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Research Article

ASSESSMENT OF RAINFALL VARIABILITY IN GIS ENVIRONMENT AT SARABANGA SUB-BASIN CAUVERY RIVER SOUTH INDIA

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ABSTRACT
Rainfall being the predominant from of precipitation causing stream flow, especially the flood flow in a majority of rivers in India. In the present study, an attempt has been made to assessment the rainfall variation and monitoring with respect to spatial distribution in Sarabanga Sub-basin, Cauvery River, South India. In this work were exiguities by GIS Technique. To achieve the aim of rainfall variations during winter (Jan. & Feb.), summer (Mar. to May), southwest monsoon (Jun. to Sep.) and northeast monsoon (Oct. to Dec.) were analyzed for the period from 2001 to 2010. These results were taken into GIS platform to prepare the spatial distribution maps. The spatial distribution maps of Southwest- and Northeast- monsoon season showed that 52.47 km^2 and 281.28 km^2 of the study area received high rainfall during the respective monsoon seasons. Annual average rainfall spatial distribution map for the years 2001-2010 revealed that 74.43 km^2 falls under high rainfall zone in the study area. The results suggest that the model reproduces the number and spatial distribution maps of rainfall extremes with some accuracy, but that mean rainfall and rainfall variability is estimated over dry regions of Sarabanga sub-basin, Cauvery River, South India.

Key Words: *Rainfall, Spatial Distribution, Monsoon Season*

INTRODUCTION

To date, many studies on rainfall variability has been used data at relatively low resolutions, either spatially such as that of global climate models (GCMs; e.g. Reason 1998; Goddard and Graham 1999; Cook 2000; Rautenbach and Smith 2001; Nicholson 2003) or at a coarse temporal resolution from monthly, seasonal to annual rainfall totals (e.g. Richard and Poccard 1998; Landman *et al.,* 2001; Thiam and Singh 2002; Bartman *et al.,* 2003). As the identification of extreme rainfall events is a function of scale, with the ability to highlight rainfall extremes increasing in step with the data resolution (Williams *et al.,* 2007). An improved understanding of extreme daily rainfall at high spatial resolution is important, because recent rainfall related disasters have highlighted the impact that rainfall variability and extremes have on society. It is generally agreed that developing countries suffer more from extreme rainfall events than developed countries because, being environmentally and socioeconomically vulnerable before the extreme event occurs, developing countries are more sensitive to such disasters. Mozambique, for example, experienced an extreme rainfall event associated with Tropical Cyclone Eline during 21–25 February 2000, resulting in severe flooding and displacing over a million people (Layberry *et al.,* 2006).

Since groundwater is a major drinking water resource and critical for irrigation in all parts of the world, evaluating and predicting the availability and accessibility of groundwater under changing boundary conditions is one of the central tasks in Integrated Water Resources Management (IWRM) (Villholth, 2006; Holman, 2006). IWRM with respect to groundwater has two main objectives namely to provide water in sufficient quantity and quality equitably to different consumers and at the same time to maintain and guarantee a sustainable qualitative and quantitative status of the groundwater resource itself (Hiscock *et al.,* 2002). A ‘good status’ of groundwater refers to its function in water supply (drinking water, irrigation, industrial use etc.) but also to its role as a long term reservoir to sustain aquatic ecosystems (wetlands) and to provide a source of discharge in dry periods.

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GIS has emerged as a powerful technology for instruction, for research, and for building the stature of programs (Openshaw 1991; Longley 2000; Sui and Morrill 2004). GIS is an important technology for geologists (Baker and Case 2000).

Study Area

The study area, lies between the latitudes 11°46’ N to 12°09’39” N and longitudes 78°12’27” E to 78°36’65” E covering an area of 1178.56 km^2. Out of which plain land covers an area of 1015.79 km^2 (Figure 1). The study area falls in Salem district of Tamil Nadu. The major source for recharge of water in this area is rainfall, during monsoon season. The average annual rainfall is 852 mm (2000 to 2010). The study area is underlaid by the Archaean crystalline rocks surrounded by wavy hills and hillocks.

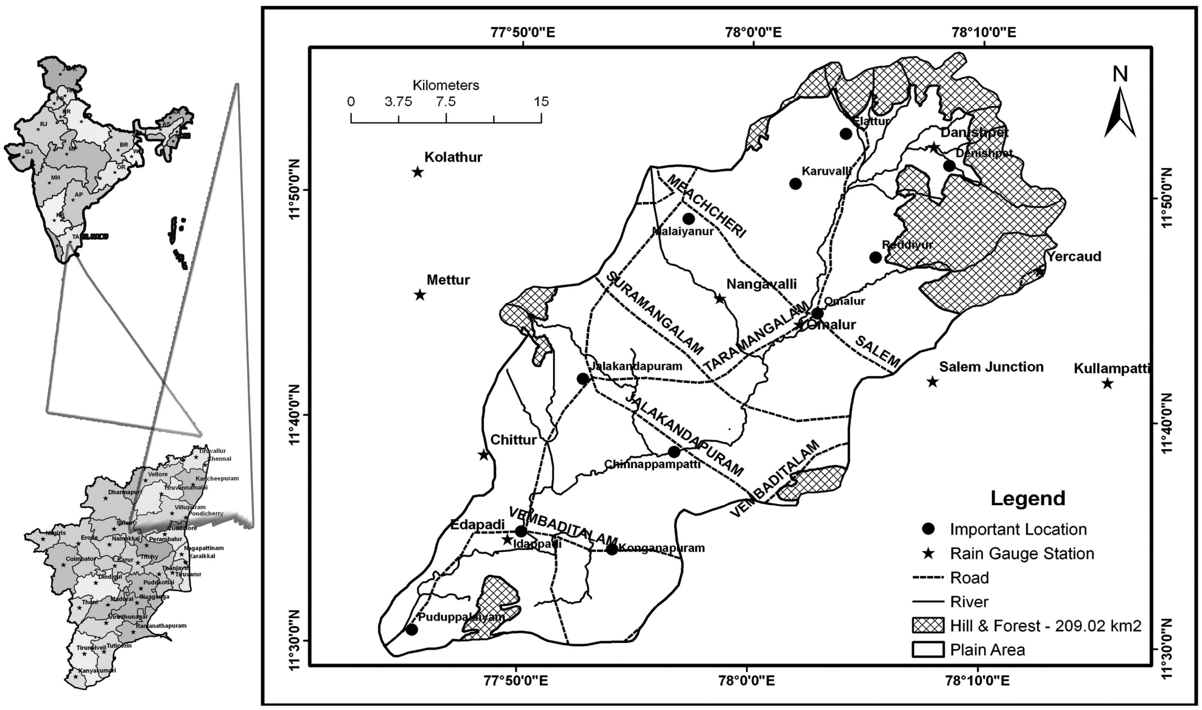

Figure: 1 Study Area

MATERIALS AND METHODS

The daily rainfall data were collected from Public Work Department (PWD), Govt. of Tamil Nadu and converted into average seasonal rainfall like Winter (January and February), Summer (March, April and May), South West (June, July, August and September), and North East (October, November and December) monsoon rainfall. From this, the average annual rainfall for the last ten years was calculated. The ten years rainfall data (2001 – 2010) are calculated in nine rainfall stations at Edapadi, Kolathur, Kullampatti, Mettur, Omalur, Salem junction, Sankari, Yercaud, Danishpet, Chittur, Nangavall in and around the study area. Based on the daily rainfall data, month wise and seasonal wise average rainfall was calculated. Finally using the above, the annual average rainfall was calculated and interpreted.

To find out the spatial distribution of the rainfall variation in the study area, GIS was employed. The rainfall location was digitized and the corresponding values (Average winter, summer, southwest, northeast and annual average rainfall) of its attributes were given as an input. Using this data, the interpolation raster maps were generated. Subsequently, these maps were classified with respect to our interest and converted into vector maps. These maps were clipped with the boundary to arrive within the boundary of the study area.

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RESULTS AND DISCUSSION

Eleven rainfall stations were studied, Out of Eleven stations one station i.e Yercaud showed a good response of rainfall. Four stations namely Kolathur, Mettur, Omalur and Salem junction show a moderate rainfall as the other four stations, namely Edapadi, Kullampatti, Sankagiri and Danespet show a low rainfall. 10 years (2001to 2010) data were collected from Public Work Department (PWD) Govt. of Tamil Nadu and were interpreted (Table 1 and Figure 2). High rainfall noticed in 2005, lowest rainfall noticed in 2002. The average Southwest monsoon rainfall is 400 mm and average Northeast monsoon rainfall is 405 mm. In summer and winter season, the average rainfall is noticed as 198 mm and 5 mm the details are listed in Table 2 and shown in Figure 3.

Table 1: Average annual rainfall data in mm (2001 - 2010)

Years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Rainfall in mm	934	862	1005	1139	1221	1003	937	1051	930	991

Table 2: Average annual seasonal rainfall data of the study area in mm (2001 –2010)

Stations	Winter	Summer	Southwest Monsoon	Northeast Monsoon
Edapadi	5	193	335	401
Kolathur	18	227	360	458
Kullampatti	9	203	324	410
Mettur	4	225	362	573
Omalur	1	190	429	350
Salem Junction	1	180	373	384
Sankagiri	2	156	263	402
Yercaud	14	256	686	477
Danishpet	2	192	465	300
Chittur	1	160	427	357
Nangavalli	0	191	371	344
Average	5	198	400	405

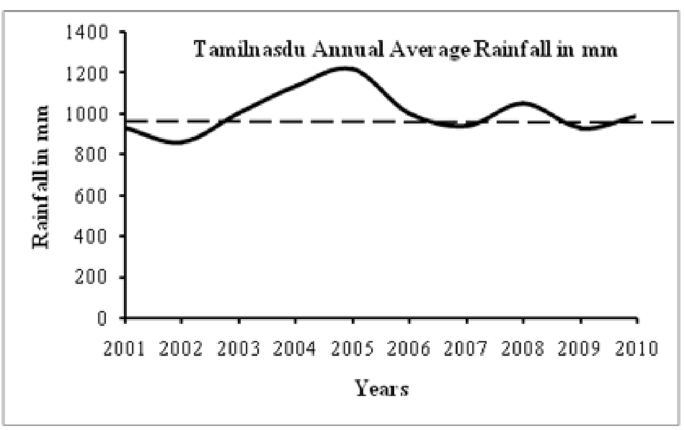

Figure 2: Fluctuation graph of rainfall data for the Period of 2001 – 2010

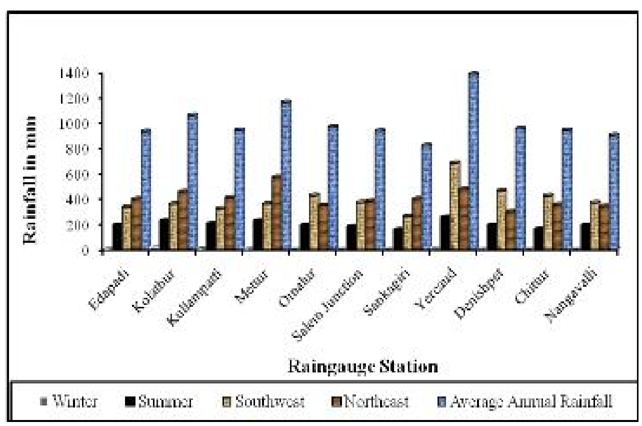

Figure 3: Season wise graph of rainfall for the period – 2001 to 2010

Gis Results

GIS is an analytical technique associated with the study of locations of geographic phenomena together with their spatial dimension and their associated attributes like table analysis, classification, polygon classification and weight classification.

The Winter, Summer, Southwest monsoon Northeast monsoon and Annual average rainfall thematic maps as described above have been converted into raster form considering 30m as cell size to achieve considerable accuracy. These were then reclassified and assigned suitable weightage and spatial distribution results (Table 3). The results of winter season, summer season, southwest monsoon season, northeast monsoon and average annual rainfall data for the period 2001-2010 were used in the spatial distribution maps. GIS spatial distribution maps and its results are shown in Figure 4 to 8 and given Table 3. The winter season GIS map reveals that a small portion of the study area are high rainfall noticed in North eastern part of sevaroys hills at the range of (More than 5.22 mm) and are classified as high rainfall zone is occupied 1.46 km^2 (Figure 4).

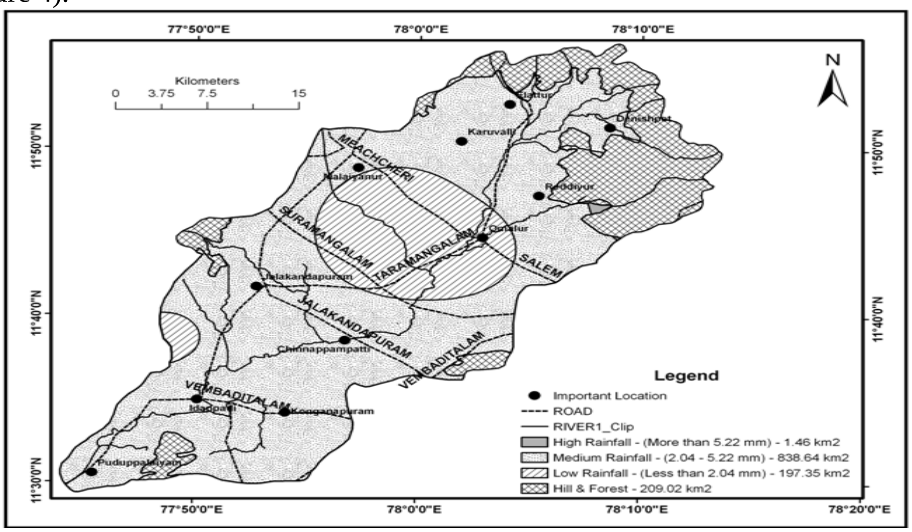

Figure 4: Annual average rainfall Winter Season – Spatial Distribution Map

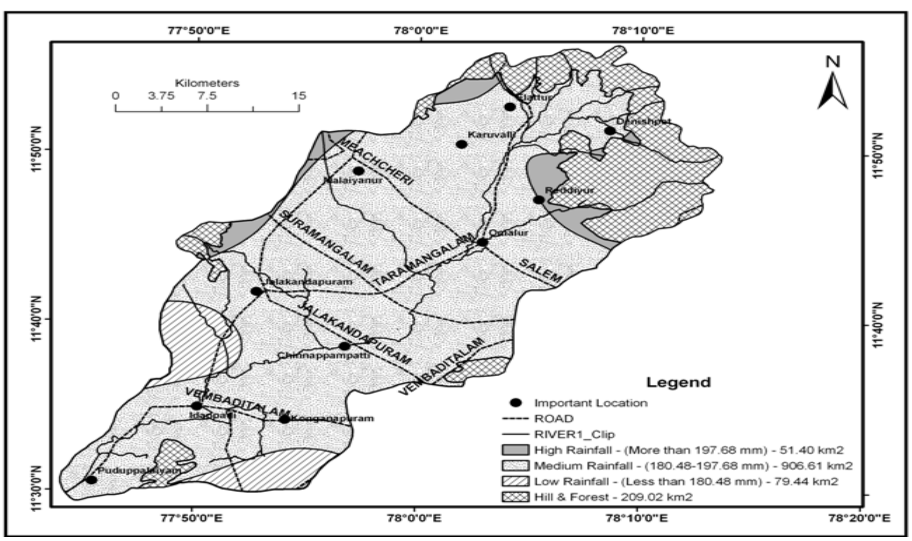

Figure 5: Annual average rainfall Summer Season – Spatial Distribution Map

Summer season GIS image reveals that spatially 51.40 km^2 area fell in the high rainfall area and 906.61 km^2 area falls in the medium rainfall category zone (Figure 5). The high rainfall area is located in near to the hill and forest (more than 500 ft height).

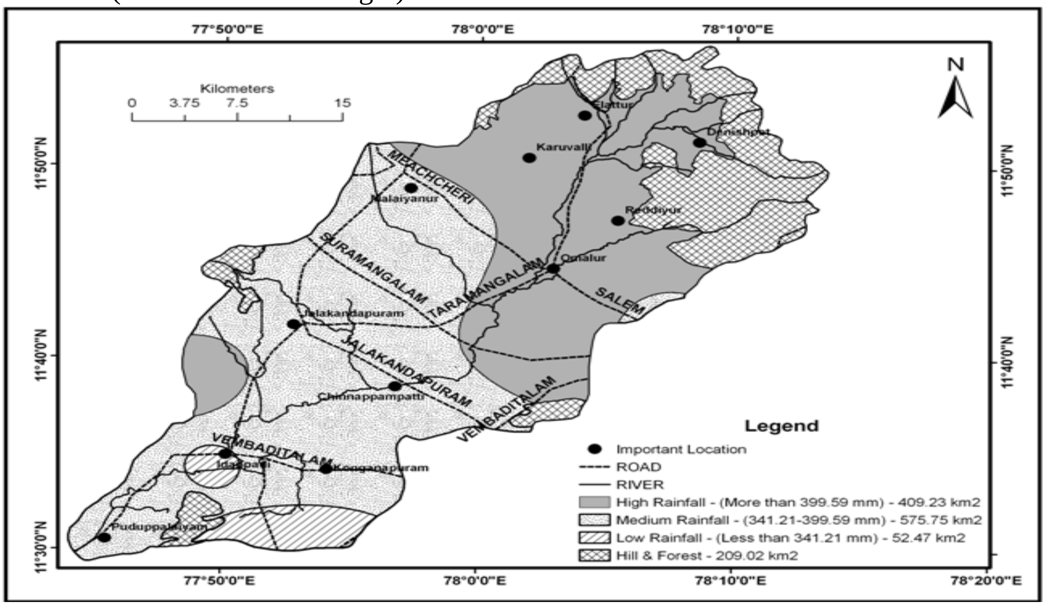

Figure 6: Annual average rainfall Southwest Monsoon Season – Spatial Distribution Map

The southwest monsoon GIS map (Figure 6) reveals that spatially 409.23 km^2 area falls in the high rainfall category and 575.75 km^2 area falls in moderate rainfall category. The high rainfall zone present in upper part of the study area.

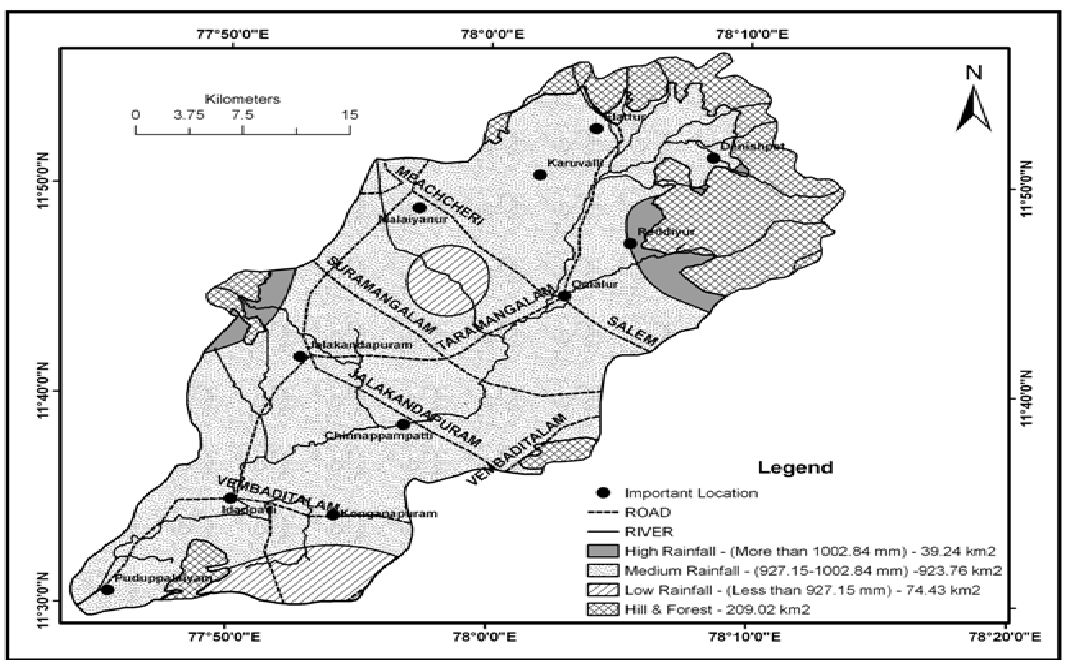

Figure 7: Annual average rainfall Northeast Monsoon Season – Spatial Distribution Map

Northeast monsoon GIS image reveals that spatially 39.24 km^2 areas falls in the high rainfall category, 923.76 km^2 area falls in moderate rainfall zones and rest of the area 74.43 km^2 falls in low rainfall zones.

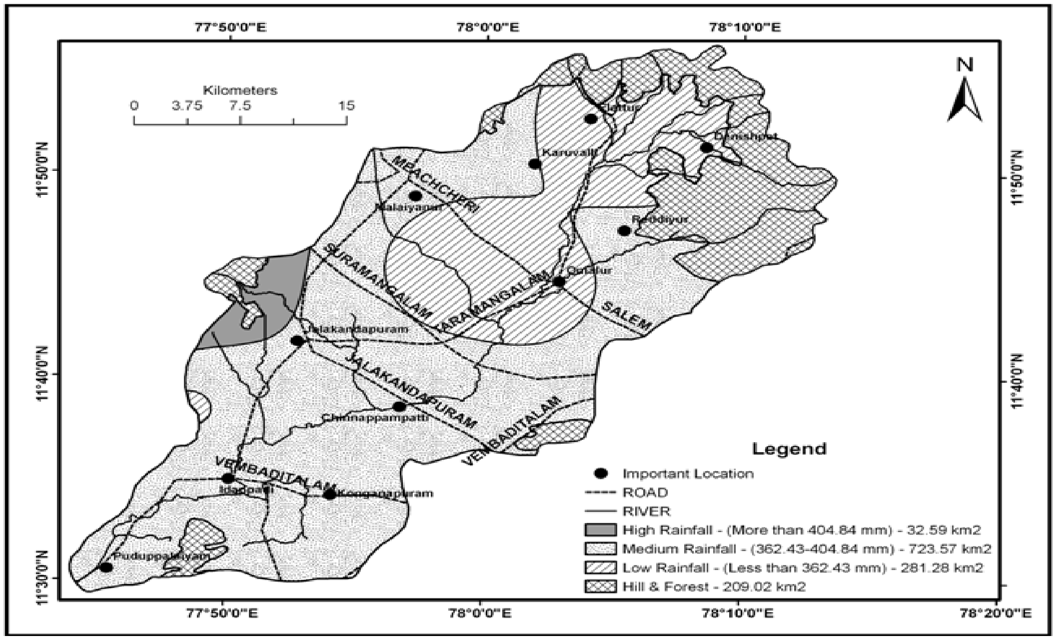

Figure 8: Annual average rainfall in 2001 to 2010 – Spatial Distribution Map

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Table 3: Average seasonal rainfall data spatial distribution results

Sl.No.	Rainfall Seasons	Class Category	Area in km^2	Area in Percentage
		High Rainfall	1.46	0.13
1	Winter	Medium Rainfall	838.64	80.84
		Low Rainfall	197.35	19.02
		High Rainfall	79.44	7.66
2	Summer	Medium Rainfall	906.61	87.39
		Low Rainfall	51.40	4.95
		High Rainfall	52.47	5.06
3	Southwest Monsoon	Medium Rainfall	575.75	55.50
		Low Rainfall	409.23	39.45
		High Rainfall	281.28	27.11
4	Northeast Monsoon	Medium Rainfall	723.57	69.75
		Low Rainfall	32.59	3.14
		High Rainfall	74.43	7.18
5	Annual Average	Medium Rainfall	923.76	89.04
		Low Rainfall	39.24	3.78

Average annual rainfall spatial distribution result shows that spatially 32.59 km^2 area falls in high rainfall zones and 723.57 km^2 area falls in moderate rainfall zones and rest of the area 281.28 km^2 falls in low rainfall zones. High rainfall spatially occupied southwestern part of the study area.

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CONCLUSION

GIS tool is highly helping in this study, to demarcating the different spatial distribution zones. It shows that higher amount of rainfall received in the Northeast and Southwest monsoon seasons, spatially 409.23 km^2 are precipitated for 79.86%. The study concludes that result the high amount of rainfall water received only monsoonal season but Non-monsoonal season in meager amount of rainfall is received. Therefore this study area rainfall is not sufficient for the purpose of irrigational as well as domestic purposes due to the deforestation. The results suggest that to develop the dance forest in the hilly region.

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