ISSN: 2456–5474 RNI No.UPBIL/2016/68367 Vol-3* Issue-3*April- 2018
Innovation The Research Concept

Application of Remote Sensing For Water Resource Management of Northern Aravalli Region

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Abstract

Water resources are natural resources of water that are potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. The majority of human uses require fresh water. The North Aravali Region has an average elevation of 271 metre (889 feet). Ridges of rocky and precipitous hills for the most part parallel to each other are a feature observable throughout the region which however is generally open to the north and east. The climate of the region is semi-arid and very hot in summer and extremely cold in winter. The monsoon season is of very short duration. The cold season starts by the middle of November and continues up to the beginning of March. The summer season follows thereafter and extends up to the end of the June. The south-west monsoon continues from July to mid-September. The period from mid-September to mid-November forms the postman soon season. The rainfall during the south-west monsoons constitutes about 80% of the annual rainfall. 577.7 mm is the annual average rainfall. The average rainfall in Northern Aravali region during 1980 to 2009 is 575.75 mm. In 1996 the rainfall was abnormally high i.e. 580.94 mm above the average and 371.27 mm less than the average in 1999. During 1980 to 1989 there was one incidence each of abnormal and excess rainfall and 4 years of normal as well as deficit rainfall. There is no incidence of scanty rainfall. The 1990-1999 decade shows a great range of fluctuations in rainfall, with excess rainfall year 1998 followed by scanty rainfall year i.e. 1999. The highest and lowest rainfall of the observed 30 years is also recorded in this decade. During 2000-2009, there is 1 year of each of abnormal, excess and scanty rainfall, with 2 deficit years. 5 years recorded normal rainfall. In general, in the last 30 years, 14 years received normal rainfall followed by 7 years of deficit rainfall. An attempt is made in this paper to study the issues and challenges for water resource management of Northern Aravalli region. (Total Words: 350)

Keywords: Challenges, Sustainable, Resources Management, Harvesting Technology.

Introduction

The study area covers whole Alwar district Jhunjunu-Khetri tehsil Sikar-Neemkathana tehsil Jaipur-Kotputli tehsil. Northern Aravali region is located from 27.28 north to 28.59 north and 75.320 east to 76.92 east. It has an average elevation of 271 meters (889 feet). The Aravalli range is the oldest fold mountains in India. The northern end of the range continues as isolated hills and rocky ridges into Haryana state, ending in Delhi. The famous Delhi Ridge is the last leg of the Aravalli Range, which traverses through South Delhi and terminates into Central Delhi where raisina hill is its last extension. It is one of the world's oldest mountain ranges. It dates back to a pre-Indian subcontinental collision with the mainland Eurasian Plate. The range rose in a Precambrian event called the Aravalli-Delhi orogen. The range joins two of the ancient segments that make up the Indian craton, the Marwar segment to the northwest of the range, and the Bundelkhand segment to the southeast. The major river flowing through the study area are sabi river, Ruparail River and many small rivers in alwar. Lakes in alwar are Siliserh Lake,Jaisamand Lake and Sagar lake. Sabi is the largest river of the District. Rising from Sewar hills (Jaipur District). it enters Bansur tehsil of Alwar District from the west and forms the boundary of Alwar District for about 25 km in the west.The Ruparel, also known as the Barah or Laswari, rises from Udainath hills in Thanagazi tehsil and

finally terminates in Bharatpur District. It passes through Sariska forest from south to north, turns east from Bara, about 19 km south of Alwar City on the Alwar-Jaipur road Chunar Sidh,it rises from Chunar Sidh hills in Alwar tehsil and flows from west to east upto Piproli. The Landoha river traces its origin from Kala Pahar, which forms the eastern boundary of the District.

Relevance of the Study

Water management is the activity of planning, developing, and distributing and managing the optimum use of water resources. It seeks to allocate water on an equitable basis to satisfy all uses and demands. Water management mainly focuses on conservation, distribution, consumption with minimal loss and waste water utilization. Water conservation refers to reducing the usage of water and recycling of waste water for different purposes. Water efficiency is the tool of water conservation. It can be defined as improved water management practice that reduce or enhance the beneficial use of water. It results in more efficient water use and thus reduces water demand. Sustainability, Energy conservation and Habitat conservation are three main goals of water conservation. There are numerous water conservation techniques practiced all over the world.

Objectives of the Study

The Aravali Range is the oldest fold mountains in India. Rain water flows away from mountains because the relief is in ups and downs. The objectives of the study are-

1. Quantitative and qualitative assessment of the water resources. Water uses according to water quantity available.
2. Geographical and demographic status of the study area to visualize the water resource demand in various sectors.
3. To study the viability for suggesting scientific and modern practices of water harvesting technologies as well as evaluation of traditional practices of water conservation.
4. To understand people's perception about the water resource conservation and management.
5. Preparing different thematic layers by utilizing the capabilities of GIS based on the satellite imageries Slope map, drainage density, land use /land cover, etc. for groundwater prospecting

Data Base and Methodology

The study entails the collection of secondary level data. Secondary data have been collected from the different publications and web surfing.

Findings of The Study

Pollution of Groundwater is a Big Concern

Chemical analysis of drinking water of villages of Sanganer Tehsil, Jaipur Dist. has been discussed by P. Jain, (2006). He suggested that the pollution of groundwater is a big concern, firstly because of human needs for utilization increasing and secondly because of the sick effects of the increased due to industrial activity. The occurrence of high fluoride concentration in the ground water has now become one of the most considerable health related geo environmental topic in many countries of the world. Our country is also facing the same problem where the high fluoride concentration in ground water resources and the resultant disease "Fluorosis" is regularly distributed in nearly 150 districts of 15 states. It has been observed that in 8700 villages in India about 25 million peoples are using ground water having fluoride content more than 1.5 mg/l. in Rajasthan. Gupta (1993) recorded the TDS and Fluoride from various districts of South-Eastern Rajasthan. Nitrate value in ground water in some districts (Churu, Barmer etc.) Some chemical components like, pH, total dissolved solids, electrical conductivity, chlorides, fluorides, nitrate etc. of ground water of different districts of Raj. Including Churu, Nagaur, Barmer, Bikaner, Jalore & Jaisalmer have been discussed by Ozha, D.D. & Jain, P.C. (1992) & Ozha, D.D. & Sharma, D.C. (1995).J.V.S. Murti in prominent book watershed management in India 1996 suggested water conservation techniques. Nitrate levels in underground water of some district of Rajasthan have also been recorded by Rai and Gulati (1997).

Utilization of Water Resources

Fresh water is a renewable resource, yet the world's supply of groundwater is steadily decreasing, with depletion occurring most prominently in Asia and North America, although it is still unclear how much natural renewal balances this usage, and whether ecosystems are threatened. The framework for allocating water resources to water users (where such a framework exists) is known as water rights. According to estimates, the total amount of water on earth is 1.4 million cubic km and if this is uniformly spread around the earth as a layer, the thickness of this layer will be nearly 3 km. However, about 97% of earth's water is contained in oceans and sea and fresh water is only 2.7% of the total available water. Out of this, nearly three quarter (75.2%) is frozen in Polar Regions and about 22.6% is buried as ground water (Korzoun, 1978). A small proportion of the remaining water is available in rivers, lakes, soil, etc. Thus only a very small fraction of earth's water is utilizable by the mankind in India, surface water resources of India are classified into river, canals, reservoirs, tanks and ponds, oxbow lakes and brackish water. The longest river system, 32,2002km, flows in the northern India in the states of Uttar Pradesh and Uttrakhand and accounts to about 17% of the total rivers and canals of the country. In comparison to the river system the tanks and ponds have maximum area in the southern part of the country mainly in the states of Andhra Pradesh, Karnataka and Tamil Nadu.

Application of Remote Sensing and GIS in Groundwater Studies

Modern technologies such as remote sensing and geographic information systems (GIS) have proved to be useful for studying geological, structural and Geomorphologic conditions together with conventional surveys. Integration of the two technologies has proven to be an efficient tool in groundwater studies (Krishnamurthy et al., 1996; Sander 1997; Saraf and Choudhury, 1998). Satellite images are increasingly used in ground water exploration because of their utility in identifying

various ground features, which may serve as either direct or indirect indicators of presence of groundwater (Bahuguna et al., 2003 and Das, 1997). The Geographic Information System (GIS) has emerged as a powerful tool in analyzing and quantifying such multivariate aspects of groundwater occurrence. It is very helpful in delineation of groundwater prospect and deficit zones (Carver, 1991). Integrating all these approaches offers a better understanding of features controlling groundwater occurrence in hard rock aquifers. Groundwater is by definition subterranean. Though aerial photographs and satellite imagery contain information about the uppermost layer of the earth's crust only, various studies have shown how remotely sensed data can contribute to 108 hydro geological investigations).

Water Level Analysis

The whole hydrologic cycle is impacted on every component if there is any anomaly in the atmosphere. The occurrence of drought and heavy precipitation are the most important climatic extremes having both short and long-term impacts on the groundwater availability. These impacts include changes in groundwater recharge resulting from the erratic behavior of the annual and seasonal distribution of precipitation and temperature; changes in evaporation transpiration resulting from changes in vegetation; and possible increased demands for groundwater as a backup source of water supply.

Water Availability in The Region

Water resources are sources of water that are useful or potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. The majority of human uses require fresh water. 97 percent of the water on the Earth is salt water and only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is found mainly as groundwater, with only a small fraction present above ground or in the air. **Rajasthan** has the least availability of water and the least reliable supply, with only 162 out of the state's 222 towns receiving water every day, says a World Bank report. At least 40-70 per cent more water can be made available for the urban Indian homes at no extra cost if physical and financial leakages in the delivery of water supply and sanitation services are plugged. The report highlights the different water supply scenario prevailing in three states - Maharashtra, Rajasthan and Haryana

Ground water management strategy

In North Aravalli region, because of high pressure of population and improvement in the standard of living, fresh water demand for both agriculture and domestic use has substantially increased. As surface flow is available only for a limited period ground water withdrawal has sharply increased. The top layer of fresh ground water is also reducing every year. Artificial recharge serves as a means for restoring the depleted ground water storage, slow down the quality deterioration and put back into operation many groundwater abstraction structures.

A Multi-Disciplinary Approach to Justify The Targeted Objectives

The study incorporates scientific, technological, and socio-economic inputs, therefore a multi-disciplinary approach to justify the targeted objectives. Secondary Data**-**Field visits to the various parts of the study area viz. Domestic users, farmers, industrial entrepreneurs, hydro geologist, water management experts and urban & rural administrators etc. for obtaining feedback from local people in accordance with the set questionnaire. Collection of water samples for determining physical, chemical and biological contents and overall quality review and Government, Semi-Government Organization, Non-Government Organization etc. Primary Data**-**Literature survey on various aspects viz. demography, land use, water resources etc. and critical compilation of literature.

Artificial Recharge and Water Conservation

Irrigation in North Aravali Region is mainly done by ground water i.e. dug wells and tube wells. Irrigation potential generated by irrigation project is negligible being scanty rainfall and high evaporation rate. Ani-cuts, tanks and check dams are surface water storage structures and these structures augment recharge to ground water bodies during monsoon period. The rain water during monsoon period can be used for artificial recharge through various techniques feasible in alluvial hard rock terrains. In hard rock terrain nala bunding and anicuts, dug wells, percolation tanks etc. are feasible structures which may be used to recharge the ground water body. In alluvial area following ways of recharge techniques may be adopted.

1. Roof top/paved area rainwater harvesting for recharge to ground water in urban and industrial areas.
2. Village water run off/ roof top rainwater harvesting by dug wells and percolation tank in rural areas
3. Construction of recharge shafts with gabian structures in Nalas.
4. Recharge by dug well/percolation pit in agriculture farms.

Conclusion and Suggestions

1. Ground water draft is very high in the region. Stage of ground water development in the North Arvali Region has reached 167% due to indiscriminate use. It has to be controlled by preventing further development.
2. Revival of traditional rainwater storage system i.e. Baori, open wells, tanka etc. for rainwater conservation for use in day to day life will reduce ground water draft.
3. Taking advantage of uneven topography of the hard rock area small water harvesting system or earthen dams, up streams of irrigation commands at suitable sites may be constructed to store rainwater. This will increase recharge of ground water which ultimately results in increase yield of wells.

4. There should be adoption of Modern agriculture management techniques and optimum utilization of the water resource.
5. High water requirement crops should be discouraged. Proper agricultural extension services should be provided to the farmers so that they can go for alternate low water requirement economical crops

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