

Drought Risk Analysis Using Neural Networks for Agri-Businesses and Projects in Lejweleputswa District Municipality, South Africa

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Abstract : Drought is a complicated natural phenomenon that creates significant economic, social, and environmental problems. An analysis of paleoclimatic data indicates that severe and extended droughts are inevitable part of natural climatic circle. This study characterised drought in Lejweleputswa using both Standardised Precipitation Index (SPI) and neural networks (NN) to quantify and predict respectively. Monthly 37-year long time series precipitation data were obtained from online NASA database. Prior to the final analysis, this dataset was checked for outliers using SPSS. Outliers were removed and replaced by Expectation Maximum algorithm from SPSS. This was followed by both homogeneity and stationarity tests to ensure non-spurious results. A non-parametric Mann Kendall's test was used to detect monotonic trends present in the dataset. Two temporal scales SPI-3 and SPI-12 corresponding to agricultural and hydrological drought events showed statistically decreasing trends with p-value = 0.0006 and 4.9×10^{-7} , respectively. The study area has been plagued with severe drought events on SPI-3, while on SPI-12, it showed approximately a 20-year circle. The concluded the analyses with a seasonal analysis that showed no significant trend patterns, and as such NN was used to predict possible SPI-3 for the last season of 2018/2019 and four seasons for 2020. The predicted drought intensities ranged from mild to extreme drought events to come. It is therefore recommended that farmers, agri-business owners, and other relevant stakeholders' resort to drought resistant crops as means of adaption.

Keywords : drought, risk, neural networks, agri-businesses, project, Lejweleputswa

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