajasthan. The percolation rate is high so the other harvesting system is not suitable in this area. Rooftop Rain Water Harvesting is the technique through which rain water is captured from the roof catchments and stored in Tanka (Prasad et al. 2017). Harvested rain water can be stored in sub-surface ground water reservoir by adopting artificial recharge techniques to meet the household needs through storage in tanks. The Main Objective of rooftop rain water harvesting is to make water available for future use. Capturing and storing rain water for use is particularly important in dry land, hilly, urban and coastal areas. Advantages of Rain Water Harvesting system can be listed as; (1) Provides self-sufficiency to your water supply. (2) Reduces the cost for pumping of ground water. (3) Provides high quality water, soft and low in minerals. (4) Improves the quality of ground water through dilution when recharged to ground water. (5) Reduces soil erosion in urban areas. (6) The rooftop rain water harvesting is less expensive. (7) Rainwater harvesting systems are simple which can be adopted by individuals. (8) Rooftop rain water harvesting systems are easy to construct, operate and maintain. (9) In saline or coastal areas, rain water provides good quality water and when recharged to ground water, it reduces salinity and also helps in maintaining balance between the freshsaline water interfaces. (10) In desert, where rain fall is low, rain water harvesting has been providing relief to people.[12]

Conclusions

Scarcity of water, poor natural resources and desertification are the most critical issues of Rajasthan. The state has the highest probability of drought occurrence in the country. Agriculture and animal husbandry are the major sources of livelihood. However, scanty rainfall and low availability of underground water make the occupations uncertain and generate low returns. Poor income has led to several other challenges in the region, including malnutrition, women's drudgery, distress migration and exploitation of natural resources. Considering the rising stress on natural resources in the region, WOTR (Watershed Organisation Trust) has primarily focused on enhancing livelihood security for the community through sustainable management of natural resources. WOTR is rendering support to

the tribal, poor and marginal families to help them earn sustainable livelihoods and break the vicious cycle of poverty. WOTR has worked in 5 districts of Rajasthan – Barmer, Dungarpur, Pratapgarh, Udaipur, and Karauli. Currently WOTR is operating in Mandrail block of Karauli district in Rajasthan. We are actively working in 3 villages of the district – Chaube ki Guwari, Alwar ki Guwari, and Amre ki Guwari. To support poor and marginal farmers in the community, WOTR is taking initiatives for water conservation and sustainable land management. By constructing simple, low -cost structures, the team promotes better techniques for water harvesting and raising the water table. Since 2008, we have extended support to over 8,400 rural households by implementing 10 projects in 54 villages of Rajasthan.[11]

A large number of farmers in Rajasthan still practice traditional farming which impacts yield due to the limited availability of irrigation water and extreme weather conditions. To combat this challenge, WOTR educates farmers on sustainable modern techniques, enhancing the resilience of agriculture to climate change and uncertain weather conditions through sustainable agriculture practices. We share knowledge and demonstrate viable systems such as organic practices and System of Crop Intensification (SCI).

In order to promote alternate livelihood options, WOTR is working closely with the community. Livestock is an integral part of the rural community of Rajasthan and WOTR is supporting farmers to take better care of their animals and increase their income. Further, our team is also building the capacity of community members to explore other avenues of income.[15]

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