

EL NIÑO AND ITS IMPACT ON ANIMAL HEALTH, PRODUCTION AND WILDLIFE: CHALLENGES AND MITIGATION STRATEGIES

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Abstract

El Niño alters global temperature and rainfall, affecting livestock health, production and wildlife ecology. It can cause heat stress, feed and water shortages, reproductive problems, reduced milk and meat production, and increased disease risk. Wildlife may also experience habitat and food shortages, altered migration and breeding, and increased human–wildlife interactions. Climate-informed management, adequate feed and water, heat-stress reduction, disease surveillance, vector control, habitat conservation and early-warning systems are essential for resilience.

Introduction

Among the natural climate phenomena affecting global weather, El Niño is one of the most significant because it can alter temperature and rainfall patterns over large geographical regions. El Niño is part of the El Niño–Southern Oscillation (ENSO), a natural climate cycle resulting from interactions between the Pacific Ocean and the atmosphere. ENSO has three phases: El Niño (warm phase), La Niña (cold phase) and the neutral phase. During an El Niño event, weakened trade winds disrupt normal atmospheric circulation, causing heavy rainfall and flooding in some regions and drought, heat waves, and water scarcity in others (Liu *et al.*, 2025).

What is El Niño?

The Climate Prediction Center (CPC) defines an El Niño event as a period when sea surface temperatures in the central and eastern equatorial Pacific Ocean remain at least 0.5°C above normal for several consecutive months (Liu *et al.*, 2025). El Niño events generally occur every 2–7 years and typically last for 9–12 months, although their intensity and duration vary.

Why Does El Niño Occur?

Under normal conditions, strong easterly trade winds drive warm surface waters toward the western Pacific, while cold, nutrient-rich water rises along the western coast of South America through upwelling. During El Niño, weakened trade winds disrupt this circulation, causing abnormal warming of the central and eastern Pacific. India is particularly vulnerable because El Niño can affect the southwest

monsoon, the major source of rainfall across much of the country.

Effects of El Niño on Animal Health

El Niño can affect animal health both directly and indirectly. Increased temperatures, droughts and floods directly stress animals, while changes in feed availability, vectors, pathogens and animal movement can indirectly alter disease occurrence.

1. Heat stress

El Niño-associated temperature rises can cause heat stress in livestock when animals cannot dissipate excess body heat. Clinical effects include panting, increased water intake, reduced feed intake, salivation, elevated body temperature, altered heart rate, impaired immunity and reproduction, and, in severe cases, dehydration or death.

2. Dehydration and water scarcity

Drought associated with El Niño may reduce the availability of drinking water. At the same time, higher temperatures increase the water requirement of animals. Animals may also be forced to drink from contaminated or stagnant water sources, increasing the possibility of water-borne diseases.

3. Nutritional stress

Reduced rainfall can decrease pasture growth and fodder production (Silva *et al.*, 2024). Prolonged drought may therefore result in deficiencies of energy, protein, minerals and vitamins. Undernourished animals lose body condition and become more susceptible to infections

4. Increased risk of infectious and vector-borne diseases

El Niño-associated changes in temperature and rainfall can alter the survival, distribution and multiplication of disease vectors such as mosquitoes, flies and ticks. Excessive rainfall can create breeding sites for mosquitoes, whereas changes in temperature can influence the developmental cycle and geographical distribution of vectors.

5. Suppression of immunity

Heat and nutritional stress may adversely affect immune responses. Increased secretion of stress-related hormones and altered metabolism can reduce the ability of animals to respond effectively to infectious agents.

6. Reproductive problems

High environmental temperatures negatively affect reproductive performance in both males and females. In females, heat stress may cause poor expression of oestrus, reduced conception rates, early embryonic losses and prolonged calving intervals. In males, prolonged heat exposure can adversely affect spermatogenesis, semen quality and fertility.

7. Increased mortality during climatic extremes

Young, old, sick and high-producing animals are particularly vulnerable to extreme heat, drought and floods. Heat exposure with inadequate shade and water can lead to heat stroke and death, while floods may cause drowning, injuries, displacement and increased infectious disease outbreaks.

Effects of El Niño on Animal Productivity

Animal health and productivity are closely interconnected. Consequently, the climatic stresses produced by El Niño can translate directly into economic losses for livestock farmers.

1. Reduction in milk production

Heat stress is one of the major environmental factors reducing dairy productivity. During hot weather, dairy animals reduce their feed intake to decrease metabolic heat production. Lower intake of energy and nutrients subsequently results in reduced milk production. Milk composition, including fat and protein content, may also be adversely affected under prolonged heat and nutritional stress.

2. Reduced growth and meat production

Heat stress caused by El Niño adversely affects the growth and meat production of livestock. During periods of high environmental temperature, animals divert more energy towards maintaining normal body temperature than growth.

3. Effect on poultry production

Poultry are particularly sensitive to high environmental temperatures. Heat stress reduces

feed intake and growth rate in broilers. In laying birds, it can reduce egg production, egg weight and shell quality. Extreme heat may also increase mortality, particularly when poultry houses lack adequate ventilation and cooling arrangements.

4. Reduction in reproductive efficiency

Reduced fertility has important long-term economic consequences. Lower conception rates, embryonic losses, reduced semen quality and prolonged calving intervals can reduce the number of offspring produced and consequently decrease lifetime productivity.

5. Feed and fodder shortage

El Niño-induced drought can significantly reduce pasture growth and the availability of green fodder. Crop failures also decrease the supply of crop residues commonly used as livestock feed. The resulting feed scarcity increases production costs and often forces farmers to rely on poor-quality feed.

6. Increased cost of livestock production

El Niño can increase livestock production costs through higher expenses for feed, water, cooling, veterinary care, disease prevention, vaccination, and infrastructure repair. Combined with reduced animal productivity, these added costs can significantly reduce farm profitability.

7. Effects on fisheries and aquatic production

During El Niño, reduced upwelling decreases the availability of nutrients in affected areas. Changes in water temperature and food availability can cause fish populations to shift their geographical distribution.

Effects of El Niño on Wildlife Health

Wild animals are intimately connected with their habitats and are therefore particularly sensitive to rapid environmental changes (Parmesan *et al.*, 2009).

1. Loss of food and water resources

Drought reduces vegetation, water availability and prey populations, causing nutritional stress in herbivores and indirectly affecting carnivores. Animals may also travel longer distances for food and water, increasing energy expenditure and exposure to additional risks.

2. Habitat alteration

Droughts, floods, wildfires and storms associated with climatic extremes can modify or destroy wildlife habitats. Forest fires may kill animals directly or destroy nesting and feeding sites. Floods can inundate terrestrial habitats, while drought can cause wetlands and seasonal water bodies to shrink or disappear.

3. Changes in migration and distribution

Many wild animals time their migration and reproduction according to environmental cues such as temperature, rainfall and food availability. El Niño can disturb these cues. Birds, marine mammals and fishes may alter their distribution in response to changes in temperature and food resources (Srygley *et al.*, 2010). Such changes can affect breeding success and survival.

4. Increased wildlife–livestock interaction

During drought, both wild and domestic animals may congregate around the limited remaining sources of water and pasture (Acosta-Jamett *et al.*, 2016). This increases contact between wildlife and livestock. Such interactions are important from a One Health perspective because they may facilitate the transmission of pathogens between wildlife, livestock and, in some circumstances, humans. Competition for limited resources may also increase human–wildlife conflict.

5. Changes in disease ecology

Changes in rainfall and temperature influence not only wildlife hosts but also pathogens and vectors. Mosquitoes, ticks and other arthropods may expand or contract their populations depending upon environmental conditions.

6. Effects on marine wildlife

Warmer surface water and reduced nutrient upwelling can reduce phytoplankton productivity in affected areas. Predators that depend upon particular fish species may consequently experience food shortages and reduced breeding success. Unusually warm seawater can also contribute to coral bleaching. Therefore, degradation of coral ecosystems can have long-lasting effects on marine biodiversity.

Possible Mitigation Strategies

El Niño cannot be prevented, but its effects on animals can be considerably reduced through early warning, preparedness and climate-resilient livestock and wildlife management.

1. Strengthening early-warning systems

Modern oceanic and atmospheric monitoring allows El Niño events to be forecast months in advance, enabling early preparedness. Timely climate advisories can help farmers, veterinarians and wildlife managers secure feed and water, improve shelters, strengthen disease surveillance and vaccination, and prepare emergency response plans.

2. Heat-stress management

Livestock should be protected from direct sunlight by providing adequate shade and well-designed shelters with proper ventilation and air

circulation. Where feasible, cooling measures such as fans, sprinklers, or foggers should be used to reduce heat stress.

3. Ensuring adequate drinking water

Animals must have continuous access to clean and cool drinking water during hot weather. Water harvesting, farm ponds and suitable storage systems can improve preparedness for drought. Water sources should be protected from contamination, particularly following floods.

4. Fodder conservation and feed banks

Fodder should be conserved during periods of surplus in the form of hay and silage. Community fodder banks can provide valuable support during prolonged drought. Drought-tolerant fodder crops and locally adapted forage species should be promoted. Crop residues can also be scientifically processed and supplemented to improve their nutritional value.

5. Strategic nutritional management

During periods of heat and fodder scarcity, diets should be formulated to provide adequate nutrients despite reduced dry-matter intake. Balanced supplementation of energy, protein, minerals and vitamins is important. Feeding schedules can be shifted towards cooler periods of the day to encourage feed consumption.

6. Disease surveillance and preventive healthcare

Veterinary authorities should strengthen disease surveillance before, during and after El Niño events for early detection and control of outbreaks. Key measures include timely vaccination, parasite and vector control, monitoring emerging diseases, rapid diagnosis and reporting, adequate veterinary supplies, and improved farm biosecurity. Wildlife surveillance is also important, especially in areas with frequent livestock–wildlife interactions.

7. Climate-resilient livestock production

Locally adapted breeds often possess greater tolerance to heat, diseases and limited feed resources than highly specialized exotic breeds. Conservation and improvement of indigenous genetic resources can therefore contribute to long-term climate resilience. Breeding programmes should increasingly consider heat tolerance, disease resistance and adaptability along with conventional production traits.

8. Flood preparedness

In flood-prone areas, livestock evacuation plans and identification systems should be established in advance. Safe elevated shelters, emergency feed, clean water, veterinary supplies and transport arrangements should be prepared. Carcasses should be disposed of safely after disasters

to minimize environmental contamination and disease risk.

9. Wildlife conservation measures

Wildlife managers should identify habitats and species that are particularly vulnerable to drought, floods, fires and changes in food resources. Protection and restoration of natural water bodies, wetlands, forests and wildlife corridors can improve ecosystem resilience. During severe drought, management of critical water resources may be necessary in selected protected areas, based on ecological assessment. Disease surveillance at wildlife–livestock interfaces should also be strengthened.

10. Adoption of a One Health approach

The consequences of El Niño demonstrate the close relationship between animal health, human health and environmental health. Therefore, veterinarians, medical professionals, meteorologists, agricultural scientists, ecologists, wildlife experts

and public-health authorities should work together. A coordinated One Health approach can improve early detection of disease, information sharing, risk assessment and response to climate-associated health threats (Singh *et al.*, 2024).

Conclusion

El Niño is a major climate phenomenon that can affect livestock, wildlife, fisheries, and animal health through changes in temperature, rainfall, water and feed availability and disease patterns. Although El Niño cannot be prevented, its impacts can be minimized through early-warning systems, climate-resilient animal management, adequate water and feed supply, preventive healthcare, disease surveillance and habitat conservation. Integrating climate forecasting with veterinary and One Health approaches can improve preparedness, reduce losses and strengthen resilience of animal production and wildlife ecosystems.

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