

# Evaluation of the Mitigation Strategies for Dry Spell impacts on Livestock Production in Homa Bay County, Kenya.

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**Abstract-** Dry spells are a major triggering factor of drought phenomena with devastating climatic hazards in many areas of the earth. Dry spells increase the risk of drought occurrence and make the affected regions more vulnerable to food insecurity. Homa Bay County location is in the Lake Victoria Basin in Western region of Kenya. The study area is influenced by sub humid climatic condition hence frequent and prolonged dry spell that causes decline in the livestock production. This paper examines the mitigation strategies for dry spell impacts on livestock in Homa Bay County. The study used a sample size of 384 households. Primary data was gathered through use of questionnaires, interview guides, Focus Group Discussions and observation while secondary data was obtained from publications, journals, newspapers and internet access. Data analyses were done using statistical package for social scientists (SPSS) version 20.0 Results reveal that majority of the respondents' 48.8% rated treatment of livestock as the most practiced mitigation strategy. Destocking was second 23.9%, drought tolerant livestock third 17.8%, and pasture management 9.5% respectively as the mitigation strategy employed to reduce the impact of dry spell on livestock in Homa Bay County. Chi-square tests showed significant variations at  $P > 0.05$  among mitigation strategies applied on livestock production. Livestock production has continuously become unsustainable given the fact that majority of the respondents practice livestock treatment (48.8%) as mitigation strategies to reduce the loss of livestock during dry spells instead of investing in a more innovative and viable strategies that can improve livestock production in Homa Bay County. The results obtained are expected to inform the livestock farmers on better interventions to mitigate the dry spells for sustainable livestock production.

**Index Terms-** Dry spells, Livestock production, Mitigation, Sustainability

## I. INTRODUCTION

Dry spells increase the risk of drought occurrence and make the affected regions more vulnerable to food insecurity. Studies indicate that large parts of the world rely on rainfed agriculture for their food security (Fischer, 2012). Over the last decades as a consequence of climate change, dry spells have been

increasing in spatial and temporal scales leading to rainfall variability that has become a concern in the rainfed agricultural regions of the world (Mugalavai and Kipkorir 2015).

In many African regions, dry spells have continuously impacted on small scale agriculture that includes livestock production which forms approximately 90% dependency for food production and 80% of the population reliance as a source of livelihood (Rockstrom *et al.*, 2003). Kenya where Homa Bay County is situated is one of the East African Countries that drought is prone due to its peculiar eco climatic conditions. It has a long history of extreme climatic conditions of dry spells and drought (Mateche, 2011). Spatial and temporal distribution of short and long rains in many parts of Kenya is defined by the general prevalence of monsoons and the corresponding agricultural practices (Stewart, 1988). Both short and long rainy periods experience some degree of dry spells that substantially influence agriculture and specifically livestock production especially in the rangeland and sub humid lands.

Lake Victoria Basin where Homa Bay County is situated is a sub humid region that experiences frequent dry spells annually (Mugalavai, 2013). This dryness is caused by predominantly continental origin of these air masses. It is intensified by the persistent divergence over most of East Africa during both monsoon seasons, which are caused by a quasi-permanent low pressure centered at Lake Victoria (Awange *et al.*, 2007). According to Ogenga *et al.*, (2018), during the period 1950-2017, (10%) of the period constituted wet years, (67%) normal years while (22.4%) were dry years in Homa Bay County respectively. The probability of dry spells occurrence during the growing seasons varies from (0 – 68%) for 1 mm DRT and (0 – 78%) for 5 mm DRT in Homa Bay County (Ogenga and Mugalavai, 2019).

Improving the potential of livestock production in the world subject to frequent dry spells and droughts should therefore be high-priority to achieve the Sustainable Development Goals. Farmers in many parts of the world for example in the Sub Saharan Africa incorporate different technologies to improve livestock production. The various mitigation strategies that are being implemented in various parts of the world are destocking of livestock, rearing drought tolerant livestock, better management of pasture and fodder among others (GoK, 2016).

### 1.1 Research Question

What are the mitigation strategies for dry spells impacts on livestock in Homa Bay County?

## II. MATERIALS AND METHODS

### 2.1 Study area

The study was carried out in Homa Bay County which is located in the Western part of Kenya in the former Nyanza province with an area of 3,154.7 km Square. It is bounded by latitude 0° 15' South and 0°52' South and longitudes 34° East and 35° East. It has an altitude of 1146 m above the mean sea level (GoK, 2017).

### 2.2 Research design and sampling procedure

Evaluation research design was used to examine the mitigation strategies for dry spell impacts on livestock in Homa Bay County. Additionally, the study utilized both qualitative and quantitative approaches. A sample size of 384 households was interviewed using questionnaires.

### 2.3 Analysis criteria of mitigation strategies in relation to dry spells impact on livestock (1950 -2017) in Homa Bay County

The use of the  $\chi^2$  necessitates preparation of cross tabulation of the variables which then generate significance test results (Nachmias, 2001). Pearson Chi square ( $\chi^2$ ) test was done to measure the association between the mitigation strategies (on-farm and off farm) of the small scale farmers with regard to dry spells impact on livestock in Homa Bay County. A test at 0.05% significance level was used to measure the variability in the mitigation strategies in relation to livestock production. All the quantitative data were analyzed using the Statistical Package for Social Scientists (SPSS) version 20.0

The study took a multistage sampling approach where 50% sampling units as supported by Mugenda and Mugenda (2003) was used. According to Awange *et al.*, (2007), the most affected sub counties by dry spells and droughts were the peripheral ones neighbouring Lake Victoria, but for the wards that are located far away from the lake shores. These sub counties include Karachuonyo, Mbita, Homa Bay Town and Rangwe. The wards under these sub counties were purposively sampled given their

proximity to the lake shores that defines the rainfall variability in the areas. The proportion of wards where the study was conducted were computed from the four sub counties based on 30 % sampling units as supported by Mugenda and Mugenda (2003).

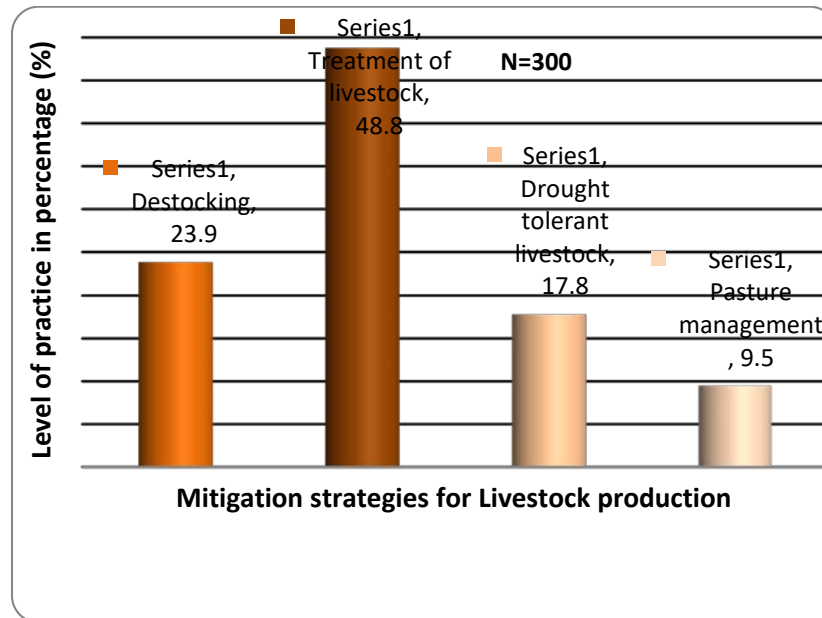
In-depth interviews were conducted using interview guides with 2 representatives from each organization including Ministry of Agriculture, Kenya Meteorological Department, Non Government Organizations and County disaster management committee totaling to Eight (8) These key informants were identified through a combination of simple random sampling, purposive and quota sampling techniques.

## III. RESULTS AND DISCUSSIONS

### 3.1 Mitigation strategies for dry spell impacts on livestock production in Homa Bay County

The study sought to examine the mitigation strategies to dry spells impacts on livestock in the study area. Based on the on farm adaptation strategies to cope with the climate change and variability, small scale farmers and other governmental and Non Governmental stakeholders in Homa Bay have come up with various on-farm strategies to mitigate the effects of dry spells (FAO, 2010). The study therefore did not evaluate all the mitigation strategies for climate change and variability but the ones identified by the relevant stakeholders in Homa Bay County. The strategies that informed the study and formed the basis of evaluation are destocking, livestock treatment, rearing of drought tolerant livestock and pasture management.

The on – farm mitigation and adaptation strategies captured in the Homa Bay County Integrated Plan 2013 to reduce dry spells impacts include destocking of livestock, pasture management that include pasture conservation and planting, rearing of drought resistant livestock and breeds and routine treatment of livestock from the diseases that frequently occur during dry spells (GoK, 2013). The results in Figure 3.1 show that majority of the respondents' (146) at 48.8% rates treatment of livestock as the most practiced mitigation strategy. Destocking is second 23.9% (72), drought tolerant livestock 17.8% (53), pasture management 9.5% (29) respectively are the mitigation strategy employed to reduce the impacts of dry spells on livestock production in Homa Bay County.



**Figure 3.1: Mitigation strategies for livestock production during dry spell periods in Homa Bay County, Kenya**  
Source: Field Data (2017)

Chi Square test value ( $X^2_{3,0.05} = 53.86$ ) conducted on the data showed that there was low significance at ( $P > 0.05$ ) level that indicated variations in livestock mitigation strategies for improved livestock production during dry spell periods in Homa Bay County. Livestock keeping is one of the major forms of livelihoods amongst fishing and crop farming in Homa Bay County. From the FGDs, livestock suffer great impacts in the event of dry spells. Different mitigation strategies such as destocking, treatment of the livestock, pasture management and rearing of drought tolerant stocks were evaluated on their effectiveness to reduce the impact of dry spells in the County.

### 3.2 Use of destocking as a strategy in mitigating dry spells impacts on livestock in Homa Bay County

The different forms of feed like pasture and water get depleted in areas of overstocking and this leaves a good number of livestock susceptible to drought. The dry spells reduces productivity and even the quality of the products. Destocking during the dry spells situation helps the farmers to reduce the pressure on the available pasture and water and is widely practiced in pastoralist communities in many parts of Sub Saharan Africa and it is meant to limit the environmental shocks to the livestock (Ngaira, 1999). However, compared to the pastoralist community, the agro pastoralists are more vulnerable to the drought impacts that majorly affect their livelihoods and food security (Nyariki *et al.*, 2005).

To reduce grazing pressure on drought stressed pasture, the stock density has to be cut down. The number of livestock per grazing acre should be reduced to minimize grazing pressure (Salem, 2010). Relocation of the animals which involves temporary movement of livestock to new and better forage areas was found to be one of the most practiced strategies (23.9%) in Homa Bay County. Many small scale farmers relocate their livestock to areas which have limited impact of dry spells.

Information gathered from key informants indicated that during prolonged dry spells and drought, some farmers in Homa Bay County were forced to send their excess livestock “*riembo jamni*” to their relatives living in non affected or better of regions in terms of pasture and water. It was established that Lambwe valley is known to have better forage even during droughts. Farmers therefore relocate their excess or all their livestock to their relatives living in those areas. Relocation as a form of destocking is a strategy has been historically practiced to increase feed reserves during the dry periods in many parts of the world including many parts of Kenya (Barrow *et al.*, 2002). Many of the respondents did not practice it given the fact that there have been frequent droughts in the area that has left so many households without or with very few livestock. This then justifies the percentage of the respondents doubting the effectiveness of the strategy to limit dry spell impacts in the area of study

### 3.3 Use of livestock treatment as a strategy in mitigating dry spells impacts on livestock in Homa Bay County

During dry spells, livestock are under stress which increases their susceptibility to outbreak of diseases (De la Rocque *et al.*, 2008). Some of the diseases are caused by increased occurrence of pests while others are due to the low immunity from the insufficient and low nutrient feed they consume. Frequent examination and routine practices to prevent the diseases of the livestock are hence required to certify their wellbeing and care. This increases production of the livestock hence increased food security.

Based on the results from Figure 3.1, treatment of livestock (48.8%) immersed as the most practiced by the residents of Homa Bay County. It therefore indicates the high number of disease cases during the dry spells. It was established that the high cases of disease occurrences that subject the farmers to seek for medical treatment of their livestock may have great economical impact to the poor farmer.

From the focus group discussions, it was found out that the livestock are very vulnerable to diseases and pests like tsetse fly that increases in number during dry spells. Despite the high number showing livestock treatment as highly practiced, many livestock suffer with reduced production and causes loss of livestock. Many of the farmers use the individual members of the community who are not qualified as veterinary officers. The situation is worsened due to the low numbers of government veterinary extension officers in the County to service all the farmers (GoK, 2016). The low veterinary officer ratio to number of farmers makes many livestock vulnerable to wrong diagnosis and wrong prescription that leads to high loss of livestock during prolonged dry spells.

The intervention program funded by Kenyan and Swedish government with the objective of transforming agriculture into an innovative, commercial oriented modern industry to alleviate poverty and improve food security in Homa Bay is however under implementation (GoK, 2016). The intervention is to disseminate information and coordinate other stake holders in value addition development to livestock. It is geared towards dairy value chain addition to transform livestock keeping in the County through vaccination. This effort is necessary in order to reach all the small scale farmers in Homa Bay County.

### **3.4 Rearing drought tolerant livestock to mitigate dry spells impacts on livestock in Homa Bay County**

Livestock such as cattle, goats and sheep were regarded for their social value like paying bride price in Homa Bay County. Based on Figure 3.1, rearing of drought tolerant livestock (17.8%) was rated the third as one of the mitigation strategies for the dry spell impacts. Most of the livestock bred in Homa Bay are of African indigenous type such as zebu cattle, red maasai sheep and the small East African goats (GoK, 2013). Several breeds of zebu and zenga are able to withstand very harsh environmental conditions where those characteristics have risen through evolutionary adaptation (Hansen, 2004).

Terefe *et al.* (2015) observes that apart from the unique physical morphological feature that distinguishes them from other livestock, the African livestock like cattle, goats have non-visible traits like disease resistant and drought tolerant characteristics. The animals have an investment value where they can be sold during hardship like drought to get access to food from the market. The African indigenous livestock generally performs poorly in terms of productivity but their selection is purely based on their ability to survive in harsh conditions like prolonged dry spells (De Roos *et al.*, 2008).

From the focus group discussions, many of the residents indicated that they keep the African indigenous livestock given the fact that many of the exotic cattle cannot survive due to their high susceptibility to high temperature in the region. It was established however that the livestock are not entirely kept to enhance food security but for their sentimental value like paying medical bills, school fees and paying dowry when needed. In this regard, majority of respondents were not of the opinion that the drought tolerant livestock have helped in mitigating the impact of dry spells when they occur.

There exists very limited commercial development of livestock resources save for the dairy goats by Heifer International and South Nyanza Community Development project (SNCDP) an

IFAD/GoK initiative in Homa Bay town, Karachuonyo, Suba and Ndhiwa Sub Counties of Homa Bay County. Due to low economic power and other environmental constraints like drought, the residents can only practice small scale household rearing of livestock that fail to improve their food insecurity status. There is need therefore for all stakeholders from the County government, NGOs, local community development groups and individual farmers to take advantage of the suitable breeds of livestock and increase the status of livestock development for increased food security in Homa Bay County.

### **3.5 Use of pasture and fodder management for livestock to mitigate dry spells impacts on livestock in Homa Bay County**

Dry spells conditions occur when there is no rain or other forms of precipitation over prolonged period of time. Reduced rainfall causes water shortage and reduced soil moisture content hence low quality and quantity of forage (Salem, 2003). Unchecked grazing or browsing can cause long term damage to pasture if not adequately managed. Overstocking and increased harsh climatic conditions can greatly destroy the available pasture for livestock resulting to low productivity.

It was established that most of the Homa Bay County residents are small scale farmers of livestock who depend on natural pasture for their livestock feed. Ndathi *et al.* (2013) observes that the most common feed resource for ASALs of Kenya are browse and natural pastures comprising of grasses and locally available legumes. This is due to the types of livestock which are mostly of indigenous types characterized by the ability to walk long distances in such of pasture and water. Large East African Zebu in Kenya are classified in same subgroup of cattle that can survive in very poor pasture, scarce water and have very good walking ability (Rege and Tawah, 2006). This explains why very few respondents regard other pasture management strategies as effective in reducing the dry spell impacts on livestock.

Due to increasing shocks as result of harsh climatic conditions in the County, some farmers have resolved into some farmers engage emerging forms of pasture management like feed conservation and diversification (GoK, 2016). It was established that through partners, ICIPE has initiated a push pull technology that has significantly benefited dairy farming in some parts of the County. The initiative is based on promoting Napier grass (silverleaf desmodium) that is of high quality dairy fodder to the farmer that has promisingly yielded some increase in livestock production.

It was established from the focus group discussions that other forms of pasture management in Homa Bay County though practiced by very few farmers include; pasture buying from the residents that are not much affected by the dry spells and pasture conservation where the livestock farmers have resorted to planting given species that are regarded to possess great nutritional value to livestock. However, there have been other challenges related to maintenance given the little knowledge among the farmers. Mnene (2006) observes that sown pastures are labour intensive and require given skills to maintain and expect better production for livestock.

The main strategy of preservation of pasture is in form of standing hay or cutting and bailing. However, Ndathi *et al.*, (2012) observes that many farmers don't conserve the harvested feeds well due to low skills and inadequate conservation structures. This



strategy if well practiced can lower pressure on the drought stressed pastures by creating dry lot feeding paddocks within the farms. However, promotion of feed utilization strategy for optimal practice of feed preservation and conservation at optimal nutritive levels would be the best bet for quality feed for livestock (Koech, 2016).

#### IV. CONCLUSION AND RECOMMENDATION

Livestock production has continuously become unsustainable given the fact that majority of the respondents practice livestock treatment (48%) as mitigation strategies to reduce loss of livestock from the impact of dry spells instead of investing more innovative and viable strategies that improve livestock production in Homa Bay County. There is need for sufficient and appropriate capacity building in terms of training, awareness creation and financial assistance for farmers. This will enhance the level of uptake and implementation of the identified strategies for sustainable livestock production.

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