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Assessment of occurrence and frequency of drought by percent normal precipitation index (PNPI) for Dharwad in northern transition zone of Karnataka

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Abstract

This study examined Percent Normal Precipitation Index (PNPI) for Dharwad in Northern Transition zone of Karnataka and the rainfall data was collected from 1951 to 2018 (68 years) for Dharwad. Drought is a prolonged period of abnormally low rainfall, leading to a shortage of water. Nowadays monitoring the drought is a crucial factor for risk management and providing impact assessments to overcome from such drought events. The Assessment of PNPI drought index was analyzed and result shows that Dharwad district have slightly decreasing trends in drought events and from 1951 to 2018 over 68 years it has shown that 9 years are in moderate drought, 19 years are in moderate wet and 40 years are in normal rainfall situation. This indicates effective real time contingency plans need to be formulated for increase in production of crops Dharwad in Northern Transition zone of Karnataka.

Keywords: Percent normal precipitation index (PNPI) and frequency of drought

Introduction

Drought is a natural disaster of below-average precipitation in a given region, resulting in prolonged shortages in the water supply, whether atmospheric, surface water or ground water leads to failure of crop. A drought can last for months or years, or may be declared after as few as 15 days. The drought can be grouped as meteorological drought, agricultural drought and hydrological drought they cannot be predict. Meteorological drought happens when dry weather patterns dominate an area and Hydrological drought occurs when low water supply becomes evident, especially in streams, reservoirs, and groundwater levels, usually after many months of meteorological drought (Wilhite and Glantz, 1985; Hayes *et al.*, 2010) [2, 1]. The important one is agricultural drought for the point of crop production. The Agricultural drought refers to circumstances when soil moisture is insufficient and results in the lack of crop growth and production and Agriculture can rebound or be impaired within a very short period of time depending upon the strength of drought conditions or precipitation events. Drought assessment is very important in the point of agriculture helps in mitigation and makes adaptation strategies to reduce risk in crop production. The drought events is unpredictable for the different drought indices are used like Reconnaissance Drought Index (RDI), Drought Severity Index (DSI) Z- Index, Palmer Modified Drought Index (PMDI), Decile Index (DI), Percent Normal Precipitation Index (PNPI), Rainfall Anomaly Index (RAI) Standardized Precipitation Index (SPI), Effective Drought Index (EFI) etc (Zargar *et al.*, 2011) [3]. The index is not universally for all climatic conditions. Based on of climate data available for the particular region.

Methods

Historical observed weather data for 68 years (1951–2018) was used for agro climatic analysis over Dharwad in Northern Transition zone of Karnataka. Percent Normal Precipitation Index (PNPI) one of forthright method used to assess drought event in for Dharwad in Northern Transition zone of Karnataka and this method is effective when used for a single region or single season. This index calculates amount of precipitation from long term in area which represents in percent.

$$\text{Formulae for PNPI} = P_1 / P * 100$$

Where P_1 = actual precipitation and P = Long term average precipitation
Categorization of PNPI

Table 1: PNPI Ranges

Class	Index Range
Moderately wet	≥110
Normal	80 to 110
Moderate dry	55 to 80
Severe dry	40 to 55
Extreme dry	≤ 40

Result

The Frequency of drought was indicated in figure 1. PNPI moderate drought occurred in the years of 1985, 1989, 2001, 2002, 2003, 2012, 2015, 2016, and 2017. And moderately wet years occurred in the year of 1957, 1958, 1961, 1966, 1967, 1974, 1975, 1979, 1980, 1991, 1992, 1993, 1994, 2005, 2007, 2009, 2010, 2014, and 2018. From the analysis of 68 years (1951 to 2018) only nine years is in moderate dry situation, 19 years are in moderately wet situation and remaining 40 years was in normal situation.

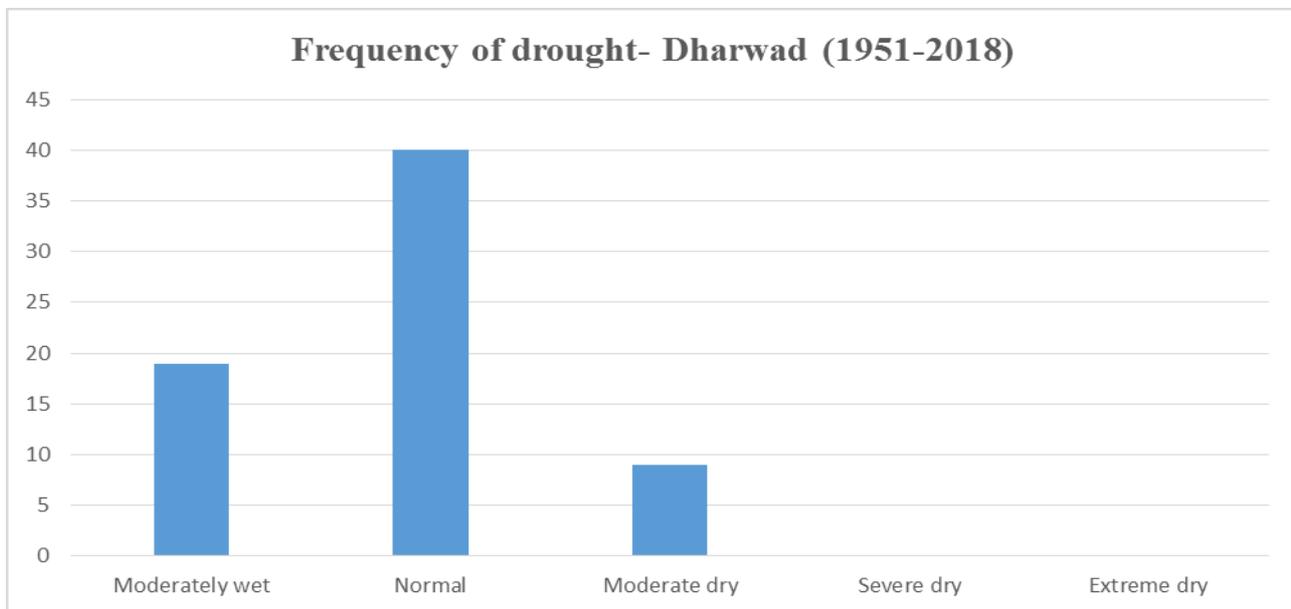


Fig 1: Frequency of Drought Dharwad.

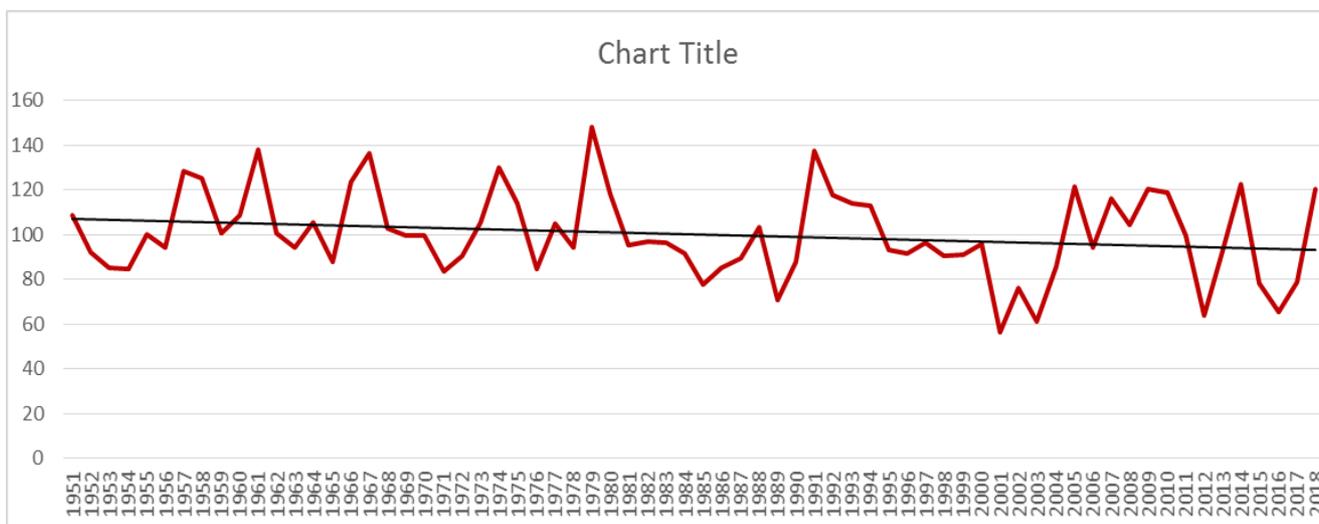


Fig 2: Rainfall Trend of Dharwad from 1951-2018

Conclusion

Drought analysis based on 68 years (1951-2018) showed that the Normal rainfall situation was found this needs efficient real time contingency plans in agricultural planning for increasing the production in crops and effective management of crops and it helps in development of Crop Weather Outlook for the better management in crops to the farmers.

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