WATER HARVESTING TECHNIQUES FOR DEVELOPMENT IN NAGAUR DISTRICT, RAJASTHAN

SAKSHI SAHNI

Abstract : Nagaur district has arid to semi-arid type of climate. The district frequently faces monsoon failure. Monsoon failure results in widespread drought which leads to a deepening of the already severe water crisis. The monsoons recharge the groundwater and surface-water systems. In the past, Nagaur District had over-exploited her groundwater without recharging, thus creating a water famine. The food and water security of the Nagaur district solely rely on the intensity of monsoon and ground water. The present paper attempts to bring a detailed study about different rain water harvesting techniques and water conservation and possible feasible approaches of drinking water supply for Nagaur district. Adding to the problem is the high concentration of fluoride which causes severe health issues. The study is based on the data collected by the students on this subject as well as personal interactions with affected inhabitants in rural areas. It is suggested that the recharging of wells using later water conservation techniques, rehabilitation of traditional water body systems, better planning of water use and proper education on the topic may help in addressing the present crisis.

Keywords: Fluoride, Mining, Poor health, Semi-arid

Introduction : Nagaur district of Rajasthan, in northwest part of India, is one area where there are severe effects of high fluoride concentration in groundwater. Nagaur district lies in Central Rajasthan and covers an area of 1771.18sq. Kms. It extends from 26 23' 35" to 27 42' 16" north latitude and 73 04' 32" to 75 21' 39"east longitude.

Fluoride is essential for human and cattle health. It helps in normal mineralization of bones and formation of dental enamel. Lack of fluoride in the body (<0.05ppm) causes health problems like dental cavities and lack of formation of dental enamel etc. especially in childhood. On the contrary excess fluoride >1ppm causes a different set of health problems, affecting metabolic activities of individuals which may cause skeletal fluorosis, dental fluorosisnon ulserdyspepsia, polyuerea (to urinate more frequently) polydipsia (excessive thirst), muscle weakness, repeated abortions/still birth due to hampering of blood flow to foetus on account of hardening calcification of blood vessels, oligospermia (deficiency of spermatozoa in semen), low testosterone and discoloration of teeth enamel.

Annual Rainfall Data

The annual rainfall of Nagaur district varies considerably from year to year to year. Though the average annual rainfall in this part of Rajasthan is recorded at 361.6 mm, but in reality there is hardly any rainfall. During the last ten years, only once was there considerable rainfall of 459.10 mm in the year 2003. The number of rainy days drastically changed from 10 in the year 2002 to twenty six in the year 2007.

Depth of Water Level

Depth of water level in the district ranges from 10 to 80 metre below ground level (mgbl). In Precambrian meta-sediments depth of water level varies from 10 to 55 while in rocks of Marwar super group and tertiary formation it varies from 25 to 80 mm and in alluvium formation it varies from 10 to 60m. Depth of water level is shallower in the eastern, northern and southern part of the district whereas in the south western, western and central part of the district water level is deeper.

Ground Water Quality

Chemical quality of ground water in Nagaur district is generally brackish to saline with few pockets having fresh water with less than 2000 micro mhos/cm at 25°C. The there are some areas suffering from high fluoride. The ground water quality is brackish to saline from east of Merta to Degana and fro Didwana to Nagaur via Jayal block in the central, western, north western part of the district. In this big pocket E.C of ground water is more than 3000 micro mhos/cm at 25°C. There are some pockets namely eastern part of Rian, southern part of Degana, major parts of Parbatsar, north and north eastern parts of Kuchaman, western and northwestern part of the Merta block, major parts of Mundawa, Kuchera-Khanwar-Gagawana area of Jayal block, south eastern part of Didwana, north and south western parts of Ladnun block, where the E.C. of ground water is within 3000 micro mhos/cm at 25°C. There are two salt lake areas where ground water has an E.C of more than 10000 micro mhos.

Problem Analysis

Low rainfall, high evapo-transpiration, moisture-scarcity, poor soil quality, less organic matter contents, poor moisture-holding capacity, limited number of rainy days, poor vegetative growth and frequent droughts are some of the key natural features of Thar desert, though the Thar desert is the

most densely populated arid zone in the world. The extreme economic backwardness of the region may be attributed directly to the environmental degradation arising from lack of appropriate planning and development. Rain-fed crop production plays a crucial role in sustaining the livelihood of the poor farmers as well as in supporting the economy of the region.

The rural women in Rajasthan live a life of overload, confinement, seclusion and silence. Women of the Thar dessert are oppressed through discriminated and exploited to a great extent.

Causes Of Water Problems

ANTHROPOGENIC PROBLEMS: - These are problems influenced by human activity. The problems created by humans in Nagaur, range from household to economic activities. Problems like irregular waste dumping from household from households has led to contamination of water bodies in Nagaur. But the main source which has led to secure contamination are the mining activities.

Mining activities:- Mining occurs in the peripheral areas of Nagaur. It is a stretch consisting of parallel belts of mines which can be observed within 2-3 kilometres. The depth of these mines range from 400-600 meters and it touches the groundwater. The mining areas are left as they are after the activities are concluded. This imbalance is harming the ecosystem.

After the mining activities are concluded the effluents released during the mining activities get discharged into surface and ground water. These effluents are believed to have high amount of toxic chemicals like Arsenic and cyanide along with some less toxic chemicals like copper and zinc. This release of effluent chemicals leads to increase in the acidity of the surface and ground water. This makes it unfit for human consumption.

Waste dumping:- During the cutting and polishing of the marbles fluoride and marble dust is released and are dumped into water which causes increase in fluoride and several toxic chemicals which further makes water unfit for human consumption.

Over exploitation:- Over exploitation of ground water table is a cause of concern. Use of water from tube wells is by the locals has led to decrease in ground water table to 20-25 cm. The use of motors for the purpose of extraction has led to such decline.

Precipitation:- Nagaur district is located in the rain shadow region of the Aravali hills which act as a cloud barrier and do not allow clouds to pass through them. Only clouds which are at high altitude

are able to reach Nagaur region and average annual precipitation of the region is 300-400 mm. The rainfall takes place for 10-15 days during a year in an irregular pattern which leads to water scarcity. Ground water table does not get recharged and in case of less/ no rainfall the condition becomes adverse.

IMPACT/CONSEQUENCES: - The continuous degradation of surface and ground water, has led to serious consequences for the locals. The locals have experienced water problems ranging from health to economic activities.

Economy:- 90% of the Nagaur village population is poor due to which they are not able to afford drought resistant seeds or HYV seeds and higher education for their children.

Due to poverty people are not able to build Pakka House so roof top rain water harvesting cannot be implemented due to irregular rainfall. There is a very high possibility of crop failure and economic loss to farmers. Farmers take loans from the administration which they are unable to pay back due to high interest rates. This causes a loss of their lands.

Education: - Most of the population of Nagaur is illiterate with women being the most uneducated [98%]. Women are mainly engaged in household work and are not allowed to study or indulge in any other kind of outside activity by the society. Due to lack of education people are unaware of the deteriorating water quality and hence cannot counter the problem. As the quality of water is not good enough the locals go to far off places to fetch potable water, which takes away their school going time.

Health: - Most of the population in Nagaur Villages are facing various health disorders/issues due to unavailability of portable water. Fluoride accumulate in human body has led to curving of bones and joint pain. An example of such problems is the 64 years old woman Mathura Devi (Asarva village) who has enlarged joints due to regular intake of ground water. At the age of 40, her movement was limited, and later also developed joint pain. This occurred because of excess fluoride disturbs the calcium absorption pathway which results in enlarged joints.

Water Harvesting Techniques: - Solutions have been offered at a local level with people practicing water harvesting on a small scale. Every village has identified the existing water problem but hasn't been able to eradicate it on a larger scale. Some of the water harvesting techniques/solutions is as follows:

1. Improving and spreading the existing water harvesting techniques over all the district or to the areas which are severely affected 2. Some of the techniques which can be used for rain water harvesting are
   - Ferro Cement Tank
   - Jalabh Water Harvesting Technique
   - Temple Tank Technique
   - Traditional Rainwater Harvesting techniques

Gender concerns in water management

Although the role of women in management of natural resources in general, and water in particular,

is accepted, involvement of women as equal participants in water resource management projects has been achieved in very few cases. All significant decisions - the location of the water source, the rules for its use, and maintenance of water quality, the application of penalties for misuse, the distribution of water among competing individuals or interests - are taken by men or male-dominated bodies.

The impact of drought is hardest on women because of their socio-cultural and economic positioning within the family and community. When men lose their jobs, they migrate often leaving their families behind, and women have to take up the additional task of earning for the family.

In the job market women are constrained by lack of education and skills, assumed lower working capacity, lesser social sophistication, and are at risk of sexual harassment. In Rajasthan it is common to have more women working on famine relief jobs than men, the reason being- how can men work for such low wages.

It follows that women have the greatest stake in water availability and therefore, it is essential to include them in the decision-making process. In India, it is estimated that the national cost of women fetching water is 150 million women weekdays per year, equivalent to national loss of income of 10 billion rupees.

Conclusion

1. Heavy Ground water withdrawal from potential zones a for agriculture use, where storage of ground water development has reached more than 250%, has to be controlled by preventing further ground water development for agriculture and industrial use. 2. Awareness programs to educate about conservation of precious ground water resources and training on rainwater harvesting will be beneficial to check decline in water level and justified use. So mass Awareness program may be organized at every gram-panchayat level.
3. Financial assistance for ground water like sprinklers development in over-exploited, critical and semi-critical area should be encouraged.
4. Use of water saving devices, drip irrigation, close field distribution channels etc. should be promoted.
5. Modern agricultural management techniques have to be adopted for effective and optimum utilization of the water resources. This can be achieved by maintaining irrigation through minimum pumping hours as per minimum requirement of water by the crop and also selecting most suitable cost effective crop pattern.
6. High water requirement crops should be discouraged. Proper agriculture extension services should be provided to the farmers so that they can go for alternative low water requirement economical crops. Changing from high water intensity to low water intensity cropping pattern & adoption of sprinklers & drip irrigation techniques can minimize heavy exploitation of ground water for irrigation.
7. Salt resistant crops can be sown in the area having brackish to saline ground water.
8. Areas having EC values more than 3000 micro mhos/cm should be avoided for drinking water supply. The areas having high fluoride & nitrite should be mixed with piped water supply schemes for drinking purpose from the areas where T.D.S. are within permissible limit.
9. Traditional rainwater harvesting structures like 'Tankas' or roof top rain water storage should be encouraged for day to day requirements which will reduce ground water draft.
10. Large-scale recharge potentials exist in depleted aquifers. Mega ground water recharge to such areas through outside surface water sources like lift canal from IGNP system or floodwater during excess rainy years be implemented.
11. Small check dams or earthen dams may be constructed to store rainwater at suitable. This will increase recharge to ground water which ultimately results in increase of yield of wells.

Acknowledgment

The author would like to thank her mother and father for their full support, editors Anoushka Kumar and Arunima Iyer and Manish Kashyap for his encouragement.

References

1. Ayoob, S. and Gupta, A.K. (2006) Fluoride in Drinking Water: A Review on the Status and Stress Effects. Critical reviews in Environmental Science and Technology, 36, 433-487. http://dx.doi.org/10.1080/10643380600678112
2. Arif, M., Hussain, J., Hussain, I. and Neyol, S. (2011) Fluoride Contamination of Ground Water of Merta Block in Nagaur District, Rajasthan, India. The Conference of Advance in Environmental Chemistry (AEC), Aizwal, 146-148. 3. Arif, M., Hussain, I., Hussain, J., Sharma, S. and Kumar, S. (2012) Fluoride in the Drinking Water of Nagaur Tehsil of Nagaur District, Rajasthan, India. Bulletin of Environmental Contamination and Toxicology, 88, 870-875. http://dx.doi.org/10.1007/s00128-012-0572-4
4. CGWB (1982). A manual on Evaluation of Aquifer Parameters. Govt. of India, Central Ground Water Board, New Delhi

4. KathleenThiessen (2006) Fluoride and Human health
5. Census, (2001). District Nagaur, Rajasthan, Government of Rajasthan
6. Unpublished reports of State Ground Water Department, Nagaur.
7. Ministry of Rural Development, New Delhi Health, 1, 20–22.
8. Subba, R. N., & John, D. D. (2003). Fluoride incidence in groundwater in an area of peninsular India. Environmental Geology