

# Drought Analysis in Southern Agroclimatic Zone of Tamil Nadu using Standardized Precipitation Index.

## ABSTRACT

Drought differs from other natural hazards in the fact that the initiation and the termination is extremely difficult to determine and that its drastic effects continue to persist well after the cessation of the event which adds to the complexity as well as the casualties. The Southern Agro Climatic Zone (ACZ) of Tamil Nadu is heavily rain shadowed during the South West Monsoon Season, several complications arise with respect to drought, causing crop failures and depleted moisture concentration in certain cases. With that idea in perspective, a study was conducted in Agro Climate Research Centre, Tamil Nadu Agricultural University, Coimbatore, India to study the frequency of drought over the Southern Agro-Climatic Zone of Tamil Nadu, India. Since precipitation that occurs over a region determines mainly the occurrence and cessation of drought events, precipitation-based Rainfall Deviation and Standardized Precipitation Index (SPI) formulated by McKee *et al.*, 1993 was used to quantify the extent of rainfall deficit or surplus over the region. The analysis of 30 years (1991 – 2020) historical rainfall data of various districts of the Southern Agroclimatic Zone of Tamil Nadu using SPI showed that the annual SPI value ranged from +3.3 to -4. The study showed that Tirunelveli and Thoothukudi districts were most prone to moderate drought and severe drought. The region showed more frequency of Moderate drought than Severe and Extreme drought.

*Keywords: Drought, Standardized Precipitation Index, Rainfall Deviation, Southern Agro-Climatic Zone.*

## 1. INTRODUCTION

Drought is the recurring periods of relatively long durations of abnormally dry weather conditions that leads to moisture deficit in the atmosphere and ultimately influences the lithosphere and the biosphere [1,2]. It is an extreme event where in water scarcity and global warming have a negative influence on crop growth and grain yield [3]. Drought is the most crucial yet least understood natural hazard [4,2]. Drought occurs more frequently in the semi-arid and arid areas. In recent decades, India has had frequent and severe droughts (once every three years) [5]. The frequency and intensity of drought is expected to increase especially during 2020 to 2050 [6]. Drought risk in India is rising due to an increase in total dry days, longer dry periods, and fewer light precipitation days. According to a quantitative study of data, India is experiencing a 49 percent rise in lengthy dry periods and a 33 percent increase in overall dry days [7]. Between 1950 and 1990, there were ten drought years. Six drought years have occurred since 2000: 2002, 2004, 2009, 2014, 2015, and 2016. At the moment, the drought in India has grown very severe that Cherrapunji, one of the world's highest rainfall places in the north east of India, with over 11,000 mm of rainfall, is considered to be in a drought for nearly nine months of the year [8]. Drought hit 330 million people in India in 2016, affecting ten states following two years of poor monsoons [9]. Since a majority of the Indian agriculture largely depends on the monsoon season, this sector is indeed the first to be influenced by drought. Besides agriculture, droughts also effect other sectors including the tourism, environment, health, marketing and ultimately the economy of the country. It brings forth various complications ranging from food crisis, various health risks, social conflicts and in the worst-case scenario, compels the farmers to commit suicide [10].

Drought is further classified into different categories: i) Meteorological Drought ii) Hydrological Drought iii) Agricultural Drought and iv) Socio-Economic Drought [11]. Drought differs from other natural hazards in the fact that it is a slowly creeping phenomenon. The effects of drought accumulate for a considerable period of time and the effects may persist for a long time after the cessation of the event. The initiation and

the termination of the drought event is difficult to determine [12,13]. Droughts usually affect agriculture first, as soil moisture levels quickly decline. In the presence of high temperatures and heavy winds, the process is accelerated [2]. Proper monitoring and assessment of drought events especially in those regions with highly vulnerable areas need to be undertaken so as to reduce the losses and damages. As a result, a greater understanding of drought climatology and the establishment of a coherent and holistic drought surveillance approach that combines climate, soil, and water supply aspects are crucial [2,14,15]. It is important to examine agricultural drought and its possible consequences on food supply in sensitive parts, particularly in drought-prone areas. Agricultural droughts' effects on food supplies may be measured, allowing governments to make more sustainable policies. It needs a comprehensive assessment of the links between spatiotemporal drought variations, farming systems, irrigation impacts, and the available water resources [16]. Drought-prone locations have a wide multitude of issues in terms of intensity, spatial and temporal scales. As a result, drought risk assessment is required to deal with this terrible drought, which has a significant impact on society. Because they simplify complicated inter-relationships between various climatic factors, drought indices are among the most significant instruments for monitoring and assessing drought [17]. [18] evaluated the risk of district-wide droughts across India using PNP from the southwest monsoon season (June to September) for 424 districts over 14 years (1988–2001) and found the highest chance (>60 percent) in various districts in northern India.

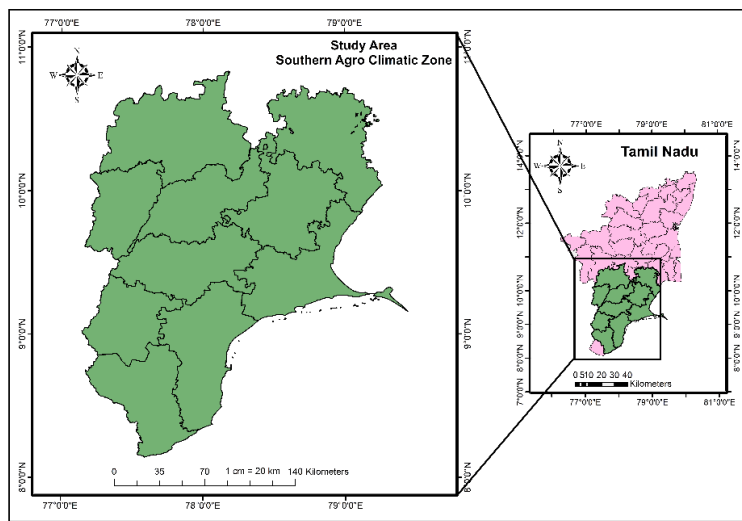
Drought indices have been devised by meteorologists and agriculturalists to accurately match the climatology of certain parts of the world in order to gauge the current type and extent of drought and to monitor drought risks across a particular region on a routine basis [19]. Several studies related to drought with the help of various drought indices have been conducted by many researchers in India. Since the majority of the Indian Peninsula receives its rainfall during the South West Monsoon, majority of the studies have used precipitation-based indices like Percent Normal Precipitation, Standardized Precipitation Index, Enhanced Drought Index and Palmer Drought Severity

Index. [14,20,21,22]. Drought-prone areas and persistently drought-affected areas were defined by [23], who discovered that the majority of the drought-prone areas were in dry or semiarid regions, where droughts occur frequently. During the monsoon season in India, categories based on rainfall deviations were utilized to monitor and evaluate patterns of precipitation across the country [24]. The main driver of drought is precipitation [25,26]. Thus, Precipitation based standardized precipitation index (SPI) has been used intensively for the quantification and assessment of drought [1,20,22,24,25,27]. Standardized Precipitation Index has been recommended by WMO as the standard meteorological drought index [24]. Rainfall pattern of 100 years (1918 to 2017) was analyzed by [28] wherein the rainfall pattern of Coimbatore district of Tamil Nadu was studied and the spatio-temporal pattern of drought was analysed using SPI. SPI is used to quantify the extent of rainfall excess or deficit over a certain time-scales which may range from 1-month time-scale to several years [26]. SPI has been used to assess drought events over time in various countries [27, 29, 30, 31, 32]. With this in perspective, a study was conducted to assess the drought intensity and frequency in the Southern Agro-Climatic Zone (ACZ) of Tamil Nadu (TN), India.

## **2. MATERIAL AND METHODS**

### **2.1 Study Area:**

The Southern Agroclimatic zone of Tamil Nadu is geographically located between 8°9' and 10°50' North Latitude and 77°10' and 79°25' East Latitude. The area extends from the high mountain regions in the west up to the coastal regions in the East. This area of Tamil Nadu lies under the rain shadow region. The elevation varies from the mean sea level at the eastern coast and up to 300m in the hilly region. The mean annual rainfall in the region is about 857mm. The major crops grown in the region include Rice, Maize, Cucumber, Sorghum, Ragi, Black Gram, Green Gram, Groundnut, Fodder Crops, Gingelly, Castor, Cotton, Chillies, Banana, Jasmine, Coriander, Onion, Lime, Cashew and Amla. The study area map is depicted in Fig. 1.



**Fig. 1. Study area showing the Southern Agro Climatic Zone of Tamil Nadu, India.**

## **2.2 Data:**

The district-wise historical rainfall data from 1991-2020 (30 Years) was collected from the respective research stations under Tamil Nadu Agricultural University located within the study area viz., Madurai, Thirunelveli, Thoothukudi, Virudhunagar, and Theni. Additional data for districts viz., Dindigul, Pudukkottai, Tenkasi, Ramanathapuram and Sivagangai and for those districts where the long-term historical data was insufficient were obtained from India Meteorological Department, Pune.

The rainfall data was further classified into various seasonal periods in order to have a better perspective viz., Cold Weather Period (CWP) which lies between January to February, Hot Weather Period (HWP) from March to May. South West Monsoon (SWM) from June to September and Northeast Monsoon (NEM) starting from October to December.

### 2.3 Methodology:

Rainfall deviation from the normal rainfall for the study area was computed as below:

$$\text{Rainfall Deviation} = \frac{(\text{Actual Rainfall} - \text{Normal Rainfall})}{\text{Normal Rainfall}} \times 100$$

The Rainfall deviation of less than -20 per cent is considered as a drought condition (IMD, Pune). The classification of rainfall deviation as given by the India Meteorological Department; Pune is given on table 1. The minimum value of the rainfall deviation is -100 per cent, which indicates that there was no rain, and the highest value is undefinable. The rainfall deviation is 100 per cent if the actual rainfall is twice the rate of the normal rainfall, 200 percent if the actual rainfall is thrice the quantity of normal rainfall, and so on [26].

| Deviation from Normal Rainfall | Category     |
|--------------------------------|--------------|
| $\geq +19$                     | Excess       |
| +10.1 to +19                   | Above Normal |
| -10 to +10                     | Normal       |
| -10.1 to -19                   | Below Normal |
| $\leq -20$                     | Deficit      |

**Table 1. Categories of Rainfall Deviations (IMD).**

Standardized Precipitation Index (SPI) was formulated by [33]. This index was proposed to quantify the deficit as well as the surplus of the precipitation on varying time scales. Eg. 1, 3, 6, 12, 24 and 48-month time-scales. The time-scales show how the precipitation for a certain period compares to the entire record, perhaps 30 or 50 or 100 years, for a given station [34]. SPI over various time scales, such as 1- or 3-month SPI of a certain month, reflects variance in precipitation totals for that month and the preceding two months, respectively. As a result, SPI values are reported in standard deviations, with a positive number indicating above-average precipitation and a negative value indicating below-average precipitation [35]. It is important to remember that when

evaluating the SPI data, the "wetness" or "dryness" is measured relative to historical averages instead of the absolute sum of precipitation for the given region [25].

The 3-month SPI was calculated from the 30 years (1991-2020) historical datasets using the SPEI package in R Studio [36]. The criteria as defined by [33] to determine the drought events and the classification of SPI for defining drought intensities at various time-scaled was used for interpretation and is given in table 2.

| <b>SPI Value</b> | <b>Intensity</b> |
|------------------|------------------|
| $\geq 2.00$      | Extremely wet    |
| 1.99 to 1.50     | Very Wet         |
| 1.49 to 1.00     | Moderately Wet   |
| -0.99 to 0.99    | Near Normal      |
| -1 to -1.49      | Moderate drought |
| -1.50 to -1.99   | Severe drought   |
| $\leq -2.00$     | Extreme drought  |

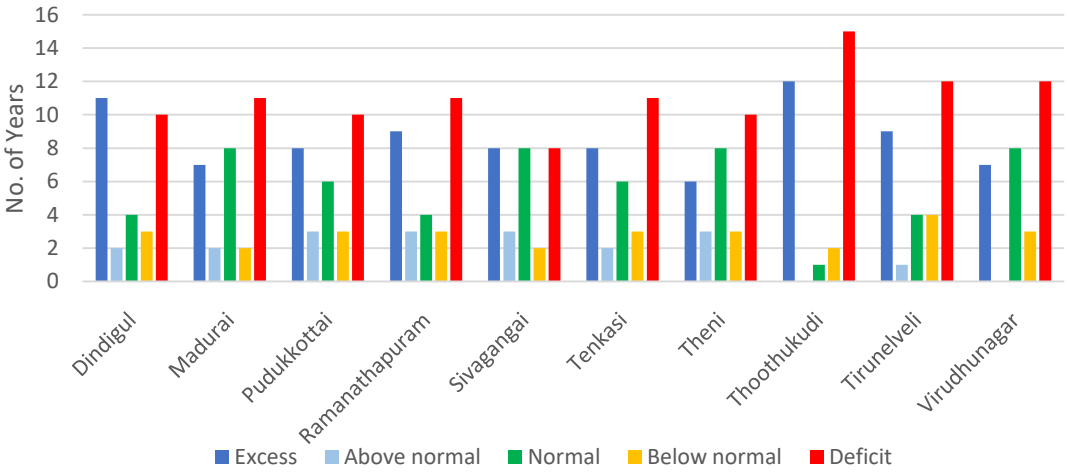
**Table 2. Classification of Standard Precipitation Index (SPI) values and the corresponding drought intensities (McKee *et al.*, 1993)**

### **3. Results and Discussion**

#### **3.1 Drought analysis based on Rainfall Deviation**

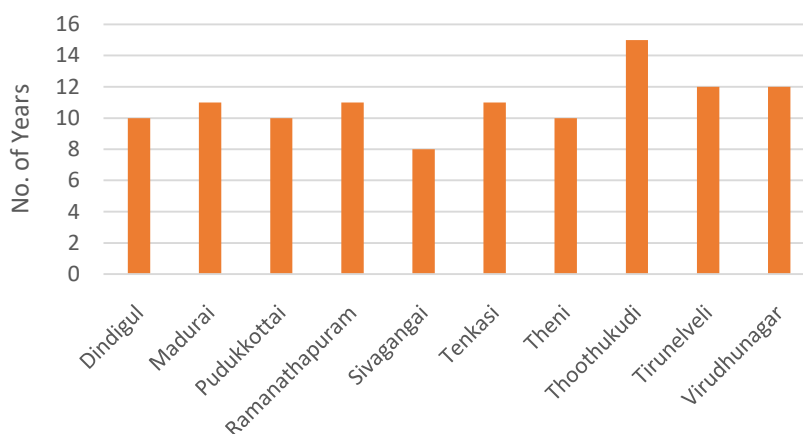
The analysis done based on the past 30 years (1991-2020) rainfall deviation for the constituent districts in the Southern Agroclimatic Zone is shown in Figure 2 and 3. The study revealed that among all the districts within the study area, Thoothukudi district have the highest extreme rainfall deficit years where there are 15 years under drought years within 30 years. This is followed by Tirunelveli and Virudhunagar at 12 years under

drought out of 30 years. Similar findings have been made regarding the rainfall variability analysis [14]. An intriguing result obtained was that despite Thoothukudi district despite having the highest average rainfall among the districts (1057.9mm) shows the highest frequency of deficit years (15 years), and also shows the greatest number of excess rainfall events with 12 years as excess. This is so because the district shows a decreasing trend in the annual total rainfall since 2001 with a brief excess in 2011-12. Pudukkottai district also shows a decreasing trend in the annual total rainfall. This raises a concern because of the fact that since the rainfall pattern of these regions shows a declining trend, the rainfall normal will get affected which in turn may put additional risks to various sectors including agriculture.



**Fig 2. Rainfall Deviation of Southern Agroclimatic Zone of Tamil Nadu.**

**Fig 3. Frequency of drought years in Southern Agroclimatic Zone as per Rainfall Deviation**



### 3.2 Drought frequency and intensity analysis from Standardized Precipitation Index

The frequency of drought along with the intensity based on the 3 Month Standardized Precipitation Index (SPI) was determined. The criteria developed by [33] was used to classify the intensity of drought. The annual and seasonal drought frequency of the districts under the Southern Agro-Climatic Zone of Tamil Nadu are on table 3 and the annual and the Seasonal 3-Month SPI ranges are given on table 4.

| Drought                 | Dindigul | Madurai | Pudukkottai | Ramanathapuram | Sivangai | Tenkasi | Theni | Thoothukudi | Tirunelveli | Virudhunagar |
|-------------------------|----------|---------|-------------|----------------|----------|---------|-------|-------------|-------------|--------------|
| <b>Moderate Drought</b> |          |         |             |                |          |         |       |             |             |              |
| Annual                  | 15       | 15      | 14          | 12             | 15       | 13      | 13    | 16          | 17          | 14           |
| SWM                     | 4        | 8       | 4           | 3              | 7        | 5       | 3     | 8           | 3           | 7            |
| NEM                     | 6        | 6       | 5           | 4              | 3        | 8       | 7     | 2           | 6           | 8            |
| <b>Severe Drought</b>   |          |         |             |                |          |         |       |             |             |              |
| Annual                  | 5        | 8       | 5           | 5              | 6        | 6       | 8     | 15          | 5           | 10           |
| SWM                     | 3        | 3       | 3           | 4              | 2        | 1       | 3     | 4           | 3           | 3            |
| NEM                     | 0        | 2       | 0           | 2              | 3        | 3       | 4     | 2           | 3           | 3            |
| <b>Extreme Drought</b>  |          |         |             |                |          |         |       |             |             |              |
| Annual                  | 5        | 3       | 5           | 4              | 4        | 4       | 5     | 5           | 5           | 2            |
| SWM                     | 1        | 1       | 3           | 0              | 1        | 0       | 2     | 1           | 1           | 1            |
| NEM                     | 3        | 2       | 3           | 2              | 2        | 2       | 3     | 4           | 3           | 2            |

**Table 3. Drought Frequency Based on 3 Month SPI Values**

| Districts      | Annual |      | SWM |      | NEM |      |
|----------------|--------|------|-----|------|-----|------|
|                | Max    | Min  | Max | Min  | Max | Min  |
| Dindigul       | 2.6    | -3.5 | 2.6 | -2.1 | 2.1 | -3.5 |
| Madurai        | 3.1    | -3.8 | 3.1 | -2.6 | 2.1 | -3.8 |
| Pudukkottai    | 2.6    | -3.6 | 2.6 | -3.4 | 1.5 | -3.6 |
| Ramanathapuram | 2.5    | -2.6 | 2.5 | -1.9 | 1.7 | -2.6 |
| Sivangangai    | 2.9    | -3   | 2.9 | -2.2 | 1.9 | -2.9 |
| Tenkasi        | 2.7    | -2.5 | 2.7 | -1.6 | 1.9 | -2.3 |
| Theni          | 2.7    | -2.9 | 1.7 | -2.6 | 2.1 | -2.6 |
| Thoothukudi    | 2.4    | -3.3 | 2.5 | -2   | 2.2 | -2.5 |
| Tirunelveli    | 2.5    | -2.8 | 2.7 | -2.6 | 1.9 | -2.8 |
| Virudhunagar   | 2.9    | -3.1 | 2.9 | -2.1 | 2   | -2.2 |

**Table 4. Annual and Seasonal 3 Month SPI Ranges**

### **3.2.1 Drought frequency and intensity analysis of Dindigul District**

Dindigul observed 4 instances of moderate drought events during the South West Monsoon Season during the years 2001, 2002, 2016 and 2019 while during the North East Monsoon season, 6 instances of moderate drought events were observed during the years 1995, 2007, 2012, 2013, 2016 and 2018. Severe drought events were observed in 3 instances in the years 2002, 2003 and 2004. Extreme drought event was observed in the South West Monsoon Season of 2003 while the same was observed thrice during the North East Monsoon Seasons of 2001, 2002, 2003. The SPI values ranged from 2.6 to -2.1 during the South West Monsoon Season and during North East Monsoon, the values ranged from 2.1 to -3.5. The extreme drought with minimum SPI value of -3.5 was observed in this region during the North East Monsoon Season of 2002 when the district was affected by extreme drought which was recurrent in both the South West Monsoon and North East Monsoon season of 2003.

### **3.2.2 Drought frequency and intensity analysis of Madurai District**

Madurai district observed 8 instances of Moderate drought events during the South West Monsoon Seasons of 1991, 1998, 2002, 2003, 2006, 2014, 2018 and 2019 while the same occurred in 6 years during the North East Monsoon Seasons of 1995, 2002, 2009, 2013, 2014 and 2016. Severe drought events during the South West

Monsoon occurred at 3 instances in the year 2001, 2002 and 2006 while the same occurred twice during the North East Monsoon Seasons of 2013 and 2016. A brief period of extreme drought occurred once during the South West Monsoon season of 2001 and the same was observed in 2001 and 2003. The SPI values during the South West Monsoon Season Ranged from 3.1 to -2.6 and that of North East Monsoon ranged from 2.1 to -3.8. This region showed the lowest minimum SPI value during the NEM season of 2001. The period showed several months with extreme negative SPI values which indicated that this region was affected by a prominent extreme drought. This was then followed again by a brief period of moderate to extreme dryness in 2003. However, this region showed moderate to wet conditions in most of the study period.

### **3.2.3 Drought frequency and intensity analysis of Pudukottai District**

Pudukottai District observed 4 instances of moderate drought events during the South West Monsoon Seasons of 1991, 2006, 2009 and 2019 while that of North East Monsoon occurred 5 times during the years 2009, 2013, 2016, 2017 and 2018. Severe droughts occurred at 3 instances during the South West Monsoon Seasons of 2002, 2003 and 2018. Extreme drought event occurred thrice in both during the South West Monsoon Season of 2001, 2002 and 2003 and also during the North East Monsoon Season of 2001, 2002 and 2003. The SPI value during the South West Monsoon Season ranged from 2.6 to -3.4 and that of the North East Monsoon ranged from 1.5 to -3.6 during the study period. This district was affected by severe to extreme drought starting from the NEM season of 2001 which extended throughout most of 2002 and 2003. This region saw a normal condition again from the SWM season of 2004 followed by brief stages of moderate dryness to wet conditions over the years studied. This district was affected by extreme drought during 2001-2003 followed by occasional wet and dry periods. The district again faced brief periods of moderate to extreme drought during 2018 and 2019.

### **3.2.4 Drought frequency and intensity analysis of Ramanathapuram District**

Ramanathapuram District observed 3 instances of moderate drought events during the South West Monsoon Season of 1997, 2002 and 2017 and the same was observed at 4 instances during the North East Monsoon Seasons of 1995, 2002, 2016 and 2020. Severe drought events were observed at 4 instances during the South West Monsoon Seasons of 2001, 2002 and 2003 and 2019 while the same was observed at 2 instances during the North East Monsoon Seasons of 2001 and 2003. Extreme drought event was observed twice during the North East Monsoon Season of 2003 and 2016. The SPI values ranged from 2.6 to -1.9 during the South West Monsoon Season while that of North East Monsoon Season ranged from 1.7 to -2.6. This region showed moderate to extreme dryness during the NEM seasons of 2001 through 2003 followed by brief periods of wet and dry periods. Moderate to extreme drought conditions was observed again during 2019.

### **3.2.5 Drought frequency and intensity analysis of Sivagangai District**

Sivagangai District observed 7 instances of moderate drought events during the South West Monsoon Season of 1994, 1996, 2001, 2003, 2004, 2006 and 2019 and that of North East Monsoon was observed at 3 instances during 1995, 1996 and 2017. Severe drought events occurred twice during the South West Monsoon Seasons of 2002 and 2006 and that of North East Monsoon was observed at 3 instances during 2002, 2003 and 2016. Extreme drought events were observed once during the South West Monsoon Season of 2002 and the same was observed twice during the North East Monsoon Seasons of 2001 and 2003. The SPI values ranged from 2.9 to -2.2 during the South West Monsoon and that of North East Monsoon ranged from 1.9 to -2.9. This region was affected by an extended period of drought years during 2001 – 2003 followed by a moderate to extreme wet conditions in 2011-12.

### **3.2.6 Drought frequency and intensity analysis of Tenkasi District**

Tenkasi District observed 5 instances of moderate drought events during the South West Monsoon Season of 2002, 2003, 2016, 2018 and 2019 and that of North

East Monsoon was observed at 8 instances during 1995, 1996, 1998, 2002, 2003, 2017, 2018, 2020. Severe drought events occurred once during the South West Monsoon Seasons of 2001 and that of North East Monsoon was observed at 3 instances during 2002, 2016 and 2018. Extreme drought events were observed twice during the North East Monsoon Seasons of 2001 and again in 2016. The SPI values ranged from 2.7 to -1.6 during the South West Monsoon and that of North East Monsoon ranged from 1.9 to -2.3. This region observed moderate to extreme drought during 2001-02 which is again repeated by an extended period of moderate to extreme drought in 2016-17 and again in 2018-19.

### **3.2.7 Drought frequency and intensity analysis of Theni District**

Theni District observed moderate drought events at 3 instances during the South West monsoon season of 2002, 2007 and 2013 and that of North East Monsoon was observed at 6 instances during 1995, 1996, 2003, 2013, 2016 and 2018. Severe drought was observed at 3 instances each during the South West Monsoon Seasons of 2001, 2009 and 2019 and at 3 instances during the North East Monsoon Seasons of 2002, 2016 and 2017. Extreme drought event was observed once in the South West Monsoon Season in 2002 and the same was observed thrice during the North East Monsoon seasons of 2001, 2002 and 2003. The SPI values during the South West Monsoon Season ranged from 1.7 to -2.6 and that of North East Monsoon Season Ranged from 2.1 to -2.6.

### **3.2.8 Drought frequency and intensity analysis of Thoothukudi District**

Thoothukudi District observed 9 instances of moderate drought during the South West Monsoon Seasons of 2002, 2005, 2006, 2008, 2009, 2016, 2017 and 2018 while the same was observed at 7 instances during the North East Monsoon Seasons of 2003, 2005, 2013, 2015, 2017, 2019, 2020. Severe drought events were observed at 3 instances during the South West Monsoon Seasons of 2006, 2008 and 2009 while that of North East Monsoon was observed at 4 instances during 2003, 2005, 2009 and 2013.

Extreme drought events occurred twice during the South West Monsoon Seasons of 2013 and 2019 while the same occurred 3 times during the North East Monsoon Seasons of 2003, 2016 and 2018. The SPI value ranged from 2.5 to -2 during the South West Monsoon while that of North East Monsoon ranged from 2.2 to – 2.5 during the years studied.

### **3.2.9 Drought frequency and intensity analysis of Tirunelveli District**

Tirunelveli District observed at 8 instances of moderate drought during the South West Monsoon season during the years 1993, 2001, 2002, 2003, 2008, 2013, 2015 and 2018 while the same was observed in 2 instances during the North East monsoon during the years 2000 and 2016. Severe drought events were observed in 4 instances during the North East Monsoon Seasons of 2002, 2003, 2004 and 2018 and at 2 instances during the South West Monsoon Seasons of 2002 and 2003. Extreme drought event was observed once during the South West Monsoon Seasons of 2003 and that during the North East Monsoon season, was observed 4 times in the year 2001, 2002, 2003 and 2013. The SPI values during the South West Monsoon Season ranged from 2.7 to -2.6 while that of North East Monsoon Season ranged from 1.9 to – 2.8.

### **3.2.10 Drought frequency and intensity analysis of Virudhunagar District**

Virudhunagar district observed 7 instances of moderate drought events during South West Monsoon during the years 1991, 1996, 2002, 2003, 2006, 2013 and 2019 while during the Northeast Monsoon, the district observed 8 instances on moderate drought events during 1995, 2001, 2003, 2009, 2013, 2015, 2016, 2018. Severe drought was observed at 3 instances both during the South West monsoon in 2003, 2013 and 2019 and during North East Monsoon in the years 2002, 2016 and 2018. Extreme drought event was observed once during Northeast Monsoon during the year 2002 while that of South West Monsoon was observed twice in 2002 and 2018. The SPI values range between 2.9 to -2.1 during South West Monsoon while the same was observed within the range of 2 to -2.2 during the North East Monsoon Season.

Overall, the 3 month SPI analysis provides an in-depth perspective of the monsoon seasons of the Southern Zone of Tamil Nadu. This region has faced drought conditions during 2002-2003 and again in 2016-17. The region shows a distinct variation in the spatial extent of drought across the region. Similar conditions have also been observed for the variability of monsoons across the study area [17,37]. The study clearly highlighted the temporal extent of drought which can be very useful in developing any agricultural planning and activities under drought risk conditions.

#### **4. Conclusion**

The rainfall deviation analysis shows a highest deficit in the district of Thoothukudi which is followed by Virudhunagar and Tirunelveli. The annual 3-months SPI analysis revealed that the southern agroclimatic zone is more prone to moderate droughts especially in the districts of Tirunelveli and Thoothukudi. The seasonal SPI also showed a comparatively higher drought events during the North East Monsoon. The decreasing trend of rainfall in certain districts within the region has to be assessed so as to sustain agricultural productivity with the limited resources. The temporal analysis of drought showed some intriguing outputs regarding the incidence of drought conditions over the regions studied. Thus, it can be concluded that Standardized Precipitation Index can be a useful tool to assess drought conditions over a region. Further, brief studies using satellite derived vegetative indices has to be made so as to obtain more relevant information of the spatial and temporal extent of drought and its mitigation measures so as to formulate effective counter-measures to tackle the adverse effects of drought.

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