

Evaluation of Agropastoral Resilience to Drought Dynamics in Uganda's Cattle Corridor

ABSTRACT

Societal resilience to drought in tropical Africa remains a fundamental challenge especially under changing conditions in Uganda. While there is consensus that drought is changing, existing knowledge is inconclusive on the dynamics of change and there is paucity of knowledge as to whether household responses and coping mechanisms employed by households contribute to resilience building at scale in Uganda's cattle corridor. Thus, the outstanding knowledge gap was to determine the drought dynamics across the cattle corridor and evaluate the extent to which the household employed measures effectively contribute to drought resilience. The objectives of the study were to; (i) determine the patterns of drought across the cattle corridor; (ii) determine the factors influencing choice of coping responses to drought; and (iii) assess the contribution of coping responses to agropastoral drought resilience. Both the longitudinal and across sectional designs were used. The longitudinal design covered the biophysical assessment of the drought dynamics for a period of 30 years extending from 1990 to 2020. The cross-sectional design was confined to the socioeconomic component of the study. Drought pattern dynamics were determined using imagery data (1990-2020) premised on Climate Hazards Group Infrared Precipitation with Station (CHIRPS), subjected to Standardized Precipitation Index (SPI). Spatial drought patterns were determined using a bilinear interpolation in ArcGIS 10.8, while temporal drought patterns at SPI at 3- and 6-months scale were analysed using Mann-Kendall Test during 1990-2020. To assess household responses and coping mechanisms, household surveys were conducted to a statistically determined sample size of 426 responses. The household data was reinforced with information from Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs).

The principal component analysis (PCA) with iteration and VARIMAX rotation computed the utility of coping responses, and a Multinomial Logistic model determined the factors influencing the choice of coping responses. The resilience index measurement and analysis model (RIMA) was used to determine the coping responses with the capability to maximize resilience by minimizing drought effects. The model capitalized on how coping responses in absorptive, adaptive and transformative capacities quantified household drought resilience. The PCA was performed to determine the factor loadings for each component. The relative importance of each capacity was examined using the ordinary least squares (OLS) regression model. Whereas, the instrumental variable regression (IVR) model was then adopted to estimate the direct effects of coping responses on agropastoral resilience using a two stage-least square (2SLS) estimator.

The results revealed that for the period 1990 to 2020, both persistent and transient patterns of drought were exhibited. The persistent pattern dominating the southern and central cattle corridor districts, while transient pattern of drought dominates the northeastern districts. This change was associated with increased frequency of severe and extreme droughts, reduced number of rainy days, longer dry spells and shorter wet spells. Drought dynamics were also associated with reduced rainfall intensity in Sembabule and xiii Rakai districts by R^2 0.41 and R^2 0.39 respectively, and increased frequency of severe and extreme droughts by 1.03 at SPI 3- and 6- months scale. There was evidence of shifting drought hot spot zones across the cattle corridor, though the drought trends were not all statistically significant and uniform at $p < 0.000$ across the studied districts. Analysis of household responses and coping mechanisms choice revealed significant inter-district and gender variations, with adaptive and transformative capacity responses being predominantly utilized compared to absorptive capacity responses. Positive and statistically significant coefficients ($p < 0.05$) of drought effects showed increased odds for the choice of planting dual-purpose crops by 0.78 times, agroforestry practices (0.98

times) and fodder making (0.19 times). Sex of household heads reduced odds for choice of planting dual-purpose crop varieties by 0.821 times. This choice of the coping responses was significantly influenced by drought effects and gender of household head.

Suggesting that Agropastoral adoption of coping responses is still in its early stages with some strategies being promoted singularly. Results of coping responses' contribution to drought resilience, indicated non-uniform strength and weaknesses in performance. Among the latent dimensions of transformative capacity; agricultural practices and technology with β -value of 0.562, and enabling institutions and environment (-0.316) showed a significant ($p < 0.000$) influence on agropastoral resilience index. This was followed by adaptive capacity dimension of asset possession (0.282). At district level, a unit increase in adoption of household's agricultural practices and technologies increased household resilience to drought dynamics in Rakai district by 0.86, Nakaseke (0.84) and Nakasongola district (0.79). Variations in household resilience index were higher in Napak and Nakapiripirit districts due to reliance on the indigenous responses. Overall, agropastoral household has a moderate resilience index to drought. 44.9% of households showed resilience to drought dynamics, 51.1% were vulnerable, and 4% were stuck in pre-drought conditions.

Therefore, the spatial-temporal patterns of drought showed progressive expansions and transitions from severe to extreme droughts affecting household resilience at different levels of susceptibility. Drought effects significantly determined the general sequence in choice of coping strategies that all households follow irrespective of other socioecological conditions. By using geospatial data, this study has shown that it was possible to identify and predict actual and potential drought dynamics, and choice of suitable coping responses for drought resilience by agropastoral households across the cattle corridor. To bolster agropastoral resilience to drought, policies should focus at enhancing absorptive, adaptive, and transformative capacities by improving assets, enabling institutions and environments, and promoting the adoption of advanced agricultural practices and technologies in Uganda's cattle corridor.