Chapter 7
Synergy of Satellite-Derived Drought Indices for Agricultural Drought Quantification and Yield Prediction

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ABSTRACT

The present study was conducted over Jharkhand state (India) for assessing the drought condition and corresponding yield of paddy (district-level) during Kharif 2018. Vegetation drought indices, namely Vegetation Condition Index (VCI), Temperature Condition Index (TCI), Vegetation Health Index (VHI), and vegetation indices (VI) anomaly, were derived from different VI (i.e., NDVI, EVI) to assess the paddy health condition during drought year (2018) and non-drought year (2017). Later, the correlation between the DES-based yield data and derived drought indices (for the year 2017) were made to develop the district-level paddy yield model for

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the drought year 2018. The key results of the study shown that VCI derived from EVI data was found to be more reasonable to depict the drought condition, wherein ~21% area was under severe drought condition, 43% area under moderate drought condition, and 36% area under no drought condition. In addition, the yield prediction model derived from VCI (EVI-based) was found to be promising for predicting the paddy yield for Kharif 2018 with fair R2 of 0.53.

1. INTRODUCTION

Agriculture and allied sectors have a significant contribution to the development of countries economy, wherein, it provides nutritious need to the billions of the world's populations. During last few decades, the agriculture sector has been dramatically affected by the climate change events e.g. unseasonal rainfall, drought, hailstorms, strong wind surges, etc. (Patel et al., 2012; Dutta et al., 2015). These undesirable weather event poses loss in agriculture production; and subsequently, it leads to many socio-economic issues, such as, escalation in global commodity values, remortgage or sale of productive croplands to endorse the real estate industry, migration of peoples from rural area to municipal centre, increases the rashness and social offence, etc. (Vaani and Porchelvan., 2018).

Agricultural drought is one of the serious and undesirable events, which poses huge loss in agricultural productivity (especially during Kharif season) (Dalezios et al., 2014). Basically, drought is a phenomenon of a long period of dry conditions where a region observes a deficit in its water supply, whether surface or underground water. Droughts are recurring phenomena in India owing to moisture stress; and comes under the chronically drought-prone areas, and they receive less than ~750 mm rainfall, while, 35% of the region comes under the drought-prone area, and they receive ~750-1125 mm rainfall. Altogether, ~68% of the country falls under the drought-prone region and experiences severe drought conditions (PACS Programme 2001-2008). The agricultural drought badly affects the economy of many agrarian dominant countries (i.e. India, China, Bangladesh, Vietnam), where more than 65% of people are dependent on the agriculture and allied sector. In India, about 16% of the agricultural area comes under the drought-prone region, wherein, ~50 million people are annually affected by the drought events (DAC 2009). However, continuous decline in the share of agriculture and allied sectors in the Gross Value Added (GVA) is observed from 18.6% (during 2013-14) to 17.4% (during 2016-2017) (DAC annual Report 2017-18).

Giving importance to the agriculture sector, it is very crucial to have detailed and timely information on agricultural drought so that the impact of the drought can