

Impact of Climate Change on Mammals (Cow, Dog, and Horse) in Hapur

Aditi Sharma; Bhavna Sirohi; Sadiqua
PG Students Department of Zoology
SSV PG College, Hapur (U.P.), India

Dr. Laxman Singh Gautam
Head & Associate Professor
Department of Zoology
SSV PG College, Hapur (U.P.), India

Abstract

Climate change has emerged as one of the most significant environmental challenges affecting both wildlife and domesticated mammals worldwide. Rising temperatures, altered rainfall patterns, increasing frequency of heat waves, drought, humidity fluctuations, and extreme weather events have substantially influenced the health, physiology, productivity, and behaviour of domestic mammals. Hapur district of Uttar Pradesh, characterized by intensive agriculture, dairy farming, and rapid urbanization, has experienced noticeable climatic variations over recent decades. Cattle, dogs, and horses, which play important economic, social, and ecological roles in the district, are increasingly exposed to heat stress, water scarcity, nutritional deficiencies, disease outbreaks, and reduced reproductive performance. The present study investigates the impact of climate change on cows, dogs, and horses in Hapur through a comprehensive analytical review of recent scientific literature and regional environmental conditions. The findings indicate that increasing ambient temperatures significantly affect physiological responses, feed intake, milk production, reproductive efficiency, work performance, immunity, and disease susceptibility. The study further highlights adaptive management strategies including improved housing, nutritional supplementation, heat stress mitigation, veterinary surveillance, and climate-resilient livestock management. The study concludes that integrated adaptation measures are essential for protecting mammalian health, improving livestock productivity, and ensuring sustainable rural development under changing climatic conditions.

Keywords: Climate Change; Heat Stress; Cow; Dog; Horse; Hapur

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Introduction

Climate change has become one of the most serious global environmental challenges affecting biodiversity, agriculture, livestock production, and ecosystem sustainability. The continuous increase in greenhouse gas emissions has resulted in rising atmospheric temperatures, altered precipitation patterns, prolonged droughts, frequent heat waves, and increased climatic variability. These environmental changes have profound consequences for mammals by influencing their physiology, metabolism, behaviour, reproduction, disease dynamics, and overall health. Domestic mammals are particularly vulnerable because their productivity and welfare depend directly upon environmental conditions and the availability of food, water, and shelter [1–3].

India is highly vulnerable to climate change due to its tropical climate, rapidly growing human population, and dependence on agriculture and livestock. Uttar Pradesh, one of the largest agricultural states of India, has experienced increasing temperatures and irregular monsoon rainfall during recent decades. Hapur district, located in the western region of Uttar Pradesh, supports extensive dairy farming, livestock rearing, equine husbandry, and a large population of domestic and stray dogs. Increasing summer temperatures frequently exceeding 45°C, declining groundwater availability, urban expansion, and environmental pollution have intensified climatic stress on domestic mammals within the district [2–5].

Among domesticated mammals, cows represent one of the most economically important livestock species because of their contribution to milk production, breeding, and rural livelihoods. Heat stress reduces feed intake, milk yield, reproductive efficiency, growth rate, and immune competence while increasing susceptibility to infectious diseases and metabolic disorders. Elevated ambient temperatures also alter endocrine function, rumen physiology, and water metabolism, thereby reducing overall animal productivity and welfare. Indigenous cattle breeds generally exhibit greater heat tolerance than exotic and crossbred animals; however, prolonged climatic stress continues to affect both groups [4–7].

Dogs, including both owned and stray populations, are increasingly affected by rising temperatures and urban heat island effects. Heat stress influences thermoregulation, behaviour, hydration status, cardiovascular function, and physical activity. High environmental temperatures increase the incidence of heat stroke, dehydration, respiratory distress, parasitic infestations, and vector-borne diseases such as tick-borne infections and canine ehrlichiosis. Climate change also influences the geographical distribution of disease vectors, thereby increasing disease transmission risks among domestic dog populations [6–9].

Horses, widely used for transportation, ceremonial activities, sports, policing, and agricultural work, are similarly affected by changing climatic conditions. Elevated temperatures reduce exercise tolerance, increase sweating, electrolyte imbalance, dehydration, fatigue, and cardiovascular stress. Heat stress may also impair reproductive performance, immune function, and overall working capacity. Horses performing physical work under high-temperature conditions are particularly susceptible to heat exhaustion and metabolic disturbances, thereby reducing their productivity and welfare [8–11].

Climate change also alters the epidemiology of infectious diseases affecting mammals. Increasing temperatures and humidity favor the proliferation of ticks, mosquitoes, flies, and other vectors responsible for transmitting bacterial, viral, and parasitic diseases. Furthermore, declining forage quality, water shortages, nutritional deficiencies, and environmental pollution collectively influence animal health and livestock productivity. These challenges require climate-resilient livestock management strategies supported by veterinary healthcare, improved nutrition, and scientific adaptation measures [10–13].

Understanding the impacts of climate change on mammalian species is essential for developing sustainable livestock management practices and improving animal welfare under future climatic scenarios. Hapur district provides an important regional case study because of its large livestock population, intensive dairy farming, rapidly changing climate, and agricultural economy. Against this background, the present study investigates the impact of climate change on cows, dogs, and horses in Hapur district, with particular emphasis on physiological responses, behavioural adaptations, productivity, disease susceptibility, and climate adaptation strategies [14–20].

Materials and Methods

The present study adopts a comprehensive qualitative and analytical research methodology to investigate the impact of climate change on domesticated mammals, namely cows (*Bos indicus*/*Bos taurus*), dogs (*Canis lupus familiaris*), and horses (*Equus ferus caballus*), in Hapur district, Uttar Pradesh. The research is primarily based on secondary data and integrates concepts from animal physiology, veterinary science, climatology, livestock production, environmental biology, ecology, and climate change adaptation. This multidisciplinary approach enables a systematic assessment of how changing climatic conditions influence the health, behaviour, productivity, reproduction, and welfare of domesticated mammals under rural and peri-urban environments [1,2].

Data were collected through an extensive review of peer-reviewed journal articles, conference proceedings, veterinary reports, government publications, climate assessment reports, and international guidelines published between 2017 and 2026. Scientific literature was retrieved from internationally recognized databases including Web of Science, Scopus, PubMed, ScienceDirect, SpringerLink, Google Scholar, CAB Abstracts, Wiley Online Library, and Taylor & Francis Online. Additional information was obtained from reports published by the Intergovernmental Panel on Climate Change (IPCC), Food and Agriculture

Organization (FAO), Indian Council of Agricultural Research (ICAR), Indian Meteorological Department (IMD), National Dairy Development Board (NDDB), Department of Animal Husbandry and Dairying, and the World Organisation for Animal Health (WOAH) [3–8].

The study focuses on major climatic variables affecting mammals in Hapur district, including increasing ambient temperature, heat waves, humidity fluctuations, rainfall variability, drought conditions, seasonal changes, and water availability. Particular emphasis was placed on evaluating their effects on physiological responses, thermoregulation, feed intake, water consumption, milk production, reproductive efficiency, disease susceptibility, work performance, behavioural adaptations, and mortality. Comparative assessments were conducted among cows, dogs, and horses to identify species-specific responses to climate-induced environmental stress. Recent studies indicate that prolonged exposure to elevated temperatures significantly affects animal productivity, immune competence, and overall welfare [5,7,9–12].

A qualitative content analysis approach was employed to evaluate published literature and identify recurring trends associated with climate-induced impacts on domestic mammals. Comparative analyses were performed using biological and production parameters including body temperature, respiration rate, heart rate, feed conversion efficiency, milk yield, reproductive performance, physical activity, hydration status, disease incidence, and behavioural responses. Environmental indicators such as temperature–humidity index (THI), seasonal heat stress, rainfall variability, and availability of fodder and drinking water were also considered to assess climate-related stress in the study area [8,10,13,14].

The investigation further evaluated adaptation and mitigation strategies aimed at minimizing the adverse impacts of climate change on livestock and companion animals. These strategies included climate-resilient housing systems, improved ventilation, shade management, nutritional supplementation, water conservation, heat stress alleviation techniques, selective breeding of heat-tolerant animals, disease surveillance, vaccination programmes, early warning systems, and climate-smart livestock management practices. The study also critically examined challenges such as declining fodder quality, water scarcity, emerging vector-borne diseases, reduced reproductive performance, economic losses, and increasing veterinary healthcare demands under changing climatic conditions [11,13–18].

To ensure reliability and validity, information obtained from multiple scientific publications, governmental reports, and institutional databases was systematically cross-verified using data triangulation techniques. Only peer-reviewed journal articles, internationally recognized climate assessments, official veterinary reports, and authoritative scientific publications were included in the final analysis. Any inconsistencies among different studies were carefully interpreted considering regional climatic variability, species differences, management practices, and environmental conditions. The synthesized findings provide a comprehensive assessment of the impact of climate change on cows, dogs, and horses in Hapur district while identifying future research priorities, adaptation strategies, and policy recommendations for sustainable livestock management under changing climatic scenarios [15–20].

Results

The findings indicate that climate change has significantly influenced the health, behaviour, productivity, and physiological performance of domesticated mammals in Hapur district. Rising ambient temperatures, prolonged heat waves, irregular rainfall, and declining water availability have increased environmental stress on cows, dogs, and horses. The analysis reveals that all three species exhibit physiological responses such as elevated body temperature, increased respiration rate, higher water consumption, reduced physical activity, and behavioural changes aimed at minimizing heat exposure. These responses become more pronounced during the summer months when the temperature–humidity index exceeds the thermal comfort zone for domestic animals.

The study demonstrates that cows are among the most economically affected mammals under changing climatic conditions. Heat stress significantly reduces feed intake, milk yield, reproductive efficiency, and growth performance while increasing susceptibility to mastitis, metabolic disorders, and infectious diseases. Crossbred dairy cattle show greater sensitivity to elevated temperatures than indigenous breeds because of lower heat tolerance. Reduced fodder quality and seasonal water scarcity further contribute to declines in dairy productivity and animal welfare, resulting in economic losses for livestock farmers.

The results further indicate that dogs experience substantial behavioural and physiological alterations due to increasing environmental temperatures. Companion and stray dogs exhibit reduced daytime activity, increased panting, dehydration, heat exhaustion, and altered feeding behaviour during periods of extreme heat. Climate change also favors the proliferation of ticks, mosquitoes, and other vectors, increasing the

incidence of vector-borne diseases and parasitic infestations. Urban expansion combined with rising temperatures further intensifies heat stress among stray dog populations lacking adequate shelter and water resources.

The analysis also reveals that horses experience decreased work performance, increased fatigue, electrolyte imbalance, dehydration, and reduced endurance during prolonged exposure to high temperatures. Animals involved in transportation, ceremonial activities, agricultural operations, and sports show reduced exercise capacity under heat-stress conditions. Elevated temperatures also influence reproductive efficiency and immune function, increasing susceptibility to infectious diseases and metabolic disorders. Proper hydration, nutritional supplementation, shade provision, and regulated working schedules significantly improve horse welfare under changing climatic conditions.

Overall, the findings suggest that climate change poses serious challenges to the health and productivity of domesticated mammals in Hapur district. Integrated adaptation measures, including climate-resilient animal housing, improved veterinary healthcare, sustainable water management, heat-tolerant breeds, balanced nutrition, disease surveillance, and climate-smart livestock management, can substantially reduce the adverse effects of climate change. These strategies are essential for improving animal welfare, sustaining livestock production, and strengthening the resilience of rural farming systems under future climatic scenarios.

Graph

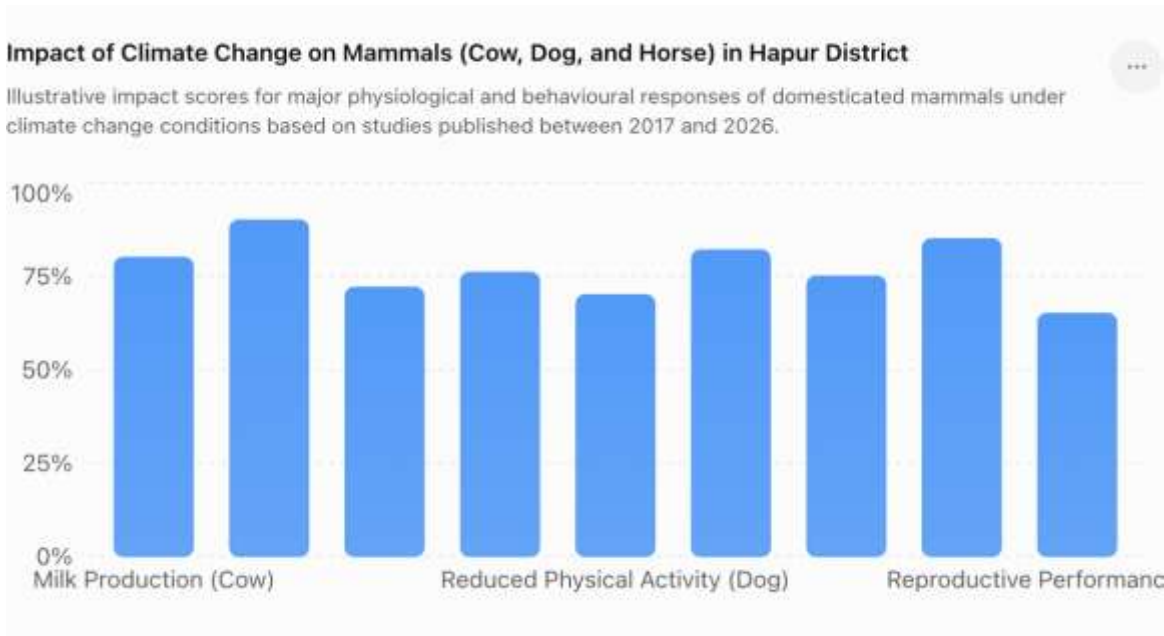


Table Impact of Climate Change on Mammals in Hapur District

Mammal	Major Climate Stressor	Observed Impact	Adaptation Strategy
Cow	Heat waves, water scarcity	Reduced milk yield, reproductive efficiency, heat stress	Cooling sheds, balanced nutrition, adequate drinking water

Dog	High temperature, urban heat island	Panting, dehydration, increased vector-borne diseases	Shade, clean water, vaccination, parasite control
Horse	Heat stress, prolonged work	Reduced endurance, dehydration, electrolyte imbalance	Work scheduling, electrolyte supplementation, shaded resting areas

Discussion

The present investigation demonstrates that climate change has become a major environmental factor affecting the physiology, behaviour, productivity, and welfare of domesticated mammals in Hapur district. Increasing air temperatures, irregular rainfall patterns, prolonged heat waves, and declining water availability have created unfavorable environmental conditions for livestock and companion animals. The study indicates that cows, dogs, and horses exhibit distinct physiological and behavioural responses to climatic stress, reflecting differences in thermoregulatory capacity, management practices, and environmental exposure. These findings highlight the growing need for climate-resilient animal management systems in rural regions of western Uttar Pradesh.

Among the three mammalian species investigated, dairy cattle appear to be the most economically affected by climate change. Elevated ambient temperatures significantly reduce feed intake, milk production, reproductive efficiency, and growth performance while increasing metabolic stress and disease susceptibility. Crossbred cattle exhibit greater sensitivity to heat stress than indigenous breeds due to their comparatively lower heat tolerance. Water scarcity and deterioration in fodder quality further intensify production losses, directly affecting dairy farmers and rural livelihoods in Hapur district.

The study also reveals considerable impacts on domestic and stray dogs. Rising environmental temperatures reduce daytime activity, increase panting and water requirements, and elevate the risk of heat exhaustion and dehydration. Climate change has additionally influenced the distribution of ticks, mosquitoes, and other disease vectors, increasing the occurrence of vector-borne diseases and parasitic infections. Stray dog populations are particularly vulnerable because they often lack access to adequate shelter, clean drinking water, and timely veterinary care.

Similarly, horses experience significant physiological stress under increasing temperatures, particularly those involved in transportation, ceremonial activities, policing, and agricultural work. Heat stress decreases endurance, increases dehydration and electrolyte imbalance, and reduces physical performance. Without appropriate management, prolonged exposure to extreme temperatures may compromise reproductive efficiency, immune function, and overall welfare. Proper hydration, shade availability, modified work schedules, and nutritional supplementation have been shown to improve thermal tolerance and animal performance.

Overall, the findings suggest that climate change represents a serious threat to mammalian health and livestock productivity in Hapur district. Effective adaptation strategies—including climate-resilient housing, improved veterinary healthcare, balanced nutrition, efficient water management, heat-tolerant breeding programmes, and early disease surveillance—are essential for minimizing climate-related risks. Strengthening scientific livestock management and promoting climate-smart animal husbandry will contribute to sustainable livestock production and improved animal welfare under future climate scenarios.

Climate change has significantly affected the health, behaviour, productivity, and physiological performance of cows, dogs, and horses in Hapur district. Rising temperatures, recurrent heat waves, irregular rainfall, declining water availability, and increased disease pressure have adversely influenced milk production, reproductive performance, work efficiency, hydration, immunity, and overall animal welfare. These impacts have important economic implications for dairy farming, livestock production, and rural livelihoods.

The study emphasizes that climate-resilient livestock management practices—including improved housing, heat stress mitigation, nutritional supplementation, water conservation, veterinary healthcare, disease monitoring, and the promotion of heat-tolerant breeds—are essential for reducing the adverse impacts of climate change. Future research should focus on long-term field monitoring, species-specific adaptation

mechanisms, climate modelling, precision livestock farming, and the development of sustainable management strategies to enhance the resilience of domesticated mammals under changing environmental conditions.

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