Study Of Rainwater Of District Churu: A Review

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Abstract
Water is a naturally occurring resource that is essential to all life. Water must be made sufficiently available, safe to drink, and easily accessible to everyone as they are necessary for maintaining life. Water makes up 60% of the human body and 90% of plants, respectively. Water resources are viewed as vital resources in this regard, and emerging nations are attempting to comprehend the capabilities of these resources. The world's most critical resource for human consumption, habitat support, and river flow is likely rainwater. They are typically transparent, colourless, and sterile and require little processing because they are naturally filtered on their way to earth. Rainwater normally has no dissolved particles but does have dissolved gases (carbon, nitrogen, and sulphur oxides), which cause the pH to be 5.5 or lower. Rainwater is a comparatively pure supply of water, and with the right care, it can even be used for potable purposes. Importantly, it is a free supply that may be gathered in large quantities and utilised for a variety of things, such drinking, washing clothes, cooling and heating systems, and watering gardens. The aim of the paper is to study the district's rainfall distribution will assist in addressing the drinking water and agricultural water shortage issues in rural and urban areas.

Introduction
Like the climate, rainfall also keeps varying throughout the state of Rajasthan. Most of the rainfall is received from the South west monsoon in the period from July to September. The average number ofrainy days usually varies from 6 to 42 depending on the dryness of the area. The average annual rainfallranges between 200-400 mm and it is as low as 150 mm in extreme dry zones. In the south eastern partof Rajasthan, rainfall is as high as 1000 mm. There are some parts in western Rajasthan which receivevery little rain and on an average; it is only 100 mm per year. The Aravalli range receives high rainfalland low temperature throughout the year. People enjoy winter season in Rajasthan from December toMarch. During this season, light winds blow from the north and north east. The temperature ranges from 4 Degree Celsius to 28 Degree Celsius. In areas like Mt. Abu and Churu, the temperature drops to 0 degree Celsius. Churu district is a semi-arid area and it receives very less rainfall. Both summer and winter monsoon are active here. In summer, monsoon arrives in Rajasthan from two ways or it branches first from Arabian Sea and second branch is Bay of Bengal. From the branch of Arabian Sea,Churu district get very less rainfall because the monsoon branch is parallel to the Aravalli range. Churureceives less rainfall from Bay of Bengal branch too because the district lies in rain shadow area of theAravalli Range but the rainfall receives from this branch is more than the Arabian branch. In winter, Churu gets rain at intervals because of western disturbance cyclonic activity.

LOCATION AND EXTENT OF THE CHURU DISTRICT:
Churu district is located in the northern part of Rajasthan. It is bounded on the north by Hanumangarhdistrict, in the east by the state of Haryana and Jhunjhunu district, south by Sikar and Nagaur districtsand by Bikaner district in the west. It stretches between 27º 24' 31.50" to 29º 00' 01.74" North latitudesand 73º 50' 39.45'' to 75º 40' 31.85'' East longitudes. It has six tehsils including Churu, Rajgarh, Ratangarh, Sardarsahar, Sujangarh, and Taranagar. The district does not have a properly evolved drainage system, except for a negligible part in the east which is part of Shekhawati River Basin, almost whole of the district is part of an 'Outside' Basin. Churu district is administratively divided into six blocks but few years back it will be divided into seven blocks and in this study, Churu dividedinto seven blocks, which are Churu, Ratangarh, Sardarsahar, Sujangarh, Rajgarh, Taranagar and Dungargarh.

GEOLOGY:
The whole of central and northern part of the district is occupied with primarily aeolian sand and partlyby fluvial deposits. The southern part of the district has some exposures of hard rock covered by Marwar Super Group which includes the rock formation of sandstone, shales, and limestone. The smallsouth-western part of the district, in Sujangarh block, occupies Erinpura granite and gneiss.

TOPOGRAPHY:
District Churu is a part of Great Indian Thar Desert. The surface is covered with sand and characterizedby dunes. The general topography is almost an undulating plain area except for some hillocks in the south. The district is part of Outside Basin, and its small part is coming under Shekhawati River basin.The general topographic elevation in the district is between 250 m to 300 m above mean sea level.

CLIMATE:
Churu district is part of the arid region. The district has a dry climate, and the area is well known for both highest in the country and lowest in the peninsular India recording below freezing pointtemperature in the winters to over 50 ºC in the summer afternoons. There is a great variation in minimum and the maximum temperature of Churu. Average rainfall in the district is 353.9 mm spreadover three monsoon months of July to September.

RAINFALL:
Figure 2 shows average rainfall of churu district from 2000 to 2021. The district received good rainfallin the year 2010. Rainfall is gradually increasing in previous years. The general distribution of rainfallrange is 300 mm to 500 mm in which, it is covering maximum parts of the district. The annual averagerainfall was 675.1 mm based on the data of available blocks while highest average annual rainfall was 777.7 mm in Rajgarh block. Lowest annual rainfall was lowest in Sujangarh block (456.9 mm). Rajgarh block has received the maximum annual rainfall of about 947.2 mm.

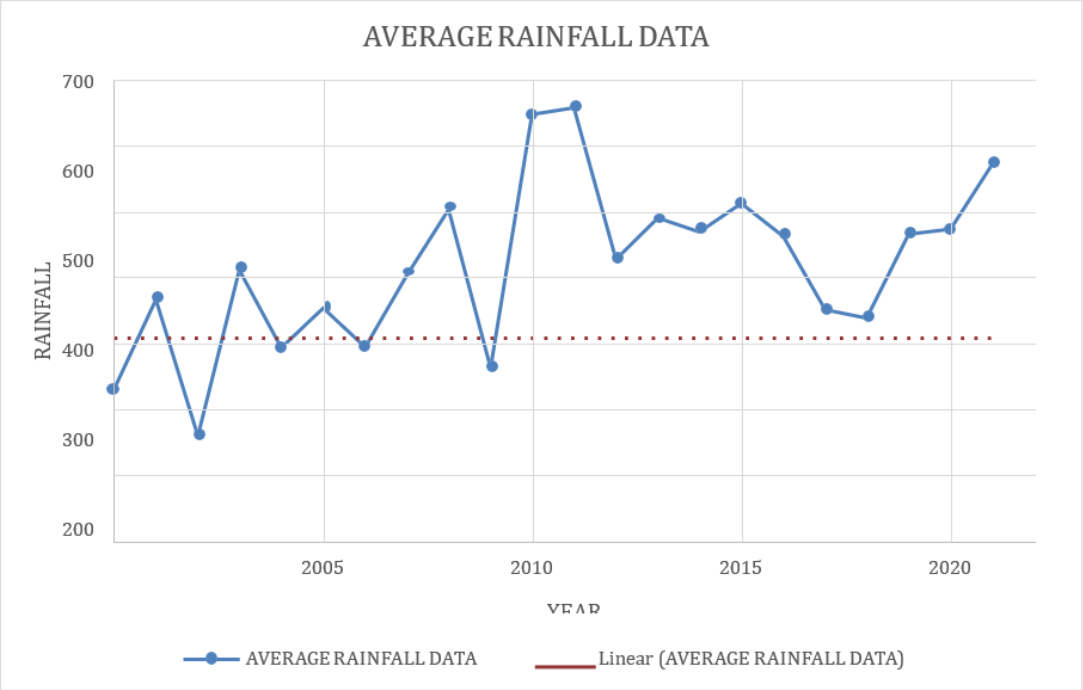

Figure 1: Average Rainfall of Churu District (Source: Water Resources Department,Rajasthan).

AGRICULTURE:
According to Department of Agriculture (Extension), Zila Parishad, Churu and Ministry of Agriculture, the major crops of the area are Bajra, Moth, Moong, Guar, Wheat, Gram, Mustard Oil seeds, Fruits and Vegetables etc.

MINERAL:
A major part of the district being thickly covered with sand and remains hidden from geological observations. But at some places rock exposures have been found both are eastern and western portions. The Delhi super Group of rock is represented by Ajabgarh group covering phyllites, slate andquartzite. The Malani igneous suite is mainly represented by an effusive phase which comprises phyllites and volcanic tuffs. The Marwar super group is represented by rocks of Jodhpur, Bilara and Nagaur group which include sandstone, shale, limestone, dolomite, anhydrite, gypsum and halite. Churu is not rich in minerals but they are found at few places. The various mineral deposits are coppersalt petrel, sand stone, limestone, gypsum etc. But these deposits are very small in size and not of mucheconomic importance.

FOREST:
As mentioned above the district is a part of the Indian Great Thar desert. The district has only 6663- hectare area under the forest which is only 0.46% of the total area of the district. The vegetation coverin the district is almost negligible due to extremes of temperature during winter and summer and scantyrainfall established sand dunes inside Grass Reserves of inside areas, free from biotic interference, contain very poor and open forest. Important trees found in the district are Khejari, Kikar, Neem, Hingotaker, Shisham, Rohira, Bhhui, Phog, Ask, Senia, Thor, Morali, Bura, Lampre, Kucha, Mural

etc. Fox, Blue, Bull, common hare, Jackal porcupine, Bats and Bush rats etc. are found here. The common birds found here are Bulbul, kite, Owl, Pigeon, Sand Grouse, Grey pasctridge, Godavan of Guraha.

LOCATION AND EXTENT OF THE CHURU DISTRICT:

The location and extent of Churu district is shown in Figure 2.

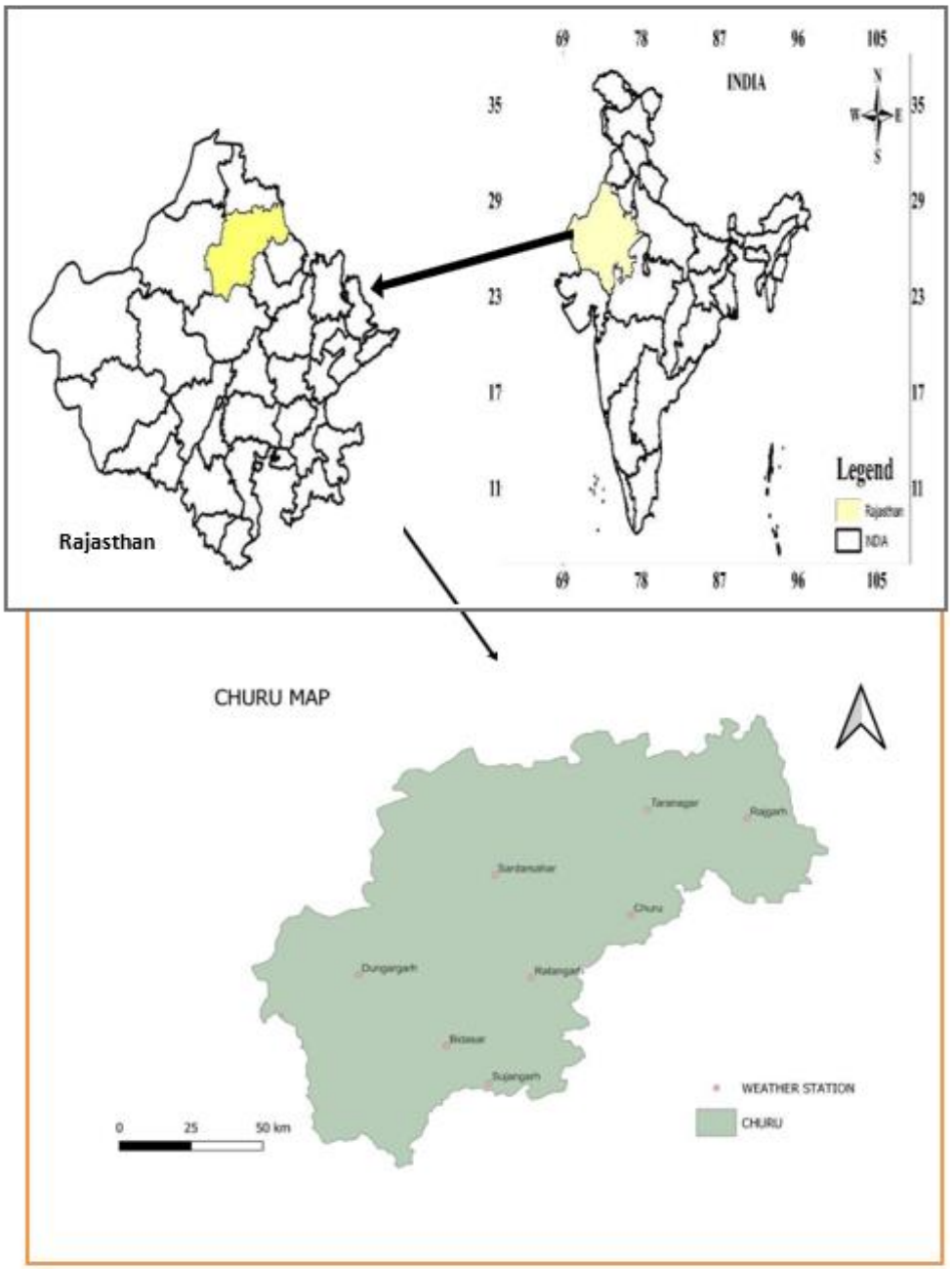

Table 1: Rain fall data Churu 2000.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINFAL DAYS
CHURU	28.3	75.97	230	19
RAJDARH	28.64	75.38	187	13
RATANGARH	28.67	75.03	184	14
SARDARSHAHAR	28.44	74.49	317	10
SUJANGARH	28.08	74.62	352	13
TARANAGAR	27.71	74.47	127	8
DUNGARGARH	28.09	74.01	283	14

Table 2: Rain fall data Churu 2001.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	413	26
RAJGARH	28.64	75.38	465	24
RATANGARH	28.67	75.03	297	23
SARDARSHAHAR	28.44	74.49	336	17
SUJANGARH	28.08	74.62	276	19
TARANAGAR	27.71	74.47	429	23
DUNGARGARH	28.09	74.01	209	15

Table 3: Rain fall data Churu 2002.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	288	14
RAJGARH	28.64	75.38	210	16
RATANGARH	28.67	75.03	78	10
SARDARSHAHAR	28.44	74.49	110	11
SUJANGARH	28.08	74.62	130	11
TARANAGAR	27.71	74.47	157	11
DUNGARGARH	28.09	74.01	73	7

Table 4: Rain fall data Churu 2003.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	570	26
RAJGARH	28.64	75.38	366	21
RATANGARH	28.67	75.03	446	27
SARDARSHAHAR	28.44	74.49	366	20
SUJANGARH	28.08	74.62	371	25
TARANAGAR	27.71	74.47	363	16
DUNGARGARH	28.09	74.01	442	21

Table 5: Rain fall data Churu 2004.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	253	22
RAJGARH	28.64	75.38	427	23
RATANGARH	28.67	75.03	250	17
SARDARSHAHAR	28.44	74.49	151	13
SUJANGARH	28.08	74.62	397	14
TARANAGAR	27.71	74.47	300	19
DUNGARGARH	28.09	74.01	115	12

Table 6: Rain fall data Churu 2005.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	444	30
RAJGARH	28.64	75.38	437	31
RATANGARH	28.67	75.03	217	17
SARDARSHAHAR	28.44	74.49	355	29
SUJANGARH	28.08	74.62	370	22
TARANAGAR	27.71	74.47	312	24
DUNGARGARH	28.09	74.01	431	28

Table 7: Rain fall data Churu 2006.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	251	17
RAJGARH	28.64	75.38	341	18
RATANGARH	28.67	75.03	226	15
SARDARSHAHAR	28.44	74.49	243	18
SUJANGARH	28.08	74.62	378	16
TARANAGAR	27.71	74.47	344	26
DUNGARGARH	28.09	74.01	202	14

Table 8: Rain fall

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	449	32
RAJGARH	28.64	75.38	532	27
RATANGARH	28.67	75.03	415	24
SARDARSHAHAR	28.44	74.49	303	25
SUJANGARH	28.08	74.62	272	22
TARANAGAR	27.71	74.47	460	29
DUNGARGARH	28.09	74.01	231	20

data Churu 2007.

Table 9: Rain fall data Churu 2008.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	636	36
RAJGARH	28.64	75.38	648	35
RATANGARH	28.67	75.03	431	27
SARDARSHAHAR	28.44	74.49	502	29
SUJANGARH	28.08	74.62	294	24
TARANAGAR	27.71	74.47	525	29
DUNGARGARH	28.09	74.01	369	29

Table 10: Rain fall data Churu 2009.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	165	19
RAJGARH	28.64	75.38	315	21
RATANGARH	28.67	75.03	245	14
SARDARSHAHAR	28.44	74.49	220	14
SUJANGARH	28.08	74.62	317	16
TARANAGAR	27.71	74.47	327	22
DUNGARGARH	28.09	74.01	199	16

Table 11: Rain fall data Churu 2010.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	635	36
RAJGARH	28.64	75.38	564	35
RATANGARH	28.67	75.03	713	35
SARDARSHAHAR	28.44	74.49	556	22
SUJANGARH	28.08	74.62	627	32
TARANAGAR	27.71	74.47	802	40
DUNGARGARH	28.09	74.01	417	23

Table 12: Rain fall data Churu 2011.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	648	33
RAJGARH	28.64	75.38	680	32
RATANGARH	28.67	75.03	533	30
SARDARSHAHAR	28.44	74.49	591	32
SUJANGARH	28.08	74.62	509	27
TARANAGAR	27.71	74.47	1001	37
DUNGARGARH	28.09	74.01	380	28

Table 13: Rain fall data

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	430	22
RAJGARH	28.64	75.38	431	21
RATANGARH	28.67	75.03	400	26
SARDARSHAHAR	28.44	74.49	283	20
SUJANGARH	28.08	74.62	665	22
TARANAGAR	27.71	74.47	368	23
DUNGARGARH	28.09	74.01	193	19

Churu 2012.

Table 14: Rain fall data Churu 2013.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	456	31
RAJGARH	28.64	75.38	453	28
RATANGARH	28.67	75.03	606	36
SARDARSHAHAR	28.44	74.49	463	28
SUJANGARH	28.08	74.62	564	35
TARANAGAR	27.71	74.47	413	29
DUNGARGARH	28.09	74.01	466	29

Table 15: Rain fall data Churu 2014.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	566	36
RAJGARH	28.64	75.38	502	27
RATANGARH	28.67	75.03	414	26
SARDARSHAHAR	28.44	74.49	421	24
SUJANGARH	28.08	74.62	461	29
TARANAGAR	27.71	74.47	466	28
DUNGARGARH	28.09	74.01	371	28

Table 16: Rain fall data Churu 2015.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTALRAINYDAYS
CHURU	28.3	74.97	500	35
RAJGARH	28.64	75.38	453	30
RATANGARH	28.67	75.03	394	21
SARDARSHAHAR	28.44	74.49	657	38
SUJANGARH	28.08	74.62	554	31
TARANAGAR	27.71	74.47	529	28
DUNGARGARH	28.09	74.01	495	32

Table 17: Rain fall data Churu 2016.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	575	28
RAJGARH	28.64	75.38	746	30
RATANGARH	28.67	75.03	328	17
SARDARSHAHAR	28.44	74.49	258	20
SUJANGARH	28.08	74.62	407	29
TARANAGAR	27.71	74.47	478	26
DUNGARGARH	28.09	74.01	346	24

Table 18: Rain fall data Churu 2017.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINY DAYS
CHURU	28.3	74.97	343	25
RAJGARH	28.64	75.38	531	29
RATANGARH	28.67	75.03	237	21
SARDARSHAHAR	28.44	74.49	314	21
SUJANGARH	28.08	74.62	395	30
TARANAGAR	27.71	74.47	306	18
DUNGARGARH	28.09	74.01	289	21

Table 19: Rain fall data Churu 2018.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	394	24
RAJGARH	28.64	75.38	344	25
RATANGARH	28.67	75.03	305	20
SARDARSHAHAR	28.44	74.49	272	20
SUJANGARH	28.08	74.62	301	20
TARANAGAR	27.71	74.47	429	22
DUNGARGARH	28.09	74.01	237	12

Table 20: Rain fall data Churu 2019.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	488	27
RAJGARH	28.64	75.38	627	27
RATANGARH	28.67	75.03	330	25
SARDARSHAHAR	28.44	74.49	393	26
SUJANGARH	28.08	74.62	578	32
TARANAGAR	27.71	74.47	391	26
DUNGARGARH	28.09	74.01	259	20
Bidasar	27.84	74.32	528	26

Table 21: Rain fall data Churu 2020.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUALRAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	515	31
RAJGARH	28.64	75.38	500	24
RATANGARH	28.67	75.03	442	30
SARDARSHAHAR	28.44	74.49	612	36
SUJANGARH	28.08	74.62	304	26
TARANAGAR	27.71	74.47	485	31
DUNGARGARH	28.09	74.01	235	21
Bidasar	27.84	74.32	537	37

Table 22: Rain fall data Churu 2021.

WEATHER STATION	LATITUDE	LONGITUDE	ANNUAL RAINFALL	TOTAL RAINYDAYS
CHURU	28.3	74.97	650	38
RAJGARH	28.64	75.38	748	29
RATANGARH	28.67	75.03	586	27
SARDARSHAHAR	28.44	74.49	428	29
SUJANGARH	28.08	74.62	620	37
TARANAGAR	27.71	74.47	413	31
DUNGARGARH	28.09	74.01	360	25
BIDASAR	27.84	74.32	705	40

Results

Churu District Average Rainfall Data:

With the help of average rainfall data we can say that Churu district received rainfall between a rangesof 200-600 mm in last 22 years and only three times the rainfall crosses this range in these years. In the years 2010 and 2011 the rainfall is more than this range with nearly 650 mm and in the year 2002rainfall is very low and it goes below the range nearly 180 mm. Average rainfall data show a gradual increases in the last years in the region.

In the year 2008, 2010, 2011, 2013, 2015 and 2021, average rainfall received in Churu is near 500mmwhich is an average so that it can be considered as normal rainfall.

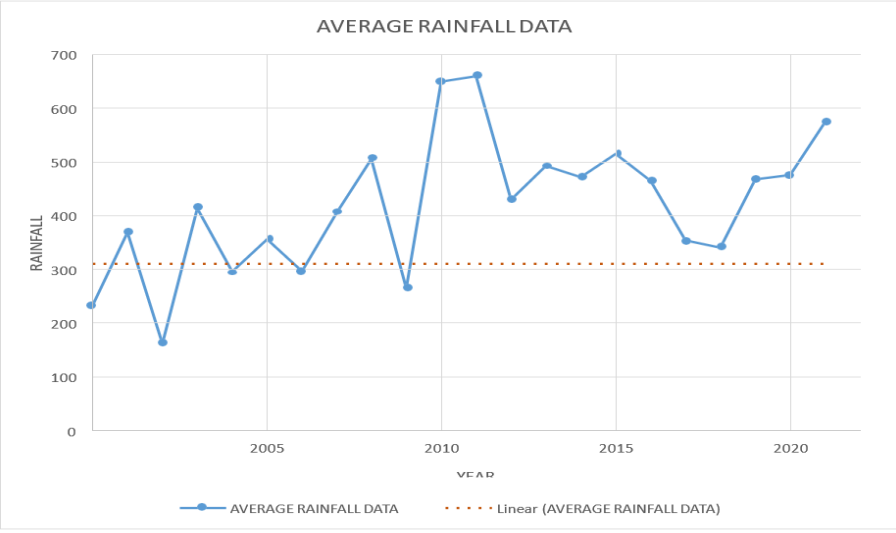

Figure 3: Churu district average rainfall data

5.1 Churu district average rainy days:

With the help of data of average rainy days we can say that Churu district rainfall days are between a ranges of 15-30 in last 22 years and average rainfall data show a gradual increases in the last years in the region. Average rainy days are consistently following an increasing pattern. In last 10 years averagerainy days are higher than 20 days and crossed 30 days line 6 times.

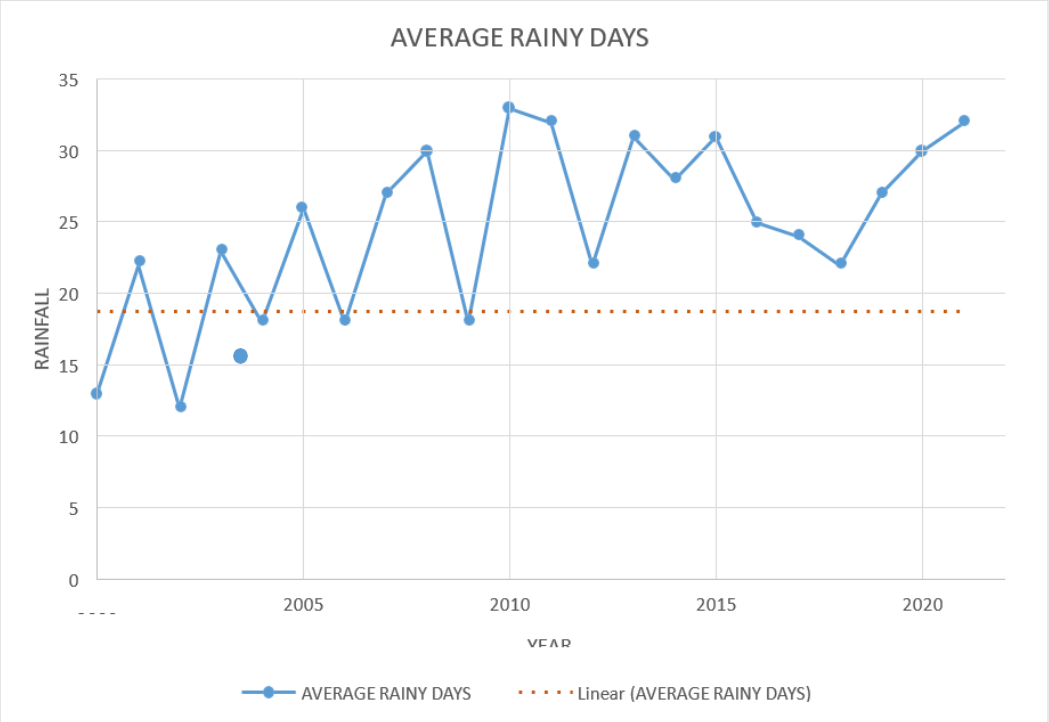

Figure 4: Churu district average rainy days.

5.2 Churu Rainfall Distribution 2000:

There were seven weather stations in Churu district in 2000. If we go through the complete rainfall distribution data of Churu district for year 2000 as per above rainfall distribution map, we found that in the year 2000 rainfall distribution in Churu district is being decreases when going north to south oreast to west direction of Churu district. Taranagar and Rajgarh blocks get highest rainfall during the whole year and Sardarsahar block is on second position. Sujangarh block get lowest rain fall during the whole year. Ratangarh and Dungargarh block get second position in lowest rainfall in the region while Churu block get average rainfall.

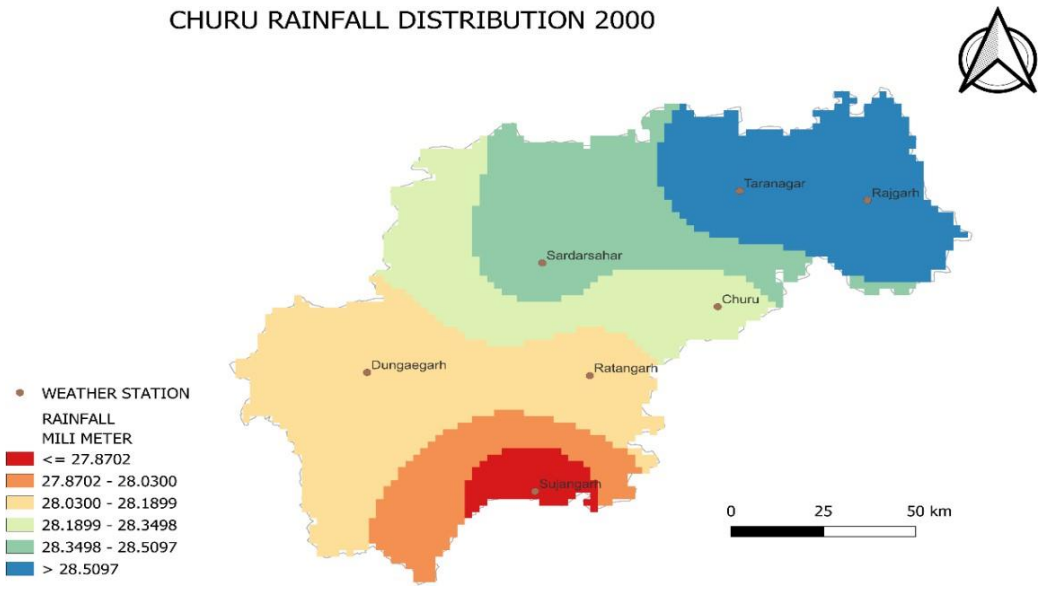

Figure 5: Churu district thematic map 2000.

5.3 Churu Rainfall Distribution 2010:

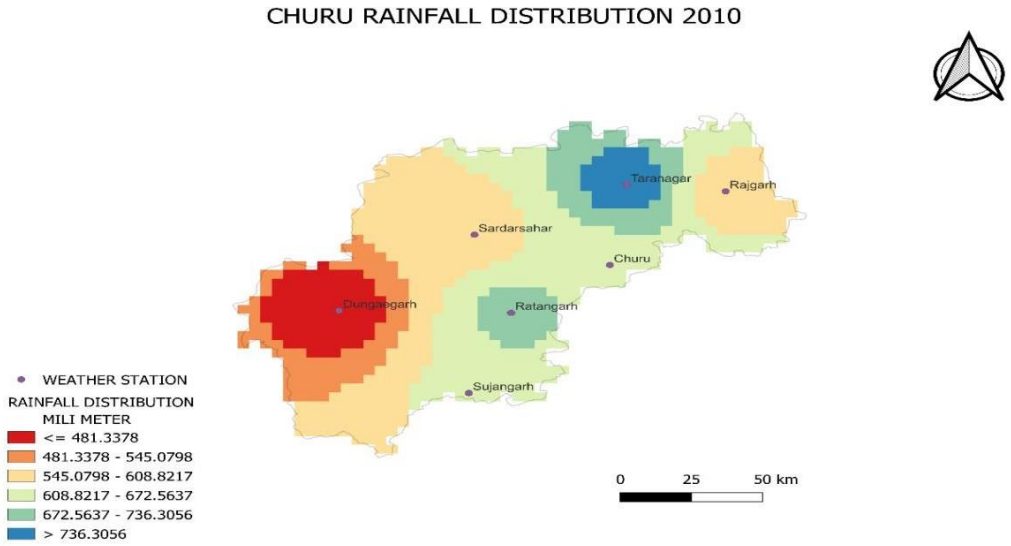

Figure 6: Churu district thematic map 2010.

In Churu district there were seven weather station in 2010. If we go through the data of complete rainfall distribution at each weather station as per above graph, we found that in the year 2010 rainfalldistribution in weather stations of Churu district is being decreases when going north to south or east to west direction of Churu district. Taranagar and Rajgarh blocks get highest rainfall during the wholeyear and Sardarsahar block is on second position. Sujangarh block get lowest rain fall during the wholeyear. Ratangarh and Dungargarh block get second position in lowest rainfall in the region. Churu blockget average rainfall.

Churu Rainfall Distribution 2020:

In Churu district there are eight weather station in 2020 and Bidasar is latest weather station. If we gothrough the complete rainfall distribution data of Churu district for year 2020 as per above rainfall distribution map, we found that in the year 2020 rainfall distribution in Churu district is also being decreases when going north to south or east to west direction of Churu district. Sardarsahar block gethighest rainfall during the whole year. Taranagar, Churu and Rajgarh blocks is on second position. Dungargarh and Sujangarh block get lowest rain fall during the whole year. Ratangarh and Bidasar block get average rainfall throughout the year.

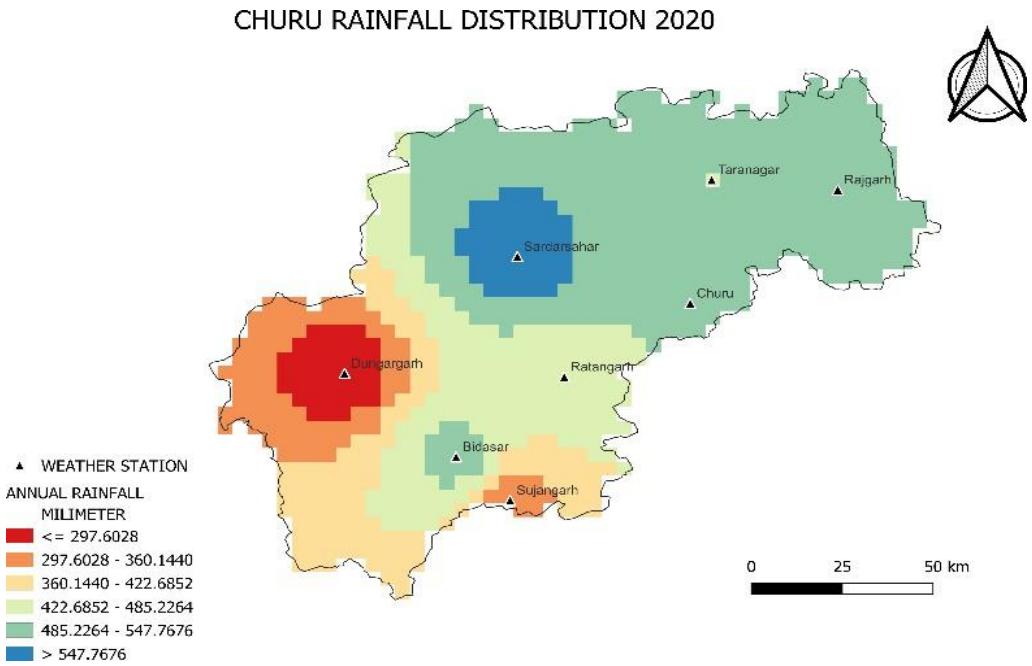

Fig 7: Churu district thematic map 2020

Churu District Average Rainfall Distribution 2000-2021:

In Churu district, 22 years average rainfall data analysis in the thematic map shows that the average rainfall of last two decades is more in south-eastern region compare to the north-western region. Bidasar block shows highest rainfall in last

decades because this weather station established in 2019 and in last 5 years rainfall in this block is high. Dungargarh block get lowest rainfall during the two decades in the district. In other blocks, in last two decades received rainfall is nearly equal at all stationsor not have much difference.

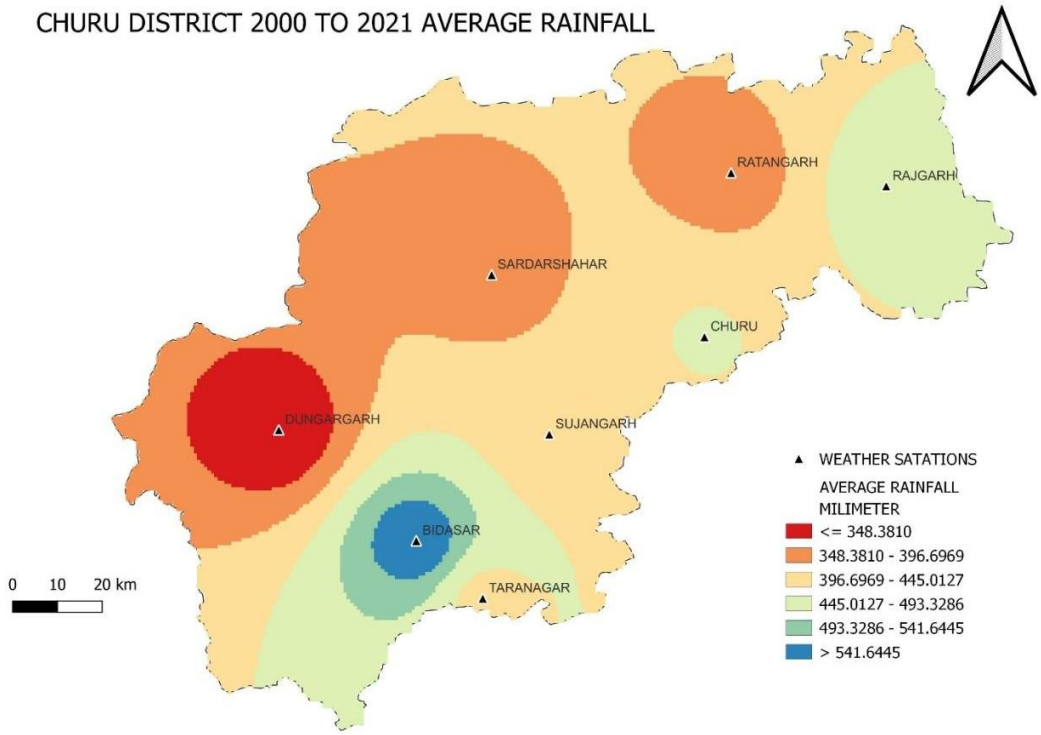

Figure 7: Churu district average rainfall from 2000 to 2021 thematic map.

Conclusion

In the present study, the analysis of the rainfall data show increasing trend in rainfall amountof Churu district and rainy days are also show a slow increasing pattern in Churu. South-western part of the Churu district get lowest rainfall and north-eastern part get maximumrainfall. In Churu district, rate of ground water recharge is very less because of the low rainfall and hightemperature. The combined use of surface water, available rainfall and groundwater is essential for betteragricultural management and irrigation in the area. The analysis helps to understand the rainfall pattern in the Churu region and to plan the plantsfor efficiency and water availability in the region.

Reference

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