ABSTRACT

A study was conducted in the pastoral rangelands of Uganda to determine trends of variability and extremes of rainfall and temperature, farmers' perceptions to changes in rainfall and temperature extremes and predict future milk production under changing climatic conditions. Data on daily rainfall, maximum and minimum temperatures from 1960 - 2013 were obtained from the National Meteorological Authority (NMA). Data to establish farmer's perceptions to trends in climate extremes were collected from 240 respondents through household interviews using a pre-tested questionnaire. Data was analysed by descriptive statistics using SPSS software. Daily rainfall and temperature data were subjected to trend analysis using non-parametric Mann-Kendall tests. Rainfall and temperature extremes were analysed using RClimdex. Future milk production using rainfall, temperatures and temperature –relative humidity index as predictors was conducted using ARIMA models in SPSS Expert modeler. Severe droughts and floods, changes in day hot temperatures and warm nights, shift in start and cessation of rains, were the most perceived climate extremes. Key adaptation strategies pastoralists used included; fencing off grazing land, integration of crop into livestock production systems, diversification of livestock species kept, control of stocking rates and changing grazing time. Age of the household head, marital status of household head, household size, cattle herd size per household and land acreage available per household significantly ($P<0.05$) influenced pastoralists adaptation strategies. Annual rainfall received showed non-significant increasing trends. Annual total wet days were increasing but not significant ($P > 0.05$). Consecutive wet days (CWD) were increasing while consecutive dry days, CDDs revealed increasing trends ($P < 0.05$). Trends in annual temperature indices revealed significant increases in hot days (TX90p) and warm nights, TN90p ($P < 0.05$). The number of warmest nights (TNx) and hottest days (TXx) was significantly increasing ($P < 0.05$). Mean diurnal temperature range, DTR showed significant decreasing trends ($P < 0.05$). ARIMA $(1,1,0)\ (0,0,0)^{12}$, was the best fit model and it could explain 82.5% variability in milk production. Milk production was projected at 287.2 Million litres in 2030. Results further revealed that the amount of rainfall received annually will increase with a percentage change of 6.57 by 2030. Maximum and minimum temperatures will increase steadily at a rate of 0.045 and 0.03^0C per year respectively. Temperature humidity index (THI) values revealed increasing trends at a rate of 0.032 per year and by 2040 the predicted THI values will be 80 far higher than 72 beyond which lactating cows begin to suffer heat stress. The observed increasing temperatures and THI values coupled with declining number of wet days and increasing CDDs will result into increased heat stress to livestock, drying of most surface water sources and changes in pasture species composition thus causing a decline in livestock productivity. Therefore, it was recommended that pastoralists in the rangelands of Uganda should keep livestock genotypes that will tolerate the increasing heat stress specifically indigenous genotypes or their F1 crosses. In addition there is need to promote water harvesting and conservation interventions appropriate to the pastoralists. There is also need for a sustained supply of pasture species tolerant to warming conditions and widen utilization of pasture conservation techniques like hay and silage making together with use alternative livestock feeds like crop residues to offset extreme drought season feeding challenges.