

Aspects of Smallholder Livestock Production Affected by the Effects of Climate Change in Njoro Sub-County

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Abstract:- Smallholder livestock production is one of the major means of livelihood supporting many families world over. This system acts as a source of food and financial security to many households therefore sustaining their socio-economic wellbeing as well as that of the nation. However, this support system is under threat due to the negative effects of climate change which are contributing to a decline in the level of smallholder livestock production. For the last 30years, changes in climate have been observed in Njoro sub-county and therefore, this study investigated the effects climate change is having on smallholder livestock production in the area. This was done through determination of the aspects of climate change/variability that have impacted on livestock production and the magnitude of their effect. The study employed a social survey research design, where primary data was collected using questionnaires and participant observation, while secondary data was sourced from journals, books, articles, and agricultural records at the sub-county and county headquarters and from the meteorological department. The study found out that climate change is affecting aspects of smallholder livestock production mostly livestock health, livestock yield, forage availability, and water availability. From the study, it was concluded that, due to the effects of climate change, mainly prolonged droughts and reduced rainfall amounts in the study area, smallholder livestock production farmers in the study area is experiencing increased disease occurrence, reduced livestock yield, reduced forage productivity and reduced water availability. These are having a negative effect in their production system.

Keywords: Smallholder, livestock production, climate change, climate variability, aspect

I. INTRODUCTION

In Sub-Saharan Africa (SSA), the livestock sector plays an important role in economic development (Kirimi, et al., 2013) and sustenance of livelihoods. The sector supports many families (especially the poor and smallholder farmers), acting as a source of food and an economic security. In Kenya, the livestock sector contributes over 30% of the Agricultural Gross Domestic Product (GDP), employing more than 50% of the agricultural labor force (Kirimi, et al., 2013). As such, sustained livestock production plays a critical role in maintaining both household and national economies.

Over the years, this sector has been under threat due to the effects of climate change on the enterprise. Climate change is a serious global challenge of our time, having adverse impacts on environment, human health, food security, natural

resources and economic activities (Majule & Mary, 2009) such as livestock production. Livestock production is a great enterprise in agriculture, acting either as a complementary or as a substitute to crop farming. With climate being a primary determinant of agricultural production, and livestock sector being at the center of it in supporting human welfare, concern has been expressed on the effects of climate change to livestock productivity (Adams, et al., 1998). Of great concern are enterprises under smallholder livestock production system, as it acts as a source of food and capital to meet major household needs (Kirimi, et al., 2013) of the poor (Ogalleh, et al., 2012).

Smallholder livestock production system is likely to suffer the most from the effects of climate change, as it relies mostly on natural systems to support its production. According to USDA, (2013) and Smith, et al., (1996), changes in climate affect livestock production in four primary ways: feed-grain production (availability and price); pastures and forage crop production and quality; the direct effect of weather and extreme events on animal health, growth and reproduction; and changes in livestock diseases and pest distribution. Changes in feed resources is one of the most evident and important effect of climate change on livestock production (Rust & Rust, 2013).

In respect to these, this study sought to find out the specific affected aspects of livestock production experienced by smallholder farmers in Njoro sub-county as a result of the effects of climate change in the area.

II. MATERIALS AND METHODS

This study employed a social survey research design where qualitative, descriptive and contextual data were sought to meet the research objectives. The design enabled the gathering of relevant cross sectional data from different smallholder livestock production farmers within the study area.

Primary data was collected through farm household surveys, where a questionnaire of open-ended and closed structured questions focusing on the study variables was administered. Secondary data on how climate change has been affecting smallholder livestock production in Njoro sub-county were sought from the County and Sub-county

Agricultural Extension offices. Other sources of secondary data were from referenced books and journals, and newspaper and internet articles. Climate data on temperature regime and rainfall amount of the area over the last 30 years were sought from the meteorological department at KALRO Njoro sub-station, so as to enable analysis of how these climate aspects have been changing over the years.

The study target population consisted of communities in Njoro sub-county, of Nakuru County, while the sampling frame was a list of smallholder farm households within the study area. The households were selected from a list obtained from the Kenya National Bureau of Statistics through consultation with the Divisional Agricultural Extension office.

The sample size was arrived based on the formulae below:

$$n = \frac{NC^2}{[C^2 + (N-1)e^2]} \text{ (Nassiuma, 2000)}$$

Where n = sample size

N = population (Population Projection for 2015)

e = Error margin (3%)

C = coefficient of variation (30%) (Nassiuma, 2000).

The sample size therefore was:

$$n = \frac{221981 \times 30^2}{[30^2 + (221981 - 1)3^2]} = 99.96 \cong 100 \text{ respondents}$$

So as to guard against an unrepresentative sample, the study used a combination of stratified random sampling and systematic random sampling in selecting the required number of household respondents to participate in the study. This was achieved through identification of strata of interest, then randomly drawing a specified number of subjects from each stratum.

III. RESULTS AND DISCUSSIONS

The aspects of livestock production affected by climate change studied were, rearing pattern; livestock yield; livestock health; water availability; and forage productivity. The livestock under investigation were cattle, goats, sheep, poultry, pigs and rabbits.

A. Effect of climate change on rearing

It is of great importance to study the effect climate change has on the rearing pattern of livestock in a region since rearing of livestock in a particular region is greatly determined by its adoptability to the climatic variables of that region. Therefore, the effect of climate change on rearing pattern was investigated on whether it had, increased rearing of livestock, decreased rearing, or if it had not affected the rearing of livestock in Njoro sub-county.

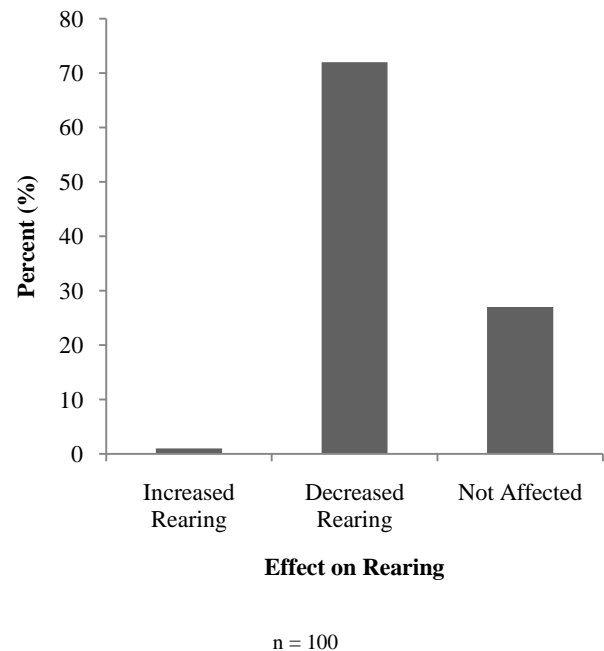


Fig. 1 Effect of climate change on smallholder livestock rearing

Majority of the respondents (72%) felt that climate change had decreased rearing of livestock, (27%) were of the opinion that it had not affected rearing of livestock, while (1%) was of the opinion that climate change effects had increased livestock keeping in the study area over time.

Climate change has reduced rearing of livestock in Njoro sub-county mainly due to decreased rainfall amounts and the effect of long dry periods. The reduced rainfall amounts accompanied with long dry periods is affecting the enterprise by reducing the productivity and availability of forage for livestock. As such, farmers have to travel long distances in search of forage for their livestock, or alternatively they are forced to purchase animal feeds or fodder from other farmers. This makes the venture quite expensive for most farmers considering their enterprise is smallholder, yielding minimal returns on investment. Therefore, majority of the farmers have had to cut the number of livestock reared or even abandon other enterprises all together. The enterprise mostly affected in terms of decline in rearing is cattle especially dairy, while the least affected is poultry. To most smallholder farmers in the study area, the rearing of cattle, goats and sheep has been greatly affected as they require a lot of feed/fodder in order to sustain productivity over time. But with the effects of climate change such as pro-longed dry periods and reduced rainfall amount in the study area, the productivity of forage lands have been greatly reduced which in turn affects these enterprises as lack of forage becomes a limiting factor. Though the effect of feed on livestock production may be indirect as argued by Thornton, et al., (2007), the decline in livestock rearing pattern due to the effects of climate change on availability and productivity of forage in the study area presents an evident effect of climate change on smallholder livestock production.

With poultry, the enterprise is the least affected in the region as most smallholder farmers rear local breeds under free range system. Here, the system is considered self-sustaining as the birds are left freely to fend for themselves plus it has wide alternative feed options such as household food remains. However, many smallholder farmers are still finding challenges in the rearing of poultry especially those that are kept for egg production, as these require a lot of feed resources which has been greatly affected by climate change. Therefore, many smallholder farmers have resulted to keeping poultry as a food security alternative and not as a business enterprise.

B. Climate change effect on livestock yield

Livestock yield is one of, if not the most important indicator of how an enterprise is performing. Therefore, in order to determine whether or not the effects of climate change had any influence on livestock yield be it egg production, milk quantity, or meat quantity, the study sought the opinion of smallholder farmers.

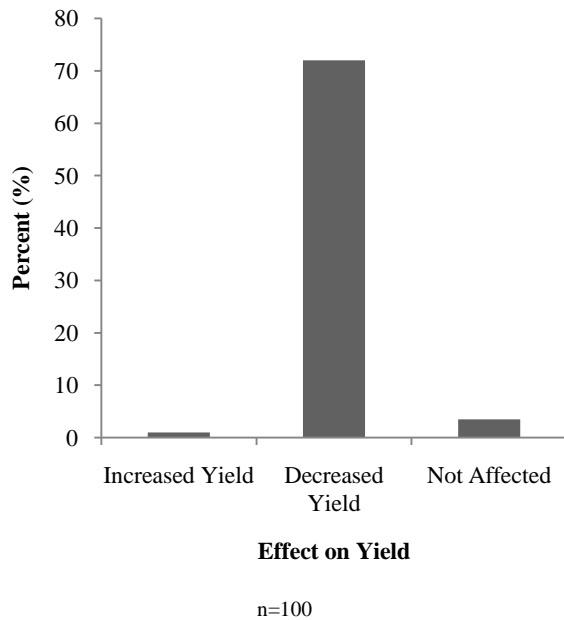


Fig. 2 Effect of climate change on livestock yield

From the respondents, (72%) find livestock yield to have decreased due to climate change effects, (27%) felt livestock yield had not been affected by climate change, and (1%) noted an increase in livestock yield. With livestock yield directly depending on feed ratio, the effect of reduced rainfall amounts and long dry periods on the productivity and availability of forage consequently affects livestock yield. A drop in the amount of forage means reduced feed ratio and in turn productivity of the livestock lowers. More so, the nutritive value of forage has been on the decline since the reduced rainfall amounts and long dry periods, has led to changes in forage species composition in Njoro sub-county. For example, respondents noted that, the highly nutritious star grass which once used to thrive is nowadays rarely found in the region. As

a result, drought resistant strands mainly shrubs, which have low nutritive values, are the ones left standing for livestock consumption. The low nutrition value strands only fill the livestock but do not improve or sustain its productivity; thus the decline in yield as has/is being experienced by smallholder farmers in Njoro sub-county. This observation supports a study by Thornton, et al., (2008), which noted that climate change will likely alter forage species composition thus compromising the ability of smallholders to manage feed deficits.

The long dry periods also subjects livestock to heat stress which further lowers productivity. The long dry periods lead to a rise in daily temperatures especially around noon time. The rise in temperatures means that the animals will need plenty of water to regulate their body temperatures. But with climate change lowering the availability of water in Njoro sub-county, livestock end up not having enough water to regulate their body temperatures, and as such, they are exposed to heat stress which lowers their yield. Assan, (2104) pointed that, there is bound to be an increase in livestock water requirements due to heat stress, under reducing quantity of livestock water sources; which will affect livestock yield if the water requirements are not met.

C. Effect of climate change on livestock health

The effect of climate change on livestock health was investigated as to whether livestock disease occurrence had increased, decreased, or had not been affected over time in Njoro sub-county due to climate change. From the respondents, (71%) noted an increase in disease occurrence, (23%) noted no change, and (6%) noted a decrease in disease occurrence over time as presented in figure 3.

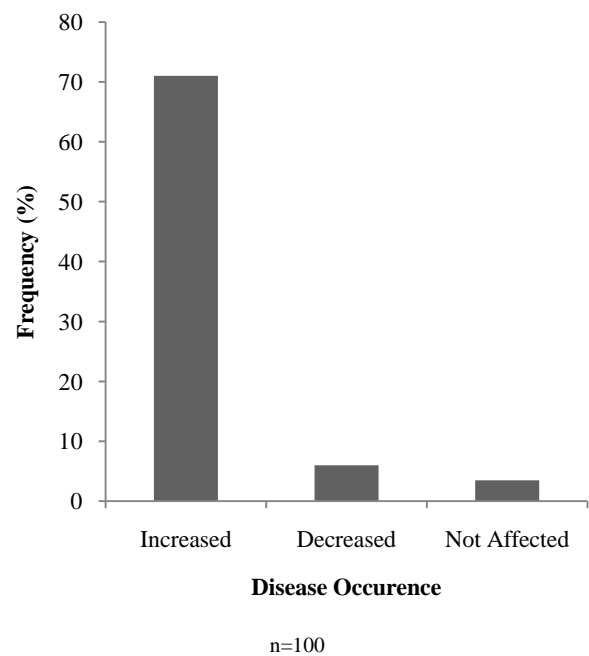


Fig. 3 Effect of climate change on disease occurrence

In Njoro sub-county, many respondents noted the occurrence of a foreign red tick that is affecting the health of their livestock. The “rare red tick” as most name it, say arose from grazing their livestock on the same fields grazed by pastoralists who migrate with their livestock into Njoro sub-county in search of pasture due to long dry periods in their localities. The tick is said to spread a strange disease that immobilizes the livestock with time until it dies as the disease rarely responds to treatment. Many farmers have count losses in their livestock especially cattle due to occurrence of the strange disease foreign to Njoro sub-county. In poultry, farmers have noted that, some chilly nights have led to great losses in chicks. They say that, during such nights, the chick(s) body becomes stiff and by morning they are all dead. All these diseases are new to the area and as such farmers are not familiar with them and how best to treat them. This occurrences support studies done by Gale, et al., (2008), and Assan, (2014), in which they noted that, due to climate change, their bound to be changes in ranges, emergence, and distribution of livestock diseases and parasites.

D. Effect of climate change on water

Climate change effect on water was looked at in terms of water availability and distance to the nearest livestock watering point. In terms of availability, (80%) noted a decrease in water availability, (17%) noted no effect in availability of water, and (3%) noted an increase in the availability of water; as presented in Table I.

Table I: Climate change effect on water availability

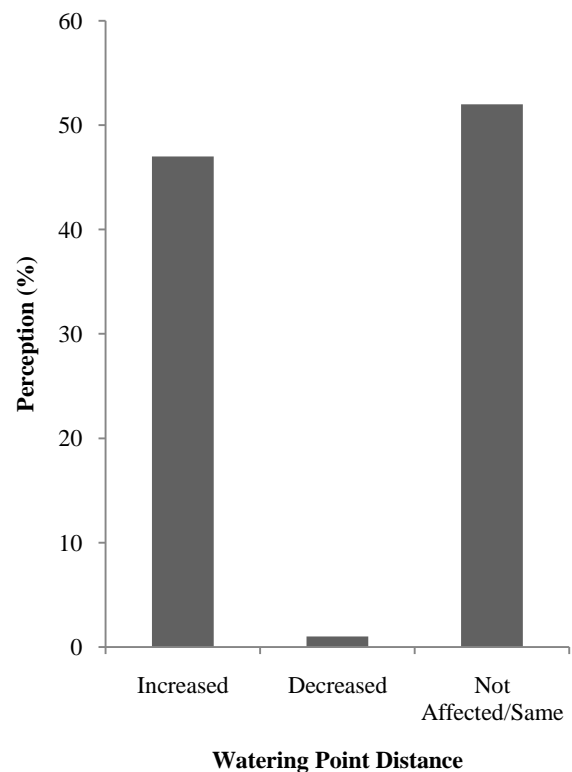
	Frequency	Percent	Valid Percent	Cumulative Percent
Not affected	17	17	17	17
Increased availability	3	3	3	20
Decreased availability	80	80	80	100
Total	100	100	100	

n=100

Even though the annual rainfall in Njoro sub-county has generally remained within 950 – 1500mm over the years, many smallholder farmers are experiencing a decrease in the availability of water needed to support their production system due to a drop in the number of rainy days in either season accompanied by long dry periods afterwards. Also, the water levels in dams and boreholes around Njoro sub-county have been gradually declining over time forcing water service providers to ration the amount of water supplied to homesteads thus affecting many smallholder farmers in the region. Furthermore, many intermittent streams which would act as an alternative source of water quickly dry up once the rainy seasons are over. For those wishing to purchase water, they sight an increase in the price of water which has limited their ability to make water readily available to their livestock.

With respect to distance, (52%) stated that distance to the nearest livestock watering point was still the same, (47%)

sited an increase in distance, and (1%) sited a decrease in distance to the nearest livestock watering point due to the effects of climate change (figure 4). To many, distance to the nearest livestock watering point remains the same as Njoro sub-county is well transected by River Njoro which is the main river where smallholder farmers take their livestock for watering or go fetch water. However, amount of water in the river has been continually decreasing over the dry periods thus limiting water availability, but it usually has some water which smallholder farmers rely on. To others, distance has increased as they used to rely on nearby shallow streams and springs which have dried up over the years. This has left them to turn to River Njoro which is located further from their homesteads as their main source of water

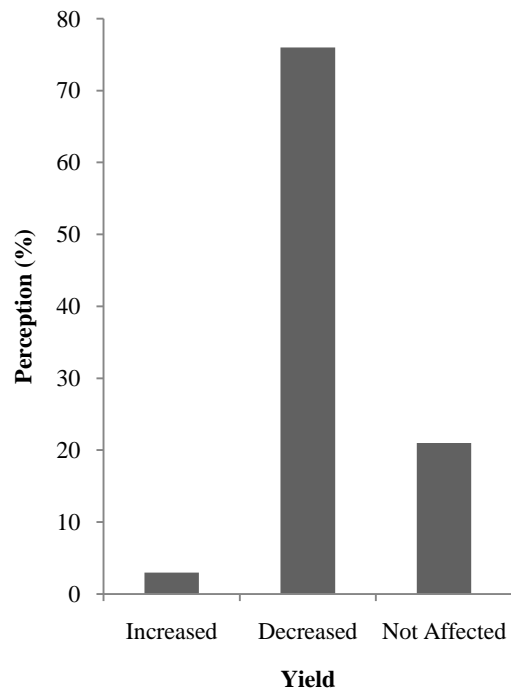


n=100

Fig. 4 Climate change effect on distance to nearest livestock watering point

E. Climate change effect on forage productivity

Forage productivity was studied by looking if the yield had, increased, decreased, or remained the same (not affected) over time due to the effects of climate change. To majority (76%) of the respondents, forage yield had decreased over time, while (21%) and (3%) sited no effect and increase in forage yield respectively as captured by figure 5.



n=100

Fig. 5 Climate change effect on forage productivity

The effect of fewer rainy days with low rainfall amounts accompanied by long dry periods has hugely affected forage productivity in Njoro sub-county as forage does not get enough water and time to regenerate. The long dry periods have further rendered many lands barren leading to loss of fertility and in turn affecting forage yield in the area, as barren lands do not yield high. The low rainfall amounts also do not support the proliferation of high yielding forage species such as star grass which is nowadays rarely found in the region.

IV. CONCLUSIONS

Based on the findings of this study, the following conclusion can be drawn:

- The effect of reduced rainfall amount and prolonged droughts have consequently led to: a decrease in the rearing of livestock in the study area; decline in livestock productivity; increase in livestock disease occurrence; decrease in water availability; and decline in forage productivity in the study area.

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