When is a drought, really drought, and not a dry spell in the Niger River Basin of West Africa?

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To effectively manage drought in the Niger River Basin of West Africa, activate water resource management measures and determine the desired level of intervention, decision-makers need to distinguish dry spells from real drought conditions, which are presently challenging. The study further demonstrates the potential of reanalysis Standardized Precipitation Index (r-SPI) as a decision support tool in a weather insurance contract (WIC) using r-SPI model-based conceptual framework designed to help farmers averse to risks of drought in the Niger River Basin. With 36 years of reanalysis precipitation records from 60 locations, the study attempts to establish index- and percentiles-based thresholds for defining dry spell and real drought through baseline assessment analysis of the 1980s historic regional drought-induced famine, using percentile rank approach.

Results indicate 1980s drought-induced famine occurred within thresholds of 20th, 10th, 5th, and 2nd percentiles, while the drought precursors, the dry spells occur within 35th, 20th, 10th, and 5th percentiles. The corresponding objective index thresholds based on SPI-2month ranges from -0.22 to -0.45, -0.45 to -0.93, -0.93 to -1.20, -1.66 to -1.83 defining dry spell, abnormal dry spell, critical/extreme dry spell, and drought conditions; and SPI-6month thresholds of range -0.38 to -1.07, -0.59 to -1.58, -0.64 to -1.79 and -0.67 to -2.21 defining drought of moderate, severe, extreme, and exceptional intensities respectively depending on location. The thresholds also vary from month to month, reflecting seasonality, and detect drought onset much earlier because of its lower values relative to the fixed higher, subjective, and arbitrary, literature-based SPI thresholds of -1.0 to -1.49 for defining moderate drought conditions that could be misleading. The threshold validation results show a success rate of 50 to 70 percent. Results operationally useful for early drought detection. Drought rose analysis revealed every 10 years, different parts of the Niger basin experience drought events of different durations and magnitudes Further results in terms of application revealed 4 to 11 cases of severe drought intensities of varying duration of 2 – 7 months or more in the basin, based on a fixed subjective threshold of -1.5. However, with varying objective thresholds of -1.33, -1.35. -1.35 and -1.33 for the Upper Niger, Inland Delta, Middle Niger, and Lower Niger sub-basins respectively, there were 4 to 13 severe drought incidences of varying duration of 2 – 7 months or more identified using the SPI 3- and SPI 12-months depending on the location. Additionally, SPI 3-months explained 83% - 88% of the variability in the standardized cereal crop yield, making it a relevant variable in WIC. Thus, an SPI-based weather insurance contract (SWIC) conceptual framework can be useful in reducing the negative impacts of weather on insured farmers in the Niger basin in terms of indemnity pay-outs should a drought disaster occur.