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Perceived Climate Variability Effects on Socio-Economic Well-Being of Dairy Farmers, Case Study of Kisii Highlands in Kenya

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Abstract: *The dairy sector globally has been hit by climate variability impacts that affect animal performance. This affects the socioeconomic wellbeing of dairy farmers across the globe. This study was conducted at Kisii Highlands, a tropical region in the western part of Kenya. The objectives to the study were: to determine the socioeconomic impact of climate variability on dairy farming along the Kisii Highlands and to assess farmers' perceptions on climate variability disease effect relation on dairy breeds in Kisii Highlands. The research took a survey approach to collect quantitative data. 100 respondents were interviewed during the study. Data was analyzed through Statistical Package of Social Sciences and Likert scale to monitor respondents' perceptions. The findings show that, climate variability effect on management practices had highest Total Weight (T.W) of 433.5 among the statement responses. The year 1984 was the driest year with (σ^2 = -35.4). From the climate variability effect disease relation, Pneumonia was the most predominant climate variability related disease in the area with 43 respondents.*

Key words: Dairy Farming; Climate Variability; Socioeconomic; Disease; Variance

1.0 Introduction

The increasing threat of climate variability across the world has affected entirely all sectors, it has led to economic implications affecting productivity in agriculture (Mathew and Akter, 2017). Livestock and crop production both for subsistence and commercial production has been compromised. Precipitation and temperature changes affect animals lowering their performance. Fodder accessibility continue to decline due to seasonal changes within the climate system resulting from variability and oscillations witnessed through global models (Altieri and Nicholls, 2017). Chobtang *et al.* (2017) agrees that, dairy farmers' wellbeing within their management systems has been stretched with increasing prices of dairy inputs like drugs to curb climate related diseases

Sub-Saharan Africa a region within the African tropics, is experiencing a record breaking effect of climate change. The year 2016 recorded the highest global average increase temperature of 1.2°C (Gao *et al.,* 2017). Different dairy breeds either exotic or indigenous saw low performance leading farmers to call for environmental expertise intervention to mitigate climate change and its variability effect to dairy farming. Economically, the prices of dairy breeds sky rocketed with increased shortage in the market. Some of the anticipated factors that led to shortage were: poor fertility among dairy breeds hampered by climate variability; inability of farmers to stock adequate dairy breeds with water scarcity and fodder access; amplified diseases like pneumonia that majorly affected calves causing increased vulnerability to death (Ozor *et al.,* 2015)

Kenya among the countries within the Sub-Saharan belt, was exposed to climate variability effects that are felt to date. Its dairy sectors saw increased prices of dairy products in the market. Majorly, at the urban settings availability of cattle milk was limited. Majority of dairy farmers from rural settings were economically affected. Low productivity could not marge the dairy inputs like cattle feeds, drugs and exhibitions at the agricultural shows (Nkonya *et al.,* 2015)

2.0 Methodology

This study was a survey that was conducted at the Kisii Highlands to the western parts of Kenya. Different sampling procedures were used to collect data during the study. Simple random sampling was applied to the respondents who were mainly dairy farmers within the area. The technique was preferred as it gave every dairy farmer an equal chance to participate on interviews during the data collection. To check on statement perceptions, Stratified random sampling was used for farmers from different areas within the Kisii Highlands. They were grouped into clusters where selection was done randomly for equal participation of each respondent that had to be a dairy farmer.

Primary data entailed collected data from questionnaires and statement tally on perception. Secondary data was obtained from Kenya Meteorological Department (KMD) that comprised precipitation and temperature. Data analysis was done through use of Statistical Package of Social Sciences (SPASS) and Likert Scale on perception that had five magnitude points. The findings were presented on tables and graphs.

3.0 Research Findings

3.1 Variance Annual Precipitation

Figure 3.1 shows the variance (σ^2) calculation values on annual precipitation averages for Kisii Region in the past 35 years. From the values, different assumptions can be given as per the annual variance values obtained through computational analysis. It can be predicted that for the past 35 years, Kisii Region had experiences wettest years. The year 1987 with (σ^2 =36.1) and 2011 with (σ^2 =31.4) respectively. The findings therefore indicate that the wet seasons might have been dormant among the two years making them the wettest years experienced in region.

The Kisii Highlands experienced two driest years between 1980 – 2015. From the findings, the year 1984 was the driest year with (σ^2 = -35.4) and 2007 with (σ^2 = -32.7). From the spread, there weren't years with (σ^2 = 0) value. This indicated that the wetness and dryness kept varying in the region in the past 30 years. For instance, (figure 3.1) shows that between 1980 – 1984 period, the area experienced varied dryness that changed from 1985 where a slight wet season was experience as per variance (σ^2 =3.6).

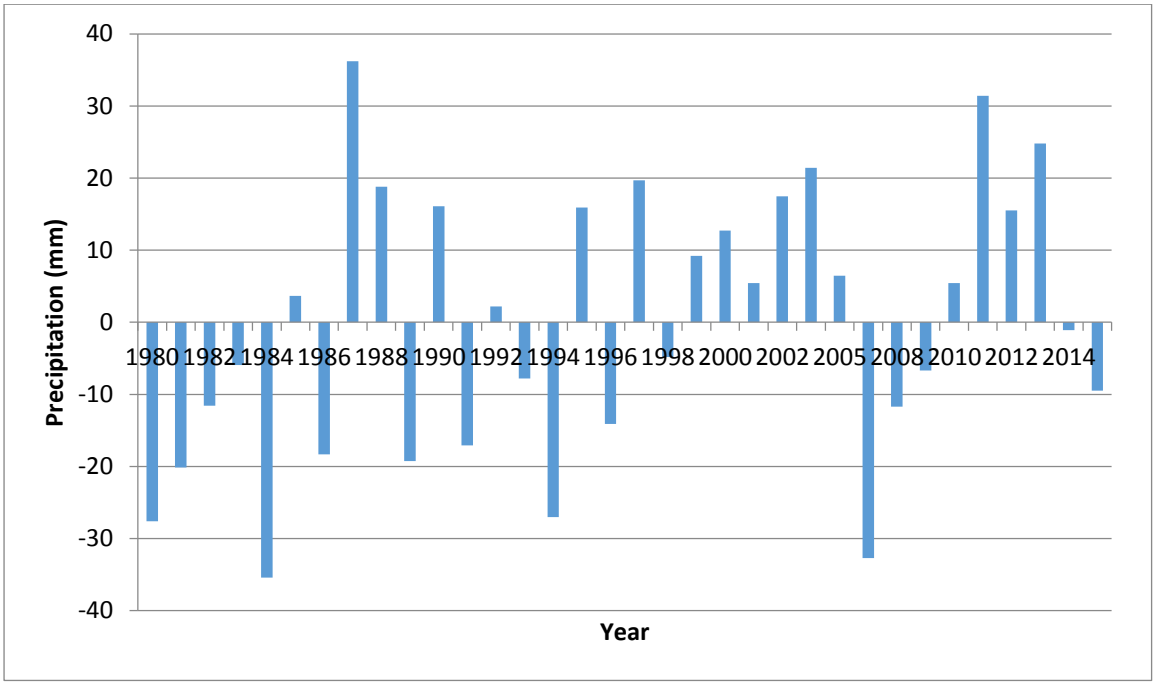

Figure 3.1: Variance of annual precipitation from long-term average in Kisii Region

Variance variations between the years 1999 – 2003 indicated wetness in the area. There was gradual increase and decrease of precipitation. The analysis showed that, 1999 had (σ^2 =9.2), 2003 with (σ^2 =5.4) and 2003 with (σ^2 =21.4). Variations in variance were increasing and decreasing but without going below (σ^2 = 0) therefore, characterizing an area wet. These variations could have been resulted from climate variability. This agrees with Zhu and Li (2017) that climate variability will cause anomalies in precipitation in different regions globally.

3.2 Effect of Climate Variability on Socio Economic Well-being of Dairy Farmers

Table 3.1 dairy farmers' perception on climate variability effect towards the socio economic wellbeing of dairy farmers along the Kisii Highlands. From the statements, the respondents' statements have been presented in the table. From the results, four statements were sampled and their perceptions were determined through the magnitude of their responses that were; S.A, A, UD, D and S.D that were analyzed with the aid of Likertz Scale. The responses from respondents were subjected to a five point Likertz scale

STATEMENTS	**Response**					
	S.A	A	UD	D	S.D	**[T.W]**
C.V causes changes in current farm management practices	35(50.7)	24(34.8)	**8(11.6)**	2(2.9)	0(0.00)	[433.5]
C.V will increase agricultural production	0(0.0)	1(1.4)	**3(4.1)**	27(37.0)	41(56.1)	[143.7]
C.V will improve standard of living	0(0.00)	2(3.0)	**3(4.5)**	35(52.2)	28(41.8)	[171.7]
C.V causes dairy farming uncertainties & investment	29(43.3)	22(32.8)	16(24.8)	0(0.0)	0(0.0)	[422.1]

Table 3.2: Effect of climate variability on the socio-economic of farmers

Bracket indicate (%), C.V- climate variability, SA-strongly agree, A-agreed, UD-undecided-disagree, SD – strongly disagreed & [T.W] – Total Weight

Climate variability from the findings, had different perceptional respondent views on its effect on the socio economic wellbeing of dairy farmers. From the sampled statements, table 3.2 had a total of four statements. From the total weight (433.5), 50.7% (n=35) of the total respondents felt that changes in the dairy farm management systems were exacerbated by climate variability effect on their socio economic. 11.6% (n=8) of the total respondents were undecided with the statement where 2.9% of the respondents disagreed with the statement.

The weighted mean 433.5 had the highest rank as farmers perceived climate variability caused changes in current management practices. McMahon *et al.* (2016), argues that changes in climate variability from their study has led to farmers' change of management systems. A study by Hennessy *et al.* (2015) on management systems on dairy can be high – output systems or grass - based systems. Changes in climate affects milk production per cow and fodder quality (Clark and Sneider, 2015). Therefore, farmers have an alternative by adapting to new systems by changing their management practices.

The statement perception that climate variability will improve the living standards of the respondents in the area recorded different responses from the findings. For instance, of the total weight of respondents 171.7 none of the respondents S.A, with this statement with only 3% (n=2) of respondents agreeing with it. 52.2% (n=35) of the respondents disagreed with the statement where 41.8% (n=28) of the total strongly disagreeing. From the finding, there is a similarity to a research done by Mandleni and Anim (2011) where respondents concurred that temperature changes affects farm production and its socio economic status.

The uncertainties towards dairy farming might have been resulted by climate variability with different views from the respondents and their magnitudes towards the statement, (Table 3.2) from the findings, 43.3% (n=29) S.A that climate variability was causing uncertainties in dairy farming with 32.8% (n=22) agreeing with the statement. Respondents that were undecided on the statement were 24.8% (n=16) where those that disagreed and strongly disagreed recorded none respectively of the total weight of 422.1. From the findings, 76% of respondents agreed that climate variability was causing uncertainties towards dairy farming investments. This might have been the effect of climate variability on dairy cattle milk production.

3.2 Perceived Climate Variability Effects on Dairy Cattle

Table 3.3 shows dairy farmers' perception on climate variability effect dairy cattle in Kisii Highlands. From the statements, the respondents' statements have been presented in the table. From the results, four statements were sampled and their perceptions were determined through the magnitude of their responses that were; S.A, A, UD, D and S.D from the Total Weight (TW).

Table 3.3: Effect of climate variability on dairy cattle

STATEMENTS	**Responses**

	S.A	A	UD	D	S.D	**(T.W)**
C.V increases disease and insect-pest infestation in animals	37(52.1)	29(40.9)	4(5.6)	1(1.4)	0(0.0)	71(443.7)
Changes in cattle feeding behavior	32(47.1)	21(30.9)	9(13.2)	5(7.4)	1(1.5)	66(411)
C.V has no effect on livestock farming	0(0.0)	4(5.9)	8(11.9)	34(50.7)	21(31.3)	67(192)
C.V causes no animal health risks	0(0.0)	1(1.4)	2(2.8)	33(46.4)	35(49.3)	71(248.9)

Bracket indicate (%), C.V- climate variability, SA-strongly agree, A-agreed, UD-undecided- disagree, SD – strongly disagreed & [T.W] – Total Weight

Respondents perceptions on effect of climate variability to dairy cattle was determined through different for statements, table 3.3. From the findings, 52.1% (n=37) of respondents S.A felt that climate variability had amplified disease infection and insect – pest infestation in animals. This was supported with those who only agreed with the statement recording 40.9% (n=29). From the findings, none of the respondents that strongly disagreed .The four samples statements from the findings showed that climate variability increased disease and insect infestation in animals with a total weight of 443.7. Therefore, C.V has effect on animal physiology to adapt to the changing climate. From the findings it is in agreement with Chevalier *et al.* (2016) that climate change has a take on vector-bone disease transmission affecting animal feeding. Thornton and Gerber 2010 had a similar observation from their study on climate variability impact on livestock.

There was different responses by the respondents on the cattle feeding behavior. From the total weight 411, 47.1% (n=32) of the respondents S.A that climate variability had an effect on dairy cattle feeding behavior with 30.9 (n=21) of the respondents agreeing with the statement. However, there were respondents with different view disagreeing recording 1.5%, (table 3.3) 1.5% (n=1) strongly disagreed that animal feeding behavior had changed resulting from climate variability.

Climate variability and its perceived effects on animal health had different responses from the respondents. From the findings, S.A recorded none from the total weight 248.9 even though 1.4% (n=1) agreed with the statement. The undecided respondents recorded 46.4% (n=33) with 49.3% (n=35) strongly disagreed. From the findings, this might have been due to little understanding of respondents on health and livestock towards climate variability.

3.3 Dairy Farming Climatic Related Disease

Figure 3.2 shows the disease prevalence perception effect facilitated by climate variability from dairy farmers'. From the study a total (100) responded to disease prevalence. Of the total 100(N=100), 43% (n=43) agreed that Pneumonia was felt more than other diseases currently in the area. Therefore, that climate variability might have predisposed cattle to pneumonia by increasing disease vectors such as blue ticks. Randhawa, 2015, states that climatic changes exerts spread of vector bone disease similar to observed case in Kisii Highlands. Therefore, the increase of Pneumonia and East coast fever might be amplified by climate change factor, climate variability as temperature and rainfall keep changing.

The respondents also rated East Coast Fever as a dangerous disease to cattle recording 37% (n=37) from the respondents. It was ranked second as Foot and Mouth and Trypanosomiasis came third and fourth respectively with 16% and 4% (n=4) infection cases as per the respondents. The combined tally was 100% where (N=100). Therefore, from the findings, East Coast Fever and Pneumonia were the most common diseases as per the survey from the respondents. They felt from their perspectives were climatically related. However, a conclusion might be made that due to increasing encroachments of wetlands, had destroyed favorable inhabitable conditions of tsetse flies in the area.

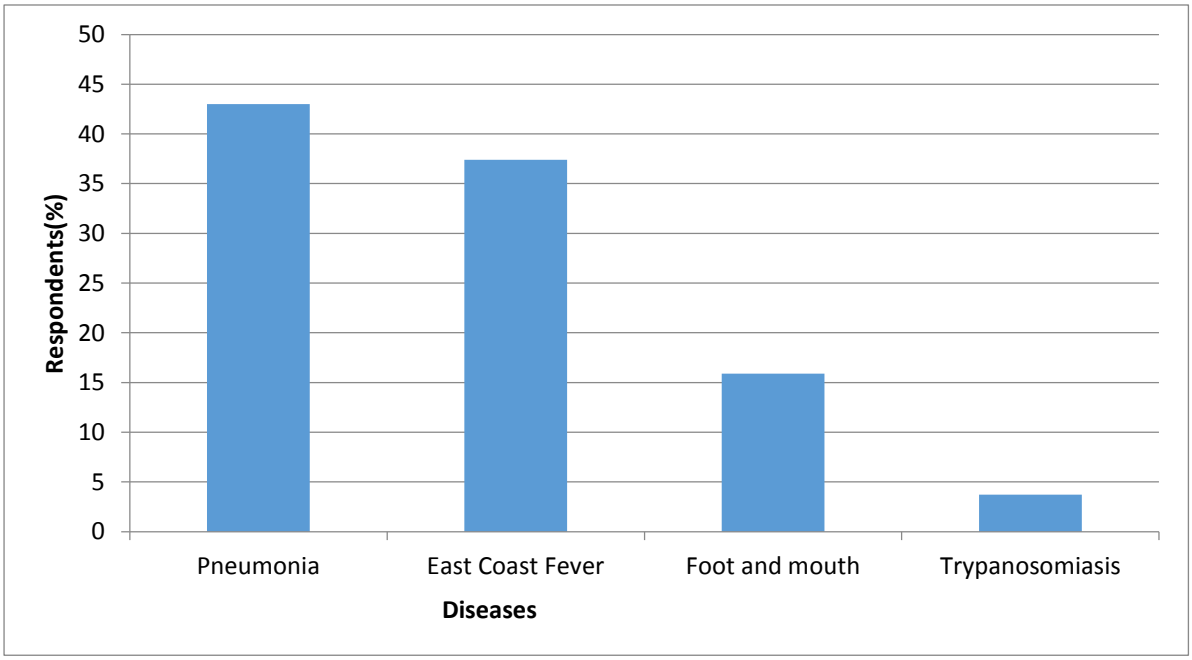

Figure 3.2: Perception on climate variability amplified diseases

4.0 Conclusion

Climate variability impacts have been felt in Kisii Highlands increasing vulnerability to socioeconomic wellbeing of dairy farmers. This has affected the dairy management systems. The dairy breed diseases have been linked and related to climate variability over the past decade. As the global temperatures increase, tropical regions along Eastern Africa have been hit. Pneumonia continue to affect the dairy industry along the Kisii Highlands thus impacting the economic benefit of dairy farmers in the region.

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References

Altieri, M. A., & Nicholls, C. I. (2017). The adaptation and mitigation potential of traditional agriculture in a changing climate. *Climatic Change,* 140(1), 33-45.

Chevalier, V., Courtin, F., Guis, H., Tran, A., & Vial, L. (2016). *Climate Change and Vector-Borne Diseases*. In Climate Change and Agriculture Worldwide (pp. 97-108). Springer Netherlands.

Chobtang, J., Ledgard, S. F., McLaren, S. J., & Donaghy, D. J. (2017). Life cycle environmental impacts of high and low intensification pasture-based milk production systems: A case study of the Waikato region, New Zealand. *Journal of Cleaner Production*, 140, 664-674.

Clark, A., & Snelder, T. (2012). Adapting dairy farming systems in a changing climatic environment. Wellington: NIWA

Gao, X., Ouyang, W., Hao, Z., Shi, Y., Wei, P., & Hao, F. (2017). Farmland–atmosphere feedbacks amplify decreases in diffuse nitrogen pollution in a freeze-thaw agricultural area under climate warming conditions. *Science of The Total Environment*, *579*, 484-494.

Hennessy, D., Delaby, L., Dasselaar, A., & Shalloo, L. (2015). Possibilities and constraints for grazing in high output dairy systems. *Grassland Science in Europe*, 20, 15-21

Mandleni. B and Anim F. (2011). Perceptions of cattle and sheep farmers on climate change and adaptations in the Eastern Cape Province of South Africa. *Journal of Human Ecology 34* (2):107–12

Mathew, L. M., & Akter, S. (2017). Loss and Damage Associated with Climate Change

Impacts. Handbook of Climate Change Mitigation and Adaptation, 17-45.

McMahon, C., Edgar, H. W. J., Hanna, R. E. B., Ellison, S. E., Flanagan, A. M., McCoy, M., & Malone, F. E. (2016). Liver fluke control on sheep farms in Northern Ireland: A survey of changing management practices in relation to disease prevalence and perceived triclabendazole resistance. *Veterinary Parasitology*, 216, 72-83.

Nkonya, E., Place, F., Kato, E., & Mwanjololo, M. (2015). Climate risk management through sustainable land management in Sub-Saharan Africa. In *Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa* (pp. 75-111). Springer International Publishing.

Ozor, N., Umunakwe, P. C., Ani, A. O., & Nnadi, F. N. (2015). Perceived impacts of climate change among rural farmers in Imo State, Nigeria. *African Journal of Agricultural Research*, *10*(14), 1756-1764.

Randhawa S., S. (2015). State Centre on Climate Change. India

Thornton, K. P., & Gerber, P. (2010). Climate change and the growth of livestock sector in developing countries: Mitigation and adaptation strategies to global change. *International Journal*, 5: 169–184.

Zhu, Z., & Li, T. (2017). The statistical extended-range (10–30-day) forecast of summer rainfall anomalies over the entire China. *Climate Dynamics,* 48(1-2), 209-224.