

REVIEW ON EFFECTS OF CLIMATE CHANGE ON LIVESTOCK PRODUCTION IN ETHIOPIA

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✉ Supporting Information

ABSTRACT: The main aim of this review is to assess the effects of climate change on livestock production in Ethiopia. Climate disruptions cause a huge impact on the agricultural production system. It is a primary factor for agriculture productivity. Livestock and climate change have a close relationship. Climate change could affect the costs and returns of livestock production. It has a significant effect on growth and production of animals. Climate change impairs feed intake and performance in the lactating period. Mid lactating dairy cows showed a higher decline in milk production (-38%) when the animals were exposed to heat. The higher production animals are the most affected. Heat stress increases the loss of body fluids due to sweating and panting and results in an altered water balance of the body and the osmolarity of cells. Global warming will also alter the distribution of animal diseases and the vectors. Warmer and wetter weather will increase the risk and occurrence of animal diseases, because species that serve as disease vectors, such as biting flies and ticks, are more likely to survive year-round. The most important effects of climate change on livestock production are changing the animal feed resources. It impact on rangeland biodiversity which influences livestock production. Change in precipitation patterns and intensity, increasing atmospheric water vapor, evaporation, water temperatures and changes in soil moisture and runoff. An increase in uterine temperature of 0.5°c above average is associated with a decline in conception rate of 12.8%. Heat stress compromises oocyte growth in cows by altering progesterone secretion.

Keywords: Climate, Climate Change effect, Disease, Livestock and Production

REVIEW
 PII: S222877011800026-8
 Received: July 11, 2018
 Revised: Nov 20, 2018

INTRODUCTION

Climate change caused an increment of weather-related disasters and extreme weather events (Addis Ababa, 2015). It increased dryness and higher temperatures, land use changes and changing animal disease distributions (Ayantunde et al., 2011).

African countries are more affected by climate change (Singh and Purohit, 2014; Rose, 2015). Climate change harms developing countries that generate a major portion of their GDP from climate-sensitive sectors (Mesfin, 2012). Agriculture is the backbone of the Ethiopian economy (World Bank, 2012). Agricultural sector remains a key source of growth in Ethiopia but it continues to face major challenges (IMF, 2012). It is amongst the climate sensitive sectors in Ethiopia (Addis Ababa, 2015). Crop yield reduction, shortage of grazing land, and loss of livestock are the most frequently affecting negative effects of climate change.

The livestock sector has a significant contribution to Ethiopian economy (Funk et al., 2012). The subsector contributes 16.5% the national GDP, 47% of the agricultural GDP, 15% of export earnings, 30% of agricultural employment and 80% support and sustain livelihoods of all rural population. Even though the largest GDP of Ethiopia is covered by livestock, climate change has a negative impact on their product in different ways (Kassahun, 2016). It affects their health, product, carrying capacity of rangelands; livestock feed, heighten and reinforce the susceptibility of livestock (Addis Ababa, 2015). Therefore, the objective of this paper is to review the effects of climate change on livestock production.

MAIN ITEMS OF REVIEW

Climate change and agricultural production

Climate is one of the basic inputs in agriculture and its disruption cause a huge impact on the agricultural production system (Lemmi, 2013). Climate is a primary factor for agriculture productivity (Shongwe et al., 2014). More than 85% of the Ethiopian people depend mainly on agriculture (Yohannes, 2009). Though, agriculture is the backbone of Ethiopia's economy. It has been adversely impacted by various extreme weather events. Droughts,

floods, diseases, and pests are among the prevalent disaster risks related to climate change in the lowlands of Sothern Ethiopia (Zelalem et al., 2009).

Livestock production and climate change

Ethiopia is believed to have the largest livestock population in Africa (CSA, 2013). Livestock provides many benefits in the form of Milk, Meat, Hides, Manure, and Socio-cultural capital (Nkedianye et al., 2009). Livestock and climate change have a close relationship (Iqbal, 2013). Climate change could affect the costs and returns of livestock production (Key and Sneeringer, 2011). It has a significant effect on the growth and production of animals (Padodara and Ninan, 2013). It also has maximum impact on vulnerable pastoral communities (Saidu and Omedo, 2010).

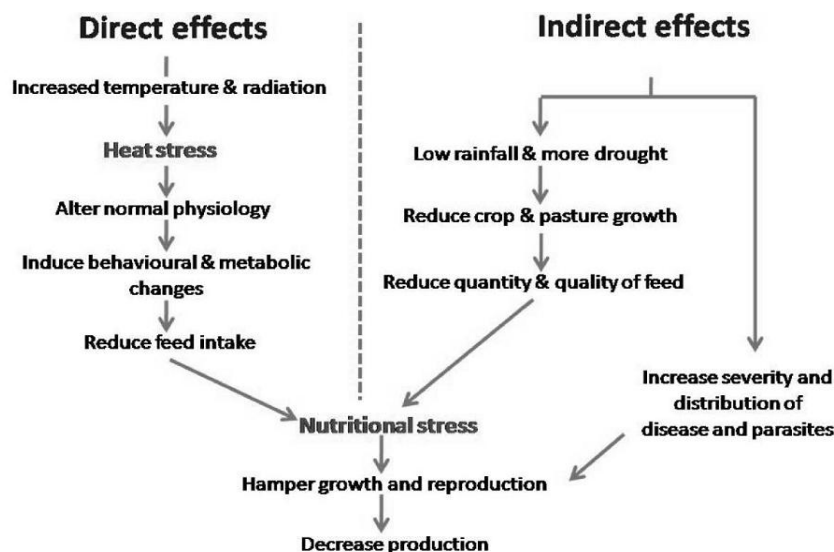


Figure 1 - Effects of climatic change on livestock production (Abebe, 2013)

Effect of climate change on milk production

Climate change impairs feed intake and performance in the lactating period (Savsani et al., 2015). Heat stress in dairy cows leads to a decline in milk production and fertility (Sere et al., 2012). The increase in milk yield increase sensitivity of animals to thermal stress (Kassahun, 2016). Mid lactating dairy cows showed a higher decline in milk production (-38%) when the animals were exposed to heat (Bernabucci et al., 2010). Because the higher production animals are the most affected (Veerasamy et al., 2016). Milk yield is very sensitive to increased temperatures, with measurable declines in yield occurring in high producing cows at 24 °C (Moreki and Tsopito, 2013).

Heat stress increases the loss of body fluids due to sweating and panting and results in an altered water balance of the body and the osmolarity of cells (Rhoads et al., 2009). Dairy herds decrease in milk production of 5 to 15 pounds per cow per day (Larry, 2014). Milk yield decline by 0.2kg per unit increase temperature humidity index (THI), when it exceeded 72 (Shambel, 2017).

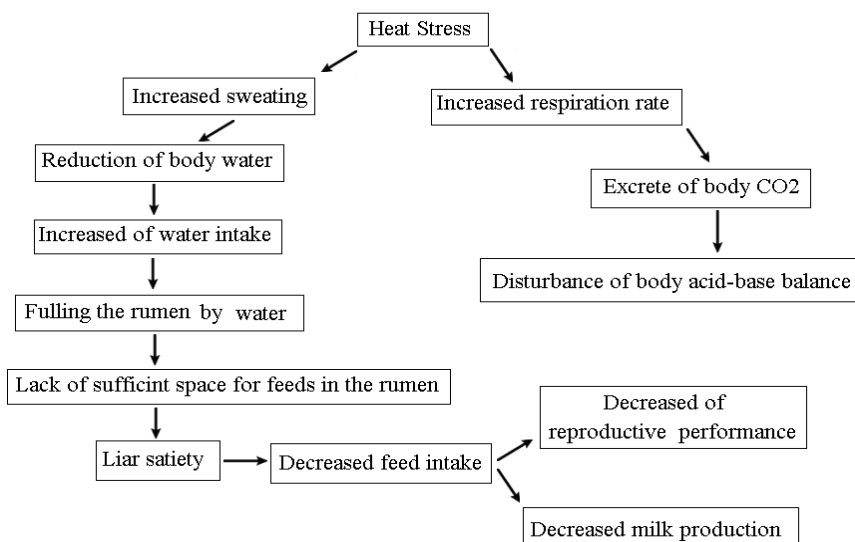


Figure 2 - Effects of heat stress on milk production (Pejman and Aghdam, 2012)

Effects of climate change on livestock disease distribution

Global warming will also alter the distribution of animal diseases and the vectors (Scholtz et al., 2013). Among identified disease about 58% are climate sensitive (FCC, 2014). Higher temperatures results in development of pathogens or parasites (Nejash and Kula, 2016). Warmer and wetter weather will increase the risk and occurrence of animal diseases, because species that serve as disease vectors, such as biting flies and ticks, are more likely to survive year-round (Veerasamy et al., 2016). Livestock diseases can cause indirect losses (additional costs for drugs and vaccines, added labor costs and profit losses due to denied access to better markets and use of suboptimal production technology) (Getachew, 2016).

Climate change on livestock feed and fodder availability

The most important effects of climate change on livestock production is changing the animal feed resources (Addis Ababa, 2015). It impact on rangeland biodiversity which influence livestock production (Savsani et al., 2015). Decline in rainfall, reduced length of rain season and increased temp which has directly affected animal fodders (Never, 2014). Change in temperature compromise the quantity and quality of forage by increase lignifications of plant tissues and reducing digestibility and rate of degradation (Mulata, 2016). Frequent drought and a decrease in annual rainfall affect yield of pasture and crop residues (Gray and Muller, 2011).

Effects of climate change on water resources

Arid and semiarid areas of Africa where water resources are very sensitive to climate variability, particularly rainfall (Solomon, 2016). Climate change intensifying the water cycle (FAO, 2011), changes in precipitation patterns and intensity, increasing atmospheric water vapor, evaporation, water temperatures and changes in soil moisture and runoff. Climate change increased surface temperatures, melting of snow and glaciers, rise in sea level and an increase in extreme weather events. The response of livestock to climate change is increasing e.g. *Bos indicus* weight index (WI) increases from about 3 kg per kg DM intake at 10 °C ambient temperature, to 5 kg at 30°C, and to about 10 kg at 35 °C (Mulata, 2016).

Climate change on livestock reproduction

Thermal stress leads reproductive inefficiency (Naqvi et al., 2012). An increase in uterine temperature of 0.5°C above average is associated with a decline in conception rate of 12.8% (Funk et al., 2012). Heat stress compromises oocyte growth in cows by altering progesterone secretion (Veerasamy et al., 2016). Heat stress causes infertility in most of farm animals (Kassahun, 2016). Animals exhibit sexual activities during cooler part of the year when the THI generally remains <72 (Upadhayay et al., 2009).

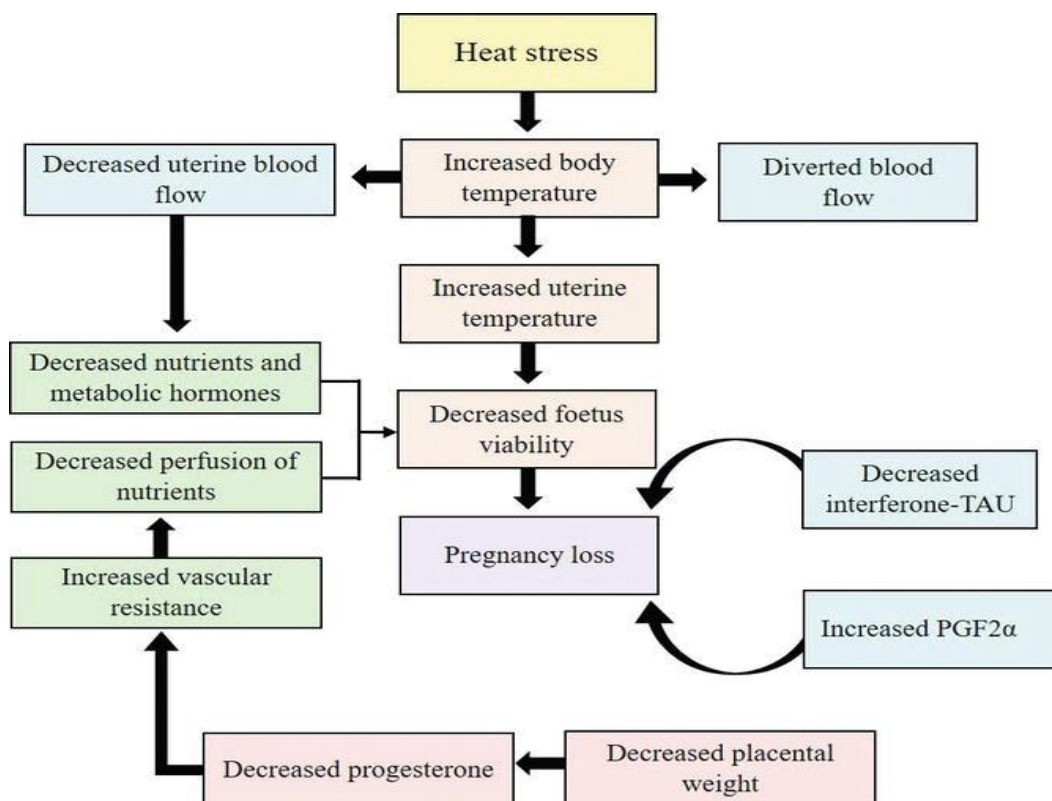


Figure 3 - Effects of heat stress on pregnancy loss of dairy cow

CONCLUSION AND RECOMMENDATIONS

From the point of this review, climate change is major driver effect on livestock production. Climate change has direct and indirect impact on livestock production. Ethiopia is the primary producer and export of livestock production in Africa. However, their production is affected by climate change by direct effect and indirect effect. Dairy cattle milk is affected by climate change. Mid lactating dairy are more sensitive than other phase. Emergence of new diseases and changes the prevalence of diseases caused by climate change. Climate change compromises the quantity and quality of forage by increase lignifications of plant tissues and reducing digestibility and rate of degradation. In addition, it aggravates water scarcity. Environmental education and awareness creation to bring change through adaptation and mitigation options. Practice ban grazing and intensive livestock production system also used to prevent global warming.

DECLARATIONS

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Authors' contribution

The author contributed alone to this work from starting searching up to preparation of this review.

Acknowledgments

The authors would like to thank Assosa University for providing different facilities for the work.

Competing interests

The authors declare that they have no competing interests.

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