Assessment of Drought and Implications on Agriculture

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**Abstract**

Drought, a frequent and impactful climatic extreme, has a significant impact on the context of Nepal. Drought adversely impacts the agriculture sector by reducing soil moisture (SM) levels, leading to decreased crop yields and increased water scarcity, thereby threatening food security and the livelihoods of a population predominantly reliant on farming. Unlike previous studies on this region, this study uses multiple SM products to evaluate agricultural drought index. This study analyzes agricultural drought in Nepal, aiming to identify the basin that is most vulnerable to drought conditions. Using satellite-based and model-based SM observations (Soil Moisture Active Passive (SMAP), Soil Moisture and Ocean Salinity (SMOS), Global Land Data Assimilation System (GLDAS-2.1), Famine Early Warning Systems Network Land Data Assimilation System (FLDAS)) along with climatology and discharge measurements, we examine the spatial and temporal drought patterns. By utilizing Soil Water Deficit Index (SWDI) alongside Standardized Precipitation Evapotranspiration Index (SPEI) and Standardized Flow Index (SFI), the research highlights the complex progression from meteorological to agricultural and hydrological droughts. The findings reveal a strong relationship (r=0.35) between SWDI-GLDAS (SWDIgl) and the Atmospheric Water Deficit (AWD), confirming SWDIgl’s reliability for identifying agricultural drought. Notably, SPEI’s impact in SWDI is more evident with the three-month lag (r=0.38), and SPEI correlates strongly with SFI at a 12-month lag (r=0.38). Significant correlations were found for winter wheat (r=0.31) during their sowing and growing period. These findings suggest that further monitoring and forecasting of agricultural drought should incorporate SWDIgl due to its strong correlation with AWD. These insights can inform targeted interventions for winter wheat during their critical growth periods to mitigate drought effects in agriculture.

**Keywords**: Soil Moisture, Drought, Crop Yields, Agricultural drought, hydrological drought, Meteorological drought