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Between Gobra and Guzerat: a reinvention of human-cattle-environment relationships in the Great Green Wall (northern Senegal)

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This article explores, based on local perceptions of the environment, the conditions that lead pastoralists to reinvent their farming practices—particularly through crossbreeding and diversification of activities—in a context marked by a strong presence of development projects. By combining qualitative methods (focus groups, interviews, ethnographic observation, and photo-elicitation), this study shows (1) that the narratives of pastoralists and project stakeholders are intertwined around the decline of the bush; (2) that the projects are a component of the pastoralist's world that allows them to consider the possibility of not transhuming by gaining access to various resources (fodder, employment, etc.); and that (3) in the context of declining biodiversity and the implementation of projects, some pastoralists are considering to reframe their herding practices to be able to meet their needs during the dry season. This reinvention of herding practices is offset by crossbreeding local Gobra cows with Guzerat bulls from Brazil and by diversifying activities beyond livestock farming. These strategies are part of an adaptation to the environmental, economic, and political context while also meeting symbolic aspects valued by the pastoralists.

KEYWORDS

environmental change, Great Green Wall, pastoral breeds, Sahel, Senegal

Introduction

Pastoral livestock farming is now widely recognized for its ability to adapt to climatic, ecological, and economic variations (Ancey et al., 2025; Behnke et al., 1993; Krättli, 2015; Scoones, 2023) and even political changes (Eriksen and Lind, 2009). Several studies show, through an examination of the continuities and changes in pastoral practices, that pastoralists' strategies are constantly adapting and do not remain static over time (Adriansen, 2006; Chao et al., 2025; Jandreau and Berkes, 2016). Indeed, the specificities of pastoral lifestyles and the strategies adopted or considered by pastoralists are based on in-depth, context-specific, and complex knowledge that adapts to socio-ecosystems characterized themselves by high variability. The strategies they employ are as diverse as they are varied (adjusting herd size, changing herd composition or breeds, forage production, or even migration) and depend as much on social, environmental, and political contexts as on pastoralists' economic capacities (Bostedt et al., 2023) or their personal aspirations (Magnani, 2020). In the Sahelian region of northern Senegal, pastoral

livestock farming is undergoing profound changes that are prompting pastoralists to rethink their farming methods as they adapt to a wide range of political, climatic and social variables.

Senegal's sylvopastoral zone¹ has experienced numerous developments that have profoundly altered its socio-ecosystems. Before the 1950s, the zone was inhabited only when water was available, during the rainy season. The installation of pastoral boreholes, beginning in 1950, made the area habitable all year round through a continuous access to water (Santoir, 1980). The aim of this policy was to encourage pastoralist populations to settle down by making pastures accessible (Join-Lambert and Ba, 1990, p.55). This transformation in land management has contributed, in particular, to three major changes: firstly, a change in transhumance routes, with the abandonment of transhumance towards the River Senegal (Cesaro et al., 2010), secondly, a threefold increase in livestock numbers between 1950 and 1975 (Barral, 1982) and thirdly, the disappearance of pasture management systems during the rain-fed cropping season, known as 'hurum' (Barral, 1982; Ka et al., 2021). Subsequently, severe droughts in the 1970s and 1980s had a lasting impact on the landscapes and livelihoods of the region's inhabitants. The consequences were notably a high mortality rates among animal and plant populations and episodes of famine among human populations.

Accounts and images of these droughts and their consequences have shaped local and, even more so, international narratives by reviving a pessimistic discourse that took shape during the colonial era. Indeed, it was in this context that the United Nations organized a conference on desertification in Nairobi in 1977, which took up—and modified—the concept of desertification developed by foresters in the French colonial administration (Aubréville, 1949; Lavauden, 1927). These discussions subsequently led to the development of a plan to combat desertification and the signing of the United Nations Convention to Combat Desertification in 1994, upon which the Great Green Wall is based today. At the national level in Senegal, two major initiatives emerged in the wake of these droughts: the creation of the Société de Développement de l'Élevage dans la zone Sylvo-Pastorale (SODESP) in 1974 and the implementation of the Senegal-German reforestation project in 1975. More specifically, SODESP aimed to implement a policy of livestock modernization through geographic stratification, with a focus on breeding in northern Senegal. In the case of the German technical cooperation project, which combined livestock farming with reforestation, a model for controlling livestock density within fenced areas was implemented, along with the granting of exclusive property rights to water and pastures. These interventions, which included significant zootechnical aspects related to animal health and the economic value of byproducts, aimed to integrate livestock farming into commercial networks and turn it into an income-generating activity (Diallo, 2021). Subsequently, the implementation of the

PAPEL project and pastoral units (PUs) in the 1990s perpetuated a model that sought to transform the management techniques traditionally developed by pastoralists, underestimating the logic of pastoral systems—particularly transhumance—in favor of modernisation, intensification, and sedentarisation (Ancey and Monas, 2005; Wane et al., 2006).

These successive interventions share a common feature: they have consistently sidelined the knowledge and practices of the very populations they sought to transform. Pastoralists were cast as the problem to be solved rather than as actors whose expertise and adaptive strategies might inform more effective and equitable policy design.

Pastoral lifestyles and the associated knowledge—whether concerning herds or the environment—are rarely taken into account in political discourse and decision-making (Ba and Cesaro, 2026; Nori and Scoones, 2023). Indeed, the knowledge that pastoralists have of their environment has long been denigrated, relegated to the local and the specific, and maintained within a folklorized or essentialized vision that confine this knowledge to an “inferior” level. In a study on the sedentarization of nomads and pastoral water management in Senegal, Santoir (1980, p. 2) accused pastoralists of “*squandering a precious resource that rightfully belongs to the nation by using herding methods from a bygone era.*” This dismissal of pastoral livestock rearing and pastoral knowledge—deemed archaic and irrational—developed within a context of colonization and the rise of capitalism. It was made possible by the emergence of a narrative on desertification in which pastoralists were held responsible for environmental degradation, while the climatic dimension of environmental changes was overlooked (Benjaminsen and Hiernaux, 2019; Davis, 2016). Several studies (Behnke et al., 1993; Scoones, 1995; Krätli, 2015) subsequently rehabilitated pastoral lifestyles by focusing on the adaptive dimension of pastoralism to semi-arid ecosystems, whose main characteristic is being in a state of imbalance.

A concrete understanding of ecosystems and the effects of climate change lies in everyday sensorily-based experience and connects globally established scientific facts to realities lived and experienced locally (Jasanoff, 2010; De Wit, 2020). However, local ecological knowledge² remains fundamentally unequal when compared to scientific knowledge and is given little, if any, consideration in environmental and development policies (Reyes-García et al., 2024). In some cases, this asymmetry leads to strategies for circumventing environmental projects and policies because they do not align with local realities and demands (Naess, 2013). Indeed, scientific knowledge—and even more so political decisions—must make sense to local communities (Jamison, 2001; Jasanoff and

1 The sylvopastoral zone (ZSP), often referred to as “ferlo” in the scientific literature, is an area located in the northern third of Senegal where pastoral livestock farming is the predominant activity. It is characterized by a Sahelian climate (precipitation ranging from 200 to 350 mm) to a Sudano-Sahelian climate (precipitation ranging from 350 to 600 mm) and is geographically constrained by the expansion of peanut cultivation to the south and the hydro-agricultural development of the Senegal River to the north (Cesaro et al., 2010).

2 We prefer to use the term ‘local ecological knowledge’ here to emphasise the local rather than the traditional aspect of ‘traditional ecological knowledge’ defined as ‘a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment’ (Berkes, 2008, p.7). The term ‘local ecological knowledge’ is also preferred to distance ourselves from the concept of ‘indigenous knowledge’, which refers to the way in which the inhabitants of Senegal were referred to during the French colonial period.

Martello, 2004) and cannot be imposed from above (Scoones, 2015). From this perspective, the integration of local ecological knowledge into policies is envisioned as a shift from a top-down approach—which confines community participation to a marginal role—to a bottom-up approach grounded in ontologies and ways of life that encompass both humans and non-humans (Descola, 2025). While we have long been aware of the special value of cattle to Fulani pastoralists (Dupire, 1962), few studies ultimately pay attention to how pastoralists shape their livestock breeds (Marshall, 2014). Yet according to Krätli (2023), p.8, “*pastoral breeds are constantly in the making; they are developed to interface production with landscapes that are also constantly in the making; they are defined by their variability.*”

It is precisely within this asymmetric knowledge landscape—where pastoralists’ deep ecological expertise is structurally marginalized by both development projects and scientific institutions—that the present study is situated. Rather than documenting this marginalization from the outside, we seek to trace the knowledge it suppresses: the perceptions, strategies, and ontological frameworks through which pastoralists navigate environmental change on their own terms. From this perspective, we therefore understand the environment through the Pulaar name ‘*taarindi*’, which refers to ‘everything that surrounds us’ (Juillard, 2024, p.83).

By linking the theoretical frameworks of political ecology and multispecies studies, this study seeks to understand how pastoralists adapt their practices by drawing on and updating the local ecological knowledge they possess. It supports the idea of an ontological shift in which strategies for adapting to environmental changes are constructed not only through the interweaving of the local perspectives of pastoral communities and the global perspectives of development actors or researchers (Konaka and Little, 2021), but also through the multiple and dynamic relationships maintained between humans, animals, plants, and minerals (Haraway, 2019; Tsing, 2017).

This research approach makes it possible to document, from the residents’ perspective, a process of livestock adaptation that has remained largely invisible in both pastoral science and development policy. In Senegal, where livestock policies emphasize industrial forage production and increased productivity (PSE, Senegal 2050) and where pastoralists face a scarcity of pastures and the expansion of the “unpalatable” herbaceous plant *Diodia scandens* (Flintan et al., 2022), some pastoralists are introducing Guzerat bulls, imported from Brazil, into herds of local-breed cows dominated by the Pulfuli (Gobra zebu) (Manoli, 2012; Camara, 2013). According to Fall et al. (2023), p.179, “*the spread of Guzerat blood is such that it is now difficult to find herds in rangeland areas or around watering holes made up entirely of Gobra cattle*”. However, shifts in livestock breeds have been documented following pastoral crises in the savannas of Cameroon and Burkina Faso (Boutrais, 2022) but never in the Sahelian pastures of Senegal. This gap in the literature points to a broader silence: the absence of studies that document how pastoralists in this region simultaneously navigate ecological decline, the proliferation of development projects, and deep transformations in their relationships with animals and the bush.

This article addresses this gap by examining three interrelated research questions: (1) How do pastoralists in northern Senegal perceive and narrate environmental change, and to what extent do

their discourses intersect with—and diverge from—those of development actors? (2) How do development projects, particularly the Great Green Wall, shape and constrain pastoralists’ access to fodder and water resources, and how do pastoralists navigate these constraints? (3) How are pastoralists reconfiguring their livestock practices—including herd composition, breed selection, and livelihood diversification—in response to ecological, economic, and political changes? In addressing these questions, this study moves away from narratives that portray pastoralists as victims or agents of desertification and as mere recipients of development policies and projects, and instead foregrounds their agency as knowledge-holders and strategic actors in a rapidly changing socio-ecosystem.

Materials and methods

Study locations

The two study sites, Widou Thiengoly (WT, Tessekere municipality) and Koyli Alpha (KA, Mboula municipality), were selected because they have a long tradition of pastoral livestock farming and they both host a variety of projects related to the Great Green Wall. These projects include reforestation plots (WT, KA), nurseries (WT, KA), an Integrated Community Farm (WT), a garden (KA), Balanites aegyptiaca oil processing units (WT), and a Community Nature Reserve (KA). Widou Thiengoly is notable for its long tradition of hosting such projects (the Senegal-German project from 1975 to 1995,³ the Great Green Wall since 2008), in contrast to the village of Koyli Alpha, where this activity is more recent (first reforestation plots beginning in 2012).

The Great Green Wall project is a program aimed at combating desertification and poverty that includes a strong participatory component. Indeed, according to the strategy and implementation framework of the IGMV 2024–2034 (Union Africaine, 2024), the GMV relies heavily on “participation,” “awareness-raising,” “consultation,” and “collaboration” with local communities. The effectiveness and sustainability of this program rest on a participatory and community-based approach in which local populations are directly involved in reforestation, agroforestry, and conservation activities, particularly through the *Xëyu ndaw ñi* youth employment program. The project also contributes to the promotion of certain local knowledge, such as the production of Balanites aegyptiaca oil or tree planting using the *zaï* technique.⁴ However, community engagement and participation remain superficial, as they occur after decisions have been made rather than as part of a co-construction process (Ba and Cesaro, 2026; Bekele, 2025).

³ The Senegal-German project combined livestock farming with reforestation by establishing fenced plots where livestock density was controlled and monitored to allow for the regeneration of herbaceous and woody plants.

⁴ The *zaï* is an ancient technique that involves digging a hole at the base of plants to facilitate water infiltration in semi-arid regions. It was revived by the Burkinabe farmer Yacouba Sawadogo.

Data collection

Data were collected during several field stays ($n = 14$) in the villages of Widou Thiengoly and Koyli Alpha between June 2023 and September 2025. Data collection was conducted using an ethnographic approach combining various types of qualitative analysis methods: (i) focus groups, (ii) semi-structured interviews, (iii) photo-elicitation interviews, and (iv) ethnographic observations.

Each field study was conducted in close collaboration with a local guide who helped us meet the villagers and herders. Individual and group interviews were recorded with the consent of each participant and then translated and transcribed into French. The translation of conversations from Pulaar to French was handled by a geography student from Cheikh Anta Diop University in Dakar. These local experts contributed their in-depth knowledge of the field, the residents, and the language to facilitate smooth exchanges, promote mutual understanding, and minimize awkwardness and misunderstandings stemming from cultural differences.

Focus group discussions and semi-structured interviews

The focus groups ($n = 8$) were designed to understand local perceptions of past, present, and future environments. Participants were selected by a local guide and the groups were formed to create an atmosphere of trust and encourage everyone to speak freely (men and women separated, similar ages and living spaces). Each group consisted of between four and six men and women, all of whom identified as pastoralists during the interviews. The interviewees are Fulani and breed livestock (cattle, sheep or goats), the majority of which are moved seasonally during the dry seasons. They are resident of Widou Thiengoly or the surrounding pastoralist settlements and are involved in a variety of activities (herders, merchants, participants in the Great Green Wall projects, imams, etc.). We should note here that, in our study area, pastoral practices lie between specialisation and diversification and, for some pastoralists, include non-farm activities (Manoli et al., 2014) and the use of external labour to tend the herd (Wane et al., 2009). From this perspective, our understanding of the term ‘pastoralist’ is based on the definition given by Adriansen (2006), p.217–218, which encompasses both Fulani identity and the rearing of domestic animals, and is not limited ‘to the time devoted to animal husbandry, nor to the percentage of income or nutritional intake derived from animals’. The main question asked in the focus groups was: “Can you tell us about the environment where you live?” The discussion was then expanded to cover the elements that make up or influence the bush (rain, ponds, winds, trees, grasses, animal and human presence, reforestation and development projects, etc.) and how they have changed over time.

Individual interviews ($n = 17$) were conducted to explore points that emerged during the focus groups but could not be fully addressed there (notably local perceptions of so-called “modern” livestock farming (*ngaynaaka moderne*), herd management and composition, the introduction of the Guzerat breed, and local conceptions of vegetation). An interview was also conducted at the Zootechnical Research Center (CRZ) in Dahra Djoloff to

triangulate the results obtained, particularly regarding pastoralists’ preference for Guzerat cattle, as the CRZ was responsible for introducing Brazilian Guzerat cattle and crossbreeding them with the local Gobra breed via artificial insemination (Camara, 2013; Fall et al., 2023). Furthermore, when secondary points required clarification, they were explored in follow-up interviews.

Ethnographic observation and photo-elicitation interviews

The data were verified and supplemented by field observations conducted at different times of the year to gather multiple perspectives and capture the variability of water, trees, and herbaceous resources across the seasons. The process was documented through photography, with the resulting images subsequently printed, presented, and re-engaged in the study using the photo-elicitation method (Bignante, 2010; Collier, 1967). This same iterative process was applied to audio recordings through reactivated listening interviews (Augoyard, 2001). The photographs and sounds used included images of cattle, sheep, goats, birds, trees, herbaceous plants, and soils recorded during various field missions. The use of these methods, inspired by multispecies studies (Van Dooren et al., 2016), made it possible to focus on the sensory dimension of visual and auditory landscapes, as well as to pay attention to the relationships that bind humans, animals, plants, and minerals. This methodology also helped establish a lasting connection with the interviewees by sharing certain results and presenting some of the data, which encouraged direct feedback on the survey.

Data analysis

The data were analyzed gradually as the fieldwork progressed. Initially, the interviews (individual and group) were translated and transcribed from Pulaar into French by the interpreter and the first author of the article upon their return from the field. This translation process provided an opportunity for an initial critical reflection on the data, paying attention to the species mentioned in the interviews (livestock breeds, bush animals, plants, soil types, etc.).

In a second step, the analysis of the results continued based on a thematic analysis of the focus groups (Paillé and Mucchelli, 2016). Three main themes emerged from this analysis, which we develop in the results section of this article. The first theme was the loss of biodiversity and changes in the state of the bush (grasses, trees, rainfall, land use). The second theme was the use of development projects. Finally, the third theme was the diversification of livelihoods and the emergence of “modern” livestock farming (*ngaynaaka moderne*), characterized notably, according to the pastoralists, by a decrease in the number of animals. However, the decline in the number of animals creates a paradox, as it would inevitably result in both economic and symbolic losses for the pastoralists. While seeking to understand this inconsistency, the issue of introducing exotic breeds emerged during the study. The data collected through these interviews, and confirmed by field observations, were then incorporated into the results section to clarify and refine the trends observed during the thematic analysis.

Results

This section is structured around four points that examine how herders in Widou Thiengoly and Koyli Alpha conceptualise and adapt to their environment, understood here as their surroundings. By first detailing the socio-historical context of this area, we outline the main aspects of the relationship between the herders, their livestock and the bush. We then show that current local conceptions of the bush are shaped by a significant decline in biodiversity, which is profoundly altering the conditions of life for both humans and animals. Thirdly, against this backdrop of dwindling resources and a high concentration of development projects, herders emphasise the need to rethink and reorganise their livestock farming methods and strategies, particularly in light of the numerous reforestation and development projects linked to the Great Green Wall. Finally, this reinvention of socio-ecosystems and livestock farming practices is taking place through the diversification of economic activities, the diversification of herd composition, and the introduction of new breeds of cattle and sheep.

People, cattle and bush: a socio-historical baseline

The villages of Widou Thiengoly and Koyli Alpha are situated in the area between the River Senegal and the Ferlo Valley, which roughly corresponds to the ‘Six boreholes’ sylvopastoral reserve. This area is mainly inhabited by Fulani pastoralists, who breed herds of cattle, sheep, goats as well as equines for transportation (horses, donkeys). To a lesser extent, the area is also inhabited by Wolofs, who are more involved in agriculture, and by Moors, who specialise in camel herding and the production of gum arabic. The vegetation consists of shrubs and trees growing sparsely on sandy soil. The climate alternates between a rainy period (*ndungu*), followed by a cold dry season (*dabbunde*), a hot dry season (*ceedu*) and a very hot, very dry season (*cedcedle*), which precedes the return of the rains.

Before the introduction of boreholes in the 1950s, this area was inhabited for only part of the year, when water was available in ponds and wells. During the dry seasons, herders would then mainly move their herds towards the River Senegal. This alternation made it possible both to preserve crops until harvest and to benefit from pastureland throughout the year. These ways of inhabiting the landscape are reflected in particular in the history of certain place names. For example, the name Widou Thiengoly refers to a tree, the *thiengoly* (*Lannea acida*), where shepherds would gather with their flocks to spend the night during the rainy season:

“Before the name Widou Thiengoly existed, it was just a patch of scrub that was there. There was not even a borehole. There were only pools, and nobody lived here [all year round]. When it rained, the herders would come with their animals. In the evening, they would gather and chat under a tree that was cool and beautiful. That tree was called Thiengoly. That’s where they would gather with their belongings.” (Interview with a cultural figure from the village, 25 June 2023).

At that time, the area was divided between inhabited areas situated near a water source (*jeu*) and the bush, which was accessible to all (*ladde*) (Ka et al., 2021). The inhabited areas comprised the

village (*wuro*), a rain-fed field (*guese*) and a grazing area. These areas were governed by a system of prohibitions known as *hurum guese* (literally “field prohibition”), which served to protect crops from wandering animals until harvest time. Another type of prohibition known as *hurum durngal* (literally “pasture prohibition”) was intended to reserve the pastures adjacent to the camp for one’s own herd. According to Touré and Arpaillange (1986), p. 18, the *hurum* system allows the herd to “graze all day in the opposite direction to the crops without being watched over by a herdsman and without posing a risk to the crops of neighbouring settlements”.

In the 1950s, during the colonial period, the introduction of pastoral boreholes—intended to encourage herders to settle in one place and make pastures accessible (Join-Lambert and Ba, 1990) – significantly altered the ways in which the area was inhabited and livestock-rearing practices. Indeed, improved access to water and the development of land-use planning policies for the Senegal River valley contributed to the abandonment of transhumance routes to the north and a shortening of transhumance routes (Grosmaire, 1957). These conditions also led to a threefold increase in cattle, sheep and goat populations between 1945 and 1975 (Santoir, 1983). Winter camps gradually evolved into villages, and the number of settlements increased (Barral, 1982), leading to a reduction in bushland (*ladde*) and bush animals (*kouililadde*).

During the droughts of the 1970s, this combination of factors led to heavy losses in livestock numbers, linked in particular to the reduced mobility of the herds. Furthermore, the decline in rainfall led to a change in the composition of the bush’s woody vegetation. Certain useful and symbolic species, such as the *thiengoly* (*Lannea acida*), have virtually disappeared, whilst others, such as the *muchoteki* (*Balanites aegyptiaca*), have become dominant in the area.

This change in the bush, in terms of both species and area, creates a sense of loss for the pastoralists, who, through their in-depth knowledge of the bush, remain the primary witnesses to the environmental changes in this area.

Local conceptions of the bush: the narrative of a shared decline

When we ask the residents of Widou Thiengoly and Koyli Alpha to tell us about the environment, they say that the bush (*ladde* in Pulaar) is “empty,” “finished,” “broken.” It has “burst.” But what is the bush to them? “It is a place that can go a month without anyone walking on it, where jujubes, monkey bread, and desert dates rot. It is called *diure sao*.” (Focus group with men living in Widou Thiengoly, October 24, 2024) In this quote, the bush seems to be perceived as a space that should neither be inhabited nor traversed at any given time, in order to promote the decomposition of wood, fruit, and leaves and thus allow for soil regeneration. *Diure sao* is a metaphor that refers here to a cattle trail (*sao*) covered by a layer (*diure*) of vegetation. The presence of this layer of vegetation on the cattle trail indicates that it has not been used for some time. In the past, certain areas of bush with dense vegetation—also known as *ladde ougarre* (sparsely visited bush)—were rarely traversed and inhabited only by hunters. These were areas perceived as dangerous, and many people were afraid to go there because the grassy cover provided shelter for bush animals such as hyenas, lions, and others.

The construction of boreholes starting in the 1950s and the decline in rainfall beginning in the 1970s subsequently led to a reduction in vegetation cover and the drying up of waterholes, causing the disappearance of habitats for bush animals. In this context, bush animals gradually disappeared, and with them the practice of hunting. The scarcity of rainfall also led to a decline in rain-fed agriculture (whose crops were regularly eaten by birds), while livestock farming expanded in the absence of predators and with the proliferation of boreholes. Indeed, according to the inhabitants, their parents were self-sufficient and did not own much livestock. This statement corroborates Barral's (1982), p. 23 observations regarding the low cattle density at the beginning of the 20th century, which was approximately 0.56 head of cattle *per capita*. The number of livestock (cattle, sheep, goats) subsequently increased sharply, as did the human population. This increase in human and animal populations has led to greater settlement of the bush, with an increase in the number and size of villages, as well as their dispersion. "The bush has become crowded."

The decline in available grazing resources is therefore the result of a combination of social, ecological, and political factors, ranging from human and animal population growth to reduced rainfall, including the establishment of plots for the Great Green Wall. "If we fence off the bush, we fence off the fields, we fence off the cemeteries, and since the villages are large, the bush comes to an end" (interview with a village chief, July 6, 2024). The development of this infrastructure network (boreholes, weekly markets, fields...) goes hand in hand with the growth of new settlements in previously uninhabited areas. This trend creates new constraints for non-transhumant herders, as the bush—which was supposed to be communal—is becoming private. Furthermore, according to pastoralists, what is causing the current state of the bush is also the rise of individualism and a breakdown of bonds of solidarity, characterized in particular by the decrease of mutual aid systems such as the *diilaane naï*, which involved lending a cow to a relative in need so that they could benefit from the milk.

The finite and limited nature of the bushland and the scarcity of resources (trees, grass, water) are all factors that prevent the continuation of pastoral livestock farming as it is currently practiced. These discourses of loss align with the narratives of development projects and the concept of desertification, which posits the idea of a void that must be repaired or filled. According to the inhabitants, the bush, considered a space free of humans and livestock, has declined due to reduced rainfall and the proliferation of villages, boreholes, and herds, resulting in a loss of habitat for bush animals. This bush is becoming increasingly fragmented and individualized, leading to a reorganization of bush occupation and ancestral solidarity systems.

The need for water and grass for pastoralists: sharing knowledge to advocate for mutual aid

The context of resource scarcity discussed above appears to be perceived as perpetuating a vicious cycle in which the decline in trees is both the cause and the consequence of reduced rainfall. There are no longer enough trees to make it rain because "trees attract rain," and it does not rain enough to allow vegetation to grow properly. In

this context of ecological crisis, reforestation and development projects—with which researchers are often associated—appear to be key players capable of finding solutions to this situation. At the start of an interview, a woman speaks up and asks the interpreter, "Does she like this area? Tell her, 'Welcome to the area.'" "We're going to help each other. After the rainy season ends, we face nothing but difficulties. There's no water. There's no grass. Going to fetch water is a huge problem. Going to fetch grass is a huge problem too. That's what wears us out." (Focus group with women living in Widou Thiengoly, December 2, 2024).

While the densification of the borehole network makes access to water possible during the dry season, the increasing frequency of breakdowns and the growth in livestock numbers create the perception that water is still in short supply. During the dry (*ceedu* and *cedcedle*) seasons, the availability of water and forage is a primary concern for pastoralists, for whom meeting the herds' basic needs is paramount. This concern intensifies in years of low rainfall. In July 2023, on two occasions we helped women pastoralists lift their cows because they were too weak to stand. This situation is particularly acute for those who do not practice transhumance, as they must navigate a complex set of local variables to feed and water their animals. *Cili* pods (*Vachellia tortilis*) and baobab bark (*Adansonia digitata*) are now supplemented with commercial livestock feed, which is playing an increasingly important role in the animals' diet.

Pastoralists are increasingly buying grass, livestock feed, or crop residues to supplement their animals' diets during the dry season. "Everything the animals eat, people collect to sell. They leave nothing behind. Even the grass is sold," says a man (focus group with men living in pastoral settlements, October 27, 2024). For example, crop residues from fields that were once free are now often collected and sold. The same applies to grass, which is kept in fenced-off plots with controlled access. On the other hand, relying on aerial forage by cutting branches from trees in the bush is risky for herders because certain trees are "inhabited" by invisible entities and must not be cut. Herders also face penalties from the water and forestry services, which tolerate this practice only during certain times of the year and at the discretion of officials. In this context, herders face both mystical and economic constraints. Indeed, livestock feed prices rise in line with demand, which itself depends on the duration of the dry season and the number of animals to be fed. The longer this period without grazing lasts, the more pastoralists are forced to buy feed for their animals or find other options and resources.

Initiatives that help meet these needs for forage and water are generally well received. This is true of the plots in the Great Green Wall (Figure 1), as well as certain private plots, which are used as fodder banks during dry seasons. The plots, which are locally called "parcelle" in French or "guese" (field) in Pulaar, are fenced-in areas with restricted access for periods ranging from several months to several years. Their establishment is sometimes controversial because, in some cases, it contributes to the perception of a reduction in bushland and grazing areas. Indeed, pastoralists hold differing views on the plots depending on their uses (vegetable farming, conservation, restoration with tree planting), their management (whether guarded or not), and the area they occupy. Plots designated for restoration, some of which can cover up to 600 ha, are the most criticized because they make certain areas inaccessible that were previously used collectively for grazing,



FIGURE 1

Opening day of the Koyli Alpha Community Nature Reserve, May 13, 2025. Left: A cart loaded with grass to feed the animals. Right, on the ground: bundles of grass to thatch the roofs of the huts. The grass on the cart on the left was collected with a rake, while the grass on the right was cut with a pruning knife to preserve its length.

foraging, or travel. One resident highlights how the large plots create a divide, “separating people who used to be together” (focus group with men living in pastoral settlements, October 27, 2024), because those who live within or near them continue to use these spaces, while those on the outside can no longer do so. This fragmentation is all the more problematic because the location of the plots is decided by municipal governments and can be used for electoral purposes by favoring certain localities over others. This dynamic contributes to the creation of inequalities and can create a sense of frustration among residents.

“In my opinion, the fields help because if there were not any fields, at some point the animals would suffer because not everyone can take their animals into the bush. Not everyone has the same number of animals. Some can practice transhumance and others cannot.” (Interview with a transhumant herder, September 1, 2024).

The challenges regarding fodder are not only due to a lack of grass but also to ecological changes and the introduction of species that lead to a scarcity of forage grasses, including in transhumance areas. In the Dahra Djoloff region, the spread of the partially inedible *Demba Yaba* grass (the local name for the plant) is causing serious concern among pastoral livestock farmers, as ingestion during the dry season leads to digestive problems and even the death of cattle. According to the pastoralists, this grass is one of their “biggest problems.” Previously found only in the Djoloff region, where it was likely introduced, *Demba Yaba* has spread throughout Senegal, displacing other grass varieties. “When it grows, nothing else grows alongside it” (interview with a transhumant herder, September 10, 2025). Although this grass is eaten by sheep, goats, donkeys, and horses, *Demba Yaba* is harmful to cows. Indeed, one herder mentions that *Demba Yaba* seeds remain in the intestines of cattle, which prevents them from ruminating in a process similar to ingesting plastic, thereby

causing their death. However, no study has been published to date on this process. Some herders even report transhuming during the rainy season to prevent their animals from grazing on this grass.

“If you’re looking for what killed the livestock farming, it was *Demba Yaba* (the local name for the grass) that did it. From Kaolack and Dakar all the way here, there are no more cows because of *Demba Yaba*. It is spreading, it is spreading. It is nothing but trouble. Cows will cease to exist if we do not stop it. If the government or development projects were to bring in plows where there’s a lot of it to try to prevent the grass from growing. If the resources were there, it would be done.” (Interview with a transhumant herder, September 11, 2025).

This interview excerpt highlights both the impact of *Demba Yaba* grass on livestock farming and the hope placed in development projects and the government to resolve this problem. However, the possibility that the grass was introduced by a development project was mentioned several times in the interviews. The interviewee here is aware of this hypothesis but attributes the spread of this grass to God and does not believe “that something that was planted could have reached this scale.” Another herder agrees: “*Demba Yaba* has made the problems worse. God brought it here; there’s nothing we can do about it” (interview with a transhumant herder, September 10, 2025). This parallel highlights the uncertainty and seems to underscore the limits of the respondents’ knowledge and ability to act, leading them to rely on an omniscient entity. “We do not know how Allah will change livestock farming” (interview with a transhumant herder, September 1, 2024). While questions about the future all seem to lead to the same answer, we can still see the outlines of the future of livestock farming taking shape through the pastoralists’ current strategies.

In an environment marked by annual seasonal variability, water and grass shortages at certain times of the year, as well as the devaluation and prohibition of certain practices such as the use of aerial forage, pastoral livestock farmers navigate the range of possibilities, whether ecological (significant variations in grass cover and declining pasture quality), economic (selling animals at markets, relying on commercial feed), or political (particularly access to land for development projects).

Diversification of herds and activities: a reinvention of the socio-ecosystems

The decline in the quantity and quality of resources available in the bush has led to the perception that a change in livestock management strategies (*ngaynaaka pewje*) is necessary so that “the bush can breathe (*ladde nde foofa*)” (interview with a village chief, April 25, 2024). Indeed, according to some pastoralists, the bush currently supports more animals than it can sustain, given the decline in rainfall and biodiversity in general, as well as the deterioration in pasture quality, which is leading to fewer births. One solution proposed to address this paradox is to reduce herd sizes in order to meet their water and forage needs

during dry seasons because, as we have seen, the decline in available bush resources leads to increased costs associated with animal care (payment for borehole water, purchase of livestock feed...) and a greater dependence of the animals on humans. “*Having a lot of animals is too tiring,*” reports a transhumant herder (interview, September 10, 2025). Women also highlight the difficulty pastoralists face in maintaining large herds during periods of drought: “*They’re waiting for the fatara [disaster, drought] to come, eat them all, and make them all poor*” (focus group with women living in Widou Thiengoly, October 25, 2024).

However, in this case, the decline in the number of animals does not appear to be the result of external pressure but stems, at least in part, from the difficulty of feeding the animals and the desire to be able to provide for their needs, particularly during dry seasons. It should be noted, however, that this alternative is being raised within a context of successive policies and projects promoting the sedentarization of pastoralists and increased livestock productivity, and that it is difficult to grasp the extent to which these narratives influence one another. Indeed, pastoral livestock farming is often discussed in relation to these projects:

“We’d like to be given something other than pastoral livestock farming because pastoral livestock farming is slipping out of our hands. People need to realize that when times change, you have to change with the times. We’d like to have projects like fields, seeds, farming... Even if it is not much, to have something to make a living from. Even if the number of animals is decreasing—because they will decrease—we’ll farm and provide grass for the livestock, even if it is not easy” (focus group with men living in pastoral settlements, October 27, 2024).

While this decline in livestock numbers—whether imposed or claimed—seems to be perceived as a transitional phase of adaptation to a particular socio-ecosystem, one might logically ask whether and how pastoralists adopting this strategy plan to compensate for this loss in their herds. From this perspective, they point out that this trend would be offset by the increased value of the animals resulting from the introduction of foreign breeds (particularly Guzerat cattle and Ladoum sheep), which command higher prices than local breeds. The idea is to have fewer animals, but animals that cost more and yield more meat and milk. Other pastoralists, however, disagree with this reduction in herd size, citing in particular the need to meet the Senegalese population’s demand for meat (especially for Eid al-Adha).

This change in herd composition is achieved through crossbreeding or absorption by selecting and introducing Guzerat bulls imported from Brazil into herds of local *Pulfuli* (Gobra) cows, and by castrating local Gobra bulls (Figure 2). The selection of *kalhaldi* (breeding bulls) is based on multiple and varied criteria and is carried out through a detailed understanding of the cattle and their physical capabilities. For example, a Gobra cow cannot mate directly with a purebred Guzerat bull because calving may be complicated due to the calf’s excessive weight and size. This observation made by pastoralists is confirmed by the Dahra Djolof Zootechnical Research Center. Purchasing a Guzerat bull therefore involves a risk for farmers for several reasons. For one thing, their price is



FIGURE 2
A Guzerat bull surrounded by a Gobra cow and crossbred calves south of Koyli Alpha in the Ferlo Valley, December 8, 2024.

significantly higher than that of a *Pulfuli* bull. While this factor is an advantage at the time of sale—as it translates to greater profits—it becomes a problem if the animal falls ill or dies, as it leads to serious financial consequences. This risk is all the greater because the Guzerat bull is known to be less well-suited to the semi-arid climate than the *Pulfuli* bull. If a Guzerat is hungry, it lies down and does not get up again. Indeed, Guzerat cattle require a higher intake of forage and livestock feed than *Pulfuli* cattle, which are more resilient to food shortages and fatigue during the *ceedu* and *cedcedle* seasons. With this in mind, some pastoralists do not seek to change the breed of their herd but instead favor crossbreeding to combine the advantages of Guzerat and *Pulfuli* cattle:

“If you take the *Pulfulis* and cross them with the Guzerats, you can get a breed that is not afraid of fatigue, that produces milk and meat, that does not quite match the Guzerats but surpasses the *Pulfulis*. That’s the quality we like best because it has meat, milk, is not too big, and is not too small either. That’s the quality we like best” (Interview with a transhumant herder, September 11, 2025).

In this case, the increase in productivity is actually offset by the decline in the livestock population and does not appear to align with the beef production objectives of food security policies. Indeed, this promotion of the Guzerat breed seems to be driven not only by economic criteria but also by environmental and aesthetic considerations. In fact, this cattle breed, much like the Ladoum sheep breed, sparks a certain desire among pastoralists to show off these animals “because it is something new; when something is new, everyone thinks it is more beautiful, but they do not know the purpose of the *pulfuli*. “*When you’ve just tried something new, you say it is better. They boast about it*” (interview with a transhumant herder, September 11, 2025). Strategies therefore appear to vary, with some pastoralists tending to seek out the purebred Guzerat, others favoring crossbreeding, while a minority—whom we were unable to interview—wish to preserve the *Pulfuli*. Owning Guzerat confers a certain social prestige, as purchasing them requires financial resources that not everyone possesses.

These changes in local breeds go hand in hand with a diversification of activities both within and outside of pastoral livestock farming. Indeed, pastoralists combine short-term

strategies—such as selling some animals from the herd to feed the others—with long-term strategies that involve investing in their children's education or in the creation of activities related to livestock farming (employment in development projects, in commerce, etc.) to generate the necessary funds to reinvest in livestock farming and provide for the herd's needs. From this perspective, some pastoralists suggest the possibility of combining livestock farming with formal education, which, in their view, would allow them to reduce the number of animals and continue farming through proxy. This type of livestock farming, considered “modern,” would be contingent on earning a salary, which would allow herders to no longer depend entirely on their herds, but simply to continue livestock farming in a different way. The use of the concept of “modern livestock farming” reveals a reappropriation of project-based vocabulary that appears disconnected from food security objectives. Indeed, according to the herders, “modern livestock farming” is defined in particular by a reduction in herd size, the establishment of fodder plots equipped with a tap for feeding and watering the livestock, and the abandonment of transhumance. Indeed, transhumance seems to be viewed as a necessity driven by the need to sustain the herd. While some herders note that “transhumance remains close to people's hearts even if it is not ideal” (interview with a transhumant herder, September 1, 2024), the general consensus highlights the difficulties of transhumance:

“When you go on transhumance, you're always under the trees, under the tarps with the dust, hunger, fatigue, and dirt. And if you do not watch your animals, they'll get lost. You're always chasing after them at noon and in the evening. It is too exhausting. If [the children] study, they might have something better than this without getting tired” (interview with a transhumant herder, July 3, 2024).

The devaluation of transhumance, which occurs within the context of a long-standing policy of promoting the sedentarization of pastoralists through public policies, is particularly emphasized by women. Characterized by constant proximity to animals and trees in the bush, transhumance is perceived as a necessity that ensures the animals' survival but, due to the harshness and demands of this way of life, drives some herding families to seek alternatives for future generations.

In conclusion, the results show a reconfiguration of the relationships between humans, animals, and plants that is emerging in both the discourse and practices of pastoralists. Changes in herd composition resulting from the introduction of highly valued exotic breeds (Guzerat, Ladoum) highlight the agency of pastoralists, who adapt their strategies to align with their desired lifestyles (decline of transhumance, wage employment, children's education).

Discussion

Beyond confirming existing findings on pastoral adaptability (Behnke et al., 1993; Scoones, 2023), this study makes three distinct contributions to the literature. First, it documents, for the first time in the Sahelian pastures of Senegal, a process of breed transformation driven not by external prescription but by pastoralists' own agency—a phenomenon previously observed only in the savannas of Cameroon and Burkina Faso (Boutrais,

2022). Second, by combining photo-elicitation with multispecies frameworks, it reveals how the intertwining of pastoralists' and developers' discourses around biodiversity loss conceals fundamentally different ontological positions—with significant implications for the design of participatory projects. Third, it challenges the dichotomy between “modern” and “traditional” livestock farming by showing how pastoralists themselves reappropriate and redefine the concept of *ngaynaaka moderne* in ways that diverge from food security policy objectives. Taken together, these findings call for a rethinking of participation in pastoral development contexts: not as a procedural add-on, but as a genuine co-construction rooted in the ontological frameworks and adaptive knowledge of herding communities.

The intertwining of discourses on loss

Our study shows that the narratives of pastoralists and development projects are intertwined around the decline of the bush, yet they reflect distinct rationales. In a context where reforestation and development projects are largely accepted and encouraged by local residents, the intertwining of discourses regarding the decline of biodiversity occurs through the “selective incorporation of technologies, discourses, and institutions of the modern West” (Hanchard, 1999, p.247). However, while the discourses of development actors (as well as scientists and politicians) and local discourses agree on the idea of environmental degradation, this observation actually masks different perceptions of the bush, as the two groups do not see the same things and do not share the same epistemes. Indeed, from the developers' perspective, the loss of biodiversity is not a loss of “beings” or “cohabitants” of the bush, but rather the loss of non-human components of an ecosystem—a view rooted in a naturalistic framework based on a nature-culture dichotomy (Descola, 2005).

However, from the inhabitants' perspective, certain species found in the bush (animals, trees, grasses, etc.) are perceived as possessing an agency capable of influencing human lives in either a favorable or unfavorable way (Laloi and Diatta, 2025). Notably, one can refer here to the practices of *salminaari* and *dieynaari*, which consist, respectively, of greeting and making an offering to a tree in order to harvest a part of it for therapeutic purposes, as plants are “inhabited” and endowed with the power to act (Ka, 2016: 193–195). Although this knowledge is not distributed evenly across the population—since it depends both on the ability to possess this knowledge and to transmit it—the perception of the disappearance of numerous animal and plant species living in the bush is shared by all inhabitants. Indeed, Juillard (2024) highlights the consistency in how residents of the sylvopastoral zone perceive environmental changes, where biodiversity loss is viewed through a relational lens: climate change causes a reduction in herbaceous and tree cover, which leads both to the disappearance of habitats for bush animals and a decline in livelihoods for pastoralists and their herds. This observation is linked to the recognition of the increase in land use, the finite nature of space and subsistence possibilities for humans and animals, and leads to a devaluation of transhumance (Adriansen, 2020) and an increase in requests for land allocation for pastoral use as a means of securing these spaces (Ba and Cesaro,

2026). It stands in contrast to the Western conception of unlimited growth and allows for a perspective grounded in the needs of pastoralists (Sarr, 2016).

This ontological divergence is not merely a theoretical observation: it constitutes a structural obstacle to genuine co-construction in development projects, and accounts for the repeated gap between project objectives and local appropriations documented in this study and elsewhere (Ba and Cesaro, 2026; Bekele, 2025).

Emerging agency

In a world shaped by the ideology of development and environmental changes, pastoralists navigate the variability of projects and infrastructure just as they navigate the variability of rainfall and pastures. Indeed, as the example of the Demba Yaba herb shows, the “*dynamics of multi-species resurgence*” upon which these ways of life rely are being disrupted by the emergence of invasive species (Tsing, 2022). The scarcity of bushland and the decline in the quality of forage are occurring both in the *wuro* (home villages) and during transhumance, prompting pastoralists to reinvent their livestock-rearing practices.

By highlighting the inadequacy of Hardin’s tragedy of the commons model, Mugelé et al. (2023) demonstrate the diverse responses of pastoralists to the pasture crisis through changes in transhumance routes and the use of supplementary livestock feed (storage of crop residues, purchase of feed supplements, fodder cultivation). From this perspective, the Great Green Wall projects are appreciated and widely supported by the majority of residents because they address certain needs of herding families, particularly for people and animals unable to engage in transhumance. Although the results of the Great Green Wall remain limited in terms of reforestation (Zhu et al., 2025), the plots appear to offer alternatives to address the shortage of fodder during dry seasons. Furthermore, the diversification of income and activities, to which the Great Green Wall contributes through wage employment (Sacande et al., 2021), also helps to some extent to meet the needs of the herd.

Another alternative, considered by some pastoralists as a response to the ecological crisis, is to reduce herd sizes. This strategy, which has also been documented among pastoralists in Kenya (Bostedt et al., 2023), aligns with the “*mini-ranch with fodder crops*” approach described by Ba and Cesaro (2026), p.9. This reduction in livestock numbers goes hand in hand with the introduction of Guzerat breed breeding bulls, which are of higher value. This trend challenges stereotypes about Fulani pastoralists, whose strategies are said to follow a logic of accumulating livestock and to be detached from market circuits (Ancey and Monas, 2005). Camara (2013: 298) further asserts that the pursuit of social recognition does not imply the absence of economic logic, as this social recognition linked to the size of the herd simultaneously implies economic power. In the same vein, according to Tyc (1994), zootechnical studies in Senegalese pastoral settings have shown, on the contrary, that there are few or no cull animals (animals at the end of their productive life) in the herds, meaning that the rate of herd utilization is relatively high. A survey conducted by the PPZS between 2005 and 2006 in 276 settlements shows that the sale of

animals (cattle, sheep, goats) accounts for 97.9% of a household’s income (Wane et al., 2010). As Wilson-Fall (2024) notes, these commercial strategies, though not accessible to everyone, make the emergence of a viable future for young Senegalese pastoralists a plausible prospect. One of them agrees:

“Now, for us, it is all about business [in French]. It is not just about pastoral livestock farming anymore. Now, even if you’re a herder, you look for what works best for you in livestock farming. [...] The guzerats are valuable to us now” (interview with a transhumant herder, September 10, 2025).

What distinguishes this study from previous accounts of pastoral adaptation in West Africa is that the reconfiguration of breeds documented here is neither imposed by a state program nor driven purely by market pressure. It emerges instead from the intersection of pastoralists’ environmental perceptions, their aesthetic and symbolic values, and their projections of a desired future—a combination of drivers that has not previously been documented in the Sahelian context.

Thus, the emergence of the Guzerat breed within Fulani herds lies at the intersection of economic considerations, environmental dynamics and the personal aspirations of pastoralists, whilst also being linked to the symbolic and spiritual dimensions of the long history of the Fulani and their cattle.

Cattle as a companion species

As we have seen, the relationship between Fulani pastoralists and their cattle is not static, but evolves in response to environmental conditions, understood in the broadest sense. Indeed, Diallo (2025), p.20 emphasises that Fulani cosmogony is based on a triad of herder-cattle-environment, within which a “*shared destiny*” is played out. The lives of pastoralists are conceived in relation to the lives of cattle, as their existences adapt, interlock and reinvent one another in response to biological and economic possibilities, environmental constraints, aesthetic criteria, history and politics. This relationship is not based on a logic of domination but on a logic of cooperation that fits within the idea of companionship developed by Haraway (2019).

According to the *Fantang*, a poem dedicated to Fulani herders that is widely known in Senegal (Ndongo, 1986), the Fulani social organisation has its origins in an encounter between three brothers, a cow and her calf on the banks of a river. This narrative describes the encounter that led to the emergence of cattle-rearing and Fulani society, which is divided between herders, griots and laobes who work with wood. However, according to Diallo (2025), p.18, “*mythical narratives are so essential that they form the basis of the imagination and influence social, religious and cultural practices*”. Indeed, livestock plays a central role in Fulani cosmogony, encompassing aspects of identity, classification, memory and exchange (Kervella-Mansaré, 2020). Among the *Wodaaɓe* of Niger, the unity between the human group and the animal group is signified by the word *dudal*, which also refers to the herd’s enclosure area (Bonfiglioli, 1988). As this excerpt from the *fantang* highlights, herders and cattle share the same living environment:

“The Fulani lives with the cow. The cow lives with the Fulani.” (Ndongo, 1986, p.25).

From this perspective, humans transform cattle just as much as cattle transform humans in return. The herder is responsible for looking after the cows and, in return, the cows provide him with what he needs to live (milk, meat, money), as one transhumant herder mentions:

“You sell them, you eat [the money]. You slaughter them, you eat [the meat]. You milk them, you eat [the milk].” (Interview, 10 September 2025).

These material dimensions are also linked to aesthetic and symbolic considerations. Indeed, cow's milk is associated with values of hospitality and social cohesion, as well as with ritual, aesthetic and therapeutic functions (Ka, 2025). Thus, the economic perspectives within which pastoral livestock farming is situated today are underpinned by social, environmental, symbolic and spiritual dimensions that enable these new materialities to be embedded within a coherent framework of representations.

Taken together, these three dimensions—environmental perception, material adaptation, and the reconfiguration of human-animal relationships—provide a direct answer to the three research questions posed in the introduction. The convergence of pastoralists' and developers' discourses around decline (RQ1) is revealed as a surface phenomenon that conceals deeply divergent ontologies. Pastoralists' relationship to Great Green Wall projects (RQ2) is neither passive acceptance nor outright resistance, but a pragmatic navigation shaped by seasonal constraints and a desire to maintain their herds on their own terms. Finally, the reconfiguration of breeds and livelihoods (RQ3) emerges as a form of agency that is simultaneously ecological, economic, aesthetic, and symbolic—irreducible to the categories of “modernization” or “tradition” that dominate policy discourse. This last finding contributes to the growing multispecies literature by demonstrating, in the Sahelian context, that breed change is not merely a zootechnical event but a reconfiguration of the human-animal-environment triad through which Fulani pastoralists have always defined themselves.

Conclusion

The intertwining of pastoralists' discourses and strategies with those of restoration and development projects demonstrates the extent to which these projects constitute a component of daily life in northern Senegal. For over 50 years, these projects have presented themselves as experts capable of providing solutions to the problems faced by the population and ecosystems. This situation creates a posture of dependency among residents, where bonds are forged within a relationship that is desired yet unbalanced.

Drawing on the shared narrative of a decline in the bush since the droughts of the 1970s, residents adapt to the projects by reconfiguring their relationships with animals, trees, grasses, ecosystems, and places in general. This intertwining of residents' and projects' perspectives reflects a desire for collaboration, as the projects partially address residents' needs. Indeed, in the context of declining biodiversity and a shortage of fodder resources during dry seasons, reforestation plots and participation in projects provide

pastoralists with an opportunity to meet their animals' needs, particularly through the purchase of livestock feed.

The perception of the environment's limited capacity reflects pastoralists' deep concern and sustained attention to the state of the bush. This perspective leads some pastoralists to perceive the need to reduce herd sizes, challenging the stereotype that Fulani pastoralists accumulate animals without regard for market logic. In this instance, the reduction in herd size is notably offset by the diversification of economic activities and an increase in the value of the animals. This appreciation in the animals' value is achieved through the introduction of Guzerat bulls which are more valuable but less well-adapted to the semi-arid climate than Gobra zebu.

These strategies in cattle breeding seem to rest, on the one hand, on ways of being in the world grounded in measurement and exploitation, and on the other hand, on relationships built through the care given to other living beings. The crossbreeding of these breeds demonstrates that economic and technocratic conceptions encompass other ways of describing human-animal-plant-mineral relationships that are more oriented toward ways of inhabiting the world. From this perspective, the metamorphoses of the Fulani bull offer insight into how the reinvention of relationships between humans, animals, plants, and minerals allows us to move beyond a focus solely on economic development by also taking into account environmental limits, local ecological and technical knowledge, and the diversity of all beings in the world.

Data availability statement

The datasets presented in this article are not readily available because the ethnographic data used is not available to the public. Requests to access the datasets should be directed to chloe.laloi@scpobx.fr.

Ethics statement

Ethics committee approval (Comité national d'Ethique pour la recherche en santé) was not required, since this study involves only qualitative data and does not include any biomedical data. No physical measurements, medical interventions, clinical examinations, or biological samples were collected. The qualitative data were processed anonymously, and all participants were informed of the study's purpose and the nature of their participation.

Author contributions

CL and AD conducted the experiments, CL analysed of the data and wrote the manuscript, and AD, J-NF and PD reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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References

- Adriansen, H. K. (2006). Continuity and change in pastoral livelihoods of Senegalese fulani. *Agric. Hum. Values* 23, 215–229. doi: 10.1007/s10460-005-6108-3
- Adriansen, H. K. (2020). “Indigenous knowledges and academic understandings of pastoral mobility,” in *Indigenous Knowledges and the Sustainable Development Agenda*. Editors A. Breidlid and R. Krøvel (London: Routledge), 167–184.
- Ancey, V., and Monas, G. (2005). Le pastoralisme au Sénégal, entre politique “moderne” et gestion des risques par les pasteurs. *Rev. Tiers Monde* 184 (4), 761–783. doi: 10.3917/rtm.184.0761
- Ancey, V., Krätli, S., and Dabire, D. (2025). “Ce que le pastoralisme nous dit du réchauffement climatique,” in *L’Agriculture Et Les Systèmes Alimentaires Du Monde Face Au Changement Climatique. Enjeux Pour Les Suds*. Editors V. Blanfort, J. Demeois, and M. Hrabanski (Versailles: Quae), 207–220.
- Aubréville, A. (1949). *Climats, Forêts Et Désertification De L’Afrique Tropicale*. Paris: Société d’Éditions Géographiques, Maritimes et Coloniales.
- Augoyard, J.-F. (2001). “L’entretien sur écoute réactivée,” in *L’Espace Urbain En Méthodes, Marseille: Editions Parenthèses*. Editors M. Grosjean and J.-P. Thibaud, 127–153.
- Ba, B., and Cesaro, J. D. (2026). Transhumance, ressources et décentralisation: le besoin d’articuler les échelles pour sécuriser les systèmes pastoraux au Sénégal. *Revue d’élevage de médecine vétérinaire des pays tropicaux* 79, 37908. doi: 10.19182/remvt.37908
- Barral, H. (1982). *Le Ferlo Des Forages: Gestion Ancienne Et Actuelle De L’Espace Pastoral: Étude De Géographie Humaine*. Dakar: ORSTOM.
- Behnke, R. H., Scoones, I., and Kerven, C. (1993). *Range Ecology at Disequilibrium. New Models of Natural Variability and Pastoral Adaptation in African Savanna*. London: Overseas Development Institute.
- Bekele, M. (2025). Resistance as agency: reimagining participation in forest landscape restoration in Tigray, Ethiopia. *Trees, Forests People* 21, 100967. doi: 10.1016/j.tfp.2025.100967
- Benjaminsen, T. A., and Hiernaux, P. (2019). From desiccation to global climate change: a history of the desertification narrative in the West African Sahel, 1900–2018. *Glob. Environ.* 12 (1), 206–236. doi: 10.3197/ge.2019.120109
- Berkes, F. (2008). *Sacred Ecology*. New York: Routledge.
- Bignante, E. (2010). The use of photo-elicitation in field research. *EchoGéo*, 11. doi: 10.4000/echogeo.11622
- Bonfiglioli, A. M. (1988). *Dudal: histoire de famille et histoire de troupeau chez un groupe de Wodaabe du Niger*. Paris: Les Éditions de la MSH.
- Bostedt, G., Knutsson, P., Muricho, D., Mureithi, S., Wredle, E., and Nyberg, G. (2023). Adaptive pastoralists—Insights into local and regional patterns in livelihood adaptation choices among pastoralists in Kenya. *Pastoralism* 13, 26. doi: 10.1186/s13570-023-00290-8
- Boutrais, J. (2022). Migrations pastorales et races bovines en savanes (Cameroun, Burkina Faso). *J. des Afr.* 92 (2), 8–38. doi: 10.4000/africanistes.12686
- Camara, A. (2013). *Le Rapport Au Changement Dans La Société Pastorale, Ph. D. Thesis*. University of Bourgogne. Available online at: https://www.isra-bame.sn/wp-content/uploads/2025/04/These_Astou_Diao_Camara-docx.pdf (Accessed July 27, 2026).
- Cesaro, J. D., Magrin, G., and Ninot, O. (2010). *Atlas De L’Élevage Au Sénégal*. Montpellier, Paris: CIRAD, Université de Paris I. Available online at: <http://geoprodig.cnrs.fr/items/show/207262> (Accessed July 26, 2026).
- Chao, O., Reyes-García, V., Molnár, Z., and Li, X. (2025). Living knowledge: persistence and adaptation of traditional ecological knowledge in East Ujimchin, Inner Mongolia, China. *Ecol. Soc.* 30 (4), art39. doi: 10.5751/ES-16447-300439
- Collier, J. Jr (1967). *Visual Anthropology: Photography as a Research Method*. New York: Holt, Rinehart and Winston.
- Davis, D. K. (2016). *The Arid Lands: History, Power, Knowledge*. 1st ed. Cambridge, Massachusetts: The MIT Press.
- De Wit, S. (2020). “What does climate change mean to us, the Maasai,” in *Global Warming in Local Discourses: How Communities Around the World Make Sense of Climate Change*. Editors M. Brüggemann and S. Rödder (Cambridge, UK: Open Book Publishers), 161–208.
- Descola, P. (2005). *Par-delà Nature Et Culture*. Paris: Gallimard.
- Descola, P. (2025). *Politiques Du faire-monde*. Paris: Seuil.
- Diallo, A. H. (2021). *Marché Hebdomadaires Et Mutations Du Système De Production Pastoral Au Ferlo (Sahel Sénégalais), De L’Économie D’Autosubsistance Au Jigoore, Ph. D. Thesis*. University Cheikh Anta Diop of Dakar.
- Diallo, A. O. (2025). Le pasteur, les bovidés et l’environnement dans la tradition orale peule. *Tydskr. Vir Lett.* 62 (3), 18–25. doi: 10.17159/tl.v62i3.18638
- Dupire, M. (1962). Des nomades et leur bétail. *L’Homme* 2 (1), 22–39. doi: 10.3406/hom.1962.366447
- Eriksen, S., and Lind, J. (2009). Adaptation as a political process: adjusting to drought and conflict in Kenya’s drylands. *Environ. Manag.* 43, 817–835. doi: 10.1007/s00267-008-9189-0
- Fall, A. K., Montcho, M., Sissokho, M. M., and Ndiaye, F. B. (2023). Evaluation of the reproductive performance of gobra, guzerat breed cattle and their cross-breaking products at the dahra djolof zootechnical research center (CRZ) (Senegal). *Int. Res. J. Adv. Eng. Sci.* 8 (4), 172–180. doi: 10.13140/RG.2.2.14652.24968
- Flintan, F., Diop, A., and Coulibaly, M. (2022). *Opportunities for Participatory Rangeland Management (PRM) in the Great Green Wall Initiative in Mali and Senegal*. Addis Ababa: ILRI.
- Grosmaire, P. (1957). *Éléments De Politique sylvo-pastorale Au Sahel Sénégalais*. Saint Louis: Service des Eaux et Forêts.
- Hanchard, M. (1999). Afro-modernity: temporality, politics, and the African Diaspora. *Public Culture* 11 (1), 245–268. doi: 10.1215/08992363-11-1-245
- Haraway, D. (2019). *Manifeste Des Espèces Compagnes*. Paris: Flammarion.
- Jamison, A. (2001). *The Making of Green Knowledge, Environmental Politics and Cultural Transformation*. Cambridge: Cambridge University Press.
- Jandreau, C., and Berkes, F. (2016). Continuity and change within the social-ecological and political landscape of the Maasai Mara, Kenya. *Pastoralism* 6 (1), 1. doi: 10.1186/s13570-016-0048-y
- Jasanoff, S. (2010). A new climate for society. *Theory, Cult. and Soc.* 27 (2-3), 233–253. doi: 10.1177/0263276409361497
- Jasanoff, S., and Martello, M. (2004). *Earth Politics: Local and Global in Environmental Governance*. Cambridge: MIT Press.
- Join-Lambert, A., and Ba, A. S. (1990). Stratégies commerciales et identité peule. Le “teefankaagal” au Sénégal. *Études Rural.* 120, 53–69. doi: 10.3406/rural.1990.3289

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- Juillard, L. (2024). *Représentations Des Changements Environnementaux À Travers La Mémoire Des Expériences De Nature Au Sénégal: Mémoires, Récits Et Expériences Au Prisme Des Transformations Environnementales Et Sociétales*. Ph. D. Thesis. Museum national d'histoire naturelle - MNHN PARIS. Available online at: <https://theses.hal.science/tel-05031079> (Accessed July 27, 2026).
- Ka, A. (2016). *Manger À Widou Thiengoly (Nord-Sénégal), De L'Abondance Remémorée À La Dépendance Aux Marchés*. Ph. D. Thesis. University Cheikh Anta Diop of Dakar.
- Ka, A. (2025). Aspects symboliques et usages sociaux du lait et des produits laitiers chez les pasteurs peuls du Sahel sénégalais. *Anthropozoologica*, 60, 103–113. doi: 10.5252/anthropozoologica2025v60a8
- Ka, A., Perrotton, A., Cisse, B., and Goffner, D. (2021). Mieux comprendre la complexification de l'espace pastoral. *Vertigo* 21 (2). doi: 10.4000/vertigo.32507
- Kervella-Mansar, Y. (2020). "Le Peul au miroir de sa vache," in *De La Bête Au Non-humain: Perspectives Et Controverses Autour De La Condition Animale*, Paris: Éditions Du Comité Des Travaux Historiques Et Scientifiques. Editor S. Dalla Bernardina, 135–146. doi: 10.4000/books.cths.9801
- Konaka, S., and Little, P. D. (2021). Introduction: rethinking resilience in the context of East African pastoralism. *Nomadic Peoples* 25 (2), 165–180. doi: 10.3197/np.2021.250201
- Krätli, S. (2015). *Valuing Variability: New Perspectives on Climate Resilient Drylands Development*. London: IIED. Available online at: <http://pubs.iied.org/10128IIED.html> (Accessed July 24, 2026).
- Krätli, S. (2023). Issues of declining livestock breeds: revisiting domestic animal diversity in pastoral systems. *Pastures and Pastor.* 1, 1–14. doi: 10.33002/pp0101
- Laloi, C., and Diatta, B. D. (2025). Poétique et politique des relations humains-animaux-végétaux-minéraux dans le tracé de la grande muraille verte au Sénégal. *Corps* 23 (1), 253–267. doi: 10.3917/corp1.023.0117
- Lavauden, L. (1927). *Les Forêts Du Sahara*. Paris: Berger Levrault.
- Magnani, S. (2020). Socio-technical objects at the crossroads between 'Universal' policy models for livestock production development, local practices and dynamics of change. *Nomadic Peoples* 24, 286–298. doi: 10.3197/np.2020.240208
- Manoli, C. (2012). *Le Troupeau Et Les Moyens De Sécurisation Des Campements Pastoraux: Une Étude De La Gestion Des Troupeaux De La Communauté Rurale De Tessekre, Dans Le Ferlo Sénégalais*. Ph. D. Thesis. University of Montpellier. Available online at: https://www.supagro.fr/theses/extranet/12-0032_Manoli.pdf (Accessed July 27, 2026).
- Manoli, C., Ancy, V., Corniaux, C., Ickowicz, A., Dedieu, B., and Moulin, C. H. (2014). How do pastoral families combine livestock herds with other livelihood security means to survive? The case of the Ferlo area in Senegal. *Pastoralism* 4 (1), 3. doi: 10.1186/2041-7136-4-3
- Marshall, K. (2014). Optimizing the use of breed types in developing country livestock production systems: a neglected research area. *J. Animal Breeding Genetics* 131 (5), 329–340. doi: 10.1111/jbg.12080
- Mugelé, R., Ninot, O., Dia N'Diaye, N., and Diallo, A. H. (2023). La "crise" des pâturages dans le Ferlo: une commune tragédie des communs. *Bull. l'Association Géogr. français* 100 (1), 20–37. doi: 10.4000/bagf.10566
- Naess, L. O. (2013). The role of local knowledge in adaptation to climate change. *Wires Climate Change* 4 (2), 99–106. doi: 10.1002/wcc.204
- Ndongo, S. M. (1986). *Le Fantang, Poèmes Mythiques Des Bergers Peuls Textes De la Tradition Orale Peule*. Paris: Karthala.
- Nori, M., and Scoones, I. (2023). Rethinking policies for pastoralists, governing the rangelands. *Rangel.* J. 45 (2), 53–66. doi: 10.1071/RJ23010
- Paillé, P., and Mucchielli, A. (2016). "Chapitre 12. L'analyse thématique," in *L'Analyse Qualitative En Sciences Humaines Et Sociales*. Editors P. Paillé and A. Mucchielli (Paris: Armand Colin), 235–312.
- Reyes-García, V., García-Del-Amo, D., Porcuna-Ferrer, A., Schlingmann, A., Abazeri, M., Attoh, E. M. N. A. N., et al. (2024). Local studies provide a global perspective of the impacts of climate change on Indigenous Peoples and local communities. *Sustain Earth Rev.* 7 (1), 1. doi: 10.1186/s42055-023-00063-6
- Sacande, M., Parfondry, M., Cicatiello, C., Scarascia-Mugnozza, G., Garba, A., Olorunfemi, P. S., et al. (2021). Socio-economic impacts derived from large scale restoration in three great green wall countries. *J. Rural Stud.* 87, 160–168. doi: 10.1016/j.jrurstud.2021.09.021
- Santoir, C. (1980). *Sédentarisation Des Nomades Et Hydraulique Pastorale*. Paris: ORSTOM.
- Santoir, C. (1983). *Raison Pastorale Et Politique De Développement: Les Peuls Sénégalais Face Aux Aménagements*. Paris: ORSTOM.
- Sarr, F. (2016). *Afropia*. Paris: Philippe Rey.
- Scoones, I. (1995). *Living with Uncertainty: New Directions in Pastoral Development in Africa*. London: Institute of Development Studies.
- Scoones, I. (2015). *Sustainable Livelihoods and Rural Development*. Rugby: Practical Action Publishing.
- Scoones, I. (2023). Confronting uncertainties in pastoral areas: transforming development from control to care. *Soc. Anthropology/Anthropologie Soc.* 31, 57–75. doi: 10.3167/saas.2023.04132303
- Touré, O., and Arpaillange, J. (1986). *Peul Du Ferlo*. Paris: L'Harmattan.
- Tsing, A. (2017). *Le Champignon De La Fin Du Monde: Sur La Possibilité De Vivre Dans Les Ruines Du Capitalisme*. Paris: La Découverte.
- Tsing, A. (2022). *Proliférations*. Paris: Wildproject.
- Tyc, J. (1994). Etude Diagnostic Sur L'Exploitation Et La Commercialisation Du Bétail Dans La Zone Dite Des "Six Forages", *Rapport De Mission Pour Le Compte Du Projet D'Exploitation agro-sylvo-pastoral Des Sols Dans Le Nord Du Sénégal (GTZ)*.
- Union Africaine (2024). Stratégie et cadre de mise en œuvre de l'IGMV 2024-2034. Available online at: https://au.int/sites/default/files/documents/43834-doc-FINAL_FINAL_FRENCH_Integration_Document_DRAFT_AU_GGW_STRATEGY.pdf (Accessed July 27, 2026).
- Van Dooren, T., Kirksey, E., and Münster, U. (2016). Multispecies studies: cultivating arts of attentiveness. *Environ. Humanit.* 8 (1), 1–23. doi: 10.1215/22011919-3527695
- Wane, A., Ancy, V., and Grosdidier, B. (2006). in *Les Unités Pastorales Du Sahel Sénégalais, Outils De Gestion De L'Élevage Et Des Espaces Pastoraux, Développement Durable Et Territoires, Dossier* 8. doi: 10.4000/developpementdurable.3292
- Wane, A., Camara, A., Ancy, V., Joly, N., and Ka, S. (2009). Choix individuel et sécurisation collective: le salariat dans les exploitations pastorales du Ferlo (Sahel sénégalais). *Econ. Sociétés* 9, 14–43.
- Wane, A., Ancy, V., and Touré, I. (2010). Pastoralisme et recours aux marchés: Cas du Sahel sénégalais (Ferlo). *Cah. Agric.* 19 (1), 14–20. doi: 10.1684/agr.2009.0329
- Wilson-Fall, W. (2024). Winners and losers: pastoralists futures in Senegal. *Afr. Today* 70 (4), 49–70. doi: 10.2979/at.00012
- Zhu, A. L., Ndiaye, A., Dahm, R., Mauclore, M., and Boas, I. (2025). Africa's great green mirage? Assessing the disconnect between global finance and local implementation in Africa's great green wall. *Land Use Policy* 157, 107670. doi: 10.1016/j.landusepol.2025.107670