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Droughts in Tamil Nadu: A Qualitative and Quantitative Appraisal

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A Qualitative and Quantitative Appraisal

Tamil Nadu experiences recurrent droughts. Tamil literature also indicates that famine-like conditions prevailed during the Pandiyan Kingdom for nearly 12 years. The state normally benefits from northeast monsoon rainfall from October to December, unlike other regions of India, which are dominated by southwest monsoon rainfall.

In general, four major parameters determine the nature and extent of drought conditions in Tamil Nadu: (1) rainfall, (2) ground water, (3) reservoir levels, and (4) crop conditions. It is estimated that nearly 50% of the districts in the state are drought-prone. The state receives nearly 80% of its annual rainfall during the northeast monsoon, whereas it experienced below-normal rainfall in the southwest monsoon for 30% of the years in the last 25 years. During the southwest monsoon period, water demand always exceeds rainfall, but the water deficit is quite low in the northeast monsoon period. Hence, due to severe water deficit, drought recurs during the southwest monsoon and also in summer months in Tamil Nadu.

The severity and extent of drought in the state is believed to be the result of aberrations in rainfall, overexploitation of ground water, lower reservoir levels, and crop stress conditions. Red, black, and alluvial soil types predominate in Tamil Nadu, but sandy soils in the southeast part of the state are prone to chronic droughts. This article discusses and apprizes the qualitative and quantitative aspects of rainfall climate, drought profile, episodic drought events, remedial drought measures, and drought management. This information may serve as feedback for policy makers and administrators in evolving strategies.

Mean Annual Rainfall (mm)	Districts
<800	Coimbatore
800–1,000	Pudukottai, Tirunelveli, Ramanathapuram, Madurai, Salem, Dharmapuri, North Arcot, Tiruchchirappalli
1,000–1,200	South Arcot and Tanjavur
1,200–1,400	Madras and Chingleput
1,400–1,800	Kanyakumari
>1,800	The Nilgiris

Table 1. District rainfall in Tamil Nadu.

Climate Pattern

The state's climate may be characterized as dry subhumid to semiarid. The state has three distinct rainfall climates: (1) southwest monsoon (June–September), (2) northeast monsoon (October–January), and (3) dry season (February–May). The state's cropping system centers on the northeast monsoon season. Tamil Nadu is classified into seven agroclimatic zones: northeast, northwest, west, south, higher rainfall zone, high altitude hilly, and cauvery delta zone. Of these, the most fertile zone is the cauvery delta zone, which is located in the humid tropics. It has a mean annual rainfall of 1,273 mm, mostly contributed by the northeast monsoon. The state has a normal annual rainfall of 945 mm, with 45 rainy days. Table 1 shows district rainfall in the state.

Regarding soil moisture and water deficit, some stations experience more deficit in summer than in winter. Table 2 shows the variation in climatic moisture status in Tamil Nadu. The state as a whole is water deficient. The northeast zone, comprising the Tiruchchirappalli, North Arcot, and Chingleput districts, experiences cyclones during the winter. The

Station		Seasonal PET	Seasonal Rainfall	Soil Moisture	Water Deficit
Vellore	I	690	634	3	137
	II	788	340	369	171
Salem	I	644	621	71	0
	II	892	217	550	73
Coimbatore	I	642	297	335	0
	II	801	248	511	61
Tiruchchirapalli	I	992	448	580	0
	II	858	331	500	73
Madurai	I	708	475	285	4
	II	794	344	402	100
Pamban	I	767	225	607	0
	II	854	671	391	73
Palayankottai	I	845	210	675	0
	II	829	489	369	7
	I	Winter			
	II	Summer			

Table 2. Climatic moisture status of Tamil Nadu.

mean annual rainfall in the zone is 1,054 mm; of this, 500 mm is contributed by the northeast monsoon. The northwest zone has an annual rainfall range of 560–1,080 mm, while the hilly regions receive 1,300 mm annually. Districts like Dharmapuri and Salem, which are in this zone, receive 45% of their annual rainfall from the southwest monsoon. The districts of Periyar, Coimbatore, Salem, and North Madurai are in the west zone, which has a mean annual rainfall of 635 mm. This zone has a semiarid to subhumid climate with frequent droughts. In this region, almost half the rainfall is from the northeast monsoon. The cauvery delta zone has a tropical climate, with a mean annual rainfall of 1,278 mm. The southern zone of Tamil Nadu, comprising the districts of Ramanathapuram, Tirunelveli, Dindigul, South Madurai, and Pudukottai, is under the rain shadow region, having a prolonged dry climate. Only northeast monsoon rainfall is dependable here. Hence, the mean water deficit exceeds rainfall in all months except October and November.

Tamil Nadu has 8 drought-prone districts covering 833,997 km^2, or about 64% of the total area of the state. The drought-prone districts are Coimbatore, Dharmapuri, Kanyakumari, Madurai, Ramanathapuram, Salem, Tirunelveli, and Tiruchchirappalli. Coimbatore district has erratic and unpredictable rainfall. About 30% of the district's annual rainfall is recorded in the southwest monsoon and 50% is contributed by the northeast monsoon through cyclonic activity. Generally, rainfall decreases from north to south. Dharmapuri district has pleasant dry weather, with most of its rainfall coming from the southwest monsoon. Because of its close proximity to the sea, Kanyakumari has a maritime climate. Here the southwest monsoon begins in June and lasts until September. The rainfall in this region is provided equally by the southwest and northeast monsoons. In the Madurai region, 29% of the annual rainfall is contributed by the southwest monsoon and 42% by the northeast monsoon. Because of variations in the district's topography, the rainfall is erratic in time and space. A dry and hot climate prevails in Ramanathapuram, with only 24% of the annual rainfall coming from the southwest monsoon and 53% coming during the winter monsoon. Salem district has a dry temperate climate, while Tiruchchirappalli is predominantly a dry zone, with 33% of its annual rainfall from the southwest monsoon and the rest from the northeast monsoon. Tirunelveli is a hot tropical region with nearly 60% of its annual rainfall occurring from October to December.

Drought Pattern during 'Kharif' Period

Although the northeast monsoon has a major impact on rainfall distribution and cropping patterns in Tamil Nadu, most of the droughts occur in the southwest monsoon or kharif season (June–September). An analysis of rainfall from 1871 to 1985 shows 4 consecutive years of deficit rainfall from 1928 to 1931 and 3 consecutive years of deficit rainfall from 1968 to 1970. These had a great impact on ground water levels, reservoir levels, crop conditions, and soil moisture. Sandy soils in the region are more prone to severe drought. Recent droughts occurred in 1966, 1967, 1979, 1982, 1986, 1987, and 1989. Each of these droughts posed different types of problems. Some of the droughts were chronic or severe and some were mild.

During the 1966 drought, there were 2 consecutive weeks of severe drought, and no moderate droughts occurred during the kharif season. In 1967, there were 3 severe consecutive drought weeks followed

by 3 weeks of moderate drought. In 1979, chronic drought occurred, with 9 consecutive weeks of severe droughts followed by moderate drought weeks, and a similar situation occurred in 1982. The droughts of 1986 and 1987 were also chronic and significant for India as well as Tamil Nadu. The problem was resolved by efficient management practices and through remedial measures by the state administration.

Impact of Some Significant Droughts

The drought of 1980 destroyed the groundnut crop, which covered about 1 lakh[1] ha in Chingleput and North Arcot districts of Tamil Nadu. As a result of the failure of the northeast monsoon in 1980, drought prevailed in 3 or 4 districts in early 1981. Thousands of coconuts dried up and mangoes were damaged. There was also an acute drinking water problem. Unemployment increased in handloom industries. During the 1982 drought, there were huge losses of paddy and groundnut. Even moisture-surplus regions like Nilgiri and Coonoor had severe drought, which resulted in the loss of about 6,000 ha of tea plantation. At the same time, during June to August, North Arcot district had a severe drought, resulting in transplantation of Samba variety of paddy of about 25,000 ha instead of the normal 80,000 ha. About 1 lakh ha of the groundnut crop was affected. Even Kuruvai variety of paddy (0.61 ha) was adversely affected because of the prolonged dry spell and rainfall failure.

The state lost crops such as paddy, pulses, and millets covering 1 lakh ha during the 1983 drought. Hydropower generation failures occurred because of the low level of water in the Mettur Dam. The 1985 drought resulted in an acute drinking water problem in Coimbatore, Trichy, Salem, Dharmapuri, and Madurai districts. The ground water level went below 2 meters in these regions.

The most alarming recent droughts occurred in 1987 and 1989. During 1987, about 108 lakh cattle were severely affected and catchment areas were nearly dry. There were 290 poor rainy days, 48 marginal rainy days, and 27 good rainy days in 1989, covering about 50% of the area. The ground water level fell more than 11 m below normal. The most severely affected crop was paddy, which was sown in an area of 20 lakh ha, compared to a target of 24 lakh ha. Paddy production also dropped by 10 lakh tons. Millet production decreased by 4 lakh tons and pulses decreased by 1 lakh ton.

Because of poor catchment and storage of water, the cropping pattern was changed to make the best use of the situation. The broadcast method of sowing was recommended to farmers. The impact of the 1989 drought was as critical as that of the 1987 drought in Tamil Nadu. Because of the acute shortage of water, the administration issued ration cards to people to collect drinking water at the various supply outlets. The water supply was made on alternate days only, because of low storage at Poondi, Red Hills, and Cholavaram reservoirs.

Anti-Drought Measures and Management

In Tamil Nadu, the labor force in the agrarian sector is substantial—about 30% of the total work force. This is higher than the all-India average of 23%. Hence, the labor force was employed on projects involving desilting work, strengthening bunds of irrigation tanks, constructing percolation ponds, and other moisture conservation measures. This type of work helped in drought proofing and capturing rainwater during monsoons and recharging the ground water potential.

Major work like afforestation and labor-oriented work was undertaken by the state forest department during the 1987 and 1989 droughts. The same department provided water facilities (through open and bore wells) for wildlife populations. A unique project undertaken by the state administration during this period was the establishment of about 20 ecological farms, covering almost all districts of Tamil Nadu. Another positive feature was the mass training of the coastal belt villagers of the state in fish farming.

To reduce the severe impact of drought on the cattle population, the state government gave full subsidy on paddy straw to poor farmers. This also

[1] **1 lakh = 100,000**

prevented the need for cattle migration, and no cattle camps were needed. Distress sales of cattle were also negligible. Fodder production increased to 13,000 ha in drought regions. Drinking water facilities were provided for cattle by means of bore wells near water tubs.

As a contingency measure, seeds, fertilizers, and pesticides were distributed at subsidized rates to small and marginal farmers. For this, a sum of 45 lakh rupees was allotted by the agriculture department, benefitting 2 lakh farmers in the state. Table 3 gives an account of the expenditures incurred in drought management strategies in Tamil Nadu. A novel plan of "direct sowing" was adopted for the first time by the farmers in the Tanjavur region. Here the strategy was to raise a crop during rains and then, as the reservoir level in Mettur dam improved, release the water to supplement rainfall. However, this requires constant monitoring. The response from farmers was very good. It was said that the entire paddy (Samba variety) would have been lost but for the "direct sowing" plan. Because of this plan, about 49% of the area was brought under paddy and the production level was maintained despite drought in the region.

Thus it is apparent that the interactive approach between the public and the administration in managing droughts in Tamil Nadu is quite commendable. The people's participation in identifying extension priorities has produced "farmer friendly" packages that have been well received.

Year	Amount (Rs. in crores)	Year	Amount (Rs. in crores)
1966–67	2.739	**1978–79**	13.140
1968–69	2.450	**1979–80**	24.620
1969–70	17.408	**1981–82**	61.810
1972–73	7.809	**1982–83**	17.080
1973–74	8.261	**1983–84**	106.210
1974–75	21.420	**1984–85**	21.556
1975–76	33.760	**1985–86**	67.508
1976–77	33.510	**1986–87**	30.910
1977–78	58.720	**1987–88**	77.150

Table 3. Expenditure incurred on drought management in Tamil Nadu (1966–88).

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