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## CLIMATE CHANGE AND LIVESTOCK PRODUCTION

Dr Prafull Kumar\*

\*Sanskriti University, Mathura, Uttar Pradesh, INDIA

Email id: praful@sanskriti.edu.in

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### ABSTRACT

*Rapid change characterizes livestock systems in emerging nations, owing to reasons such as population expansion, rising demand for livestock products as wages rise, and urbanization. Climate change is compounding the significant development difficulties presented by these change factors. How can livestock keepers take advantage of rising demand for livestock products when possible, and how can the poor's livestock assets be safeguarded in the face of changing and more unpredictable climates? Because of the complexities of livestock and crop-livestock systems, a combination of technical, regulatory, and institutional changes will be needed. We address some of the probable effects of climate change on livestock and livestock systems, as well as some of the key livestock development problems that have arisen as a result: water and feeds, livestock genetics and breeding, and animal health. We emphasize livestock's importance in reducing poverty and assisting families in dealing with climate change. However, our understanding of how climate change and increased climatic variability may impact livestock systems and the livelihoods of those who rely on them is severely lacking.*

**KEYWORDS:** Agriculture, Breeding, Climate Change, Livestock, Variability.

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### 1. INTRODUCTION

In emerging nations, livestock systems are quickly evolving in response to a number of factors. The global population is projected to grow from approximately 6.5 billion people now to 9.2 billion by 2050. More than a billion people will be added to the world's population in Africa. In emerging nations, rapid urbanization is likely to continue. In the next decades, worldwide demand for animal products will continue to rise substantially. Furthermore, the climate is changing, and with it, climatic variability, which adds to the complexity. Many nations in the tropics and subtropics are already facing significant development difficulties. The potential effect of these global change factors on livestock systems and resource-poor people who depend on them There is a great deal of reliance on them. The vulnerable poor in livestock systems are the main subject of this study. Asia and Sub-Saharan Africa are two of the world's most populous regions. The availability and possibilities provided by the natural resource base have shaped livestock systems in various areas. The development of market forces is likewise influenced by market forces. livestock management systems We describe (at the risk of oversimplification) for the purposes of this study. There are three major livestock systems:

- Natural resources are limited in agro-pastoral and pastoral systems, and humans and their animals develop adaption methods to satisfy these limitations.
- Smallholder crop-livestock systems have natural resources that can be managed to increase the system's production.
- Industrial livestock systems, which are more intensive than agro-pastoral and smallholder mixed systems and are less linked to the local natural resource base.

The fastest-growing trend in livestock production in emerging nations is the rapid rise in demand for livestock and livestock products, which is fueled by urbanization, population expansion, and rising incomes. This so-called livestock revolution is mostly centered on underdeveloped countries. Improved quantity, especially when earnings grow from USD 2 to 10 per day, and increased quality, particularly among urban customers who buy animal goods from supermarkets, will be the trends in demand. This increasing demand must be satisfied somewhere, and the CGIAR's task is to maximize the benefits to the poor from this demand-driven income potential. According to studies, the poor may play a bigger part in certain livestock production and market chains than others. On the one hand, smallholders are significant participants in the dairy industry; in fact, agro-pastoral and mixed systems generate nearly all of Africa's meat and milk. Industrial systems, on the other hand, are significant players in the constantly expanding poultry industry.

The emphasis of research that may help the poor should be on what is happening in these demand-driven and evolving livestock systems. Both supply-side changes in natural resource usage and market-driven demand shifts will impact these adjustments. The complexity of livestock systems will need a combination of technical, regulatory, and institutional advances. Improvements in technology will be connected to a mix of feed and nutrition, genetics and breeding, health, and environmental management choices, with various combinations suitable for different systems. We describe some of the probable effects of climate change on livestock and livestock systems in this article, and then address some of the most pressing livestock development problems related to climate change that we believe are significant.

### *1.1 Climate Change Context:*

The world's climate is expected to continue to change at unprecedented speeds in recent human history. During the twentieth century, the global average surface temperature rose by approximately 0.6 degrees Celsius (IPCC, 2001). "much of the observed rise in the globally averaged temperature since the mid-20th century is very likely attributable to the observed increase in human greenhouse gas concentrations," according to the IPCC's Fourth Assessment Report (IPCC, 2007). According to IPCC climate model predictions from 2001, global average surface temperature would rise by 1.4 to 5.8 degrees Celsius by 2100, with the range dependent mainly on the amount of fossil-fuel burning between now and then, as well as the various models employed. Global food production may grow in the lower range of temperature rises (1 to 3 °C), but it will most likely decline beyond this range (IPCC, 2007).

However, since the effects of climate change are expected to be extremely spatially varied, overall trends will be overwhelmed by local variations. Precipitation increases are highly probable at high latitudes, whereas precipitation reductions are very likely in the tropics and subtropical land regions in most places, according to a suite of various models (IPCC, 2007). At the same time, weather variability is expected to rise, but it is difficult to predict the amount and geographical variation of this increasing variability based on existing understanding[1].

Crop and animal agriculture will obviously be impacted by the combination of generally rising temperatures and changing rainfall quantities and patterns. In the tropics, feed is and will continue to be a major restriction to livestock output, and crop productivity is a good proxy for feed availability in most areas. Crop production may rise somewhat for local mean temperature increases of up to 1-3 °C in mid- to high latitudes, depending on the crop, while crop productivity is expected to fall at lower latitudes for even moderate local temperature increases (1-2 °C) (IPCC, 2007). Crop yields in the tropics and subtropics may decline by 10 to 20% by 2050 as a result of warming and drying, but there are certain areas where yield losses may be considerably greater [2].

Climate change is expected to affect the geographical distribution of hungry people, with especially severe consequences in Sub-Saharan Africa. Smallholder and subsistence farmers,

pastoralists, and artisanal fisherfolk, according to the Fourth Assessment Report, will face complex, localized impacts of climate change, owing to both limited adaptive capacity in many places and the additional impacts of other climate-related processes such as snow-pack decrease, particularly in the Indo-Gangetic Plain, and sea level rise (IPCC, 2007). As a result, the effects of climate change on agriculture are not only geographically different, but also spatially heterogeneous. Add to this the fact that increases in the frequency and intensity of severe climatic events will have a major effect on food production and security; it will not only be predicted mean climate change that has an impact. Heat stress, drought, and flooding events are expected to become more common, despite the fact that they are impossible to model with current levels of understanding of climate systems. These will undoubtedly have negative effects on crop and livestock productivity, in addition to the effects of changes in mean variables alone (IPCC, 2007) At least 90 percent of the world's 1.3 billion impoverished people reside in Asia and Sub-Saharan Africa. Thornton et al., 2002; Thomas and Rangnekar, 2004 estimate that 60 percent of these impoverished individuals rely on livestock for a portion of their income. Climate change is expected to have a significant effect on impoverished livestock keepers and on the livestock industry as a whole. the products and services provided by ecosystems on which people rely Changes in the environment will be one of these effects. decreased water supply and more widespread water shortages, and increased productivity of rain-fed crops and pasture The intensity and spread of major human, animal, and agricultural diseases are shifting[3].

### *1.2 climate change variability and targeting responses to benefit the poor:*

While the general outlook for climate change effects on tropical crop and animal production is bleak, the more severe consequences that will occur in specific tropical areas are even more concerning. Our knowledge of what these local-level effects are likely to be is very lacking. This is due to long-term deficiencies in Global and Regional Circulation Models, as well as uncertainty in downscaling GCM output to the high geographic resolutions required for successful adaptation efforts. It's not that downscaling can't be done; it's simply that the effectiveness of it can't be assessed objectively right now .To help alleviate this predicament, scientists are trying to gather reasonably high-resolution data on potential effects on agricultural and livestock output and productivity. The initial stage is typically to detect potential "hotspots" using broad-brush techniques[4]. For example, ILRI has identified geographical "hotspots" that are already susceptible and are expected to experience significant effects as a result of climate change in collaboration with different partners from Africa, Asia, and Europe. This study takes a "beginning point" approach to vulnerability, in which climate change vulnerability is seen as a condition controlled not just by climate change but also by numerous processes and stressors. This includes dealing with biophysical vulnerability, or the natural environment's sensitivity to a danger; and social vulnerability, or the human environment's susceptibility to the exposure. An impact is therefore a function of hazard exposure and both kinds of susceptibility in this method[5].

### *1.3 Overall livestock and climate change considerations:*

The connections between cattle populations and the environment are complicated, and mainstream developed and developing nation views seem to be quite different. The impacts of cattle on the environment were the subject of a recent FAO study titled Livestock's Long Shadow. The term "long shadow" refers to the detrimental consequences of livestock production and marketing on virtually every element of the environment; for example, livestock production is linked to carbon dioxide, methane, and nitrous oxide emissions, as well as water depletion and soil erosion. The climate change effects of livestock production (estimated at 18 percent of total world greenhouse gas emissions from human sources have been extensively discussed, especially those connected with rapidly growing industrial livestock operations in Asia.

However, livestock are one of a limited number of broad-based alternatives in smallholder crop-livestock, agro-pastoral, and pastoral livestock systems to boost earnings and maintain the livelihoods of an estimated 1 billion people with a low environmental impact. Livestock are especially essential for improving the resilience of impoverished people who are susceptible to climatic, market, and disease shocks by diversifying risk and boosting assets. Given that virtually all human activity is linked to GHG emissions, livestock emissions in these systems are minor in comparison to the contribution that livestock makes to the livelihoods of such a large number of people. This delicate balancing act of resource usage, greenhouse gas emissions, and livelihoods is probably guaranteed to become much more difficult. Another issue that will place growing strain on the natural resource base and the balance between various natural resource uses, particularly in mixed crop-livestock systems, is the need for energy supply through biofuels. Livestock will play a role in both mitigation and adaptation to climate change. Technical and managerial solutions for reducing GHG emissions from livestock, as well as the integration of livestock into larger environmental service initiatives, may be included in livestock mitigation measures. These aren't addressed any further in this paper. Rather, we concentrate on the particular consequences of climate change on livestock systems, as well as the potential for livestock to assist the poor in adapting to the effects of climate change. Impacts on the natural resource base supporting livestock production (primarily feed and water); livestock genetic resources, breeding, and management; and livestock health are among the livestock elements.

#### *1.4 Livestock genetics and breeding:*

From intensifying and controlled systems to adaptable systems in more marginal settings, livestock genetic adaptation responses will differ. Traditionally, animal selection in tropical breeds has been adaptable, but in recent years, market pressure has sparked a fast shifting need for greater output that breed development of indigenous animals could not meet soon enough. There has been widespread animal cross-breeding, mainly with "improver" breeds from temperate areas mated with indigenous animals with mixed results. From previously acclimated and higher producing tropical breeds, little systematic research has been done on matching genetic resources to various agricultural and market chain systems. Given the increased climate unpredictability and stressors that are expected, this is a sensible response to the adaptive difficulties that will be encountered.

Adaptive characteristics of indigenous animal genetic resources will play the most important role in more marginal settings when climatic and other shocks are more frequent. Indigenous breeds that have co-evolved in these systems for millennia and adapted to the prevailing climatic and disease conditions will be critical. The demand for greater output, as well as land-use changes, are putting significant strain on these systems. In these conditions, it is critical to ensure the continued availability of these adaptable animal breeds to fulfill the demands of an uncertain future. The adaptive challenge will be to increase production while keeping adaptable characteristics[6]. Within various systems, this co-evolution will occur at varying rates. In this environment, rising demand will have to be met with a largely non-expanding land and water resource base, necessitating continuous productivity improvements. Current animal breeding methods are insufficient to satisfy this need, and additional research is needed to enhance breeding programs in various livestock production and marketing settings[7].

Animal genetic diversity preservation has not received the same level of attention as plant genetic variety preservation as a worldwide insurance policy against unexpected change. Ex-situ, particularly in vitro, conservation should be regarded as an essential component of a broad-based approach to preserve key adaptive genes and genetic characteristics when conservation via usage is inadequate (as is the case with indiscriminant cross-breeding). In recent years, the science has advanced considerably, and several industrialized nations are creating national cryobanks. Most poor nations, on the other hand, lack the financial and technological resources to set up and manage such cryobanks. Given the challenges of establishing and maintaining such facilities, it

seems logical to apply a same approach to plants and build multinational banks like the CGIAR gene banks' In-Trust plant collections. Such gene banks would serve as a supply of genetic material for breeding projects as well as an insurance policy[7].

### *1.5 Livestock and Human Health:*

The most significant effects of climate change on livestock and human illnesses have been vector-borne diseases. The spread of vector populations into cooler regions has been aided by rising temperatures, either into higher altitude systems (for example, malaria and livestock tick-borne illnesses) or into more temperate zones (for example, the current outbreak of bluetongue disease in northern Europe). During wetter years, changes in rainfall patterns may also affect the spread of vectors. This may result in massive disease outbreaks, similar to those observed in East Africa owing to the Rift Valley Fever virus, which is spread by a variety of biting insects. The spread of tsetse flies in Sub-Saharan Africa exemplifies the potential complexity of climate change interactions with other variables affecting vector populations. Tsetse flies are known to transmit African trypanosomes to cattle (ruminants, equids, and pigs).

Tsetse are very vulnerable to environmental change, whether caused by climate change or direct human influences on habitat, although the effects of main species groupings differ. Forest and riverine species are more susceptible to climatic variables than savannah species, while riverine species are more adaptive to rising human population densities than the other categories[8]. Tsetse populations and animal trypanosomosis will decline most in the semi-arid and sub-humid zones of West Africa, as well as in many but not all areas of Ethiopia and eastern and southern Africa due to a combination of population pressure on savannah species and climate change pressure on riverine species. In the humid forest zones of central and western Africa, the situation with animal trypanosomosis will be less altered[9]. If coordinated control measures are not undertaken, sleeping sickness, especially the gambiense variety, will continue to be a significant issue, as it is today. Aside from vector-borne illnesses, temperature and humidity will have a big impact on helminth infections, especially in tiny ruminants. Changes in livestock dispersal may potentially affect disease spread indirectly as a result of climate change. Camels and tiny ruminants would be the only animals that could survive as areas became increasingly dry. If these species are compelled to congregate near water sources, parasitic illnesses may become more common[10].

## **2. DISCUSSION**

Climate change's effects on agricultural output and livestock are difficult to discern from other natural and human-caused changes. Migration, overgrazing of natural pastures, changes in livestock management, and changes in human and animal populations are all non-climatic factors that are linked with climate change impacts. Climate change will boost agricultural output in certain regions while decreasing agricultural production in others. On a worldwide basis, these regional gains and reductions are unlikely to cause significant changes in food production in the next century. Physical, biological, and socioeconomic factors all influence climate change vulnerability. Low-income people who rely on subsistence farming are especially vulnerable. Low-latitude regions, arid and semi-arid locations, and particularly rain-fed, non-irrigated agricultural systems, will be more severely impacted on regional and local food production. South and Southeast Asia, as well as Africa, are home to several of these high-risk zones. The decrease in animal output may be considerable, costing these areas a lot of money. Climate change presents a problem because of the uncertainty around it and the timescales associated with it. Which locations, regions, and nations will be impacted by the changes, and to what degree, is unknown. As a result, commencement of mitigation actions may be viewed with trepidation. Climate change will have a significant impact on livestock output in Africa and Southern Africa, particularly in the developing parts of the continent. To adapt to and fight the potential impacts of climate change on a local, national, and regional level, continuous research, education, and sensitization are required.

### 3. CONCLUSION

Climate change's effects on agricultural output and livestock are difficult to quantify and differentiate from other natural and human-induced changes. Many non-climatic factors, such as migration, overgrazing of natural pastures, changes in livestock management, and changes in human and cattle populations, are linked to climate change impacts. As a consequence of climate change, some regions will profit from increased agricultural output while others may see losses. On a worldwide basis, these regional gains and reductions are unlikely to result in significant variations in food output during the next century. Climate change vulnerability is determined by physical, biological, and socioeconomic factors. People living on a low income who rely on subsistence agriculture are especially vulnerable. In low latitude regions, arid and semi-arid locations, particularly rain-fed, non-irrigated agricultural systems, the effect on regional and local food production will be more severe. South and Southeast Asia, as well as Africa, are home to several of these high-risk regions. The decrease in animal output may be considerable, resulting in major expenses for these areas. The problem with climate change is the lack of clarity about its causes and timelines. The degree to which the changes will impact specific locations, regions, and nations is unknown. This may lead to a hesitant attitude to implementing mitigation measures. Climate change is putting livestock production in Africa and Southern Africa, particularly in the developing parts of the continent, at jeopardy. On a local, national, and regional level, constant research, education, and sensitization are required to adapt to and fight the potential impacts of climate change.

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