

Climate change impacts on livestock health in Morbi District

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Climate change poses increasing challenges to livestock health, productivity and dairy – based livelihoods, particularly in regions with high temperature, less rainfall and water – related stress. The present study assesses field – level observation of climate change impacts on livestock health in Morbi region of Gujarat, using a descriptive cross – sectional questionnaire survey of livestock – owning respondents. The study also reviews temperature and rainfall data to provide climatic background for interpreting the survey findings. The results indicate that livestock owners are observing climate related challenges through water scarcity, changes in milk production, increased animal stress, disease prevalence, feeding adjustments and reproductive concerns. The findings suggest that the livestock health in the study area is affected through multiple connected pathways involving heat – stress, water – stress, feed availability and animal management conditions. While this study relies on descriptive field data and does not infer direct causality, it provides evidence on climate induced livestock health risks. The findings highlight the urgent need for interventions in water governance, veterinary support, fodder security and climate – resilient animal husbandry practices.

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INTRODUCTION

Climate change has become a significant concern for agriculture and livestock-based livelihoods because changes in temperature, rainfall and extreme weather conditions affects mental health, productivity and farm management. Review shows that livestock are exposed to climate stress through heat, water – scarcity, fodder storage, disease occurrence and changes in the reproductive performance. (Rojas-Downing et al., 2017; Cheng et al., 2022) This is especially critical across regions where the rural economy is deeply reliant on dairy farming and livestock rearing.

Joshi et al. (2019) investigated the impact of climate change on annual and monthly rainfall in the Bhadar River Basin, India. The study analysed rainfall trends using Linear Regression and Innovative Trend Analysis (ITA) methods.

Livestock health is sensitive to environmental conditions, high temperature can lead to heat stress, reduced feed intake, higher water demand and changes in normal physiological functions. Lees *et.al*, 2019; Henry *et al.*, 2012 reported that heat load affects cattle through changes in thermoregulation, behavior, production and welfare through direct heat stress as well as indirect effect such as changes

in disease patterns, feed availability and water resources. Dairy animals are particularly vulnerable because milk production depends in animal conform, nutrition, hydration and reproduction. Heat stress has been widely reported to reduce milk yield and affect milk quality (Lacetera, 2019). St-Pierre *et al.* (2003) showed that heat stress can cause economic losses in livestock industries due to reduced production and health – related impacts. In dairy cattle, heat stress may also affect immune response, making animals

more vulnerable to disease. Bagath *et al.* (2019) reviewed the effect of heat stress on the immune system of the dairy cattle and highlights that thermal stress can disturb physiological and immune functions.

Climate induced stressor including heat stress, nutritional deficits and water scarcity can severely compromise livestock reproduction performance, leading to reduced fertility, impaired breeding success and unfavorable gestational and calving outcomes. These effects align with findings by Hansen (2009), who reported that elevated temperature impair reproductive processes in mammals including bovine species. Therefore, monitoring reproductive parameters is critical for assessing the broader impacts of climate variability on livestock health.

In India, livestock rearing and dairy farming serve as vital pillars of the rural agrarian economy and household livelihoods. According to the National Dairy Development Board (NDDB), the country sustains one of the world's largest dairy animal inventories, predominantly comprising cattle and buffaloes; with Gujarat ranking among the leading milk producing states. In such agro – pastoral landscapes, climatic variability threatens not only animal health and physiological well – being, but also milk productivity and the socio – economic stability of livestock owners. To address this knowledge gap, the present study examines the climate – induced livestock health vulnerabilities in Morbi District, Gujarat. Integrating primary questionnaire – based field surveys with secondary meteorological data, this paper evaluates reported shifts in water availability,

feeding regimes, disease occurrence and reproductive performance. The study aims to provide local evidence on climate related livestock health concerns and support the need for climate – resilient animal husbandry practices.

Methodology

The study was conducted in Morbi District, situated in the semi – arid Saurashtra region of Gujarat, India. Morbi covers approximately 4,872 sq. km and has a population of about 9,60,329. The district consists of five talukas including both urban and rural settlements where agriculture, livestock rearing and dairy – related activities contribute to

local livelihoods. The study was selected because livestock owners in this region are exposed to high temperature, irregular rainfall, water scarcity and fodder – related challenges. These conditions make Morbi district suitable for studying field – level observation of climate change impacts on livestock health and dairy productivity.

A descriptive cross – sectional research design was used. Primary data were collected through a structured questionnaire administered to livestock – owning respondents selected through purposive sampling. A total of 102 responses were obtained and analyzed, which gave adequate operational diversity across varying herd size, animal profiles and management regimes, thereby providing a robust representative cross – section of the district's livestock – rearing landscapes.

The questionnaire covered animal ownership, climate – change awareness, observed temperature and rainfall changes, disease prevalence, water scarcity, milk quality and quantity, feeding pattern,, mortality, animal stress, fertility and husbandry practices. The rainfall and temperature data of 30 years were used as climatic background.

Results and Discussions

The survey was focused on respondents directly involved in livestock rearing or animal husbandry activities. Among these respondents, cow ownership was the most common category with 56 respondents followed by 17 buffalo owners and mixed cow – buffalo owners. The survey results showed high level of climate – change awareness

among them, out of 102 respondents, 86.3% stated that they were aware of climate change scenarios and 74.5% stated that they are noticing changes in the temperature and rainfall variation in their region. These responses indicated that the climatic changes are being observed at the field level by people directly involved in the dairy farming. The rainfall and temperature data collected for 30 years showed strong year – to – year variation. These climatic patterns are relevant

to livestock management because rainfall influences water and fodder availability, while high temperature contributes to heat stress and increased water demand. Similar pathways have been reported in livestock climate studies where climatic extreme affects feed supply, milk yield, morbidity, mortality and reproductive efficiency (Sejian *et al.*, 2016; Kebede, 2016; Godde *et al.*, 2021)

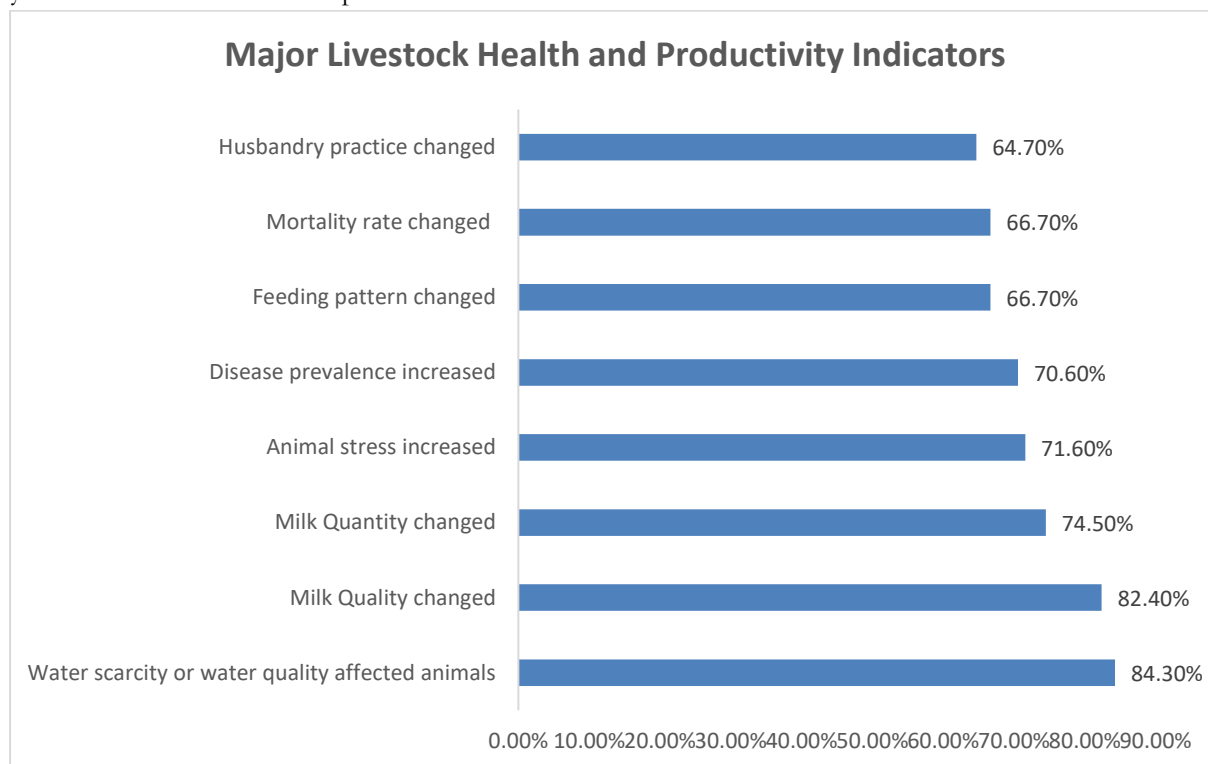


Figure 1: Major livestock health and productivity indicators reported by respondents

The figure given above shows the water related stress was the strongest reported concern with 84.3% of respondents indicating that water scarcity or the water quality have changed, affecting animal health. Milk related changes were also prominent with 82.4% reporting changes in milk quality and 74.5% reporting changes in milk quantity. Health related indicators included increase animal stress (71.6%) and increased

disease prevalence (70.6%). The survey also recorded changes in the mortality and animal movement. A total of 66.7% reported changes in the mortality rate while 60.8% reported observing migration of animals in their area. Moreover, 66.7% of respondents indicated changes in the feeding pattern, suggesting adjustments linked to fodder availability, seasonal conditions or animal requirements.

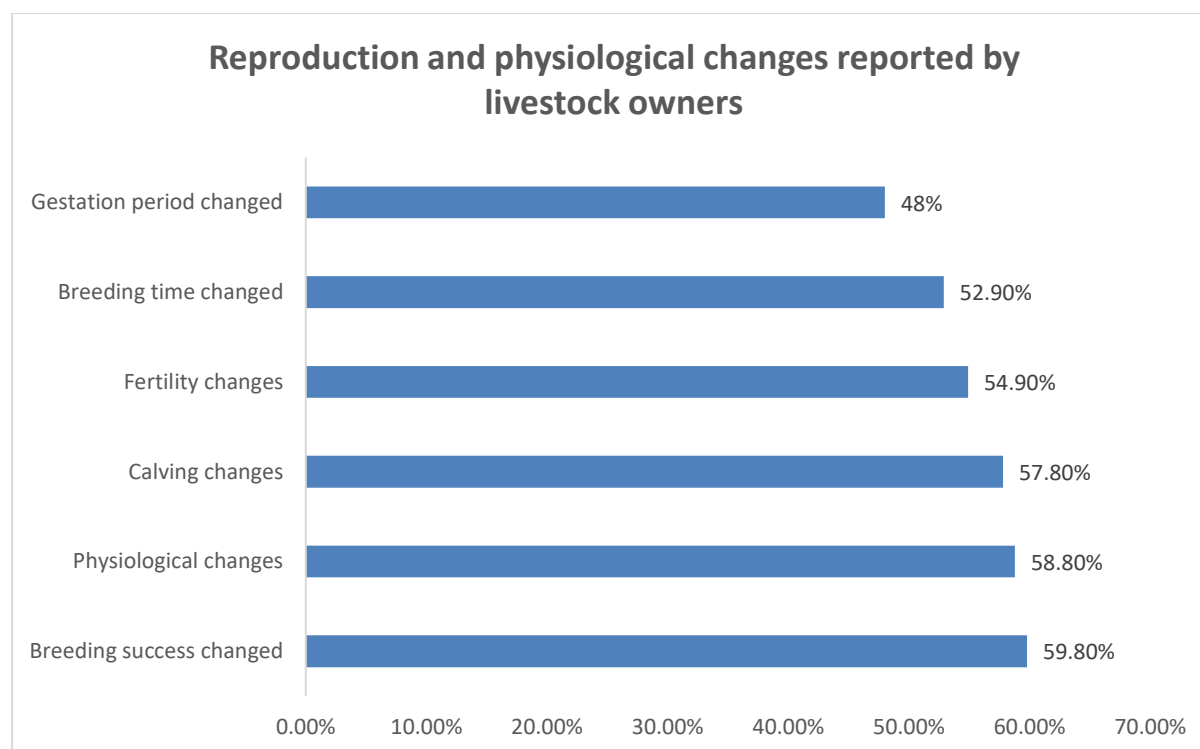


Figure 2: Reproductive and physiological changes reported by respondents

The findings of reproductive and physiological changes suggest that the observed livestock health concerns extend beyond immediate disease and milk production to include breeding and reproductive performance. The changes were reported for breeding success by 59.8%, physiological condition by 58.8%, calving by 57.85, fertility by 54.9% and gestation period by 48%. In the multiple – response question on climate – related impacts, increased heat stress was the most frequent issue, followed by disease outbreak, changes in the feed availability and water scarcity.

Overall, the findings suggest that livestock owners in Morbi district are observing climate induced

challenges through connected pathways involving water stress, heat stress, feed availability, animal health and milk production. The pattern is consistent with broader literature that treats livestock vulnerability as location – specific and dependent on local production systems, adaptation capacity, farmer resources and institutional support (Rojas-Downing *et al.*, 2017;

Godde *et al.*, 2021; Ghasura *et al.*, 2024). While these field – level observations highlight significant climate – related vulnerabilities, livestock health outcomes are inherently confounded by non – climatic factors such as genetic breed difference, nutritional management and biosecurity practices. Thus, these results provide valuable descriptive baseline evidence rather than direct casual attribution.

Conclusions

The present study highlights the field – level observations of livestock owners regarding climate impacts on livestock health in Morbi District, Gujarat. Most respondents were aware of climate change, with 86.3% reporting awareness and 74.5% observing changes in temperature or rainfall events. The strongest reported concern was water scarcity which was reported by 84.3% of respondents. Milk production changes were also prominent with 82.4% reporting changes in the milk quality and 74.5% reporting changes in the milk quantity. The health – related concerns were reported through increased animal stress by 71.6%. These findings are relevant for dairy – based livelihoods because cows and buffaloes formed the major share of

surveyed livestock. However, the consistency of responses across different indicators shows that climate induced stress is a significant issue for the livestock owners. Improved water management, veterinary support, fodder security, heat stress reduction and climate – resilient animal

husbandry practices can help reduce vulnerability. Further research using veterinary records, dairy production records and detailed climate analysis can strengthen evidence on climate variability and livestock health in Morbi district.

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