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Water Management in Western Rajasthan

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ABSTRACT

In the rapidly changing world where man is blessed with modern technology that has given power to use and abuse the resources. The Western Rajasthan is bestowed with the technology which supply substantial amount of water in water deficient arid region. Gone are the days, when the farmer used to perform extensive farming in order to fulfil the basic needs. With commercialization in agriculture, the extensive farming has shifted rapidly towards intensive farming. The mechanization in farming has managed to improve the livelihood of the farmers of Western Rajasthan but the pressure on land and water resource is immense. The dependency on water resources has been broadened by submersible tube wells which has successfully replaced traditional wells to extract groundwater. There is no visible shortage of water in the region because people are successfully extracting groundwater to meet their requirements, which basically includes the irrigation of crops. The current scenario looks good but the near future of the region is in a grave danger. The overexploitation of groundwater by the farmers is contributing to a non-sustainable farming practice. This will not only affect the social life of the people but also the economic life. The study of inventory of groundwater depletion in Western Rajasthan deals with non-visionary human approach to fulfil their wants instead of focussing on their needs. The overexploitation of groundwater without any proper management/planning and the shift from the conventional water resource conservation will create a problem in the near future for the present people. The future generation will be left with no or very little amount of water because of this non-sustainable water management.

Keywords: Convectional, Cropping pattern, Groundwater, Hod, Sustainability, Submersible pumps, Tractor-tanker

INTRODUCTION

In the present scenario, the population is increasing at a very fast rate and the diffusion of technological advancement has put an intense pressure on the available natural resources. The gap between the resource availability and demand of resources is increasing every day. The human livelihood becomes further more competitive because water is one of the major natural resources to determine the sustainability. In Semi-arid to arid climatic region of western Rajasthan, there are three major sources to supply the water i.e. a) Water from Rain, b) Water supply through Canals and c) Extracting the Groundwater.

Rain Water: Rainwater has a very limited supply in the western Rajasthan. The rainfall is calculated to be approximately 10-25 cm with very few rainy days. Conventionally, the residents depend on water harvesting techniques to collect rainwater to make use of water throughout the year. In the present modernized world, these conventional rainwater harvesting techniques are depleting because of the ground water is easily and cheaply available.

Canal: Canal acts like a hope and life line of the people of western Rajasthan. Indira Gandhi Canal (IGC) runs through the western Rajasthan which transfers water from the western Himalayas to western Rajasthan. Though, the Indira Gandhi Canal has successfully resolved many problems but it has its own limitation. The limited capacity of the canal cannot feed the entire regional demand. It's a fact that a large portion of the area doesn't have access to the water which is provided by IGC. The water from IGC is mostly used for agricultural and drinking purpose mainly on its right margin distributaries.

Groundwater: Groundwater comes into usage when the water from the rain and canal fails to fulfil the large demand for water. Even though the groundwater is not available in all the area, its accessibility and property vary from place to place. The quality of ground water also deteriorated with increasing depth of tube wells. The increased depth of tube wells supply the water with very high TDS value which increased sodacity and alkalinity of the soil which leads to diminishing return in farming.

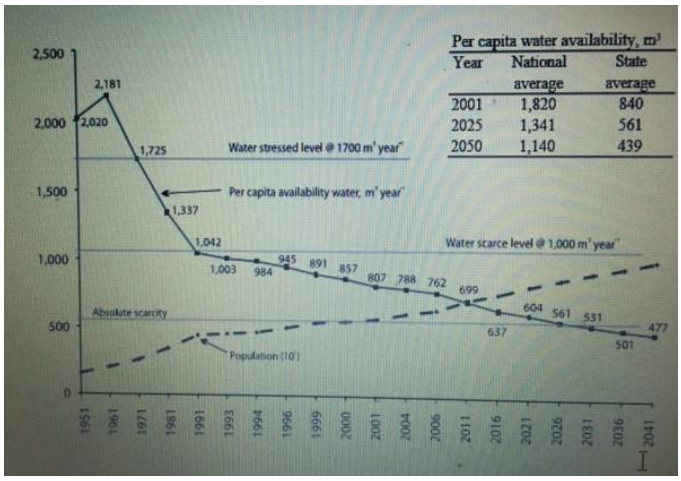
The study focusses on the inventory of water conservation techniques/approaches being practiced and presenting new techniques which can be implemented in Western Rajasthan and implications of technology on depleting ground water. The region is arid to semiarid with low and erratic rainfall, high summer temperatures, low humidity and high-velocity wind causing an average potential evapotranspiration of 2,000 mm, a negative water balance and acute water deficit and very high pH value (alkalinity) of soil.

Table.1. Per Capita Water Availability in m^3.

Year	National Average	State Average of Rajasthan
2001	1820	840
2025 (projected)	1341	561
2050 (projected)	1140	439

Source: Ministry of water Resource.

FIG.1. Projections of Population versus per capita water availability in Rajasthan



The per capita availability of water is continuously decreasing as the quantum of water supply is almost constant while population size and consumption pattern is continuously increasing in the regionDroughts of varying intensity, are a recurring phenomenon in the region. During 1901-2003, western Rajasthan experienced 20 moderate droughts (with 50% to 75% of the normal annual rainfall). The project work concentrates on recent field visits to parts of Jodhpur, Jaisalmer and Nagaur. All the villages have been chosen precisely for their distinguishing characteristics are as follows:-Beetan (Nagaur), Nedayi, located on the zero head of IG Canal

(Jaisalmer)), Thaiyat, a Bhil tribe inhabited village (Jaisalmer), Badnu (Bikaner), Karda (Bikaner) and Nathusar, a small hamlet located on IG Canal (Bikaner).

FIG.2. Satellite image showing Rain water conservation system in a village pond at Beetan, Nagaur.

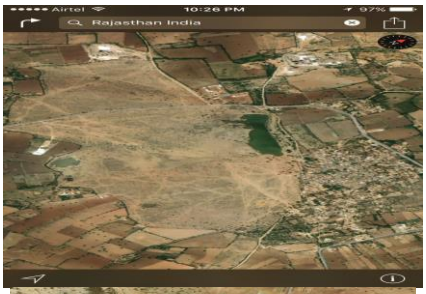


FIG.3. Satellite image showing Green conopy and landuse pattern at village Nadiyion Zero head IG Canal, Jaisalmer

METHODOLOGY

The study has been conducted on the basis of extensive fieldwork, a collection of first-hand information and primary data from the villagers including the village Sarpanch through questionnaire method. The participatory approach was also applied to obtain precise information about inventory and prospects of water. The respondents were randomly selected on the basis of their economic and social compositions. Informal and formal interview methods have been used to collect the information. Finally, the findings have been evolved on the basis of analysis of collected information. The villages for the survey were selected on the basis of their distinct source of water such as a pond, closeness to IG Canal, the supply of tap water and a tribal dominated village.

The TDS of ground water samples of varying depths and areas close to IG Canal and far off region were taken into consideration. The variation in the TDS value of rain water, ground water and canal water were recorded by TDS meter. Soil samples were obtained to measure the pH value through Litmus paper to find out the level of alkalinity in the soil due to ground water irrigation.

RESULT AND DISCUSSION

After the extensive field survey, water resource basedsocio-economic livelihood of the people residing in Western Rajasthan was obtained. The discussion of water based issues from the collected information have been listed below.

Intensification of farming: Being a drier region, Western Rajasthan has always done extensive farming but this kind of farming wasn't able to deliver a proper livelihood to its inhabitants. In order to improve the livelihood, the farmers have recently shifted to intensive farming after moving away from extensive farming. The change in the farming practices has

also resulted in to the change in the cropping pattern of the region. The focus has shifted from dryland crops to water intensive cash crops which give high economic return. The water intensive cash crops are sustained by the introduction of submersible tube wells which assure the supply of water for irrigation round the year. The nature of crops have changed from dryland farming, drought resistant and prone to crop failures (with low economic return) to cash crops as mentioned in the table below.

Table.1. Change in cropping pattern after the introduction of submersible tube wells.

Kharif Crops(1990's)	Changed to (2015)		Rabi crops (1990's)	Changed to (2015)
Bajra	Cotton		Gram	Mustard
Jowar	Linseed		Wheat	Onion
Pulses	Husk (Isabgol)		Chilly	Carrot
Moth	Gwar		Barley	Tomato
Millet	Spinach		Arhar	Cummins seed

Source: based on the field visit survey.

Accessibility of technology: The modern development in technology has managed to touch every area of the country and Western Rajasthan is not an exception. The availability of technology has not only ensured the usage of technology but also the overuse of the technology. The use of submersible tube well technology diffused throughout the western Rajasthan since early 1990's. Simultaneously, the mechanised drilling of submersible tube well become very cheap and easily available. The submersible tube well ensure the complete withdrawal of ground water of an artesian aquifer at a particular depth while mechanised drilling further increase the depth of artesian aquifer and ensure the complete withdrawl of ground water which accumulated in sub soil in millions of years. This non-visionary act of farmers of western Rajasthan of extracting entire sub soil water seems that it is there last generation on the earth and no further generation will come in the future so consume entire ground water from the earth.

The western Rajasthan is an arid region and suffering from recurrent drought where farming is prone to crop failure. Whereas Western Rajasthan has not only increased the net sown area in the last two decades but also started raising water intensive crops to improve their livelihood. This intensive farming demands water supply from multiple sources. And during the non-availability of multiple sources of water, groundwater goes through an acute pressure to meet the demand of water intensive crops. The demand of water has given rise to the demand of submersible tube wells.

Conditions favouring use of submersible tube wells:

1. Cheap availability of submersible tube well technology.
2. Banking finance availability for submersible tube wells.
3. Subsidized electricity supply for submersible tube wells on farmland by the Rajasthan State Government.
4. Availability of drilling/ installation technology of submersible tube well by machines.
5. Regular failure of monsoon (drought) for the last five years.

Result of using submersible tube wells:

1. Water is pumped out mechanically and the depletion of water has taken place up to 1200 feet.
2. Intensification of cropland of cash crop such as ground nut and cotton.
3. Deviation from rainwater harvesting techniques such as nadi and talab.
4. With increased depth of ground water the TDS value of the water increases which deteriorated the quality of soil. At the depth of 400 feet the TDS of ground water is about 500 ppm while at the depth of 800 feet the TDS increased to 1200 ppm.
5. With increased alkalinity up to 8.5 pH value due to irrigation of high TDS value of ground water, the production of ground nut decrease from about 15 quantal per acre to 5 quantal per acre. But farmer compensated the loss of deceased productivity by increasing the net sown area where waste land (sand dunes) brought under cultivation.

There are many conditions favouring the use of submersible tube wells that allows withdrawing groundwater. This has resulted in an enormous amount of pressure on groundwater. Groundwater is overexploited with submersible tube wells by the people as it is a common resource and farmers evolved a sense of competition to exploit more ground water for economic benefits bypassing the concept of future sustainability. The result of this is clearly visible in the form of depletion of groundwater in the region in the past two decades.

Table.2. Ground Water depletion with the intensification of cash crops.

S. No.	Village	Year-1990	Year-2015	Reason
1	Chowkri Kala (Jodhpur)	70 feet	350+ feet	Cotton cultivation and submersible pumps
2	Bitan (Nagaur)	200 feet	550+ feet	Agricultural intensification of chilies, cotton and onion and increased number of submersible pumps.
3	Nedayi (Jaisalmer)	250 feet	450+ feet	Agricultural intensification of horticulture and vegetables. Rapid increase in the number of tube well installation.
4	Thaiyat (Tribal Village-Jaisalmer)	350 feet	400+ feet	Losing the agriculture land to Indian Army. Bhil tribal village with extensive farming of wheat, vegetables and Bajra.
5.	Kharda (Bikaner)	400 feet	1200 feet	Poor artisan aquifer level and cultivation of water intensive ground nut.
6.	Nathusar on the margin of IG Canal (Bikaner)	300 feet	250 feet	Ground water level increased marginally due to the close proximity of IG Canal.

Government Incentives: The main objective of the government initiative for rain water harvesting and conservation is to construct “hods” (metalled tanka) to store the rainwater in the farmlands which can be used later for irrigating the farmland even during the drier seasons. The series of problems are visible in the actual implementation of the hods. The hods were constructed above the surface that too with plastic polythene and/or concrete metalled material. The hods were further filled up with groundwater, which clearly indicates a failure in the understanding of the actual objective behind the implementation of hods.

Fig.4. Unmetalled Hod with plastic polythene above the surface to store the ground water for irrigation.

Hod, however, has managed to supply a substantial amount of water to the farmers throughout the year. This has resulted into agricultural intensification as hods ensure the farmers to supply water round the year for irrigating the fields. After its introduction, the farmers have shifted from drip irrigation and sprinklers irrigation to carpet irrigation. In carpet irrigation, a huge amount of water is misused.

Fig.5. Metalled Hod below the surface to harvest rain water for irrigation and filled up by submersible pumps in dry season.

No doubt about the result that Hod has managed to increase the output of the farmers rapidly but it has also led to the decrease of the groundwater table at an alarming rate and rainwater harvesting is hardly practised through hods. Farming has become non-sustainable for the future generation.

Availability of tractor tanker: Conventional water procuring system for drinking and household purpose has become an inevitable necessity. Every household has constructed a tanka (metalled underground water storage within house premises of capacity upto 20000 liters.) which is filled by tractor tanker at very cheaper price. Before the introduction of tractor tanker water supply, the tanka was used for traditional rain water harvesting and conservation. But after the introduction of tractor tanker water supply on very nominal price in their home depleted the traditional rain water conservation techniques and become depended on ground water which is having very high TDS value upto 1300ppm.

Fig.6 Tractor-tanker fetching water for drinking and other household purpose from Nadi. (Common village water)

While the TDS of rain water is the most ideal for human consumption i.e. upto 150ppm TDS. It has developed the non-conservative social attitude towards the water and has mismanaged to deplete the groundwater level rapidly to non-replenishing level.

CONCLUSION

With the increase in the population pressure, it is evident that the pressure on the natural resources will also increase. Several methods to escape this pressure is given by technology that has helped in mechanizing the farming process which has resulted into agricultural intensification. Though the technology has successfully solved the problem temporarily, the benefits gained by it will have a short life. The traditional knowledge and the technological use doesn't go hand in hand. One has to let go of the traditional knowledge in order to welcome technological use whole-heartedly for fulfilling the ever increasing human greeds. The situation can be explained by taking the case study of Western Rajasthan where the introduction of technological innovations has received a huge and surprising response. People of the region have shifted the methodology of tradition farming and water management practices to an intensive farming and overexploitation of water. Though this change in the path can manage to give temporary benefits to the people but the price that the society will have to pay in the future in infinity. The groundwater table of the region will soon deplete because of the non-sustainable approach for farming. A regular check has to be kept in the depletion of the groundwater table in order to ensure that the future generation doesn't have to live in a more water-scarce region and carrying capacity of the region will deteriorate. One way of solving the problem is engaging the population in secondary and tertiary economic activity which will remove the enormous pressure from the land and water resources. All sectors of the society should lend a helping hand for sustainable development in Western Rajasthan considering the availability of existing natural resources, climate, technological advancement and its social fabric.

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