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AN ANALYSIS OF THE WATERSHED AREA IN JHUNJHUNU DISTRICT

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Abstract:

A watershed is a geo-hydrological unit that directs water flow to a central location via a network of drains. All areas on earth are inside a watershed. Water is the wellspring of all life on Earth. Water is the most crucial component in the growth of living organisms, and human development relies entirely on its availability. The water ratio on Earth is fixed and exists in many forms such as marine areas, water vapor in the atmosphere, snow in mountain regions, and water in rocks. Nature maintains equilibrium via the water cycle. Human greed has disrupted the equilibrium of water ratios. The world's population is expanding daily, leading to a higher per capita water demand. However, water sources have remained the same for years. Industrialization, civilization, agricultural expansion, building, and everyday water use have led to significant water consumption. Additionally, water is regularly wasted in large quantities owing to numerous factors. In the future, there is a high risk of water shortages and the potential for a water crisis due to the current situation. Scarce surface water supplies and depleted ground water are significant challenges in the arid region. Rainfall is the primary source of water resources in the state of Rajasthan. Groundwater is the primary and exclusive source for providing drinking water to Jhunjhunu and Nawalgarh block. Watershed development is a complex and multifaceted endeavor that requires careful planning, implementation, and monitoring. Water has become a valuable resource. There are locations where the price of a barrel of water exceeds the price of a barrel of oil.

Keywords: Ground water, Watershed, Rain water, Nawalgarh, Quartzite, Over-exploited, Treatment, Blocks. Sprinkler, Irrigation

Introduction:

A watershed is a geo-hydrological unit that directs water flow to a central location via a network of drains. All areas on earth are inside a watershed. Water is the wellspring of all life on Earth. Water is the most crucial component in the growth of living organisms, and human development relies entirely on its availability. The water ratio on Earth is fixed and exists in many forms such as marine areas, water vapor in the atmosphere, snow in mountain regions, and water in rocks. Nature maintains equilibrium via the water cycle. Human greed has disrupted the equilibrium of water ratios. The world's population is expanding daily, leading to a higher per capita water demand. However, water sources have remained the same for years. Industrialization, civilization, agricultural expansion, building, and everyday water use have led to significant water consumption. Additionally, water is regularly wasted in large quantities owing to numerous factors. In the future, there is a high risk of water shortages and the potential for a water crisis due to the current situation. Scarce surface water supplies and depleted ground water are significant challenges in the arid region. Rainfall is the primary source of water resources in the state of Rajasthan. Groundwater is the primary and exclusive source for providing drinking water to Jhunjhunu and Nawalgarh block. Watershed development is a complex and multifaceted endeavor that requires careful planning, implementation, and monitoring. Water has become a valuable resource. There are locations where the price of a barrel of water exceeds the price of a barrel of oil.

Statement of the problem:

The area mostly experiences rainfall during the Monsoon season from the southwest monsoon. It also has less or no precipitation throughout the winter months. The region has scorching summers and freezing winters with less rainfall in the southwest monsoon season. The average annual rainfall in the district from 1901 to 2015 is 480.51 mm. The rainfall in the area has significantly risen in the last year. The average annual rainfall in Nawalgargh block is 657 mm. Conserving soil and water resources is crucial to mitigate the effects of rising temperatures, declining groundwater levels, and frequent droughts. Soil without water is barren, and water without soil is ineffective. Effective treatment strategies are needed in the region to improve soil and water conservation.

Study Area:

Jhunjhunu district is situated between latitudes 27.38°N to 28.31°N and longitudes 75.02°E to 76.06°E. The area comprises 5928 square kilometers in the eastern section and is situated in the northeastern region of Rajasthan state. Jhunjhunu district is part of Jaipur division and consists of 8 sub-divisions and 8 blocks: Surajgarh, Nawalgarh, Udaipurwati, Chirawa, Buhana, Khetri, Jhunjhunu, Alsisar. The district is bordered by Haryana state to the East and North-East, Sikar district to the South, South-East, and South-West, and Churu district to the North-West and North. The Nawalgarh block is located at coordinates 27.85°N and 75.27°E, covering an area of 696.80 square kilometers. The location is in the southwestern part of the district, bordered to the south and southwest by Sikar district, to the north and northwest by Jhunjhunu, and to the east and

southeast by Udaipurwati. There are 40 Gram panchayats and 120 villages in Nawalgarh block. The total population and number of households in the region are 326,663 and 43,034 respectively, according to the 2011 Census. The average elevation is 379 meters (1243 feet).

The district has mostly flat terrain, with the exception of the southeastern periphery where the Aravalli range hills extend across sections of Nawalgarh, Udaipurwati, Khetri, and Buhana block, going in a northeast direction. The tallest peak, standing at 1051 meters, is on the boundary of Sikar district to the south of Lohagar hamlet. The district is characterized by sand dunes and inter-dual sandy plains, with a thin South-East periphery strip covered by Delhi super group hills. The primary water-bearing formations in the area consist of older and younger alluvium of Quaternary age, quartzite, phyllites, and schists of the Delhi Super Group. In the Nawalgarh block, the main water-bearing formations are older alluvium and quartzite. The research region is characterized by a rolling terrain with minor isolated hills.

Objectives:

Main objectives of the study are as follows:

1. To Conduct a Geographical Analysis of the Jhunjhunu district blocks' watershed area.
2. To research the ground water situation and draw attention to local ground water-related issues.
3. To evaluate the treatment techniques used in the research region for watershed area development.
4. To provide practical solutions for managing and developing water resources, so assisting in the provision of drinking water.

Database and Methodology:

The Central Ground Water Board, the State Ground Water Board, the PHED district water testing lab, the district ground water department, the soil department, and other governmental and non-governmental entities provided the majority of the secondary data used in the research. To evaluate water management, random samples taken at the village level have been gathered as main data. For an initial base profile of current and future management and water supplies, the research is based on secondary data bases.

Methodology:

Thus, statistical and cartographic approaches were used to analyze and portray the data that was gathered from primary and secondary sources. Data on land usage, irrigation, ground water level, and climate that is prone to drought are utilized in this research and are shown as Mean, S.D., and %. The 2001 and 2011 census years' features have been utilized to examine the population. The current investigation was conducted using a variety of approaches and strategies. A variety of cartographic techniques are used to illustrate the study's findings.

Drainage system:

The district lacks a structured drainage system because, with the exception of a strip in the middle that runs from north-west to south-east and is a part of the Shekhawati River Basin, the majority of the district's area, to the east and west, is part of an "Outside Basin."

Table: 1 Main River or streams of district drainage system.

Name of River or Streams	Area drained in district (Km2)	Percentage of area drained in district (%)	Total length in district (in Km)	Altitude at Origin (MSL)	Place of Origin
Kantli	44.71	0.75	105.808	332	Khandela hills
Chandrawati	7.927	0.133	43.445	440	Biharipur hills
Lohargal	5.908	0.099	39.584	466	-

The district is mostly located within the Sekhawati basin, with its northwestern section being outside the basin and having inland drainage. All rivers are ephemeral, flowing in response to high monsoon rains. The whole Nawalgarh block is located outside the basin. The district area is mostly drained by the Kantli river.Shekhwati, Kantli, and the Chandrawati River, together with its tributaries such as Udaipurki nadi, Lohargal ki nadi, Dongar, and Sukh nadi, drain the region. The district does not have a perennial river.

Rainfall:

The area mostly experiences rainfall during the Monsoon season brought by the south west monsoon. It also has less or no precipitation throughout the winter months. The region has scorching summers, freezing winters, and little rainfall in the south-west monsoon season. The average annual rainfall in the district from 1901 to 2015 is 480.51mm. The data suggests a notable rise in rainfall inside the area in recent years. The coefficient of variance is 36.6%, suggesting that the rainfall is quite erratic. Between 1979 and 1991, the area had little rainfall, save for a few years. Subsequently, the region had a beneficial period of consistent heavy rainfall for 7 years from 1992 to 1998. The district saw drought conditions from 1999 to 2002. In 2002, the rainfall was 62.3% below the average annual rainfall.

Table: 2 Block wise annual rainfall statistics (derived from year 2010 meteorological station data)

Block Name	Minimum Annual Rainfall (mm)	Maximum Annual Rainfall(mm)	Mean Annual Rainfall(mm)
Khetri	680.9	1125.5	913.7
Alsisar	697.2	987.2	854.7
Buhana	569.4	816.9	650.5
Nawalgarh	657.5	838.1	740.7
Chirawa	567.2	894.4	734.0
Surajgarh	568.8	785.0	617.5
Jhunjhunu	699.1	848.8	778.9
Udaipurwati	746.2	1129.4	888.0

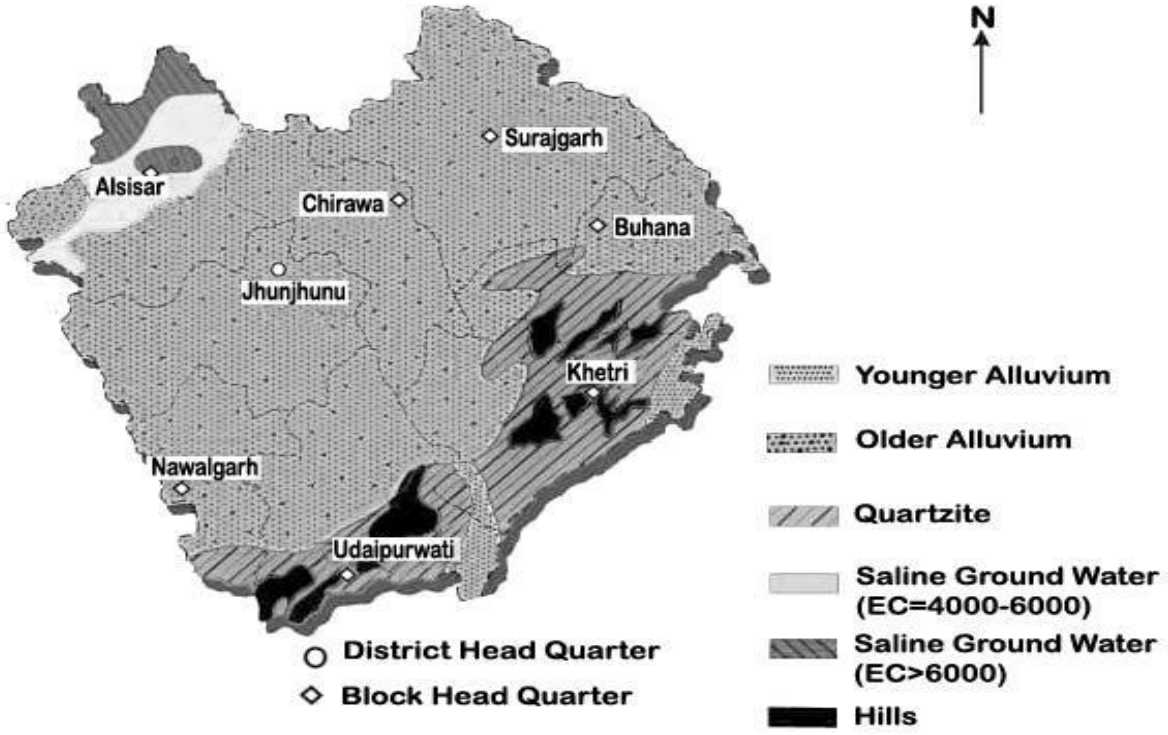
The rainfall in 2010 was much higher than in previous years. Rainfall distribution may be visualized using isohyets. Areas near hills in the southern section of the district and the northwestern part get the maximum rainfall, reaching around 1000 mm. The eastern and southern sections of the district have less rainfall and are located outside the basin. The mean annual precipitation is 772.3 mm according to the data from the accessible blocks.

Hydrogeology:

The sub-district may be divided into two zones based on hydrogeology: older alluvium zone and Quartzite (hard rock) zone. The main water-bearing deposit in the study region is the older alluvium of Quaternary age, although Quartzite hard rock of Delhi super group is present in certain parts of the south and southwest of the sub-district (Fig.1). Alluvial aquifers in the region are mostly made of sand, silt, clay, kankad, and gravel, making them the main and promising aquifer system. Groundwater is found in primary porosity in unconfined to semiconfined conditions.

The thickness of alluvial sediments in the region rises from less than 60m in the south to more than 100m in the north and northeastern portions. The Quaternary alluvium aquifer comprises 4639 km2 (78.25%) of the district, whereas hard rock aquifers, including quartzite and post Delhi intrusive formations, encompass 754 km2 (12.71%). The saturated thickness has decreased dramatically, causing the disappearance of alluvial aquifers due to declining water levels that have reached the underlying hard rocks. The Delhi supergroup consists of quartzite, schist, phyllite, gneisses, and limestone, while the post-Delhi intrusive includes granite, amphibolite, and pegmatites. These formations make up the auxiliary aquifer located in the southern and southeastern part of the district.

Fig.1. Block wise Ground Water Potential and Aquifer map of the Jhunjhunu district.



Source: Central Ground Water Board (WR).

Groundwater is found in unconfined circumstances in the worn mantle and in unconfined to semiconfined conditions in deep-seated secondary porosity such as cracks, joints, and contacts in hard rock formations.

Ground water resources:

The table below shows the dynamic ground water resources based on the 2013 ground water estimate. The whole land is classified as non-exploited since the sole possible source of irrigation, excessive drawing of groundwater, is being used. The improved situation in Alsisar block is due to the less groundwater depletion caused by the presence of salty water in the region.

Table: 3 Ground Water Resource

Block	Ground Water Availability (MCM)	Irrigation Draft (MCM)	Domestic/Industrial Draft (MCM)	Gross (MCM)	Draft Stage (MCM)
Alsisar	26.7296	17.7706	9.1498	26.9204	100.71
Buhana	26.6425	40.3020	9.9937	50.2957	188.78
Chirawa	5.6765	5.2762	3.1069	8.3831	147.68
Jhunjhunun	32.3191	45.5782	13.1006	58.6788	181.56
Khetri	5.0267	9.1164	1.0592	10.1756	202.43
Nawalgarh	17.8170	44.3556	10.4390	54.7946	307.54
Surajgarh	22.8437	53.4720	11.4982	64.9702	284.41
Udaipurwati	29.9514	56.5182	15.5900	72.1082	241.56
Total	250.7626	462.6845	104.0513	566.7358	226.00

Groundwater is the only source of water for the water needs of the sub-district. The region has a ground water development stage of 307.54%, indicating excessive removal of ground water and its classification as "Over-exploited" by CGWB. The groundwater availability in Nawalgarh block is 17.8170 million cubic meters (mcm). The irrigation draft for the sub-district is 44.3556 mcm, while the household and industrial draft is 10.4390 mcm. The gross draft is 54.7946mcm, which is the largest among the 8 blocks in the district according to estimates by CGWB, representing a stage of 307.54%. An urgent need exists for the systematic development of groundwater and the efficient management of existing groundwater resources via an integrated strategy that includes actions on both the demand and supply sides.

Irrigation:

The primary sources of water in the whole Jhunjhunu district are rainfall and groundwater. There are dams and tanks in the area used for irrigation. Wells and tube wells are primarily used in the region for irrigation on farms and for floriculture. In essence,

Table: 4Tanks under the jurisdiction of water resources department district Jhunjhunu

S.N.	Dam	Tehsil	Construction year	Gross Storage Capacity (MCM)	Live Storage Capacity (MCM)	CCA (Ha)
1.	Ajeet Sagar	Khetri		4.63	4.63	662
2.	Modi Ilakhar	Khetri	1996-97	5.69	4.54	1070
3.	Ranva	Khetri	1985-86	1.55	1.21	426
4.	Mavta	Udaipurwati	1986-87	1.14	1.01	364
5.	Nirankaki Dhani	Udaipurwati	1987-88	1.26	1.15	302
6.	Ponkh	Udaipurwati	1962-63	1.33	1.32	819
7.	Sarju Sagar or Kot	Udaipurwati	1923-24	NA	NA	NA

Sprinklers and drip irrigation are both used to efficiently use available water for irrigation. Over 70,000 sprinkler units are operational in various blocks of Jhunjhunu tehsil.

Conclusion & recommendations:

An analysis of water level variations in open and bore wells before and after watershed area development in a chosen hamlet revealed that the average water level in open wells declined by 1.81 meters, and in bore wells by 6.19 meters. This study focuses on the groundwater resources, management strategies, development potential, hydrogeological conditions, efforts of authorized officials, water quality, emerging health concerns, and current requirements in the Nawalgarh block of Jhunjhunu district, classified as over-exploited by CGWB. Despite the current limitations of water resources and low rainfall, the implementation of water conservation, storage, and management through collaborative efforts of individuals, communities, and government authorities can bring about a positive change in the deteriorating and scarce water conditions. A separate sector of the watershed region in Jhunjhunu district was researched during study on A Geographical Study of Watershed area. When developing a watershed region, it is crucial to encourage communities and farmers to utilize water judiciously and efficiently. Utilize contemporary drip and sprinkler watering techniques.

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