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The Impact of Rainfall on Water Changes in the Alwar Region

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Abstract – Water is one of the world's most important natural resources without which humans cannot survive and rain is a major source of it. Water is the key to health. It is one of our basic needs for survival. Alwar had many water sources but in recent years, it has experienced significant reductions in water levels reaching even in the dark. Rainfall is one of the main causes. Over the past decade, the average rainfall of the alwar has dropped dramatically, to 64cm in 2010-2011. Such declines cause rapid groundwater depletion in alwar. Previously, groundwater runoff was around 0.30 m per year but has now reached about 1m per year. The worst affected areas are the Behror and Neemrana block where the water level reached a depth of more than 40 meters. The main cause of last year's rainfall is seasonal changes due to global warming. Now is the time to take the matter seriously. Overall, we can reverse the decline in water levels by harvesting rainwater and other management measures, so that levels can improve slightly. The Alwar region in Rajasthan is considered to be the dry part of the country. The only source of renewable water supply to the region is rainfall as many rivers have certain seasons. Therefore, the region needs a major water harvest to rehabilitate groundwater in a traditional and modern way. That is why 'johad' plays an important role in this region.

Keywords : - Alwar Geographical Study :- Location & Population, Topography of Alwar, water in Alwar, Alwar Weather, Alwar Region Rainfall, Statement of Ground Water Development, Water Monitoring, Water Quality Development Pre Monsoon 2010, Water Opening Period, Water Change (Change Before Obtaining Annual Permit 2010), Ground Water Chloride Distribution, Ground Water Fluoride Distribution, Ground Water Nitrate Distribution

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INTRODUCATION

Water is one of the world's most important natural resources without which humans cannot survive and rain is a major source of it. The most well-known and most important rainwater effect is to provide you with drinking water. According to the United States' underground survey, rainwater enters the ground through a process called intrusion. Some of the water penetrates deep into the ground where it fills the space between the subterranean rock - becoming groundwater, also called table water. Less than 2% of the world's available groundwater is groundwater. Groundwater is a powerful natural resource that can be highly regenerated during the rainy season with year-round rainwater. Nowadays, there are significant fluctuations in rainfall due to rising deforestation rates, global warming, urbanization, and other negative impacts on groundwater levels. Water can be considered one of the most important sources of human life for all natural resources. However, Rajasthan is not well served with this service and is the driest province in India with alarming water resources. Since there are no rivers in the province from glaciers, it is entirely dependent on rainfall to supply it. Alluvium and sandstones located in a large area of the state with soft rocks and composite structures including Tertiary and Mesozoic rock period. The most productive water sources in the region are under alluvium covers but the quality of groundwater in the region is salty. The Alwar region in Rajasthan is considered to be the dry part of the country. The only source of renewable water supply to the region is rainfall as many rivers have certain seasons. Therefore, the region needs a major water harvest to rehabilitate groundwater in a traditional and modern way. That is why 'johad' plays an important role in this region.

ALWAR GEOGRAPHICAL STUDY:

Location:-

Alwar County is located in the eastern part of Rajasthan. It is bounded in the north by the province of Haryana, in the east by the province of Bharatatur, in the south by the province of Dausa and in the west by the province of Jaipur. It stretches between 27^0 02 '33 .21 ”to 28^0 13 '46.14” North latitude and 76^0 06 '50 .32' 'to 77^0 15' 31.79 '' East longitude covering an area of 8,382.9 sq km . Most of the district has a sytematic drainage system, as the whole district is

part of the basins namely 'Shekhawati River Basin', 'Sabi River Basin', 'Ruparail River Basin' and 'Banganga River Basin'.

Alwar Population: -

Official details of the Census 2011 of Alwar, Rajasthan district released by the Directorate of Census Operations in Rajasthan. Key censuses were conducted with census officials in the Alwar region of Rajasthan In 2011, Alwar had a population of 3,674,179 of whom 1,939,026 males and females were 1,735,153 respectively. In the 2001 census, Alwar had a population of 2,992,592 of which 1,586,752 were males and another 1,405,840 were females. Alwar County makes up 5.36 percent of the population of Maharashtra. According to the 2001 census, the Alwar region's population was 5.30 percent of the population of Maharashtra. There was a 22.78 percent change in population compared to the 2001 census. In a previous Indian census 2001, the Alwar region recorded a 27.22 percent increase in its population compared to 1991. The following table summarizes the basic regional statistics. The Alwar region is officially divided into 14 Blocks. The following table summarizes the basic district statistics at the block level. Alwar District has 2021 cities and valleys, of which fourteen are headquartered.

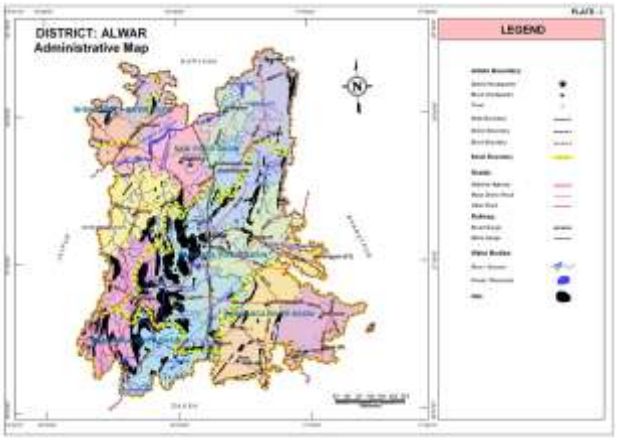


Table :- 1 . Block wise Administrative Set-up - Census 2011

S. No.	Block Name	Population (Based on 2011census)	Area (sq km)	% of District Area	Total Number of Towns and Villages
1	Bansur	214000	693.2	8.3	131
2	Behror	140000	363.3	4.3	90
3	Kathumar	212000	577.0	6.9	158
4	Kishangarh Bas	177000	507.5	6.1	135
5	Kotkasim	118000	350.1	4.2	116
6	Lakshmangarh	236000	603.0	7.2	206
7	Mandawar	198000	590.2	7.0	146
8	Neemrana	143000	373.1	4.5	85
9	Rajgarh	145000	761.3	9.1	146
10	Ramgarh	220000	638.0	7.6	177
11	Reni	136000	385.5	4.6	147
12	Thanagazi	190000	843.4	10.1	148
13	Tijara	261000	680.2	8.1	187
14	Umren	227000	1,017.1	12.0	149
Total		3674179	8,382.9	100.0	2021

TOPOGRAPHY DISTRICT ALWAR: -

The region is located in the northeastern part of the Aravalli range and exhibits a magnificent arch-type arch. To the east and southeast, the region has a stable landscape. The central part of the SSW region is covered with hills of distances running north-east to south-west from an altitude of 625m to 771m above sea level. The Hilly area reflects the prominence of roads in the southern and western part of the region. The Sabi River controls the flow of the northern part of the region and is the largest stream in the region. The Ruparail River inhabits large parts of the central and southern parts of the region. The overall height of the region is 250 m to 375 m amsl. Height distances range from at least 190.3 m amsl in the Tijara block in the northeastern part of the district to 771.1 m amsl in the Bansur block in the western part of the district.

Table :- 2 . BLOCK WISE TOPOGRAPHY DISTRICT –ALWAR

S. No.	Block Name	Minimum Elevation (m amsl)	Maximum Elevation (m amsl)
1	Bansur	308.2	771.1
2	Behror	295.7	581.8
3	Kathumar	191.7	405.4
4	Kishangarh Bas	244.0	514.7
5	Kotkasim	244.0	397.8
6	Lakshmangarh	204.2	439.5
7	Mandawar	260.7	609.4
8	Neemrana	264.9	503.8
9	Rajgarh	266.0	677.4
10	Ramgarh	213.8	447.7
11	Reni	234.2	520.9
12	Thanagazi	328.3	716.3
13	Tijara	190.3	433.9
14	Umren	239.2	677.4

Water in Alwar: -

There is no river that flows regularly in the region. lRupa Rises from the Hills of thanagazi and finally Terminators in Bharatpur district river Sabhi Rises from Jaipur district and it enter Bansur Tehsil of the district river than flow through the role mandavar Kishangarh bas Tijara Tahsil and enter Gurgaon district in Haryana region there are no natural lakes in the region which are two important requested and adjudicated a local person within 30 kilometers of the program from Alwar respectively

Alwar Weather: -

The climate of the region is moderate and is part of a region with low humidity. The region has a hot and dry summer and holds a cold season. Usually, the winter season starts in November and lasts until February during the rainy season from July to the first half of September. While the temperature rises steadily over the course of the period from March to June it falls

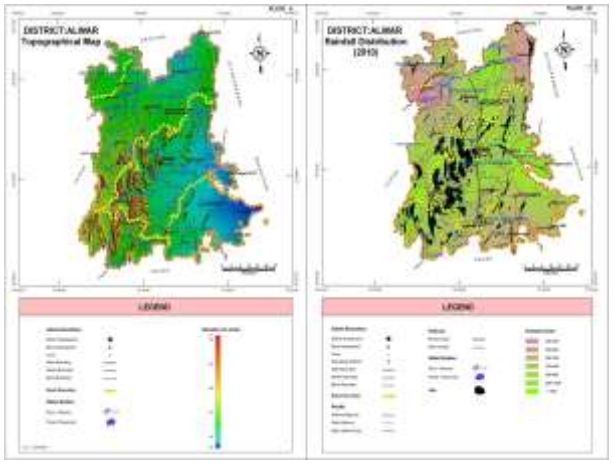
backwards in mid-November and drops to at least in January. The annual rainfall of the province is 668.6 mm.

Alwar Region Rainfall: -

The district received good enough rainfall in most of the blocks and slightly below other blocks (such as Behror) in 2010. The average annual rainfall in the Alwar region was approximately 761.1 mm based on the available block data. The highest annual rainfall was observed in the Lachhmangarh area (1,250.9 mm) and the lowest was in the Behror block (422.0 mm). The average annual rainfall in the region is seen in the Thanagazi block (887.7mm).

Table :- 3 Block wise Rainfall statistics 2010

Block Name	Minimum Annual Rainfall (mm)	Maximum Annual Rainfall (mm)	Average Annual Rainfall (mm)
Bansur	538.6	903.5	756.8
Behror	422.0	619.4	540.0
Kathumar	610.5	969.2	748.11
Kishangarh Bas	728.2	871.8	807.3
Kotkasim	596.1	1,005.9	858.4
Lachhmangarh	600.6	1,250.9	858.7
Neemrana	551.2	778.8	670.3
Rajgarh	657.4	880.3	775.3
Ramgarh	748.6	980.8	854.7
Reni	588.3	779.8	671.2
Thanagazi	805.7	937.3	887.7
Tijara	495.2	839.5	648.6



OBJECTIVES:

1. Assessing the total availability of groundwater and the level of its use.
2. Establish a link between rainfall reduction and groundwater depletion over the past 10 years
3. Finding a solution to the problem.

HYPOTHISIS:

1. Decreased rainfall is a major cause of groundwater depletion.
2. Human consumption is directly related to the depletion of groundwater.

Data Collection: -

1. Key data collection
2. Secondary data collection (a) water resources development, Alwar
3. Field study

STATEMENT OF GROUND WATER DEVELOPMENT:-

Many blocks in the region fall under the category of 'excessive exploitation' indicating that groundwater is under pressure and exploitation beyond recycling. Two blocks, Behror and Rajgarh are included in the 'information' category which means that the groundwater situation was very stressful.

Table :- 4 . STAGE OF GROUND WATER DEVELOPMENT

Categorization on the basis of stage of development of ground water	Block Name
Over Exploited	Neemrana, Bansur, Reni, Tijara, Kishangarh, Bas, Mandawar, Kotkasim,Umren, Ramgarh, Lachhmangarh, Kathumar, Thanagazi
Notified	Behror, Rajgarh

Basis for classification: - Groundwater development> 100% - Excessive use. In notified blocks groundwater construction is also not permitted.

WATER MONITORING:-

The district has a well-distributed network of surveillance resources (310) and groundwater monitoring stations (177) in the RGWD (268 and 116) respectively) and CGWB (42 and 61 respectively). Experimental sources have formed the basis for the definition of a three-dimensional groundwater distribution system. Benchmarking research and efficiency suggest that groundwater monitoring should be strengthened by adding 54 more sources to six blocks and an additional 232 water quality monitoring.

Table :- 5 Block wise count of wells (existing and recommended)

Block Name	Exploratory Wells			Ground Water Monitoring Stations			Recommended additional wells for optimization of monitoring network	
	CGWB	RGWD	Total	CGWB	RGWD	Total	Water Level	Water Quality
Bansur	1	12	13	4	9	13	-	24
Behror	1	23	24	6	9	15	-	13
Kathumar	4	17	21	3	5	8	-	21
Kishangarh Bas	3	26	29	4	9	13	3	11
Kotkasim	3	13	16	5	6	11	-	14
Lakshmangarh	1	21	22	7	10	17	-	21
Mandawar	6	9	15	7	6	13	1	25
Nemrana	5	9	14	4	8	12	-	15
Raigarh	5	8	13	3	11	14	23	2
Ramgarh	-	14	14	6	10	16	-	26
Reni	-	7	7	-	3	3	4	12
Thanagazi	7	7	14	2	12	14	15	6
Tijara	3	24	27	6	12	18	-	23
Umren	3	78	81	4	6	10	8	17
Total	42	268	310	61	116	177	54	232

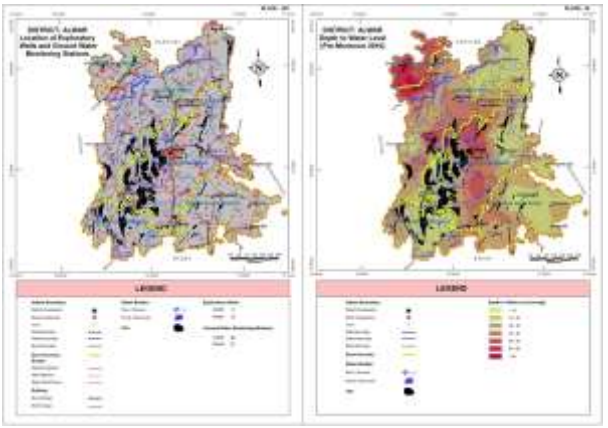
WATER QUALITY DEVELOPMENT (PRE MONSOON - 2010)

The 10m interval was adopted to show depth at groundwater levels in the Alwar region as shown in Plate - IX. Depth of water level varies greatly from less than 10m below ground level to over 60m bgl. The northwestern part of the region namely, Bansur - Behror - Nemrana District shows water depths of 30m - 50m on average, and reaches> 60m below ground level in some areas. In the northeastern, south-eastern and south-western parts, the water level is moderately shallow (10-30m bgl), the water level shall be shallow and at least 10m bgl in remote areas of the region. The central part of the region has a relatively low water depth ranging from a depth of 20-40m bgl.

Table :- 6 BLOCK WISE DEPTH TO WATER LEVEL (PRE MONSOON – 2010)

Depth to water level (m bgl)	Block wise area coverage (sq km) *													Total Area (sq km)
	Bansur	Behror	Kathumar	Kishangarh Bas	Kotkasim	Lachhmangarh	Mandawar	Neemrana	Raigarh	Ramgarh	Reni	Thanagazi	Tijara	Umren
<10	1.8	-	-	-	-	59.1	-	-	1.2	5.9	-	8.6	-	-	24.8
10-20	75.1	-	603.1	78.3	241.2	242.6	24.3	-	328.3	361.3	-	237.0	670.8	138.8	2,512.4
20-30	317.6	12.0	160.9	191.2	100.9	315.0	316.5	28.6	131.2	163.8	228.8	341.9	162.0	189.5	2,580.0
30-40	166.7	53.6	-	143.5	-	21.4	209.9	83.5	130.1	109.2	119.7	67.6	-	263.6	1,368.0
40-50	50.9	75.7	-	26.7	-	-	30.0	164.3	-	11.8	-	5.1	-	231.4	625.9
50-60	11.5	179.9	-	-	-	-	-	90.9	-	-	-	-	-	-	281.9
>60	3.7	34.2	-	-	-	-	-	-	-	-	-	-	-	-	37.9
Total	627.4	355.0	572.0	469.7	350.1	588.1	580.5	359.3	590.9	592.0	348.5	659.8	633.5	734.5	7,460.5

The area covered in the derived maps is less than the total district area since the hills have been excluded from interpolation/contouring.



WATER OPENING PERIOD (PRE MONSOON– 2010) DISTRICT - ALWAR: -

The direction of normal groundwater flow is shown on the water table map (Plate - X). In the central and southern part of the region, the flow from west to east is shown and in the northern part, the north-west inclination is evident. The height of the water table in the region reaches a height of> 440m amsl in the south-western part (Thanagazi block) of the region and the minimum is seen in the southeast of the region where the height of the <200m amsl water table in the Kathumar area is maintained.

Table :- 7 Block wise area covered in each water table elevation range

Water table elevation (in amsl) range	Block wise area coverage (sq km)													Total Area (sq km)
	Bansur	Behror	Kathumar	Kishangarh Bas	Kotkasim	Lachhmangarh	Mandawar	Neemrana	Raigarh	Ramgarh	Reni	Thanagazi	Tijara	Umren
< 200	-	-	272.7	-	-	46.1	-	-	-	10.9	-	-	-	-	329.7
200 - 220	-	-	298.7	9.7	-	445.2	-	-	-	238.9	5.8	-	-	117.7	1,115.2
220 - 240	-	-	0.8	137.3	66.4	94.6	-	2.5	11.2	101.6	289.8	-	9.6	192.5	1,056.1
240 - 260	-	9.3	-	132.0	206.9	2.2	134.4	260.8	584	10.6	133.7	-	224.7	107.7	1,340.1
260 - 280	1.8	227.6	-	198.5	76.8	-	321.6	96.8	97.7	-	-	-	231.4	70.7	1,292.9
280 - 300	595	113.4	-	0.2	-	-	127.2	-	87.2	-	-	-	145.8	77.7	611.0
300 - 320	212.8	4.7	-	-	-	-	17.3	-	119.2	-	-	-	22.0	30.7	606.7
320 - 340	153.9	-	-	-	-	-	-	-	99.6	-	-	11.0	-	25.5	289.8
340 - 360	172.8	-	-	-	-	-	-	-	63.6	-	-	111.3	-	13.5	361.2
360 - 380	20.6	-	-	-	-	-	-	-	33.9	-	-	180.0	-	5.0	240.3
380 - 400	-	-	-	-	-	-	-	-	29.1	-	-	166.8	-	2.9	196.8
400 - 440	-	-	-	-	-	-	-	-	20.6	-	-	190.9	-	1.8	213.3
> 440	-	-	-	-	-	-	-	-	0.2	-	-	0.2	-	-	0.4
Total	627.4	355.0	572.0	469.7	350.1	588.1	580.5	359.3	590.9	592.0	348.5	659.8	633.5	734.5	7,460.5

WATER CHANGE (CHANGE BEFORE OBTAINING ANNUAL PERMIT 2010): -

The 2m interval used to visualize fluctuations in groundwater level causes a fall of 6 meters in one area and then rises in other areas up to 12m (Plate XI). Variable areas - indicated by red / pink regions) are areas where overuse occurs and even after the water level to recover rainfall has not increased and has actually decreased in relation to pre-rainfall levels. Such large watersheds are found around Bansur, Umren, and Kishangarh Bas, the western part of Lachhmangarh and Tijara, the eastern part of Kotakasim, and other remote areas. The region as a whole has shown a modest increase in groundwater levels during the monsoon season in relation to the pre-heavy rainfall region. A height of more than 12m can be seen in the eastern part of the Reni block.

Table :- 8 Block wise area covered in each water fluctuation zone

Water level fluctuation range (m)	Block wise area coverage (sq km)													Total Area (sq km)
	Banoor	Behror	Kathuwar	Kishangarh Bas	Kotkasim	Lachhmangarh	Mundawar	Neemrana	Rajgarh	Ramgarh	Reni	Thanagazi	Tijara	Umrain	
<-6	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
-6 - -4	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8
-4 - -2	9.9	-	-	-	-	14.1	-	-	-	-	1.2	-	0.4	-	25.6
-2 - 0	106.5	14.3	58.7	24.8	163.1	96.6	26.0	38.9	-	7.9	34.2	9.4	87.9	94.7	747.0
0 - 2	408.8	317.7	266.4	250.5	187.0	345.4	539.7	284.8	22.8	260.7	142.8	163.4	418.4	299.0	3,707.6
2 - 4	81.2	23.0	240.7	194.4	-	95.9	23.8	63.6	206.9	318.4	94.3	148.0	127.2	322.8	1,940.2
4 - 6	17.4	-	14.2	-	-	13.0	-	-	311.6	5.8	32.8	228.0	-	107.6	729.6
6 - 8	-	-	-	-	-	21.0	-	-	48.5	-	20.2	199.0	-	-	189.5
8 - 10	-	-	-	-	-	8.2	-	-	1.9	-	13.1	-	-	-	23.2
10 - 12	-	-	-	-	-	2.7	-	-	-	-	7.9	-	-	-	10.6
>12	-	-	-	-	-	8.4	-	-	-	-	3.2	-	-	-	3.6
Total	627.4	355.0	572.0	469.7	350.1	588.1	589.5	359.3	590.9	592.0	340.5	659.0	633.5	734.5	7,460.5

GROUND WATER CHLORIDE DISTRIBUTION:-

The high concentration of chloride in groundwater also makes it unsuitable for domestic and other purposes. The yellow-colored regions on plate XIII are areas where the chloride concentration is low (<250 mg / l) occupies approximately 65% of the regional area and is suitable for local application. Areas with moderate to high chloride concentrations (250- 1000mg / l) are shown in green and occupy approximately 31% of the region's area, especially the northern and western and eastern parts of the region around Lachhmangarh and Ramgarh. A small portion of the remaining region of about 4% falls under high chloride filtration (> 1000mg / l), especially around Lachhmangarh and Ramgarh. Groundwater in the region is not suitable for domestic use.

Table :- 9 Block wise area of Chloride distribution

GROUND WATER FLUORIDE DISTRIBUTION:-

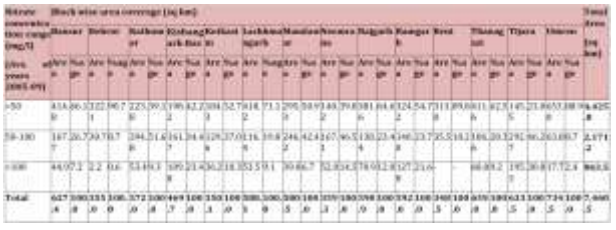
Fluoride torture map is shown on Plate -10 . Areas with low concentration (e.g.,> 1.5 mg / l) are shown in yellow and occupy approximately 80% of the regional area suitable for home purpose. A moderate area (1.5–3.0 mg / l) in scattered green dots, especially around Ramgarh, north of Kotkasim and Behror. A small portion of the remaining region (approximately 5%) has a high concentration of Fluoride (> 3.0 mg / l) shown in red, especially the northern part of Kotkasim and Kekri around areas where groundwater is unsuitable for domestic purposes.

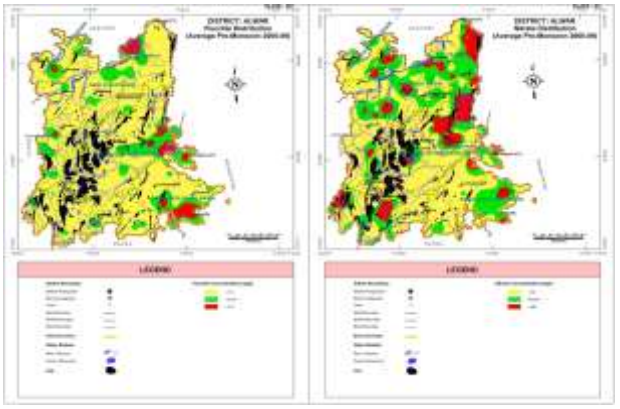
Table :- 10 Block wise area of Fluoride distribution

GROUND WATER NITRATE DISTRIBUTION:

Plate 11 shows the distribution of groundwater in Nitratein. Low nitratecon centrationbb (<50mg / l) is shown within colorban doccupies approximately 59% of the region is not suitable for agricultural purposes. Areas with moderate nitrate concentration (50-100 mg / l) are indicated by a green color that appears as scattered dots throughout the region, especially in the north, and occupies approximately 29% of the region. The rest of the region is covered with high nitrate (> 100 mg / l) concentrations shown in red areas where groundwater is unsuitable for agricultural purposes.

Table :- 11 Block wise area of Nitrate distribution





CONCLUSION:

The main reasons for rainfall fluctuations in the affected study areas could be an increase in temperature, global warming of Shift etc. are already experiencing some of the fluctuations of rainfall .inside the Sahibi catchment area, including large blocks .Because of the groundwater used in excess of the nitrite, chloride and fluoride content increases.

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