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Rinderpest eradication and the resilience of African pastoralism

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Rinderpest eradication is often presented as a landmark in veterinary public health; less systematically examined are its medium- and long-term implications for pastoral systems that rely on mobility and collective rangeland use. This narrative review synthesises historical and contemporary evidence on (i) how rinderpest shocks interacted with pastoral livelihoods during the African pandemic and subsequent outbreaks, and (ii) how eradication-era approaches to surveillance, vaccination logistics and field delivery shaped later models for controlling transboundary animal diseases. It is argued that the same features underpinning pastoral resilience–mobility, flexible herd management, and social networks–may also increase disease exposure and hinder sustained access to veterinary services, particularly where service delivery models remain campaign-centred and externally financed. Although the eradication of rinderpest produced substantial welfare gains, these benefits were uneven and were often limited by the ongoing burden of other infectious diseases (e.g., peste des petits ruminants, foot-and-mouth disease) and by under-resourced routine animal health systems. Lessons for current eradication initiatives can be drawn: credible surveillance needs to be embedded within locally legitimate institutions; vaccination strategies should be aligned with seasonal mobility and market networks; and enabling environments for Community Animal Health Workers are essential to sustain coverage beyond time-limited programmes. These insights help reposition rinderpest eradication as both a success story and a cautionary case for designing equitable, durable animal health services in pastoral settings following a One Health approach.

KEYWORDS

African pastoralism, eradication, one health, rinderpest, technical cooperation

Introduction

Pastoralism is a form of economic and social system that uses herd mobility to make productive use of arid and semi-arid environments characterised by climatic variability.

Pastoralism has at times been framed in policy and development debates as an 'archaic' or low-productivity system; however, a substantial body of rangeland and development scholarship documents pastoralism as a rational, adaptive and often highly productive livelihood in drylands (Krätli and Schareika, 2010; Byakagaba et al., 2018). Pastoralism is a pillar of African rural economies through milk and meat production, associated value chains and mutual-aid mechanisms that buffer climatic and market shocks (Behnke et al., 1993; Homewood, 2008; Hesse and Catley, 2023). Mobile livestock husbandry tends to thrive where settled agriculture is ecologically constrained (Cecchi et al., 2015). Pastoral societies have also developed customary institutions for managing pastures and water and long-standing relationships with markets and political authorities (Chao et al., 2025).

Pastoralism contributes beyond the "farm-gate" value of livestock: processing, trade and services generate income and support food and nutritional security (Homewood and Rodgers, 1991; Ensminger, 1992; Homewood, 2008). Seasonal mobility remains central to exploiting variable water and forage resources and sustaining productivity in savanna systems (Behnke et al., 1993; Hesse and Catley, 2023).

Mobility and flexible herd management buffer dryland shocks, but can also increase infectious-disease exposure and make routine delivery of vaccination and clinical services harder. This tension is central to understanding rinderpest impacts and post-eradication service design (Barrett and Rossiter, 1999; McVety, 2018).

Rinderpest caused severe symptoms and high lethality in susceptible herds (Barrett and Rossiter, 1999).

From an eco-epidemiological perspective, seasonal congregation at watering points likely amplified contact between domestic cattle and wild ungulates in several savanna systems (Plowright, 1982; Prins and Weyerhaeuser, 1987; Marquardt, 2005).

The great African pandemic of 1888–1897 marked a watershed for pastoral economies: an outbreak of rinderpest South of the River Zambezi killed about 5.2 million cattle. In sub-Saharan Africa, rinderpest outbreaks resulted in the death of 90% of domestic oxen (Phoofolo, 2003; Ndow et al., 2019). The resulting famine, both from loss of livestock and diminished agricultural produce, led to significant mortality among Ethiopian and Maasai populations (Pankhurst, 1966; McVety, 2018). The most recent interpretations, avoiding mono-causal explanations, frame rinderpest as a multiplier of vulnerability in contexts already marked by conflicts, climatic shocks and post-colonial transformations (Gilfoyle, 2003). This perspective also aligns with analyses of uneven trajectories in animal-health investments across regions and production systems, including the notion of persistent "cold spots" where routine services remain limited and disease burdens concentrate (Perry and Grace, 2009). Such framings are important because they shift attention from campaign success alone to the political and infrastructural conditions that sustain equitable coverage.

For African pastoralism, rinderpest operated along multiple channels. The destruction of animal capital directly affected incomes, household assets and bridewealth or dowry systems. Disruption of flows of meat, milk and animal draught power reallocated labour towards precarious subsistence activities. Coercive control measures–quarantines, sanitary culling ("stamping out"), movement barriers–when not contextualised to pastoral mobility, further eroded livelihoods and social cohesion (Hutcheon, 1897; Gilfoyle, 2003; Schneider, 2012). In short, rinderpest constituted a systemic risk, capable of simultaneously undermining production, exchange and community institutions. Beyond recounting eradication milestones, we use rinderpest as a lens on how mobility, market integration and governance shape pastoralists' exposure to infection and access to veterinary services–tensions that remain central for equitable One Health programming.

In this review, "One Health" (Zinsstag et al., 2011) is used in a pragmatic sense: rinderpest and its eradication affected not only animal health, but also human nutrition and income (through milk/meat and draught power), wildlife health and conservation (through spillover to wild ungulates), and ecosystem governance (through how mobility corridors, grazing access and water points were regulated). We therefore treat One Health as a lens for assessing whether disease-control strategies were equitable and durable across mobile populations, and whether eradication investments translated into routine capacities that can manage multi-disease burdens at livestock–wildlife–human interfaces.

The 20th century international response increasingly relied on coordinated vaccination and surveillance programmes (e.g., the Joint Project 15, JP15 and The Pan-African Rinderpest Campaign, PARC), discussed in detail below (Tambi et al., 1999; FAO, 2010).

However, many of the positive outcomes depended on time-limited, campaign-style delivery platforms and did not always translate into robust routine services for other endemic diseases. The historic milestone came in 2011 (Figure 1), when the Food and Agriculture Organization of the United Nations (FAO) and Office International des Épizooties (OIE; now World Organisation for Animal Health, WOAH) jointly declared the global eradication of rinderpest (FAO, 2010; Taylor et al., 2022). The milestones in Figure 1 and the programme sequence summarised in Table 1 also show how progress depended on repeated shifts in delivery models and governance arrangements–not vaccines alone.

Rather than treating rinderpest eradication as a purely veterinary milestone, this narrative review asks what it meant on the ground for people whose livelihoods depend on livestock mobility in Africa's drylands. Our guiding question is: how has rinderpest eradication affected pastoral resilience in African drylands? Here, we use "resilience" to mean the ability of pastoral systems to withstand shocks, adjust through mobility and herd management, and rebuild livelihoods over time. We address this question by tracing evidence along three connected threads: first, how successive rinderpest shocks shaped pastoral livelihoods during the African pandemic and later outbreaks; second, how surveillance, vaccination and delivery platforms developed during eradication interacted with mobility, institutions and markets; and third, what the eradication

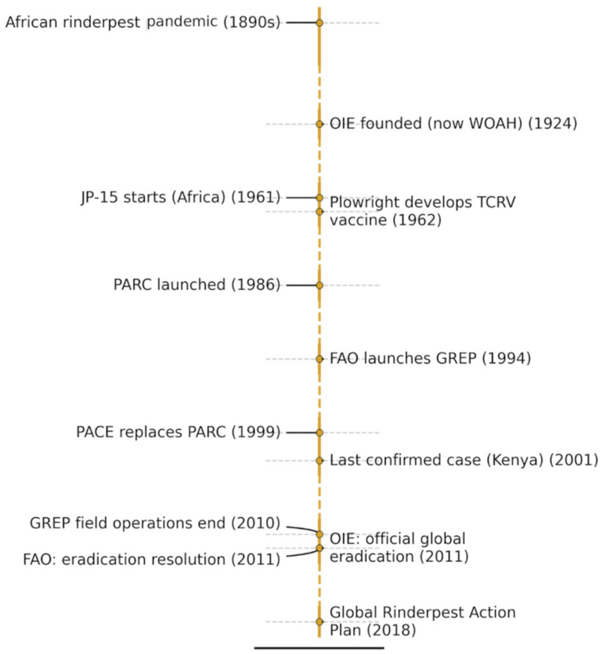

FIGURE 1
Milestones in the history of rinderpest.

legacy did–or did not–translate into in terms of routine animal-health services, especially those now central to One Health challenges. The paper therefore begins with the ecological and institutional logic of pastoralism, moves to a review of rinderpest epidemiology and its historical spread, and concludes by examining how eradication strategies influenced post-eradication service capacity and equity.

This narrative review drew on targeted searches of multidisciplinary sources (veterinary history, epidemiology, rangeland ecology and policy). We consulted PubMed and institutional repositories (FAO, WOAH/OIE, AU-IBAR) using combinations of terms such as "rinderpest", "pastoralism", "mobility", "surveillance", "vaccination campaign", "CAHW", "PPR" and "FMD". The search prioritised African material from the late 19th century to 2025, complemented by seminal historical accounts and programme evaluations. Sources were included when they provided empirical evidence or authoritative synthesis on (i) livelihood impacts of rinderpest shocks, (ii) campaign design and delivery in pastoral settings, or (iii) post-eradication institutional legacies relevant to other transboundary animal diseases.

The intertwining of African pastoralism and rinderpest highlights four main findings: (i) pastoralism is an economic engine and a social architecture of resilience in climatically hostile environments; (ii) rinderpest exploited–and at the same time undermined–the ecological logic of mobility, becoming a vector of systemic impoverishment; (iii) for pastoral societies the disease represented an existential risk, capable of destabilising production, exchange and institutions; (iv) eradication provides a concrete test of whether campaign investments can be converted into equitable, routine animal-health services for mobile pastoral populations–an issue central to contemporary One Health challenges. Eradication generated substantial benefits, but gains were uneven and often constrained by persistent endemic infections, limited access to routine veterinary services and recurrent shocks (drought, insecurity and market volatility). These constraints matter for designing equitable programmes from a One Health perspective (FAO, 2010; Taylor et al., 2022). The following sections therefore examine both the historical spread of rinderpest and the institutional legacy of eradication for contemporary service delivery in pastoral settings.

Pastoralism in the savanna economy

The origins of pastoralism in Africa date back to the Neolithic domestication of cattle, goats and sheep (Marshall and Hildebrand, 2002; Gifford-Gonzalez and Hanotte, 2011) and subsequently, of dromedaries and camels (Almathen et al., 2016). Pastoral production expanded particularly in arid

TABLE 1 Major anti-rinderpest programmes.

Programme	Years	Lead institutions	Core components	Notes/outcomes
Joint Project 15 (JP15)	1961–1976	Regional partners (Africa); international donors	Phased regional vaccination across the intertropical belt	Incidence reduced but residual foci remained; later recrudescence in the 1980s (FAO, 2011)
Pan-African Rinderpest Campaign (PARC)	1986–1998	OAU-IBAR with major EU support; PANVAC for vaccine quality control	Mass vaccination; vaccine quality control; surveillance; quarantine; epidemiology & diagnostics	Benefit–cost ≈1.83:1 (Tambi et al., 1999); strengthened veterinary services (FAO, 2011)
Pan-African Programme for the Control of Epizootics (PACE)	Late 1990s–2000s	African partners; international support	Consolidation of PARC gains; systems strengthening	Bridged to verification phase (FAO, 2011)
Somali Ecosystem Rinderpest Eradication Coordination Unit (SERECU)	2000s	AU-IBAR/SERECU	Final verification of absence of viral circulation in the Horn of Africa	Crucial for final proof of freedom (AU-IBAR/SERECU, 2007; FAO, 2011)

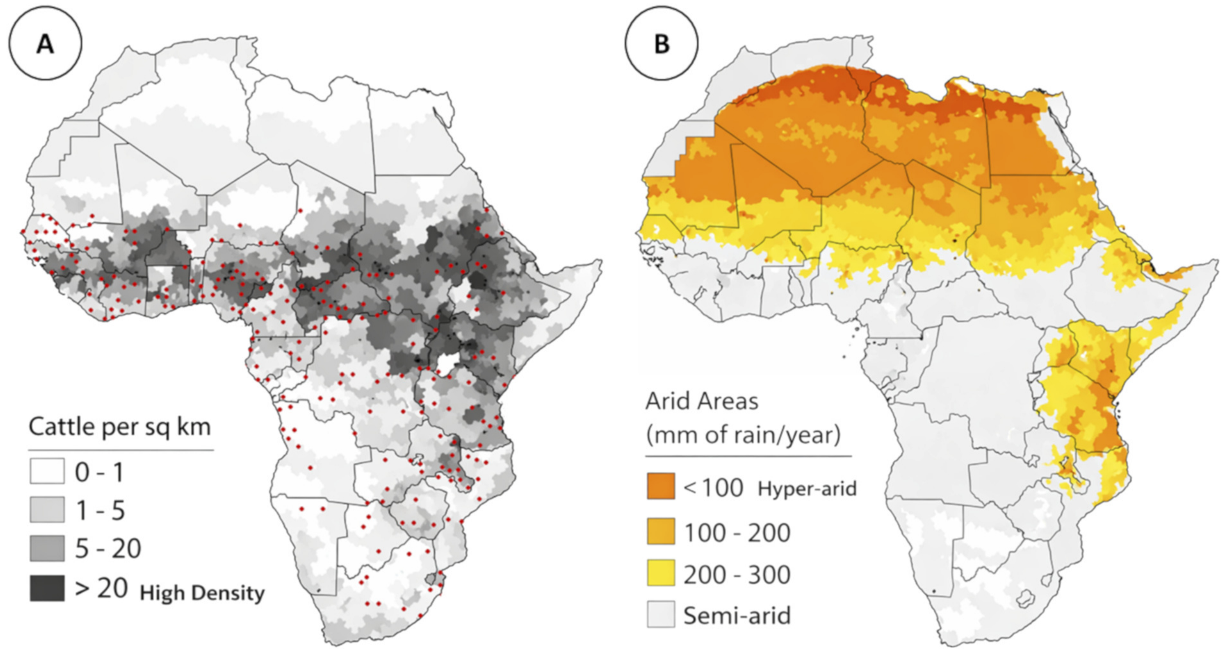

FIGURE 2
(A) Cattle density per square kilometre (data from: (Robinson et al., 2014) and tsetse fly distribution. Red dots indicate the presence of *Glossina* spp. (data from: Cecchi et al., 2015; Cecchi et al., 2024); **(B)** Annual precipitation (mm/year) (data from: Karger et al., 2017).

and semi-arid regions where rain-fed agriculture is constrained (Behnke et al., 1993; Homewood, 2008). Groups such as the Fulani, Maasai and Tuareg developed subsistence models centred on seasonal mobility to exploit resources that are scattered in space and variable across seasons (Dyson-Hudson and Dyson-Hudson, 1980; Homewood and Rodgers, 1991). In broad terms, this corresponds to African drylands where annual rainfall is often below 1,000 mm (Homewood, 2008; UNCCD, 2009; Siebert, 2014; IPCC, 2023). Pastoralism decreases in more humid tsetse-infested zones, where trypanosomiasis limits economically sustainable livestock husbandry (Figure 2A) while rainfall gradients structure where and when herds can concentrate and move (Figure 2B), (Cecchi et al., 2015). Together, these ecological constraints help explain why mobility is not optional but constitutive of production–hence why vaccination and surveillance must be designed around seasonal calendars rather than fixed facilities.

On the social and organisational level, pastoralism and the consequent way of life lend themselves to multiple interpretations. One of the most convincing identifies two fundamental components: the relationship of interdependence between human and animal and the capacity of herders to adapt to environmental requirements (Dyson-Hudson and Dyson-Hudson, 1980; Homewood, 2008). The term "pastoralism" refers both to an economic activity and to a cultural identity, but the latter does not necessarily imply the former. From an economic perspective, pastoralism is a system of animal production that exploits the characteristic instability of rural environments, in which key resources such as feed and water for livestock become available for short and largely unpredictable periods (Behnke et al., 1993). The crucial aspects of pastoral specialisation are: (i) the interaction between people, animals and environment, in particular the strategic mobility of herds and selective feeding; (ii) the development of flexible systems of resource management, in particular institutions for the collective management of land and non-exclusive rights to water resources (Dyson-Hudson and Dyson-Hudson, 1980; Ensminger, 1992; Hesse and Catley, 2023).

In public discourse, African pastoralists have often been portrayed as a marginal population, visible mainly during drought, conflict or other compound crises. Media depictions of emaciated animals and displacement can obscure the fact that mobility is a rational strategy for managing variability in water and forage, and that pastoralism supports markets and food security across dryland regions. Yet repeated shocks–especially those linked to climate change–can erode households' ability to recover and to reintegrate into seasonal transhumance cycles, pushing some into long-term settlement and precarious wage labour (FAO, 2022; IPCC, 2023).

Pastoral systems persist in drylands because they exploit spatiotemporal variability: mobility allows herds to track patchy resources, while flexible herd composition and reciprocal social arrangements spread risk (Meillassoux, 1963;

Galaty and Bonte, 1991; Homewood, 2008). These mechanisms buffer climatic shocks, but also have epidemiological implications: communal grazing and seasonal aggregation around water and markets can facilitate transmission and reduce the feasibility of static, facility-based service delivery. Effective animal health strategies therefore require service models aligned with mobility calendars and co-produced with locally legitimate institutions (Dyson-Hudson and Dyson-Hudson, 1980; Homewood and Rodgers, 1991; Behnke et al., 1993). Beyond disease-specific campaigns, sustained gains depend on routine platforms for vaccination follow-up, outbreak reporting, and basic clinical care functions that often require trained paraprofessionals and CAHWs operating within an enabling regulatory and supervisory framework.

Rinderpest

Rinderpest, also known as cattle plague and, more rarely, as steppe murrain (Scott, 1976), was a highly contagious and often lethal infectious viral disease that mainly affects domestic cattle, yaks, wild African buffaloes (*Syncerus caffer*) and Asian water buffaloes (*Bubalus bubalis* and *B. arnee*) but also other domestic ruminants such as camelids, sheep and goats (Baron, 2025). Wild ruminants can also become infected, generally developing a milder form of the disease, while nonetheless playing an important epidemiological role in the transmission cycle; wild swine can also be infected and show symptoms (Barrett and Rossiter, 1999; Baron, 2025).

In the advanced stages rinderpest caused severe cachexia that rapidly led to the animal's death (Barrett and Rossiter, 1999).

The German physician Johann Kanold (1679-1729), working in Prussia, recognised the contagious nature of rinderpest. In 1711, he reported that the disease was transmissible and that cattle recovering from infection became resistant. The first scientific description of the disease was drawn up in 1712 by the Italian physician Bernardino Ramazzini (1633-1714), professor at the University of Padua (Wilkinson, 1984; Youde, 2013). In 1902 the microbiologist Maurice Nicolle and the veterinarian Mustafa Adil-Bay at Imperial Bacteriological Laboratory in Constantinople (Nicolle and Adil-Bey, 1902; Sarı and Yavuz, 2025) demonstrated the viral aetiology of the disease (Barrett and Rossiter, 1999; McVety, 2018; Franco, 2020).

The causal agent of cattle plague (rinderpest virus, RPV) is an RNA virus classified in the genus Morbillivirus (ICTV, 2025), belong to the subfamily Orthoparamyxovirinae in the family Paramyxoviridae (Seki and Takeda, 2022), a small group of closely related viruses, each responsible for severe diseases in different mammals. RPV is closely related to the viruses causing peste des petits ruminants (PPRV), canine distemper (CDV), and measles (MeV) (Marrana et al., 2024).

It is possible that all known morbilliviruses share a common ancestral origin; however, the genetic homologies between MeV and RPV are greater than those found among other morbilliviruses. A relaxed-clock Bayesian analysis indicates that rinderpest and measles viruses, despite their close kinship, became distinct viruses in the 11th–12th centuries, contradicting, in the case of RPV, claims of an origin as early as cattle domestication (Furuse et al., 2010).

These viruses share a similar infection cycle, characterised by continuous transmission from infected individuals to susceptible ones. In closed populations, where most adults have acquired immunity after recovery, persistence and viral circulation are maintained through the constant introduction of new susceptibles via births; for this to occur, the host population must be sufficiently large and interconnected (Barrett and Rossiter, 1999).

The disease has an ancient history: the oldest description of a disease, suspected to be rinderpest, is found in the Veterinary Papyrus of Kahun written about 4,000 years ago (Yamanouchi, 2012). Central Asia is considered the ancestral cradle of the disease, from which it probably spread to Europe, carried by animals accompanying the Huns in the 4th century (McVety, 2018).

There is evidence of alternating disappearances and reappearances of the disease from the 10th to the 16th century, with a marked recrudescence during the Thirty Years' War (1618-1648), when cattle from the eastern steppes were moved to supply the armies. The virus also spread eastwards, reaching Siberia, Mongolia, Manchuria, China, India, the Korean peninsula and Japan (McVety, 2018).

The devastating impact of this pandemic on cattle populations is recognised, throughout human development, as one of the main factors that limited animal production. Consequently, rinderpest significantly influenced the availability of livestock for food, work, agricultural development, transport and human migrations (Table 2). In Europe alone it is estimated that over 200 million cattle died of cattle plague during the 18th century (Barrett and Rossiter, 1999; McVety, 2018).

Emmanuel Leclainche, one of the founding figures of the OIE, stated in his foundational work on the history of veterinary medicine that "Epidemics and epizootics have influenced the life of all peoples [. . .]. It is certain that epizootic diseases have significantly affected the migrations of pastoral populations, forced to seek new pastures, fleeing from permanent sources of infection. It is probable that the Indo-Aryans, settling in Central Asia, sought to escape bovine plague or other infections" (Leclainche, 1936).

For centuries, rural and urban areas of Europe and Asia were repeatedly devastated by the disease, without there being any effective containment actions. Only when the alarm was raised by mass deaths in the papal herds did Pope Clement XI appoint his personal physician, the Pontifical Archiater Giovanni Maria Lancisi, to elaborate and formalise appropriate control measures (Mantovani and Zanetti, 1993).

His foundational work *Dissertatio Historica De Bovilla Peste* (Lancisi, 1713) laid the bases of modern veterinary epidemiology

TABLE 2 Rinderpest risk channels and impacts.

Risk channel	Immediate impact	Downstream livelihood effects	References
Livestock mortality & morbidity	Loss of animal capital; collapse in milk and meat supply	Breakdown of reciprocity and bridewealth transfers; food insecurity and indebtedness	Pankhurst (1966), Barrett and Rossiter (1999), McVety (2018)
Mobility restrictions & coercive controls	Quarantines, sanitary culling (stamping out), barriers to movement	Erosion of transhumance corridors; higher transaction costs; reduced market access	Hutcheon (1897), Gilfoyle (2003), Schneider (2012)
Ecological interface at watering points	High wildlife–livestock contact; amplification of transmission	Epidemic front advancement across savannas aligned with rainfall-driven congregation	Plowright (1982), Prins and Weyerhaeuser (1987), Marquardt (2005)
Market and labour disruptions	Loss of animal traction; collapse of trade flows for meat and milk	Labour reallocation to precarious subsistence; reduced household incomes	Ensminger (1992), Homewood (2008)

and of the fight against infectious diseases of domestic animals–principles that remain current despite advances in scientific knowledge (Wilkinson, 1984; Mantovani and Zanetti, 1993; Youde, 2013).

The need to control cattle plague, because of its catastrophic economic impact on livestock husbandry, led to the founding of the first two veterinary schools in the world in France: Lyon (1761) and Alfort (1765) (Yamanouchi, 2012). Moreover, rinderpest was the first of the nine "priority" diseases listed at the founding of the OIE, which took place in Paris on 25 January 1924 (McVety, 2018).

The founding act (OIE, 1924) established that "Governments shall telegraph to the Office [. . .] notification of the first confirmed cases of bovine plague or foot-and-mouth disease in a country or in a previously disease-free region; [. . .] at regular intervals, bulletins drafted according to a model adopted by the Committee, providing information on the presence and extent of the diseases included in the following list: cattle plague, rabies, foot-and-mouth disease, glanders, contagious bovine pleuropneumonia, dourine, anthrax, swine fever, sheep pox".

This early mandate combined supranational coordination with explicit safeguards for state sovereignty, a balance that has remained central to international animal health governance (OIE, 1924).

In 2011, FAO and OIE officially declared rinderpest eradicated worldwide, marking the culmination of decades of coordinated global action (FAO, 2011; Taylor et al., 2022).

In June 2019, the last declared residual stock of RPV was destroyed at the Pirbright Institute, UK (Pirbright_Institute, 2019). Post-eradication risk management now focuses on secure sequestration and progressive destruction of rinderpest virus-containing material (RVCM) held in a small number of authorised high-biocontainment facilities (Budke et al., 2022).

Rinderpest in Africa

The rinderpest pandemic in Africa, which spread at the end of the 19th century, became a defining event because of its impact on indigenous communities, domestic animals, wildlife, settlers,

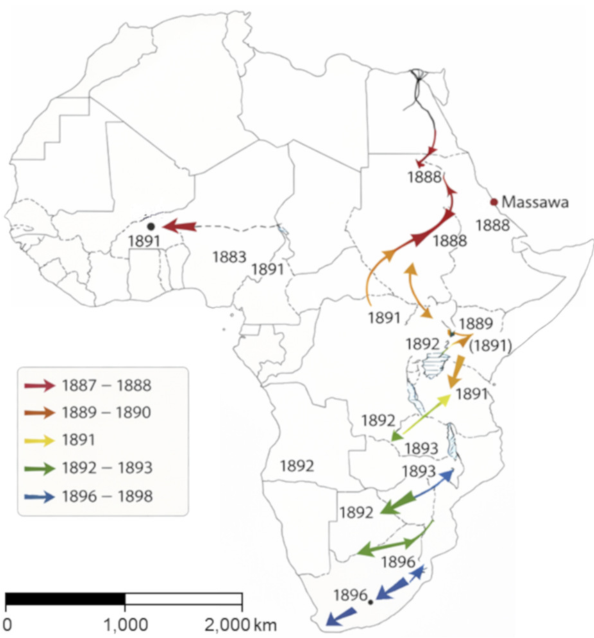

FIGURE 3
Approximate spread of the African rinderpest pandemic (1888–1898), starting from Massawa (present-day Eritrea) and extending across eastern, central, western and southern Africa (data from: Taylor et al., 2022).

administrators, colonial officials and the ecology of the African savannas (Plowright, 1982; Morens et al., 2011; Sunseri, 2018).

Although it is clear that this epidemic did not represent the first appearance of the disease in Africa, the enormous number of animals killed at the turn of the twentieth century made this the most dramatic and widespread event ever recorded on the continent; it also contributed to the famine described in the most realistic and in-depth manner by Pankhurst for Ethiopia (Pankhurst, 1966).

The previous waves of rinderpest in Africa were most likely caused by the introduction of livestock from Europe and Asia, regions in which the disease was widespread between the 17th and 18th centuries; however, the disease remained relatively contained and appears to have undergone spontaneous, near self-limiting extinction in some settings (Rowe and Hødnebø, 1994; Sunseri, 2018).

Descriptions of episodes attributable to rinderpest in Egypt and in other countries are recorded already at the beginning of the 19th century, but the virus never spread in so extensive and destructive a manner as during the great African rinderpest pandemic (Rowe and Hødnebø, 1994; Sunseri, 2018).

It is now a widely accepted view that in 1885 an Italian expeditionary force occupied the port of Massawa (present-day Eritrea); following the importation of infected cattle from India to supply these troops, the virus entered the continent in 1888 and subsequently spread (Morens et al., 2011; Sunseri, 2018) with an epidemic front advancing thousands of kilometres in just a few years. The rapid westward and southward advance of the epidemic front (Figure 3) reflects the connectivity of trade routes and transhumance systems, reinforcing the risk-channel synthesis in Table 2 that links mobility, market nodes and watering point congregation to accelerated transmission.

Although the chronology of spread remains important, the main explanatory issue is not simply where the virus moved next, but why transmission proved so efficient across some regions and slowed in others.

At the time, conditions were clearly favourable for large-scale dissemination, and the introduction of the disease into the Horn of Africa appears to have triggered the wider pandemic spread (Sunseri, 2018).

Military expeditions, the herds of the colonies and of the indigenous communities, and wildlife–in particular buffalo and antelope–propagated the virus across the continent; the geography of the Sudan played a crucial role, offering a corridor westwards along the routes of nomadic herds and of trade flows (Rowe and Hødnebø, 1994; Sunseri, 2018).

Meanwhile, the disease spread rapidly in eastern Africa until it met the ecological barrier of the miombo woodlands (*Brachystegia* spp.) in the present-day United Republic of Tanzania, where it halted temporarily. The disease flared up again subsequently–probably carried by wildlife–eventually reaching Zimbabwe and South Africa and leaving behind a trail of dead animals, human suffering and devastation (Plowright, 1982; Prins and Weyerhaeuser, 1987; Marquardt, 2005).

The disease then took root in some parts of Africa (Eastern, Central and Western), with periodic outbreaks in the following decades (Plowright, 1982; Morens et al., 2011).

West and Central Africa also illustrate the long tail of rinderpest dynamics and the uneven geography of control. Residual foci after JP15 and the mid-1980s recrudescence in West Africa underscore how gaps in routine surveillance and vaccination could re-seed outbreaks across interconnected Sahelian trade and transhumance systems. In these settings–including Fulani/Peul pastoral zones spanning multiple national borders–effective control depended less on fixed territorial quarantines than on negotiated access to herds, market-linked reporting and synchronised cross-border action (Roeder and Rich, 2009).

Beyond this chronology, the African rinderpest pandemic is best understood through the interaction of ecology, mobility and political economy. Environmental variability, geography and animal movements–including trade, military logistics and pastoral mobility–interacted with livestock–wildlife interfaces to shape the speed and direction of spread. In particular, rainfall variability concentrated domestic cattle and wild ungulates at shared watering points, where intensified contact and exposure to infectious material created repeated opportunities for transmission. Animals infected at these sites could then carry the virus onward along roads, tracks and open rangelands, accelerating the epidemic front across connected savanna systems (Plowright, 1982; Prins and Weyerhaeuser, 1987; Marquardt, 2005). This mechanism corresponds to the ecological interface risk channel summarised in Table 2 and helps explain why high-contact nodes and seasonal congregation windows are relevant not only to understanding historical spread of rinderpest, but also to contemporary PPR and FMD control.

The words of the South African Minister of the time vividly illustrate this mechanism of contagion linked to the watering points (cit. in Marquardt, 2005): "There are three watering points there: Maritsani, the Setlagoli basin and the Maribogo River [. . .] at each of these centres more than 12,000 head of cattle water. They come from a radius of eight–ten miles and traverse the same ground to reach the water. Now the only plan would be to kill every animal that drinks there, but the government hesitates despite the increasing revenues".

The dialectical relationship between pastoralism and rinderpest

The relationship between pastoralism and rinderpest was not simply one of exposure to infection. It was mediated by mobility systems, colonial governance, veterinary knowledge and the social legitimacy of control measures. Earlier interpretations often personalised blame or relied on rumours and culturally biased explanations, obscuring the material mechanisms through which the disease spread and the unequal burdens imposed by control. A more useful reading is therefore to see rinderpest as both an epidemiological event and a crisis of governance: one that exposed the limits of coercive quarantines, fixed territorial controls and poorly contextualised veterinary interventions in mobile pastoral settings (van Onselen, 1972; Gilfoyle, 2003; Schneider, 2012).

van Onselen (1972) addressed various aspects of the disease, reporting different interpretations of the spread of the pandemic, often in the form of narratives and rumours. These stories frequently fuelled local unrest and hostility between colonisers and herders: some Europeans believed that the disease was spread by Africans, while the latter were convinced that rinderpest was a product of the cruelty and arrogance of the European settlers.

Contemporary accounts provide important insights into the social, economic, political and veterinary responses to the disease, but there seems to have been little effort to understand the technical mechanisms of the spread of rinderpest (Gilfoyle, 2003).

Not infrequently, interpretations of the epidemic called upon an autonomous entity: an animistic and anti-scientific worldview, still widespread in sub-Saharan Africa at the end of the 19th century. This perspective allowed colonial authorities and institutions to avoid engaging in disease-control activities or to do so with little determination (van Onselen, 1972).

Had such control activities been implemented more effectively, they might have limited cattle mortality or at least reduced the scale of the damage.

However, in some cases effective measures were imposed. A clear example is the containment system adopted in Namibia, where the authorities established quarantine corridors/cordon fences around the pastoral territory known as "Hereroland" (Schneider, 2012). In South Africa stamping out (sanitary culling) was also used (Hutcheon, 1897).

Over time, in line with advances in knowledge, interpretations moved away from mono-causal explanations, contextualising the effects of the disease and adopting more scientific approaches (Gilfoyle, 2003).

Consequently, rinderpest came to be understood as one of the many factors responsible for the poverty of the time and as a component of a complex history of social, economic, political and environmental challenges faced by sub-Saharan Africa.

Among the few Authors who undertook this retrospective inquiry, Gilfoyle (2003) stands out for the clarity of method and the holistic approach: he highlighted the technical and scientific aspects and focused attention on how rinderpest steered veterinary science in new directions up to bringing about the containment of the disease (Gilfoyle, 2003).

By the second half of the 20th century, the literature began to reflect a more balanced understanding of the spread of rinderpest and its consequences. In Africa, the first counter-actions were carried out in various phases and on territories corresponding to aggregations of nations and/or colonies. It is important to remember that this took place at a time when many liberation and independence movements were engaged in armed struggles, with entirely different priorities.

At the beginning of the 1960s, some international donors decided to support a regional vaccination programme against rinderpest in Africa. Between 1961 and 1976, six phases of the Joint Project 15 (JP15) (Figure 1; Table 1) were carried out in the intertropical belt. This overall initiative significantly reduced the incidence of the disease, coming very close to eradication. However, despite the belief that the disease had disappeared, some herds remained infected and these residual outbreaks inevitably led to a recrudescence of rinderpest in West Africa in the mid-1980s (FAO, 2010).

From 1986 to 1998, JP15 was followed by the Pan-African Rinderpest Campaign (PARC), developed by the Organisation of African Unity–Interafrican Bureau for Animal Resources (OAU-IBAR) and largely supported by the European Commission; implemented from 1986 to 1998. This campaign aimed to eradicate the disease from the African continent through technical assistance, mass vaccinations, vaccine quality control (with the support of the Pan-African Veterinary Vaccine Centre–PANVAC), epidemiological and diagnostic research, and quarantine areas (Tambi et al., 1999; FAO, 2010; Tounkara et al., 2011).

We also recognise that campaign delivery can impose short-term burdens on mobile communities–through opportunity costs, altered movement decisions, or tensions around enforcement and compliance. In settings where rinderpest was not perceived as the primary constraint on livelihoods, such disruptions could affect trust and participation. These trade-offs underscore the value of delivery platforms that are socially legitimate, locally mediated, and coupled to routine services rather than standing alone as episodic campaigns. Eradication rested not only on vaccine availability and logistics but on approaches that worked with, rather than against, mobility. Community-based animal health workers, negotiated access to herds at seasonal grazing and watering points, and flexible deployment that tracked transhumance calendars all proved decisive. Programmes that recognised customary authorities and pastoral institutions shortened the "last mile" to remote herds and increased trust in surveillance and reporting.

Sustaining these gains, however, required delivery platforms adapted to pastoral mobility. Community Animal Health Workers (CAHWs) and other locally embedded paraprofessionals were especially important where conventional staffing models could not reliably reach remote herds, but their effectiveness depended on an enabling environment of training, supervision, supply chains, data reporting and clear accountability within national veterinary services.

As an initial result, livestock mortality was progressively reduced and herd sizes increased: for example, in Ethiopia and Sudan the number of cattle recorded in 2015 increased by 136% and 190%, respectively, compared with the 1985 census, according to the FAOSTAT series (FAOSTAT, 2023).

To complement the narrative evidence with routinely available quantitative signals, FAOSTAT time series were used for a small set of comparable indicators in selected pastoral and agropastoral countries.

For example, across the 49 countries of Sub-Saharan Africa (World_Bank_Group, 2026), cattle stocks more than doubled, increasing from approximately 113 million head to approximately 285 million head between the start of the first coordinated vaccination and surveillance programmes (1961) and the declaration of rinderpest eradication (2011).

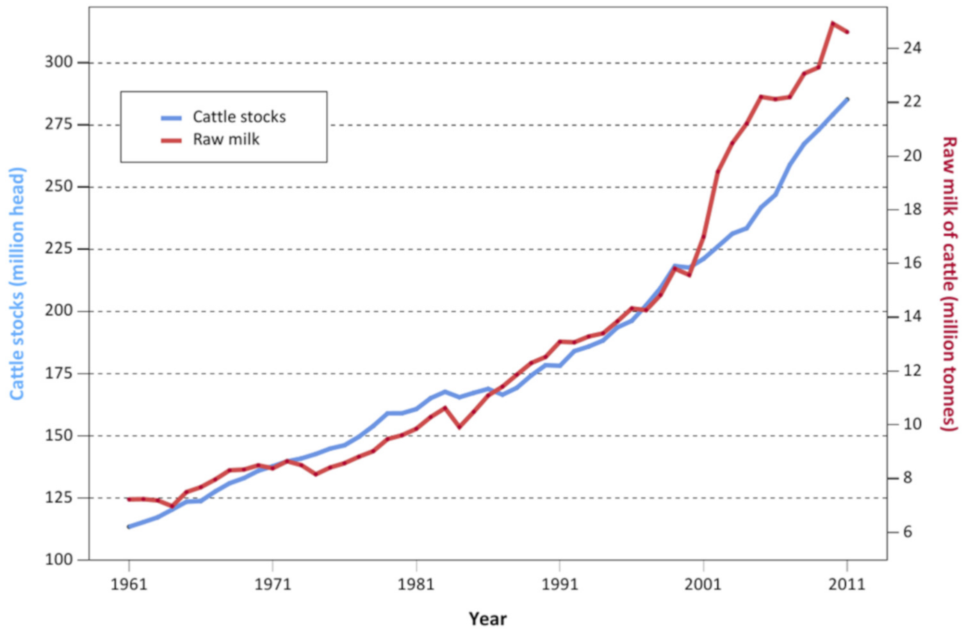

FIGURE 4
Cattle stocks and total milk production in the 49 countries of Sub-Saharan Africa from 1961 to 2011.

Over the same period, total milk production increased more than threefold, rising from about 6.7 million tonnes/year to about 24.1 million tonnes/year (Figure 4), providing a parsimonious output proxy that maps more directly onto livelihood pathways than headcounts alone. Figure 4 therefore provides a simple, comparable signal that productivity proxies moved alongside long-run disease control, while also motivating the need to test whether production gains keep pace with herd growth under recurring shocks and endemic disease pressure.

It is very likely that the progressive reduction in rinderpest incidence and geographic spread, associated with successive anti-rinderpest programmes (Table 1), contributed to these marked improvements in livestock production. Table 1 also helps distinguish periods dominated by vertical campaigns from phases in which surveillance and routine service capacity were strengthened.

Taken together, these indicators help distinguish herd recovery from welfare translation: increases in animal numbers may occur without proportional improvements in production where endemic disease pressure, constraints on market access, insecurity, or climatic shocks continue to limit productivity. This is directly relevant for current FMD and PPR control strategies, suggesting that programme performance should be assessed not only through vaccination and outbreak metrics, but also through a minimal set of downstream, comparable indicators (herd structure across species and production proxies) that capture whether control efforts are yielding measurable livelihood and system benefits.

Finally, the programmes contributed to a new model of animal health by strengthening public veterinary services and, in some contexts, expanding the role of private actors and cost-sharing arrangements (FAO, 2010). Beyond disease elimination, eradication efforts contributed to longer-term capacity building in some contexts, including investments in training and veterinary education. In Ethiopia, for example, veterinary education capacity expanded markedly; the number of veterinary schools increased from 1 to 15 between 2005 and 2015 (Mayen, 2006).

These spillovers were not automatic, but where embedded in national systems they improved the ability to address other endemic and transboundary diseases. The durability of eradication gains therefore hinges less on the absence of rinderpest alone than on whether routine, trusted and accessible animal-health services can be sustained amid recurrent shocks. The formal recognition of community-based animal-health providers has historically been contested and, in some settings, delayed within regulatory frameworks–despite their practical importance for reaching mobile and remote populations; recent WOAH guidance (WOAH, 2024) reflects an evolving consensus on competencies and supervision. Beyond aggregate benefit–cost ratios, household-level incentives mattered: easing movement permits after vaccination, providing fair compensation for sanitary culling where applied, and reducing market frictions at border posts encouraged compliance. Where corridors and markets reopened predictably, herders could rebuild animal capital and diversify income (milk, live-animal trade, fattening), reinforcing the virtuous cycle between disease control and livelihoods.

Lastly–and without any claim to exhaustiveness–programmes aimed at consolidating the results of JP15 and PARC and supporting the path towards eradication are recalled: the PACE programme and the Somali Ecosystem Rinderpest Eradication Coordination Unit (SERECU), the latter crucial for the final verification of the absence of viral circulation in the Horn of Africa (AU-IBAR/SERECU, 2007; FAO, 2010; 2011).

Discussion

Although rinderpest is now eradicated, the institutional and delivery lessons of eradication remain directly relevant to contemporary transboundary disease control. Making these lessons explicit helps translate a historical success into actionable principles for designing mobility-aware, equitable and durable service platforms for PPR and FMD. We summarise the key lessons as follows.

Work with variability and mobility rather than treating them as anomalies

Rinderpest eradication provides a fully observed example of how a transboundary animal disease can reshape–and be reshaped by–dryland livelihoods. This narrative review has shown that rinderpest epidemiology cannot be separated from the institutions, mobility calendars and market relations that organise pastoral production. Seen through this lens, "equitable One Health" depends on designing animal-health systems that work with variability and mobility rather than treating them as anomalies.

Governance and delivery matter as much as vaccines

Eradication success relied on delivery and governance, not vaccines alone: surveillance and vaccination worked best when aligned with seasonal movement patterns and when locally legitimate intermediaries reduced transaction costs and strengthened trust.

From campaigns to durable routine service platforms

Campaigns can eliminate a pathogen, but durable gains require routine service platforms that remain accessible to mobile and remote populations and that can address multiple endemic infections, not only emergency targets.

Maintain transferable capacities beyond emergency cycles

Eradication left transferable capacities–diagnostics, early warning, coordination and field delivery experience–that can support other priority diseases (e.g., PPR, FMD and avian influenza) if they are maintained beyond emergency funding cycles.

Equity and preparedness in a post-eradication world

At the same time, eradication benefits were uneven. In many settings, persistent endemic infections, limited access to routine veterinary services and recurrent shocks (drought, insecurity and market volatility) constrained who could convert herd recovery into sustained wellbeing. Recognising these constraints shifts attention from aggregate benefit–cost ratios to distributional outcomes and to the governance choices that determine who is reached. Finally, a rinderpest-free world still requires preparedness: rapid rule-out of look-alike syndromes and careful stewardship of any authorised rinderpest virus-containing material. Looking forward, increasing climatic variability is likely to intensify congregation pressures around scarce resources; strengthening participatory surveillance and routine animal-health services–without undermining pastoral mobility–will be central to sustaining pastoral resilience.

Implications for current eradication and progressive control programmes

Taken together, these successes and shortcomings provide concrete guidance for today's control and progressive control programmes: by learning from where rinderpest strategies failed (e.g., exclusionary movement restrictions, weak routine services, fragmented cross-border coordination) and where they worked (mobility-aware delivery, trusted local intermediaries, and durable surveillance systems), FMD and PPR interventions can be designed to be both more effective and more equitable in pastoral settings.

Mobility governance as a public good

Experience from eradication also shows that indiscriminate movement prohibitions often amplified livelihood losses, encouraged avoidance of official controls, and reduced reporting. Better results came from working with mobility: negotiating access to herds along agreed corridors, using market and corridor checkpoints for two-way risk messaging, and applying movement measures only when necessary–proportionate, time-limited and targeted to clearly defined risk periods or routes. For FMD and PPR, this argues for mobility-sensitive plans that protect transhumance while still reducing high-risk contacts.

Seasonal synchronisation around high-contact nodes

Seasonal rainfall patterns concentrate animals and traders at watering points, grazing bottlenecks and markets, creating predictable peaks in contact and transmission. FMD and PPR control can exploit this seasonality by aligning vaccination, sero-surveillance and communication with local mobility calendars: prioritising high-contact nodes, timing booster doses before aggregation windows, and using market days to reinforce reporting and biosecurity without disrupting access to water and pasture.

Integrating CAHWs within enabling systems

CAHWs and other paraprofessionals remain essential to reach remote or highly mobile "cold spots," but their contribution is sustainable only when embedded in an enabling system. This requires formal recognition, defined scopes of practice, competency-based training and certification, structured veterinary supervision, reliable cold-chain and supply logistics, and routine integration of syndromic reporting and sample referral into national information systems. In FMD and PPR programmes, tiered task allocation (e.g., vaccination support, case detection, sample transport, referral) combined with auditing and feedback loops can extend coverage without diluting professional standards.

Cross-border coordination and compatible systems

Rinderpest-era laboratory networks, early-warning arrangements and coordination platforms (including ecosystem-based approaches such as SERECU) provide practical templates for today's transboundary control. Multi-country PPR and FMD initiatives benefit when neighbours share data protocols, use compatible diagnostics, conduct joint outbreak investigations, and agree synchronised vaccination calendars along livestock corridors and trade routes–shifting from isolated national campaigns to coordinated regional action.

Leaving behind multi-disease routine service platforms

Eradication improved milk yields, draught power and trade, yet welfare gains were not uniform where routine services were thin and other endemic infections remained unmanaged. A key lesson for FMD and PPR is that vertical campaigns should deliberately leave behind affordable, multi-disease service platforms–follow-up vaccination, basic clinical care, outbreak reporting and referral–that continue to function after external funding declines. Making this transition explicit helps prevent post-campaign backsliding and supports resilience during drought, insecurity and market shocks.

Equitable one health and governance of shared resources

Finally, rinderpest control shaped human nutrition and income, wildlife populations and landscape governance because it interacted with rules over corridors, grazing access and water points. Making these linkages explicit strengthens an equitable One Health approach for FMD and PPR: one that jointly optimises animal health outcomes, livelihood security and the governance of shared resources at livestock-wildlife interfaces, rather than treating disease control as a standalone technical exercise.

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