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Thesis Title

CLIMATE VARIABILITY, VULNERABILITY AND ADAPTATION AMONG TURKANA PASTORALISTS IN NORTH-WESTERN KENYA

Thesis Abstract

Climate variability and change is increasingly being recognized as a critical challenge to pastoral production systems in the arid and semi-arid rangelands. The projected climate scenarios are expected to aggravate some of the existing vulnerability of natural resource-dependent communities, and likely to impose new risks beyond the range of current experiences. An explicit understanding of households' vulnerability to climate variability and adaptation strategies is, therefore, crucial for targeting appropriate resilience interventions in pastoral environments. This study focused on better understanding of

climate variability and change, in order to provide insights on pastoralists' risk management adaptations at a micro-level. In addition, the study investigated vegetation responses to precipitation anomalies in Turkana County of Kenya.

The research study used Mann-Kendall test statistics to investigate long-term rainfall (1950-2012) and temperature (1978-2012) changes. Household questionnaire survey, focus group discussion and key informants' interviews were used to collect primary data at household and community levels. A total of 302 households were sampled using multi-stage sampling technique, and information obtained analyzed using descriptive statistics and ordinal logistic regression model. In addition, Normalized Difference Vegetation Index (NDVI) data derived from Advance Very High Resolution Radiometer (AVHRR) satellite were overlaid with precipitation to generate vegetation maps. Analysis of variance (ANOVA) was used to analyse vegetation species richness and abundance in the study area.

The result revealed high inter-annual (coefficient of variation > 90%) rainfall variability, with seasonal uncertainty. There were more years with below normal rainfall than those with mean rainfall above long-term mean (LTM). Results indicate that extreme drought events have increased over the last 63 years, with 28.5% occurrences between 1950 and 1970, to 47.9% over the last two decades between 1990 and 2012. Further, the study revealed that the area is warming at 0.13°C, with a significant ($p < 0.05$) rise in both minimum (0.2°C), maximum (0.1°C) temperature for the period 1979 - 2012. Pastoralists' perception of changes in climate characteristics matched the recorded data. As per the community perceptions, the effects of climate variability and change are being felt by many households in Turkana. The vulnerability index analysis showed that majority of households were moderately (44%) to highly (27%) vulnerable to climate-induced stresses. Factor estimates of the probit model further revealed that the main determinants of pastoralists' vulnerability were sex of household head, number of dependents, marital status, social linkages, access to extension services and early warning information, herd structure and mobility, distance to markets, and access to affordable credit. The results highlight the need for interventions to empower women in the access to education, affordable credits, livelihood diversification opportunities, and to resources that can strengthen households' resilience to climate

variability.

Vegetation will be key resources around which resilience to climate change and vulnerability will be build. In this study there was evidence that areas with low mean annual rainfall (< 200 mm/year) depicted stronger relationship between NDVI and rainfall compared to locations with mean annual rainfall of more than 300 mm/ year. Implying that NDVI may be more relevant in defining vegetation trends in arid zones compared to high more rainfall areas. In this study, there was enhanced vegetation greenness between 1998 and 2011. Only 30% of this change could be explained by rainfall anomalies, with the rest partly attributed to invasion of the rangelands by *Prosopis juliflora*. As perceived by various community groups the shifts of vegetation to more shrub bush-land will favor livestock diversification to browsers such as goats and camels. In general, the high rainfall variability and uncertainty was accompanied by raising temperature over the period under study. Besides climatic factors, socio-economic and bio-physical factors are crucial in determining households' vulnerability to climate variability and change dynamics. Therefore, interventions that are cognisant of changes anticipated, shift in vegetation composition, will require a holistic approach that not only focuses on drivers of climate variability and change, but also socio-economic factors central to building pastoral resilience in arid environments.

Keywords: adaptation, climate change, drought, pastoralism, arid and semi-arid lands, resilience, Turkana