

Impact of Drought on Agriculture in the Upper Middle Gangetic Plain in India

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Abstract : In this study, we investigate the spatiotemporal characteristics of drought in India and its impact on agriculture during the summer season (April to September). For our analysis, we have used Standardized Precipitation Evapotranspiration Index (SPEI) datasets between 1982 and 2012 at six-month timescale. Based on the criteria $SPEI < -1$ we obtain the vulnerability map and have found that the Humid subtropical Upper Middle Gangetic Plain (UMGP) region is highly drought prone with an occurrence frequency of 40-45%. This UMGP region contributes at least 18-20% of India's annual cereal production. Not only the probability, but the region becomes more and more drought-prone in the recent decades. Moreover, the cereal production in the UMGP has experienced a gradual declining trend from 2000 onwards and this feature is consistent with the increase in drought affected areas from 20-25% to 50-60%, before and after 2000, respectively. The higher correlation coefficient (-0.69) between the changes in cereal production and drought affected areas confirms that at least 50% of the agricultural (cereal) losses is associated with drought. While analyzing the individual impact of precipitation and surface temperature anomalies on SPEI (6), we have found that in the UMGP region surface temperature plays the primary role in lowering of SPEI. The linkage is further confirmed by the correlation analysis between the SPEI (6) and surface temperature rise, which exhibits strong negative values in the UMGP region. Higher temperature might have caused more evaporation and drying, which therefore increases the area affected by drought in the recent decade.

Keywords : drought, agriculture, SPEI, Indo-Gangetic plain

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