

# Hydrological Study of Sahibi River Basin in Alwar District (1970-2020), With Major Emphasis on Groundwater Depletion, Rainfall Fluctuation and Population Increase

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**Abstract –** Water is one of the most valuable natural resource. It plays an important role in the well-being and development of human society. Throughout the human history, we witnessed that man and water has been closely associated with each other as many of the supreme civilizations of ancient world were scattered along bank of rivers for example - Mesopotamia along Tigris and Euphrates river Chinese civilization along yellow river, Indus valley civilization etc. A river is a natural flowing water resource usually fresh water, river Basin is considered as the basic hydrological unit from planning and development of water resources. The recycling process of water on earth is called Hydrological cycle or “the water cycle”. This cycle plays a key role in maintaining dynamic equation of water on earth. Fresh water can only be replenished through the process of water cycle, in which water from seas, lakes, forests, lands, rivers etc. evaporates, form cloud and returns as precipitations. Nowadays due to various problems such as global warming, population increase, or urbanization etc. hydrological cycle of earth is disturbed which results in high water scarcity .Worldwide ground water is continuously depleting due to excessive human use. Due to sporadic occurrence of rainfall, recharge system is badly affected. The main aim of this paper is to assess the level of rain fall fluctuation and ground water depletion of Sahibi river basin alongwith population increase affecting recharge system, in Alwar district over last 30 year and the causes related.

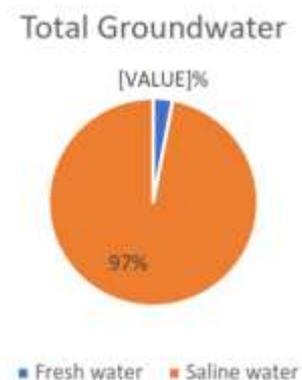
**Key Words:-** Natural Resource, Supreme Civilizations, Hydrological Cycle, Equilibrium, Scarcity, Sporadic.

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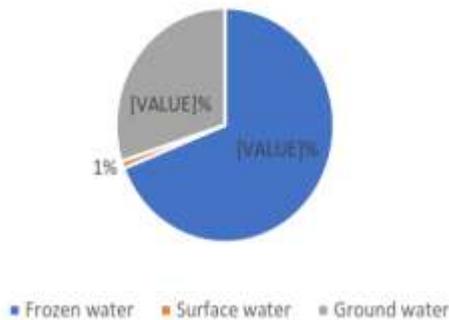
## INTRODUCTION

The scientific study of movement, distribution, and management of water on Earth including hydrological cycle, water resources, and watershed sustainability comes under Hydrology. River's, precipitation, Groundwater, etc. are the basic components of hydrological study. There should be a proper balance between these components to maintain water balance on earth. While water is considered a renewable resource. It is constantly deteriorating in both quality and quantity. The worldwide issue of water scarcity is the biggest challenge before us today. Annually about 83 million people are adding to the global population and per capita availability of freshwater is declining proportionately. Climate change, an excessive increase in human population and consumption, large fluctuations in rainfall, etc. are some of the noticeable causes of growing water scarcity in the world today.

About 71% of Earth's surface is covered by water. This is why the earth is known as “water planet”. Let's have a look at the distribution of water on earth.



Fresh Water (when total takes as 100%)



The scientific study of movement, distribution, and management of water on Earth including hydrological cycle, water resources, and watershed sustainability comes under hydrology. By examining the above analysis of water, we have acquainted to reality in a way and it is highly remarkable. In sum up of all only around 1% water is available to us as drinking water.

Groundwater is a dynamic natural resource that can be recharged mostly during the rainy season by precipitation for the rest of the year. Nowadays, there is high fluctuation is seen in rainfall due to increasing levels of deforestation, urbanization, etc. which are adversely affecting the levels of groundwater. In addition to human consumption, groundwater plays an important role in the maintenance of the economy, environment, and standard of living. It is the single largest and most productive source of irrigation water.

In the Sahibi river basin of Alwar district, large depletion of water is noticed simultaneously with greater levels in the fluctuation of rainfall. In this paper, we will assess the causes related.

### OBJECTIVES:-

1. To assess comparatively the relation between rainfall decrease and ground water depletion in the last 30 years.
2. To study the extent to which ground water of Sahibi river has decreased in 30 years.
3. To evaluate the impact of population increase on recharge system of river basin.

### HYPOTHESIS:-

1. Rainfall fluctuation is the reason of ground water depletion of Sahibi river basin.
2. Recharge system of basin is affected badly by decadal population increase.

### RESEARCH METHODOLOGY:-

To fulfil the objectives and test the hypothesis of the study, data is collected from secondary sources such

as report of central ground water board, census, official websites etc. Data is represented with proper statistical tools such as tables and graphs.

### LITERATURE REVIEW:-

Gupta (1991), discussed major issues major issues of water resources of Rajasthan related to their availability, fluctuations and variations and suggested a method to manage this resource.

Rao (1991), has studied the climatic fluctuations and water resources development in India long term fluctuation of rainfall in river basin and river flows are examined. The implications of climate fluctuations and climate change for long-term water resources planning in India are discussed. He also evaluated the national water supply with respect to climate variability.

Sharma and Sharma (2000), have founded that due to high growth rate of population, urbanisation, industrialisation, improvement in living standards and unwise use of water in Canal command area, water resources of Rajasthan are getting stressed with the declining per capita availability of water to deteriorating quality and lowering groundwater level.

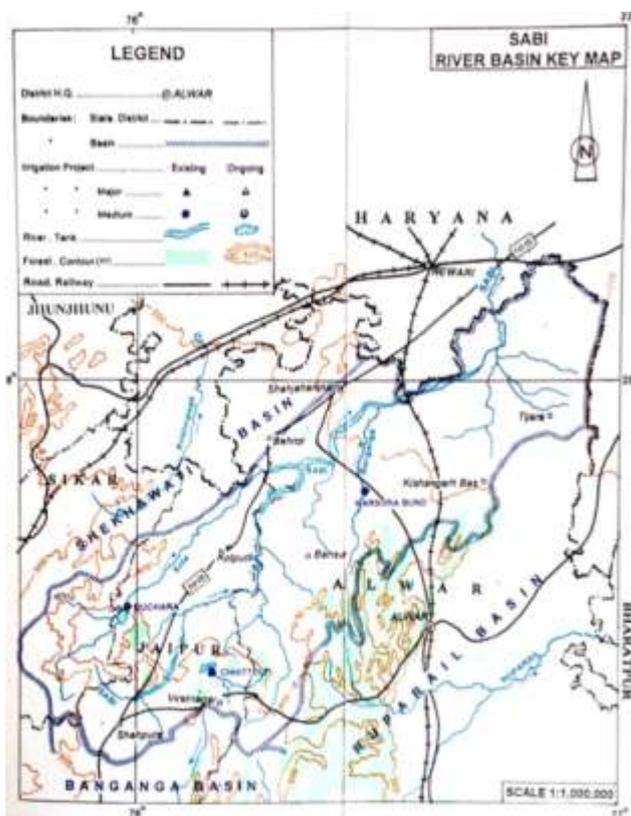
Thokal (2003), has carried out probability analysis and frequency analysis of rainfall data of 31 years of Dopali observatory representing North Kankan region of coastal Maharashtra on the basis of weekly rainfall. The rainfall occurrence at different probabilities is also estimated. The data can be utilised for planning pattern and deciding times of different agricultural operations.

Government of India of water resources central ground water board (2013), the report discussed how the groundwater of Alwar has declined considerable with sharp rate in the last years. It concluded that due to pressure of population and improvement in standard of living the demand of freshwater for both agricultural and domestic use has substantially increased.

### Study area:-

A river basin or catchment area is the portion of land drained by a river and its tributaries. Rivers of Rajasthan can be divided into three main types based on their drainage path, the rivers that drain into the Arabian Sea, in the Bay of Bengal, or with inland drainage. The most characteristic of the drainage system of Rajasthan is that nearly 60.2% of the area of the state has an inland drainage system. Sabi also known as the Sahibi river basin is located in Mid North-Eastern part of Rajasthan. It stretches between 27°18' to 28°12' North latitude and 75°45' to 76°58' longitude.

Alwar district 27°42' to 28°4' North latitude and 76°7' to 77°12' East longitude. The maximum length of the city from south to north is 137 kilometers and the breadth of the east to west is about 110 kilometers. Alwar city is the largest urban center located between Delhi and Jaipur connected by a National highway no. 8 (i.e. NH-8). The city is nearly quadrilateral in shape. The Aravali Range is its conspicuous feature. The climate of Alwar is semi-arid. Heterogeneous changes in tropospheric temperature are noticed in Alwar due to fluctuations in Global rainfall distribution in Alwar.



Sahibi is the most significant river in the Alwar district. The river flows through the North-Western part of the district. It enters Alwar near Bansur Tehsil and after flowing in Behror, Mundawar and Kotkasim. Although its tributaries are spread up to Thanagazi, Kishangarh, or Tijara. It leaves Rajasthan beyond Kotkasim Tehsil of Alwar near Ujwali village. The major tributaries of Sahibi in Alwar are Dohan, Sota, Krishnawati, etc.

Sahibi river flooded in 1977, in response the Masani barrage was constructed on the Delhi-Jaipur highway near Rewari but today the condition of the Sahibi river is already worsening. The river is completely extinct due to large fluctuations in rainfall, the groundwater level of the Sahibi basin is continuously decreasing.

The complete comparative assessment between rainfall fluctuation and groundwater level of Sahibi river basin is described below:

**Block-wise rainfall distribution (in mm)**

	1990	1995	2000	2005	2010	2015	2019
Bansur	954	887	317	628	718	685	657
Mundawar	457	1726	623	519	766	467	293
Kotkasim	904	1119	559	1061	1013	870	628
Behror	568	978	483	735	417	485	487

source: Irrigation Department

After analyzing above data we found that in all the four blocks there is high fluctuation is seen the amount of rainfall received in the last 30 years. In Bansur highest rainfall is observed in 1990 i.e. 954mm which decreased to 317mm in 2000, which is a sharp decrease in just span of a decade, afterwards constant ups and downs are being noticed till yet. In Mundawar highest rainfall is observed in the year 1996 i.e. 1726mm which decreased to 293mm in 2019 which is a large gap. In Kotkasim and Behror highest rainfall is observed in 1995 i.e. 1119mm and 798mm till then gradual fluctuation is seen up to the year 2019.

On the whole, we can say the year 1995 can be seen as a dividing year i.e. all the blocks have received a good amount of rainfall in this year since then there is great fluctuation has been observed.

**Ground water level in Sahibi river basin (in m)**

	2001	2005	2008	2011	2016	2018
Bansur	36.88	17.00	20.04	52.48	32.20	51.20
Mundawar	19.30	20.86	26.94	32.03	33.40	61.47
Kotkasim	8.50	12.87	15.07	19.43	20.15	81.26
Behror	13.17	42.01	50.04	52.48	78.00	100.39

The condition in ground water in concerned blocks is threatening. Behror is at its worst with highest depletion of ground water ranges from 13.17m in 2001 to 100.39m in 2019. Condition of Mundawar and Bansur is nearly similar though in Kotkasim constant depletion is seen. All the above blocks are categorised as red alert areas.

As per ground water report dated 31/03/2013 category of blocks under basin:-



Block (in sq. km)	Potential of Zone area	Total annual recharge (in mcm)
Bansur	604.12	117.50
Behror	334.60	33.74
Kotkasim	306.59	62.94
Mundawar	545.78	94.68

Source: Ground water report 2013

Above data clearly reveals that all the blocks under basin comes under overexploited category. A big difference is seen between total annual ground water recharge and potential of zone. Highest gap is noticed in Behror and Mundawar.

**COMPARITIVE EVALUATION BETWEEN RAINFALL FLUCTUATION AND GROUND WATER DEPLETION:**

The above data reveals that rainfall fluctuation and ground water decline are directly related to each other the decrease in one lead to decline in other. As per passing year the high rate of rainfall fluctuation is seen in basin area and level of ground water decline is also very high. We can witness that in recent years in between 2016 to 2018, the rate of groundwater depletion is very high. This high groundwater depletion is directly related to the large rainfall fluctuations which is clearly affecting recharge system of the basin area. Difference between potential of zone area and annual recharge is very big which indicates that the recharge system has been badly disturbed.

**ASSESSMENT OF POPULATION INCREASE IN LAST 30 YEARS:**

Blockwise decadal population increase			
	1991	2001	2011
Bansur	164582	214351	263663
Mundawar	162010	197582	231628
Kotkasim	95361	117687	137339
Behror	115045	139503	359261

Block wise population density (persons per sq. km)			
	1991	2001	2011
Bansur	237	310	398
Mundawar	282	344	404
Kotkasim	288	343	400
Behror	343	416	492

After assessment of the above block-wise population data, it is witnessed that a rapid increase in population is remarkable. Behror has experienced a huge increase in population density in recent decades i.e. more than 100 person per sq. km. In Kotkasim approximately an increase of 50 person per sq. km is noticed in the last two decades, similarly in Mundawar and Bansur increasing trends of population density is noticed.

**Comparative evaluations between population increase and recharge system:-**

Apart from other factors when we compare the above population and recharge data it is noticed that population increase in the concerned area results in a disturbance in the recharge system of the basin. With each decade human consumption is surging proportionately with population density which is inversely affecting the recharge system. The amount of water consumed is more than the water recharged which eventually results in low recharge and subsequently, water scarcity issues as shown by the groundwater report where all the blocks under basin come under the overexploited category. According to the recent report, alwar produces about 70 percent of

the total mustard crop of india, it is the crop which requires water in very good amount that is more stress on the groundwater. False agricultural practices with excessive use of modern techniques and lack of awareness is the major reason affecting recharge system of basin.

**CONCLUSION:**

By considering the above comparative evaluation and data, we can conclude that ground water depletion is directly related to rainfall fluctuation possible reasons of rainfall fluctuations should be monitored carefully. High population density is affecting recharge system gradually over recent decades. Water harvesting techniques and suitable agricultural practices should be encouraged in the concerned area. Afforestation should be done from time to time in convergence with public awareness programs.

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REWARI DISTRICT, HARYANA,  
Contributors: Dr Sunil Kumar, Scientist - 'B',  
Prepared under the supervision of Regional  
Director Sushil Gupta. Our vision is "Water  
Security with Low Water

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