

Global warming: Its effect on livestock and mitigation strategies

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Abstract

Climate change and livestock rearing are interrelated processes, both of which take place on a global scale. Livestock play an important role in economy of the developing countries like India. FAO estimates that per capita livestock production and productivity have been stagnant over the last two decades. This has been attributed to a number of production and productivity constraints including global climatic change. Climate affects livestock both directly and indirectly. Direct effects from air temperature, humidity, wind speed and other climate factors influence animal performance: growth, milk production, wool production and reproduction. Indirect effects include climatic influences on the quantity and quality of feedstuffs such as pasture, forage, grain and the severity and distribution of livestock diseases and parasites. Understanding the impact of climate change on livestock productivity is crucial to mitigate the adverse impact on the gains from other efforts.

Introduction

The global livestock sector is growing faster than any other agricultural sub-sector. It provides livelihoods to about 1.3 billion people and contributes about 40 percent to global agricultural output. For many poor farmers in developing countries livestock are also a source of renewable energy for draft and an essential source of organic fertilizer for their crops.

With increased prosperity, people are consuming more meat and dairy products every year. Global meat production is projected to more than double from 229 million tonnes in 1999/2001 to 465 million tonnes in 2050, while milk output is set to climb from 580 to 1043 million tonnes. But such rapid growth exacts a steep environmental price, according to the FAO report, *Livestock's Long Shadow - Environmental Issues and Options*. "The environmental costs per unit of livestock production must be cut by one half, just to avoid the level of damage worsening beyond its present level," it warns.

When emissions from land use and land use change are included, the livestock sector accounts for 9 percent of CO₂ deriving from human-related activities, but produces a much larger share of even more harmful greenhouse gases. It generates 65 percent of human-related nitrous oxide, which has 296 times the Global Warming Potential (GWP) of CO₂. Most of this comes from manure. And it accounts for respectively 37 percent of all human-induced methane (23 times as warming as CO₂), which is largely produced by the digestive system of ruminants, and 64 percent of ammonia, which contributes significantly to acid rain.

Climate change and agriculture are interrelated processes, both of which take place on a global scale. One of the biggest issues facing us right now is global warming. Its effects on animals and on agriculture are indeed frightening, and the effects on the human population are even scarier. The facts about global warming are often debated, but unfortunately, even if we disagree about the causes, global warming effects are real, global, and measurable. The causes are

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mainly from us; the human race, and the effects on us will be severe.

Global warming and climatic change is caused by increased level of carbon dioxide and other gases (Called greenhouse gases) in our atmosphere. These gases trap heat by forming a blanket around the earth. Once released, the greenhouse gases stay in the atmosphere for several years. Table 1 indicates the relative amount of green house gases. As they build up, the earth temperature rises and adversely affects the agriculture process including livestock. Estimates of Institute for International Economics & the Center for Global Development (Washington, USA) states that Global warming will cause 16% decline in global agricultural GDP by 2020. Projects output to fall by 20% in developing countries and by 6% in industrialized nations.

CO ₂	40%	Sources: Fossil fuel, oil, gasoline industry, livestock & paddy field Refrigeration
CH ₄	18%	
N ₂ O	6%	
CFC, CO, CCl ₄	14%	

General Effects of Global Warming

1. Higher local temperatures.
2. Extreme weather (floods, longer droughts)
3. Changes in rainfall pattern
4. Some regions will have increased rainfall while others will have decreased water availability.
5. Increased evaporation.
6. Glazier retreat and disappearance
7. Rise in sea level
8. Acidification.

Effects of Global warming on Livestock Health

1. Erratic Climatic changes: Global warming leads to high environmental temperature, extreme solar radiation, sudden changes in climatic factors like heat waves in winter, heavy rain fall in summer and cold waves in monsoon in tropical regions. Though livestock are homeotherm, they cannot able to adjust themselves in sudden climatic changes leading to lower productivity, health problems and mortality.
2. Decrease in feed intake: A decrease in feed and energy intake results in decreased blood flow to the tissues of the digestive system in heat stress affecting adversely the digestibility of feed lowering the productivity. Heat stress during the late pregnancy, in particular limits the development of fetus and placental mass

indirectly affecting the subsequent lactation. Besides, high temperature with high humidity is more deleterious for female fertility leading to more numbers of non-ovulatory cycles because of lower estradiol concentration especially in buffaloes. The embryonic signal in heat-stressed cows is so weak that it may not sufficient to block PGF₂ production by uterine endometrium, which in turn causes luteolysis and termination of pregnancy. Heat also reduces the metabolism and results in retarded fetal growth.

3. Respiratory problems: Higher ozone concentrations at ground level damage lung tissue.
4. Increase in cardiovascular disease.
5. Decreased resistance to diseases due to increased climatic stress.
6. Increase in favorable zones for vectors and thereby increasing vector born diseases like blue tongue and nipah viruses.
7. Drought leading to unavailability of safe drinking water.
8. Floods resulting in death of grazing livestock.
9. Higher mortalities.
10. Translocation of livestock due to global warming can affect wildlife with vector-borne diseases.

Effects of Global warming on Livestock Production

1. Decrease in productivity due to effects of higher temperature and greater temperature extremes on animal physiology and performance.
2. Change in husbandry practices-production system; water, feed and other resource used.
3. Fall in agricultural productivity resulting decrease in grain feed supply which increases animal feed price and cost of animal production.
4. Global warming causes plant nutrient deficiencies producing poor quality feed and thus affecting animal productivity.
5. Habitat affected leading to poor adaptability.
6. Reduced ruminal contractions, higher rectal temperature and reduced milk yield

Mitigation of Global Warming Effects on Animal Production

1. Use of Closed-House systems for livestock production to protect the environment from livestock habitats.
2. *Altering the Cow's Environment:* providing the

- shed to protect the cow from direct and indirect solar radiation. Animals should be kept under trees in loose housing system in heat stress condition to prevent adverse changes in body parameters and milk production if closed house system is not available.
3. Reformulation of nutrient requirements for cattle to account for reduced DMI, dietary heat increment, and avoiding nutrient excesses during hot weather. 3 to 5% fat should be incorporated in ration, as heat increment of fat is less than protein and carbohydrate. Dietary protein density should be increased (21% CP) to compensate for lower feed intake and to maintain the milk production. In addition dietary mineral concentration should be increased. Milk production and feed intake improves with addition of 0.85% sodium bicarbonate in heat stressed lactating dairy cows. Besides monensin is given @30mg/day alone or in combination with UMMB could reduce the methane production upto the extent of 32%, respectively. Methane production can also be aimed to reduce by feeding molasses urea product at a level of 600g with simultaneous increase of milk yield @1.3kg in buffaloes and 1.0 kg in crossbred cattle. Similarly, methane production can also be reduced by feeding of feeds containing bypass nutrients (protein & fat). Chaffing of fodder (dry and green) and frequency of feeding if increased reduce methane production.
 4. Development of high yielding animals through proper breeding program.
 5. Development of heat-resistant animals through breed improvement.
 6. Water stress: Use of animal species, which consumes less water vis-a-vis their body, mass: e.g. sheep and goats have better water consumption patterns than cattle.
 7. Reduce environmental pollution: zero-discharge from livestock farms.
 8. Reduce emission of methane, nitrous oxide and CO_2 : Technology use e.g. adding cysteine into feed, harvesting biogas from livestock manure (biogas reactors). Farmers keeping more than 10 animals and Panjrapole should be forced to use biogas technique to utilize methane production as fuels and reduce emission from animal waste. Enhancement of community biogas project should be made more attractive by the Govt. Govt. and NGOs should campaign to create awareness among the farmers that community manure storage at the bay of village should be by pit method instead of heap method (presently 93% heaps)
 9. Development of technology that can be applied to mitigate the effect of global warming.
 10. Use of land resources optimally. Controlling access and removing obstacles to mobility on common pastures. Use of soil conservation methods and silvopastoralism, together with controlled livestock exclusion from sensitive areas; payment schemes for environmental services in livestock-based land use to help reduce and reverse land degradation. Herds cause wide-scale land degradation with about 20% of pasture considered as degraded through overgrazing, compaction and erosion. This is due to inappropriate policies and inadequate livestock management, which contribute to advancing desertification.
 11. Atmosphere and climate - increasing the efficiency of livestock production and feed crop agriculture. Improving animals' diets to reduce enteric fermentation and consequent methane emissions, and setting up biogas plant initiatives to recycle manure.
 12. Water - improving the efficiency of irrigation systems. Introducing full-cost pricing for water together with taxes to discourage large-scale livestock concentration close to cities.
 13. Give tax incentives to farms, which undertake carbon sequestration.
 14. Develop effective legislative framework to impose ban on growing forage crops near highways as it leads to accumulation of heavy metals and hydrocyanic compounds into the fodders. Contaminated untreated wastewater for raising fodder crops should also be banned as it leads to emission of gases along with fodders.

Conclusion

The postulated effects of global warming on animal health and production are not fully known. More in depth and integrated studies are needed to fully elucidate the ramifications of global warming on livestock productivity, socio-economic effects and impacts on the nation and region as a whole.

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