

Climate Change Effects on Livestock Feed Resources: A Review

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Abstract

Livestock is a key asset for poor communities, fulfilling multiple economic, social and risk management functions. However, currently it has been challenged by climate change such as the long-term misbalance of temperature, wind and rainfall characteristics of a specific region. Climate change has affected livestock production systems through impair feed intake, metabolic activities and defense mechanisms. Furthermore, it is also expected to heighten the vulnerability to livestock feed through inducing the greatest reduction of herbage yield and increase lignifications in plant tissues and hence decrease the digestibility of forage by the animal. On the other hand, Climate change also may increase shrub cover in some grassland which had been induced Shrub encroachment tends to reduce the quantity and quality of forage available for livestock. This review also illustrated the climate change which directly and indirectly affected the livestock's health performance. Among the direct climate impact induced impact to livestock health are introduce vector- borne, soil associated, flood associated and humidity associated and whereas, indirect impacts are on livestock health performance by intricate pathways through inducing adaption of microbial populations to climate change, increase distribution of vector-borne diseases, and host resistance to infectious agents, feed and water shortages. Finally the impact of climate change on pastoral livelihood through affecting livestock production, decreasing productivity of rangeland, increasing food insecurity and inducing pastoralist health risk problems.

Key words: Climate Change; Livestock; Health; Pastoral livelihood; Lignifications

Introduction

In Pastoral and Agro pastoral area, livestock is a key asset for poor communities, fulfilling multiple economic, social and risk management functions [1]. However, it has been challenged by many factories in the worlds. The Climate change is one and the long-term misbalance of temperature, wind and rainfall characteristics of a specific regions which is have been exaggerated the livestock production in this era [2]. The climate change effect is expected to induce the vulnerability in to livestock production systems through impair feed intake, metabolic activities and defense mechanisms [3-5]. Where this happens, the delicate balance on which pastoral systems depend is undermined. The effect of climate change on crops is well known, but much less is known about the effects of climate change on livestock [6]. Livestock are socially and economically critical to pastoral livelihoods, thus high priority should be given to the sustainable management of the natural resources base that supports them [7,8]. Moreover, the climate change effects lower the productivity and grazing capacity of rangelands, the higher the nutritional stresses in livestock are likely to suffer, further exacerbating the existing vulnerability of pastoral systems [9]. Although the degree and impact of the drought varies across the pastoral groups, drought remains a major cause of asset losses and resource degradation leading to poverty. Drought also increases vulnerability of livestock to death and then threatens the pastoralist's livelihood. Therefore, it was commendable to introduce and highlight relevant information on the impact of climate change on livestock feed, livestock performances and health, and postural livelihood.

Climate Change Effect on Feed Availability

The climate change is expected to heighten the vulnerability to livestock feed in terms of quality and quantity. The hot and dry seasons has been induced the greatest reduction in biomass yield for different types of grass-growing in low land environments [10]. The research facts made by had indicated that increases in temperature, carbon dioxide levels and nitrogen deposition decrease the primary production in pastures. Conversely, many already semi-arid areas are predicted to experience

lower rainfall as a consequence of climate change [11]. The length of the pasture growing period is expected to decrease in many parts of the tropics and this may be accompanied by greater variability in rainfall patterns with more frequent droughts [2]. The study made by Tubiello et al. [12] on evaluation of climate change impact on quality of forage species revealed that high temperatures tend to increase lignifications in plant tissues and hence decrease the digestibility of forage and concurrently it was induced a shift from C3 grass species to C4 grasses which has direct implications for forage supply. Rangeland is important assets for pastoral communities and the study made on range land productivity to recognize the effect of climate change had demonstrated that climate change based effects have been depressing range pasture productivity and encouraged botanical change in vegetation composition [13]. The changes in seasonal patterns of forage availability could pose additional challenges for grazing management in the rangeland. Similarly, the climates become hotter and drier; pasture composition is likely to shift to species that may be less suitable for grazing [14]. Climate change has observed to affect rangeland species richness and biodiversity. Evidently, the studies made in the Qinghai-Tibet Plateau area had shown that a trend of warming and drying is driving a transition of highly productive alpine adapted *Kobresia* communities to less productive steppe *Stipa* communities [15]. Moreover, Nardone et al. also reported that environmental warming and drying trend are negatively affected the rangeland productivity by lowering the quantity and nutritional quality of forages besides causing

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water scarcity. Pertaining to the range forage species composition, as temperature and CO₂ levels change, optimal growth and dynamic of ranges species also change. The study made from Ethiopia by demonstrated that the Afar clans from Baadu have pushed 150 km Westwards by the Issa from their traditional rainy season pastures and further exacerbating the lost rainy season pastures is the invasion of the pasturelands by exotic species, for instance *Prosopis juliflora* [16].

Climate Change Effect on Livestock Performances

Climate change alters the physiology of livestock then reducing production and productivity performances. The study reported by to assessed climate consequence on milk production in high producing Holstein-Friesian cattle had shown that the milk production performance of high producing Holstein-Friesian cow had been declined as environmental temperature was increased [17]. Moreover, West et al. also, [18] noted the dairy cows that subjected to heat wave conditions associated with climate change have shown a 10%-14% reduction in milk production potential. In general, cattle can adapt to small increases in temperature without great problems. Nonetheless, it can be expected that in parts of the world, temperature increases associated with climate change will have a significant negative impact on levels of animal production unless management is adapted [19]. In the dry seasons the availability and quality of pasture reduced to such an extent that livestock may not fulfill the energy requirement to maintain their body weight. This has resulted in body weight loss and reduction of milk yield [20]. The growth is also other performance parameters of livestock that has been affected by the climate change. The report had demonstrated that heat stress suffered animals by reduce feed intake and result in poor growth performance [21]. The extremely high temperature caused by extreme weather events experienced at this era may still affect *B. indicus* resulting in reduced meat production and reduced time for foraging as they prefer to remain in the shade [22]. Moreover, under nutrition due to climate change is a major factor that has been constraining animal production in Ethiopia. According to study revealed that nutritional stress due to unanticipated climate change leads low growth rates, poor fertility and high mortality. Similarly, also report demonstrated that seasonal feed deficiencies due to climate change had caused the loss of weight gains performances made during more favorable periods [23]. The other study also indicated that the climate change has induced the reduction of feed consumption in the poultry in response to high temperatures. In broilers the rate of feed refusal during heat stress increases with age [24]. In addition, Gonzalez-Esquerria and Leeson reported that high ambient temperature decreases the digestibility of nutrients in poultry through in reduction the activity of trypsin, chymotrypsin and amylase. Consequently, the lower and by most probability insufficient nutrient supply limits egg production and egg mass in layers and the growth rate in broilers [25]. Moreover, also, reports had shown that during heat stress birds lose a large amount of carbon dioxide by panting, which is essential for Ca carbonate in egg shell formations and hence an insufficient nutrient supply, the compromised egg shell formation limits the egg production from 80-90% to 50-60% [26].

Climate Change Effects on Livestock Health

Climate change has affected both directly and indirectly the livestock's health performance. The reports demonstrated that the climate change has been induced direct effects on animal health through introduce vector-borne, soil associated, flood associated, and humidity associated factors. Moreover, the authors [27,28] reported that the climate change has been induced indirect effect on livestock health performance through inducing adaption of microbial populations

to climate change, increase distribution of vector-borne diseases, and host resistance to infectious agents, feed and water shortages. Moreover, Mashaly et al. [27] also reported increased in temperatures and humidity due to climate change, increase the rate of parasites and pathogens developments life cycle. Conversely, Yattoo et al. [29] clearly noted that some pathogens, parasites and vectors experience significant mortality during cold winter conditions. On the other hand, the study made from the Borana Pastoral community in Southern Ethiopia by Harvell et al. [30] demonstrated that 26% of cattle population died due to the climate change effects which had occurred in 2010-2011. Indeed, different authors corporately indicated recurrent droughts due to climate change effects may lead to a continual decline in cattle numbers that was estimated cattle to decrease by 43% in 1983-1984 [31], 42% in 1991-1992 [32] and 53% in 1999-2000 [33].

On the other hand, potential of climate change effects has bearing different climate-driven ruminant diseases which have the temporal and spatial distribution. The reports indicated that climate change effects on buffalo fly and sheep blowfly have been inferred climate scenarios in New Zealand and Australia have suggested increased incidence of epidemics of animal diseases as vectors spread and extension of cattle tick infestations and which is aggravated with changes in both temperature and rainfall [34]. Furthermore, had noted the outbreak of the diseases was observed to be correlated with the mass movement of animals which in turn is dependent on the climatic factors [35]. The study made in South Omo from the Southern Eastern Ethiopia by indicated that Seropositivity of foot and mouth disease was found within the categories limited movement, movements crossing boundary, borders of parks and sanctuary, regional state boundary and national boundaries in searching of feed due to climate change effects [36]. Also observed higher incidence of clinical mastitis in dairy cows during hot and humid weather due to increased heat stress and greater fly populations associated with hot-humid conditions [37].

Climate Change effect on Pastoral Livelihood

Pastoral livelihood and livestock production which is more correlated with rangeland productivities. In the other ways this rangeland has been affected seriously by the climate change in the lowlands which induces the frequent recurrence of drought that lead to livestock mortality. It is apparent that the livelihoods of pastoralists affected by livestock mortality [38]. The drought that took place in the year 1973/74 in the Afar pastoral region of Ethiopia had resulted in livestock mortalities of 90%, 30%, 50%, and 30% for cattle, camels, sheep, and goats respectively due to the shortage of forage supply and water [39]. Similarly, during the 1991/1992 droughts in the Borana, Southern Ethiopia, the average individual household lost about 79% of its cattle, 95% of its camels, 83% of its equines and 60% of its sheep and goats due to shortage of forage production and water [40]. According to report the drought occurred every five years in the Turkana District of Kenya (200-500 mm annual rain) and whereas, it occurs every 8-12 years in the Massai region (300-700 mm rainfall) affected the livelihood of pastoralists. Moreover, in Ethiopia in 2006 catastrophic flood due to climate change occurred and led to the destruction of huge infrastructure and the death of more than 650 people and the displacement of more than 35,000 people in Dire Dawa and South Omo and which greatly affected the livelihoods of pastoralists [41,42]. Similar situations experienced over Afar, for instance during the 2003 drought, 204,115 (18% of the total) of the Afar people were chronically affected and food insecure who required not only food assistance but also basic services such as water, health and nutrition as well as stock recovery [43]. It is evident that the factors threaten the livelihoods and food security of pastoralists in East Africa [44] and lead to livestock mortalities and declining herd productivity,

which aggravated with household food insecurity [45]. Furthermore, Robin [46] also reported that the short supply of own sources coincides with depletion of household purchasing power because of unfavorable terms of trade between livestock and food cereals. Similarly, they also noted that the times of drought, livestock off-take is primarily increased to meet the households' food requirements and secondly to minimize animal losses due to mortality which affects pastoralists' livelihoods. Conversely, also livelihood of pastoral communities threaten due to climate change impact through creating vulnerability of pastoralist to health risks and other hazards; Floods cause damage to water works, sewerage and other infrastructural resources. Hazardous chemicals as well as other disease-causing things could be washed off from waste disposal depositories or sip into flood waters thereby posing potential hazard to pastoralist health. People who have been displaced due to drought or the destruction of their homes by floods stay crowded in the same shelter until they are rehabilitated. When humans, animals, as well as activities, depend on the same limited water resource, the source will be exposed to pollution and become source for waterborne diseases. In circumstances like these the damage caused by the second exposure proves worse than that caused by the first. If, for instance, a person whose residential house has been destroyed by flood counts on repairing his house and hanging out in the flooded area and all this because of lack of alternatives or lack of means and another flood hits the same area, then, the person will sustain more damage than that inflicted by the first flood and this is seriously affected the pastoralists livelihood [47,48].

Summary and Conclusions

Climate change and variability present a major challenge to livestock feed availability, production, health and pastoral livelihood in arid and semi-arid environment. Climate change undoubtedly threaten pastoralists' livelihoods through inducing livestock mortality, reducing rangeland productivity, reducing livestock production and health performance of livestock's and affected pastoralists health. To mitigate this effect pastoral community has been exercised different adaptation strategies like use of environmentally friend forge crops, utilization of underground water and protecting environment from destruction which expose for changes. On the other hand it was concluded that information available on impact of climate change should be demonstrated to all pastoralists' communities and policy makers in order to design mitigation interventions.

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