

Socioeconomic Impacts of Drought among Pastoral Community in Kajiado County, Kenya

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Abstract: *Environmental degradation, capital and entitlement losses worsen livelihood situation, low produce value addition and poverty challenges increased livelihoods vulnerability and exposure to drought events. The aim of the research was to investigate vulnerable livelihoods coping and adaptation to worsening drought hazard. Data collection methods were household questionnaires, key informant interviews and focus group discussions. Data analyzed used content and thematic analysis, Statistical Package for Social Scientists factor analysis. Results revealed population growth, intensifying resources use pressures, escalating food insecurity, urbanization and settlement. Sale of assets, charcoal burning, beadwork, herding, labour and relief intervention coping mechanisms. Drought adaptation measures were water pans, Tourism, milk marketing cooperative, self-help groups raised capital, the motor cycle (boda boda) transport businesses borehole drilling for water adaptive mechanisms. Limited market based disaster management interventions occurred. Drought mitigation measures were veterinary services provision, education. The study concluded the intensified resource uses and destitution, resource scarcity, population growth was exacerbating the impact of drought hazard on pastoral livelihoods. The study recommended: integrated natural resources management to improve coping abilities to drought, establishment of adequate funding and timely release of funds for drought mitigation and the establishment of vocational and technical trainings to increase non pastoral related incomes.*

Keywords: Vulnerability, Coping, Adaptation, Risk

1. Introduction

Drought impacts have been associated with high vulnerability and low adaptive capacity especially in the arid lands. Property damages represent drought vulnerability. Vulnerability is defined as the set of prevailing or consequential conditions that result from physical, social, economical and environmental factors which increase community susceptibility to the impact of hazards (ISDR 2002). Productivity losses were 46 percent higher in livestock sectors than in agricultural sectors. Estimated drought related annual Gross Domestic Product long-term fiscal liability and lagged effects averaged 2.6 per cent in the 2008 to 2011 period (Government of Kenya 2008) was expected to exacerbate to 3 per cent in 2030 to 5 per cent in 2050 (SEI 2009).

Ding *et al* (2010) assessed drought economic impacts empirical data in the United States of America, Canada and Australia. Gil *et al* (2013) measured the economic impacts of drought on agricultural sector in Elbo river basin Spain with the aim of evaluating the economic impacts of a drought event on the agricultural sector are transmitted from primary production to industrial output and related employment. Kilimani *et al* (2015) assessed gross domestic product with a focus on the agro-processing industry, employment, trade balance and household welfare losses to analyze climatic variability effects on economies in Uganda with the aim of proactive planning and mitigation strategies to provide long term social economic resilience to future drought impacts.

Ding *et al* (2010) used input-output and the computable general equilibrium model. Kilimani *et al* (2015) used highly disaggregated agricultural sector general equilibrium model, which highlighted the costs of drought using actual productivity losses from the literature on crop yields. The benefits of any intervention can easily be approximated

using estimated costs that would otherwise be avoided by drought mitigation programs the costs are measured using rigorous econometric and crop yield models under different climate shocks scenarios. Gil *et al* (2013) used chained elasticities based econometric models to measure the micro and macroeconomic industrial output on employment, agricultural production and water scarcity transmission effects through attribution models to determine the magnitude of the economic loss to water storage. Huho and Mugalavai (2010) analysed drought severity effects on rural livelihoods in Laikipia district, Kenya where they tested drought severity using Standardized Precipitation Index and correlation coefficient using quantitative and qualitative approaches. Mworira and Kinyamario (2008) compared pastoralists coping strategies and response to La Nina induced drought in Muuni farms in Kiboko group and Olkarkar ranches to Chyulu national reserve and Kiboko range research station. Ouma (2011) quantified drought intensity using standard precipitation index and determined adaptation and coping practises using quantitative and qualitative approaches.

Makoti (2014) evaluated drought driven food insecurity coping strategies in Makamini, Kwale County using participatory approaches and environmental checklists. Saranta (2013) analysed alternative livelihood strategies to socioeconomic changes among Isiria Maasai in Lolgorien and Angat Barrikoi in Narok County using qualitative approaches. Gikaba *et al* (2014) assessed drought duration influence on livestock feeding practises among Maasai pastoralists in Mailwa, Namanga of Kajiado County using household questionnaires. Chege *et al* (2015) analyzed cultural influence on dietary practices and malnutrition in Sajiloni, Kajiado using focus group discussions. Opiyo *et al* (2015) examined drought adaptation and coping strategies among the Turkana pastoralists of Northern Kenya. Nkedianye *et al*, (2011) compared Maasai Mara, Kitengela, Amboseli and Simanjaro plains resident to immigrant

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livestock mortality rates in 2005 drought. Drought coping mechanism was classified into charcoal burning, illegal logging and sand harvesting (Huho and Mugalavai 2010). Supplementary feeding and grazing systems agreements (Mworia and Kinyamario 2008; Gikaba *et al* 2014). Drought adaptation were classified into migratory responses, soil and water conservation, water development (Makoti 2014; Gikaba *et al* 2014), dry and early planting, minimum tillage, horticultural and drought resistant crops, staggered cropping (Mworia and Kinyamario 2008; Huho and Mugalavai 2010), merchandising wares, land leasing and disposal, rental house investments, social ills rise (Saranta 2013), herd sizes management (Gikaba *et al* 2014), tourism and wildlife products processing and irrigated farming investment (Mworia and Kinyamario 2008), livestock offtake, financial and extension service provision, asset and income diversification, animal health, improved livestock breeds adoption (Mworia and Kinyamario 2008; Makoti 2014; Saranta 2013; Gikaba *et al* 2014; Nkedianye *et al*, 2011). Inadequate market information and access, insufficient education, technological knowledge, limited financial services, human capital, higher stocking density, exotic livestock breeds, the timing of migration and land tenure changes were challenges associated with adaptation (Saranta 2013; Opiyo *et al*, 2010; Nkedianye *et al*, 2011; Mworia and Kinyamario 2008).

Gil *et al* (2013) results indicated economic impacts were uniformly distributed. Drought caused irrigation systems and tillage processes adoption (Ding *et al* 2010) however according to Gil *et al* (2013) irrigated agriculture had higher market risks. Favourable prices smoothed supply shortages in drought stricken areas even though taxation revenues and income inevitably reduced (Ding *et al* 2010). Shiferaw *et al* (2014) indicated that Sub-Saharan Africa (SSA) economies faced resource scarcity and low agricultural technology investment which caused higher vulnerability to drought hazards. Kilimani *et al* (2015) found that agricultural sector output direct drought impacts were moderate to severe. Kilimani *et al* (2015) found also that household's level the terms of trade gains mitigate part of the potential welfare losses with respect to consumption. At the sectoral level employment within the agricultural industries is less compared to the output losses. A number of institutional and social structures which are critical to highlighting the true cost of a drought are not easily modelled using economy wide techniques (Kilimani *et al* 2015). There were gaps in the drought resistant crops, improved infrastructure and investment in irrigation adaptation strategies (Kilimani *et al* 2015).

The study sought to examine how the socioeconomic changes due to drought affect pastoralism in the Kajiado county. The collective action theory and drought vulnerability conceptual framework was used to unravel environmental governance practices, which have influenced pastoral communities coping and adaptation to drought, determine the practices contribution to disaster management. We intend to find out the social economic impacts of drought on pastoral livelihoods, continued resilience despite the worsening biophysical and socio-demographic changes, covariate risk markets failures and property right changes. The study highlights the assessment of the socioeconomic

and environmental impacts of drought that is necessary for improved water management, inform water allocation decisions in times of drought, design adequate drought mitigation and prevention measures to minimize impacts. The intervention benefits can be approximated using estimated economic impacts costs, which would otherwise be avoided by drought mitigation programs. The quantification reflects needs instrumental to establish effective mitigation programs and strategies. The research would provide pastoral livelihoods drought risk reduction, which could be generalized for the drylands covering 80% of the Kenya's landmass.

2. Methods and Methodology

The proponents of collective action theory are Olson (1965) and Harding (1982). The drought vulnerability concept examined how social, political decision making, economic processes and institutions resulted in more vulnerability after an extreme event (Mileti 1999; Wisner *et al* 2004). Vulnerability in a wider sense encompasses the concept of resilience. The moderated variables are governance frameworks. Outcomes of adaptive capacity evident in the adaptation and mitigation. Adaptive capacity determines drought resilience concept.

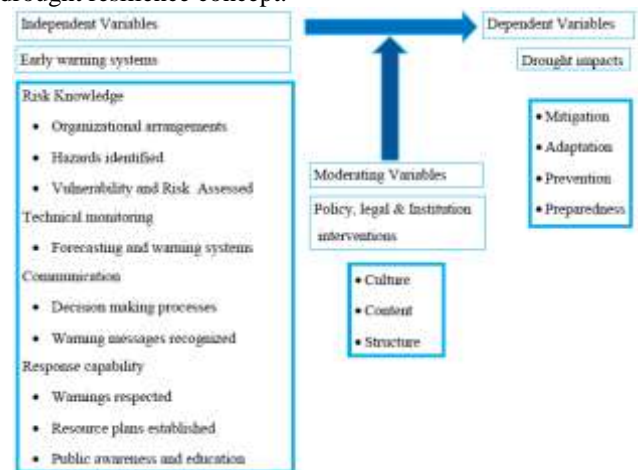


Figure 1: Early warning framework and its impacts on drought impacts

2.1 Data Capture and Analysis

Household questionnaires, key informants and group discussions were used to capture data for analysis. Statistical Package for Social Scientists (SPSS) Exploratory Factor analysis dimensionality reduction, and the transcribed data were categorized into specific socioeconomic and cultural changes and causes that were highlighted and thematically coded to determine precise conceptual relationships to discover, unearth, detect and identify and facilitate structured association.

3. Results

Agro-pastoral household were 90% and there was a rise in female-headed households in Oldonyo Nyekie, Rombo, Olkiramatian, Olturoto and Iloodokilani. Early schools withdrawal occurs to provide labour for household chores

and livestock herding labour. Socialinfrastructures are generally limited.

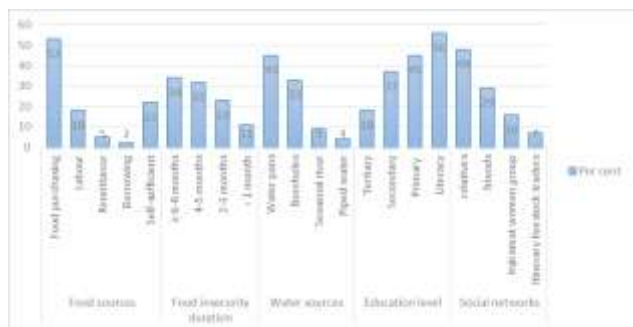


Figure 2: Food sources, insecurity duration, education level, networks and water sources perceptions

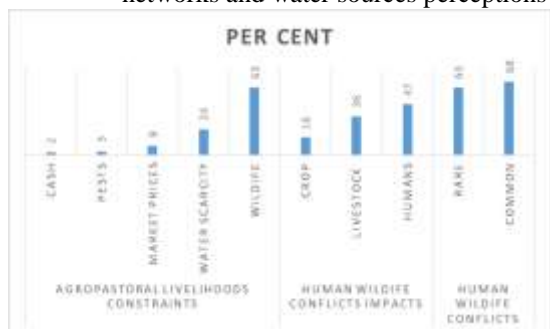


Figure 3: Percentage distributions of the perceptions of constraints, impacts and conflicts

Charcoal sales, firewood and sand harvesting, security and tourism employment, women's souvenirs and beadwork sales, herding and motorcycle transport drought coping strategies.

Drought adaptive mechanisms were migration for pasture, water and to avoid diseases, boreholes diesel subsidy provisions, rehabilitation and pump installation, water trucking services in Oldonyo Nyekie, irrigated and mechanized farming in Kuku.

Animal's movement permit and quarantine disease management. Foot and mouth disease, *Contagious Bovine Pleuro-pneumonia*, Animal health preventative and curative services for early detection, diagnosis and control interventions. Breed improvement, herd diversification, destocking and off-take.

Pasture re-seeding, Bissil and Namanga forage harvest, Chyullu and Juja negotiated drought refuges. Kenya Forest Service coordinated Plantations Enhancement Livelihood Improvement Scheme (PELIS) implemented using Community forest associations and schools Afforestation programmes was in Namanga and Loitokitok was perceived by 42.2%. Tree harvest was high in public land compared to privately owned lands, however.

All Exploratory Factor Analysis Kaiser Meser Olkin value was 0.470 - 0.51 The Bartlett's test of sphericity ($X^2(6) = 3.732, p < 0.713$) showed patterned relationships between items. The factor model failed to detect departure from the model at the 69.95% level ($X^2(1) = 69, p = 0.058$). Livestock and crop depredation and property factor loadings were negatively correlated.

Table 1: The factor loadings after rotation using a significant factor criterion of 4.0

Factor	Communalities	Eigen values	Percentage variance.
Food insecurity	0.700	1.040	14.700
Food sources		0.920	23.040
Agricultural constraints	0.490	1.070	15.740
Social networks	0.120	0.044	27.99.
Wildlife conflicts	0.57		

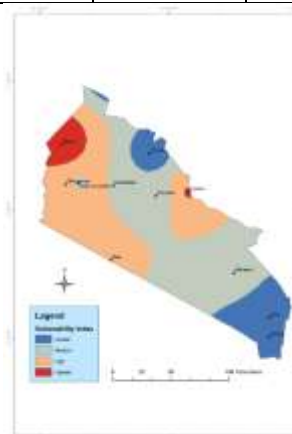


Figure 4: Drought Vulnerability index



Figure 5: Drought Adaptation index



Figure 6: Drought Risk index

High drought vulnerability index and the least drought adaptation areas were Olkiramatian and Mosiro (Figure 4) from the least infrastructure development, few non governmental organizations interventions.

Imaroro had a high vulnerability impact from sand harvesting however the presence of non governmental organization interventions improved its adaptive capacity similar to Iloodokilani, Meto, Enkorika and Mbirikani. Oldonyo Nyekie had unique water trucking services which

was additional to institutional and civil interventions in agriculture, health and education interventions. Iloodokilani, Mbirikani, have Oldonyo Nyekie, Rombo, Imaroro, and Meto had medium drought adaptation. Kuku, Enkorika, and Olturoto highest drought adaptation and low vulnerable index (Figure 5). Further, drought risk was high in Mbirikani, Oldonyo Nyekie, Iloodokilani and Olkiramatian, besides being highest in Mosiro (Figure 6).

4. Discussion

There are several factors that play a role in the severity of the impacts of droughts conditions. Variations in these factors can alter the relationship between indicators and the impact. The absence of certain impacts as a result of sound management does not imply that there is no drought. Even though with perfect management there will always be some kind of impact. Pastoralists have always adapted and coped with the vagaries of weather for centuries which are normally associated with a reduction in primary factor productivity of agricultural dependent on rainfall. Nomadic cultural adaptive practices avoided diseases, provided a framework for common water and pastures usage (Chege *et al* 2015). Opponents to this position have posited that communal land grazing areas have led to open access and therefore resources scarcity.

Environmental governance changes associated with in land registration and titling have made communal land resource management unsuitable to pastoralism. It becomes necessary for individual, community and institutional adaptation to drought hazard.

Drought frequency and severity has not only increased but ecological trends tends to favor woody species (Opiyo *et al* 2015) but have additionally limited drought recovery periods (Osano *et al* 2007). The high poverty incidence which is almost 40 per cent among pastoralist globally is aggravated by increased drought incidence of increased duration (Shiferaw *et al* 2014; Huho *et al.* 2010; UNISDR 2008). Extended drought duration has prolonged chronic food insecurity. Food insecurity is associated food price spikes (Kamuru *et al.* 2014). Relief provision, sand harvesting and deforestation are the inappropriate drought coping mechanisms.

Minale (2013), Morara *et al* (2014), Nyamasyo and Kihima (2014) concur that positive demographic change and population growth intensifies farmland, improves natural resource base, strengthens market development, diversifies incomes, supports settlement and infrastructure, supplies soil and water conservation capital investment.

On the other hand, population growth in resource fragile areas strains natural resources availability, which results in more exposure to unsafe and precarious conditions (Makoti 2014). Water ferrying and scaling up water storage network to conserve water to meet water quality needs to enable some water licence holders will be to access and utilize water resources (Makoti 2014; Gikaba *et al* 2014). This would be additional to understanding recognizing and supporting community, individual and family level adaptation response plan strategies improving breeding

services, opening up new grazing resources and improving natural areas ecosystem health.

5. Conclusion

The study assessed the socioeconomic impact of drought in the Kajiado County. The eastern Africa is characterised mainly by semi-arid and sub-humid climates with long dry seasons. Differentiated drought vulnerability appears to be related to economic contraction and rising poverty levels, biodiversity declined, wetland depletion, bush encroachment, worsening pasture quality and water scarcity may threaten rangeland livelihoods sustainability. Recurrent drought events cause water crises, disease stresses and grazing resources use pressures and food insecurity whose impacts includes limited recovery time from widespread livestock asset decimation, economic losses and vicious endemic poverty cycle (Dougill *et al.*, 2010). Deforestation is ecologically costly and intensifies climate change effects in the long-term to the detriment of pastoral livelihoods (Orindi, Nyong and Herrero 2007). Wildlife conflicts, agricultural constraints and food insecurity could be the underlying factors driving drought vulnerability. Idiosyncratic risks have been tackled using public health, schooling, micro-finance establishment to enhance. Relief insulates drought victim's enables risk taking in low income households even though it has the impact of entrenching drought vulnerability. Low human development and social development inequality makes it harder to raise decent livelihoods. Nature based rural livelihoods wealth creation remains the most effective way to cope and adapt to climatic extremes, manage seasonal hazards. Perceptions of climatic variability and climatic change which are critical in ex-ante adaptive factors decisions depends on information access and use, markets, education support, health and veterinary technological services development, management skills, financial services. Planning, learning and reorganization contribute to diversified livelihoods and sustainable development. Information could be used to guide early warning, the biophysical impact assessment approaches limitations are on complex vulnerability related dynamics evident in structural factors evident in human agency factors. The impact of the productivity shocks is conveyed through factor returns, employment and commodity prices among other critical macroeconomic variables. For household welfare it is suggested that future research areas could delve into market imperfection and market risk reflected in market prices and its impact on the effect of drought on pastoral livelihoods since evidence shows that adaptation is constrained by access to credit, property rights with respect to land and irrigation. The study is limited in the exogenous associated with partial and temporary closure of downstream manufacturing industries such as agro-processing.

6. Recommendations

6.1 Academic recommendation

Investigate urban poor low income earning groups adaptation to drought shocks.

6.2 Technical recommendation

Improve water conservation and natural resources management ecosystem health.

6.3 Operational recommendation

Promote timely mitigations actions.

6.4 Policy Recommendations

Use standards and economic incentives to foster wealth creation programs and promote equitable development growth.

7. Acknowledgement

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