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Pastoral transitions in West Africa: analysis of factors influencing herders' sedentarization in northern Benin

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Pastoral livestock in West Africa has been under increasing pressure in recent years due to land tenure challenges, climate change, insecurity, and socio-economic transformations. These pressures have often led pastoralists to shift from mobile or transhumant livestock systems toward more sedentary systems. Whether this transition is voluntary and planned or gradual and imposed, it raises questions about its viability, sustainability, and broader social and economic consequences. The debate remains marked by divergent positions among researchers, policymakers, civil society actors, and technical and financial partners. This study aims to describe and analyze the factors influencing pastoral mobility, drawing on field surveys conducted in northern Benin, in order to better understand the dynamics at play. The results show that sedentarization stems from a complex combination of agro-ecological factors (availability and quality of forage and water resources), infrastructural factors (presence of vaccination parks, livestock markets, and livestock corridors), institutional factors (secure land access, supportive public policies), and socio-economic and cultural factors (children's schooling, access to health centers, intercommunal conflicts, and generational change). Some factors act as direct incentives for reduced mobility, such as access to water, land tenure security, and availability of basic services. Others, such as conflict and generational shifts, contribute more indirectly. The analysis also indicates that the reduction of pastoral mobility is a hybrid process that combines voluntary adaptation strategies with responses to structural constraints. This findings suggest that pastoral transitions are more likely to be sustained in contexts where institutional environments are flexible, inclusive, and multi-level, recognizing pastoral knowledge, securing land rights adapted to extensive livestock production, and supporting coordinated territorial governance.

KEYWORDS

conflict, climate change, land insecurity, pastoralism, pastoral mobility

Introduction

In West African regions, pastoralism remains one of the oldest and most climate- and ecologically-adapted ways of life (Lesse et al., 2015; Starrs, 2018; Ellison et al., 2022; Kotchoni and Edja, 2023). Based on the mobility of livestock in response to the availability of pasture and water resources, this system has enabled millions of people to meet their needs, ensure food security, and contribute to national economies (Starrs, 2018; Azalou et al., 2023; Timpong-Jones et al., 2023). However, in recent decades, this model of pastoral mobility has undergone profound transformations. Increasing land pressure, changes in land use, agricultural expansion, the fragmentation of livestock corridors, and recurrent conflicts with farmers have severely undermined the viability of mobile pastoral systems (Basupi et al., 2017; Ajala, 2020; Ellison et al., 2022; Alokpaï et al., 2024). These challenges are compounded by the effects of climate change, new forms of insecurity in cross-border zones, and poorly coordinated sedentarization policies (Godde et al., 2020; Ikotun, 2023; Kotchoni and Edja, 2023). In this context of mounting pressure, a trend toward reduced pastoral mobility, or even partial sedentarization, has emerged among herders. Sometimes voluntary and planned (Imana and Beyene, 2016), sometimes constrained and gradual (Liao and Fei, 2017), this transition raises important questions about its feasibility, sustainability, and socio-economic implications.

A central question therefore arises: what factors influence changes in pastoral mobility, and how do these factors shape the social, environmental, and policy-related outcomes of these changes? The responses to this question reveal deep divisions among researchers, policymakers, civil society actors, and development partners. Some view sedentarization as an opportunity to stabilize pastoral households, promote local development, and enhance access to basic social services (Fernandez-Gimenez and Le Febre, 2006; Nkedianye et al., 2011; Haji and Legesse, 2017). These proponents emphasize that pastoral mobility is increasingly restricted by land privatization, the expansion of protected areas, recurrent droughts, land and ethnic conflicts, and other factors linked to globalization and changing markets (Fernandez-Gimenez and Le Febre, 2006; Ajala, 2020; Ellison et al., 2022). They also point out that pastoralism has faced major transformations in the twenty-first century, such as the rise of modern veterinary medicine, international pressure for sanitary control, and the declining symbolic and economic value of dairy products (Haji and Legesse, 2017). Others, however, view sedentarization as a loss of the pastoral system's adaptive capacity, potentially leading to increased food insecurity, genetic erosion of livestock, and marginalization of herder communities (Liao and Fei, 2017; Wang et al., 2022). In this regard, Houessou et al. (2020) and Scheper et al. (2020) emphasize the key role pastoralism plays in conserving local breeds, often neglected by genetic improvement programs. Furthermore, some studies indicate that pastoralist children show greater resistance to certain diseases, such as diarrheal and respiratory infections, and exhibit lower rates of stunting compared to sedentarized children (Nathan et al., 2005; Roth et al., 2005). However, other research points to high prevalence rates of infectious diseases, such as tuberculosis and brucellosis, among transhumant populations due to limited access to healthcare services (Jackson et al., 2014; Haji and Legesse, 2017), which puts into perspective the supposed health benefits of mobility. This debate highlights that the reduction of pastoral mobility is not merely a technical or individual choice. It is a multidimensional process influenced by public policies, territorial dynamics, the aspirations of younger generations, and shifting identities (Korf et al., 2015; Imana and Beyene, 2016; Liao and Fei, 2017; Dai et al., 2023). It is therefore essential to understand the factors that influence changes in pastoral mobility in order to gain insights into the social, environmental, and policy-related dynamics that accompany these transformations.

Despite extensive literature on pastoralism and sedentarization, few studies provide a detailed analysis of the factors that influence changes in pastoral mobility. Existing research tends to focus either on the socio-economic or environmental effects of pastoral mobility (Groom and Western, 2013; Imana and Beyene, 2016; Haji and Legesse, 2017; Wang et al., 2022; Dai et al., 2023), or on the tensions and conflicts arising from its persistence (Korf et al., 2015; Ajala, 2020; Kotchoni and Edja, 2023; Amoo, 2024). Few studies investigate the factors underlying changes in pastoral mobility, based on the lived experiences of the actors involved. Ideally, such an approach should combine the perspectives of herders, development practitioners, public policy representatives, and local authorities. To achieve this, it is important to adopt a qualitative, grounded, and systemic approach capable of capturing the diversity of trajectories, trade-offs, and local dynamics. This is the perspective adopted in the present study, which aims to highlight the multidimensional factors shaping the perceived reduction of pastoral mobility at the local level, based on the experiences and perspectives of interviewees.

Materials and methods

Context and study area

In Benin, traditional livestock farming plays a major role in the national economy and contributes approximately 13% to the agricultural GDP (DSA, 2020). Despite this importance, livestock systems remain traditional and extensive, with productivity strongly linked to the availability of forage and water resources. These factors determine herd movements and define production systems as either transhumant (Kperou Gado et al., 2020; Ellison et al., 2022). In recent years, Benin,

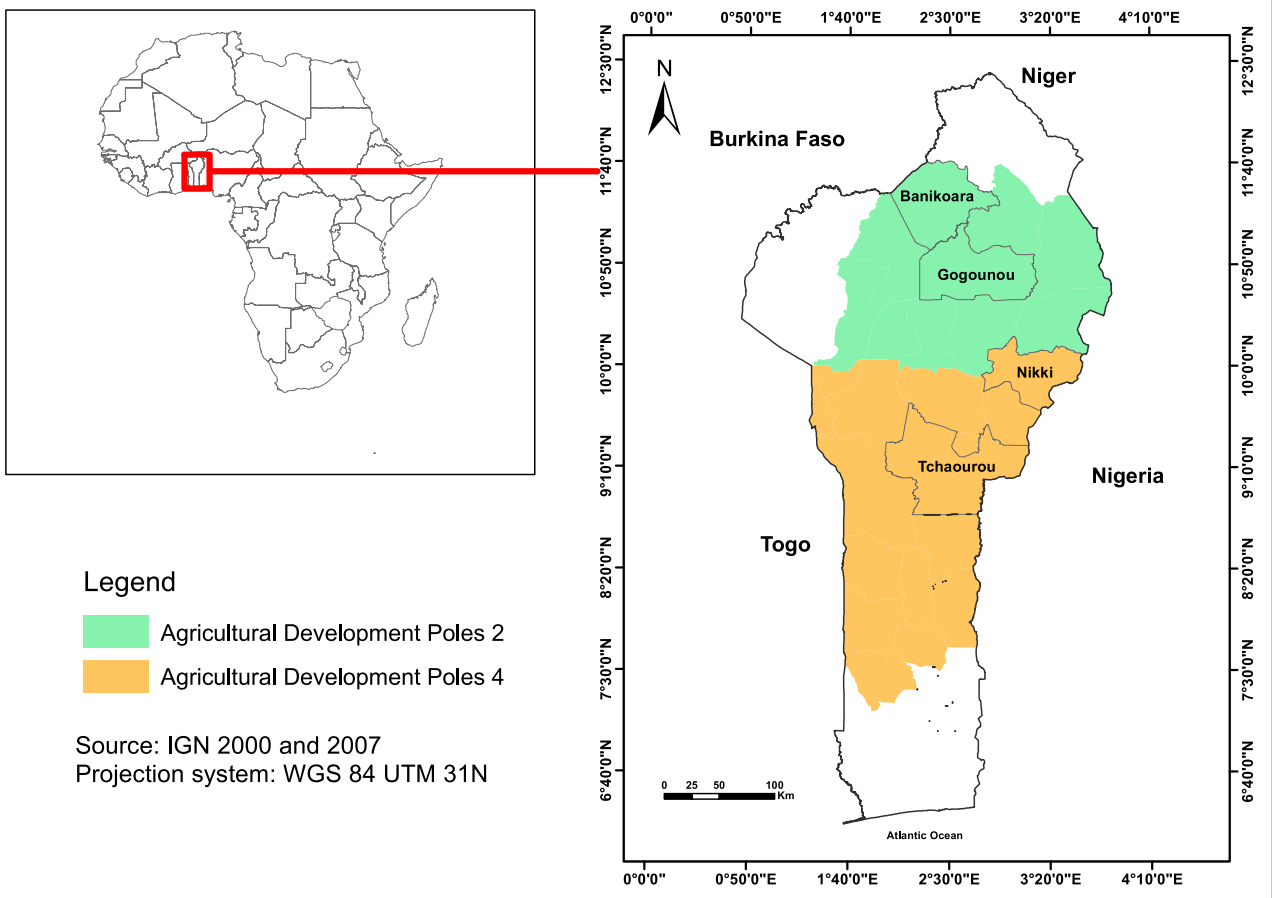

FIGURE 1
Map of the study area.

which was long considered a host country for transhumant herders, especially during the dry season, has experienced agricultural expansion that tends to reduce pastoral areas in favor of food crops (Toko Issiaka et al., 2016; Djohy et al., 2022). This situation, combined with climate change and population growth, has been the source of many conflicts between farmers and herders (Harchies et al., 2007; Kotchoni and Edja, 2023). Therefore, understanding the factors that influence changes in pastoral mobility is essential to better grasp the dynamics shaping pastoral mobility in northern Benin.

We selected Agricultural Development Poles (ADP) 2 and 4 (Figure 1) because they host the largest livestock populations in Benin, according to the National Agricultural Census (2019, https://dsa.agriculture.gouv.bj; Accessed on 06 September 2023), and because they exhibit key characteristics for understanding this transition in the national context. From each pole, we selected the two leading municipalities in terms of ruminant population: Gogounou and Banikoara in Pole 2, and Tchaourou and Nikki in Pole 4. ADP 2 is influenced by a sudanian climate, characterized by a dry season from November to April and a rainy season from June to September, with average annual rainfall below 1,000 mm and temperatures ranging from 24 °C to 31 °C. ADP 4, on the other hand, is under the influence of a sudanian-guinean climate, exhibiting a rainfall pattern that is intermediate between bimodal and unimodal, with average annual precipitation ranging from 900 mm to 1,110 mm and temperatures between 25 °C and 29 °C (DGEC, 2022). Vegetation in both ADPs is generally characterized by fallow land, savannas, woodland forests, dry forests, and riparian forest galleries along waterways.

Data collection

Data were collected between July and December 2024. Semi-structured interviews were conducted with herders and local stakeholders involved in pastoral policy implementation. Villages were selected in collaboration with officials from the local offices of the Territorial Agency for Agricultural Development (ATDA), based on criteria including the number of herders, livestock size, and accessibility. In each village, participants were randomly

TABLE 1 Socio-demographic characteristics of respondents.

Variables	Categories	Proportion (%)
Herders		
Age	Adults (30–60 years)	68.8
	Elderly (≥60 years)	17.2
	Youth (18–30 years)	12.5
Experience in livestock farming (Exp)	20 ≤ Exp <30 years	53.6
	Exp ≥30 years	46.4
Herd size (T)	20 ≤ T < 60	50.9
	60 ≤ T < 100	32.7
	T < 20	12.7
	T ≥ 100	3.6
Education level	None	79.9
	Secondary	14.8
	Primary	5.4
Local stakeholders		
Gender	Male	87.5
	Female	12.5
Professional experience (Pro)	5 ≤ Pro <10 years	42.9
	Pro <5 years	28.6
	Pro ≥10 years	28.6
Education level	Secondary	14.3
	University	85.7

selected from livestock herders with at least 20 years of experience, for whom cattle raising was the primary livelihood. A total of 120 herders were surveyed, 30 per municipality. In addition to herders, individual interviews were also conducted with local stakeholders involved in pastoral policies, each with at least 5 years of experience. These stakeholders included municipal officers, staff from the Ministry of Agriculture, Livestock and Fisheries (MAEP), forestry officers, local NGOs, veterinarians, and representatives of UCOPER (Communal Union of Professional Ruminant Herders' Organizations). In total, 35 local stakeholders were interviewed across the four municipalities, including 8 in Tchaourou, 7 in Nikki, 10 in Gogounou, and 10 in Banikoara. In addition to individual interviews, four focus group discussions were organized, one in each municipality, involving around 15 participants representing all stakeholder categories. Discussions focused on two main topics: (i) perceptions and motivations behind pastoral mobility and (ii) factors contributing to the reduction of mobility. The interviews were conducted in French and in the local language (Fulfulde). For this purpose, a field assistant was recruited in each locality to facilitate the interviews. Most of the herders surveyed (68.8%) were adults between the ages of 30 and 60, with 53.6% having between 20 and 30 years of professional experience in livestock farming, and 50.9% owning herds of 20–60 animals (Table 1). A majority of the herders were not formally educated (79.9%), and all were men. Regarding the local stakeholders, most were men (87.5%), with 42.9% having between 5 and 10 years of professional experience. The majority of them had university-level education (85.7%).

Data analysis

All interviews were first transcribed from local languages into French, which served as the primary language for data analysis. For the purpose of this article and to facilitate understanding by the international readership, relevant excerpts were then translated into English. To ensure accuracy, a back-translation process was conducted. This step helped to clarify the content of

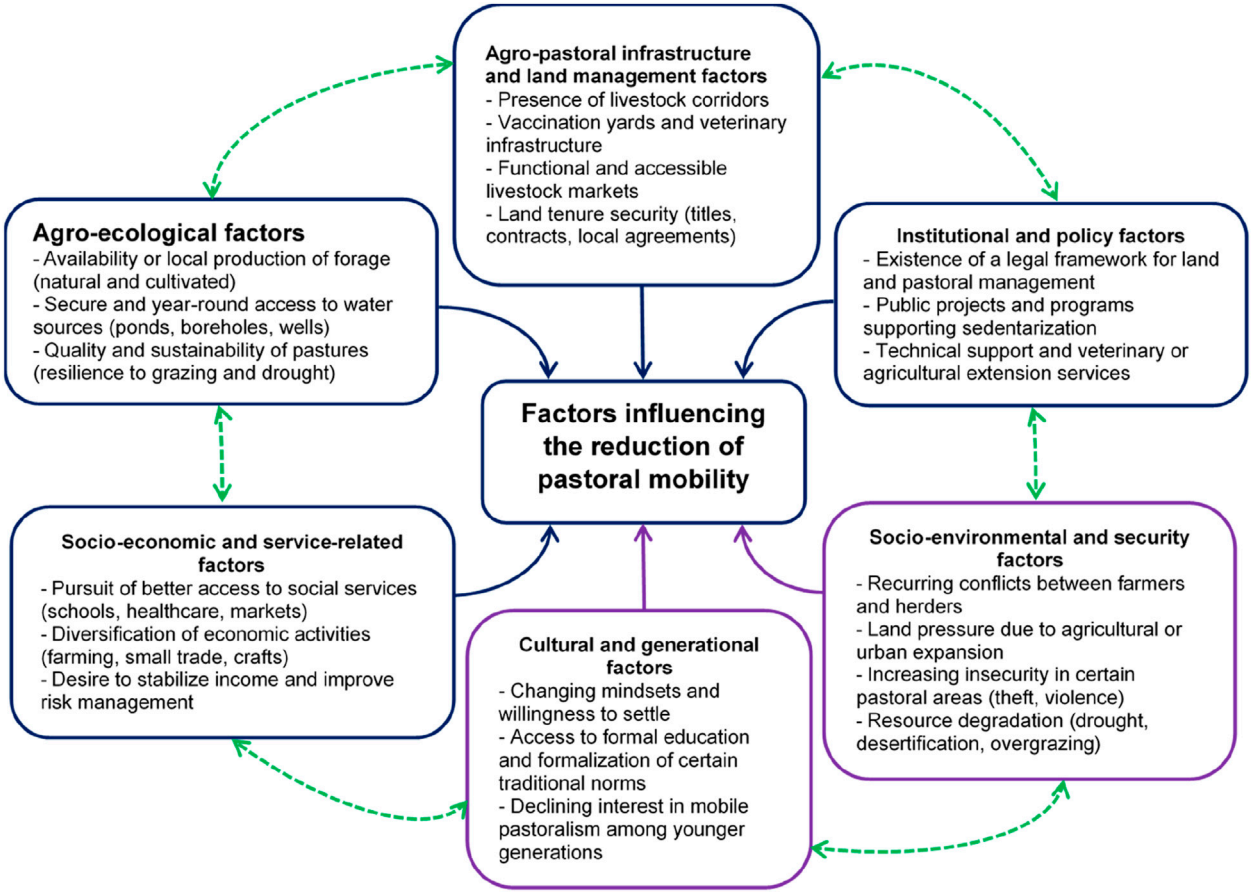

FIGURE 2
Factors influencing the reduction of pastoral mobility in northern Benin. The solid dark blue and solid purple arrows respectively indicate direct and indirect incentive factors for reducing pastoral mobility. The green dashed arrows indicate interactions between the different factors.

the discussions and extract the key ideas (primary concepts) that reflected the factors influencing pastoral mobility. Transcription was conducted simultaneously with data collection to identify any new ideas or emerging factors related to mobility reduction.

The transcripts were imported into ATLAS.ti 7 software for systematic coding. This step helped identify secondary concepts related to the socio-economic, institutional, and environmental factors influencing herders' decisions and practices that support reduced mobility. Codes were applied to the relevant interview excerpts concerning participant strategies and perceptions.

Next, primary concepts were grouped based on their relationships and interconnections to identify aggregated theoretical themes. These aggregated concepts were used to construct an analytical framework on the factors that either facilitate or hinder the reduction of pastoral mobility. Relationships among these factors were analyzed to highlight the social, economic, and institutional strategies that influence herders' decisions regarding mobility.

Results

General overview of factors contributing to the reduction of pastoral mobility in a context of climate change

In the context of climate change and increasing pressure on natural resources, some herders in Benin are showing a growing preference for reduced pastoral mobility as a strategic adaptation. Based on interviews conducted with local stakeholders, the main factors that support the transition toward more sedentary and less mobile livestock systems under climate change conditions are presented in Figure 2.

The findings reveal that the reduction of pastoral mobility is influenced by a combination of agroecological, infrastructural, institutional, socio-environmental, cultural, and economic factors. Some of these factors are internally driven, stemming from the agency of herders themselves. Other factors are

externally driven, resulting from policies, infrastructure, or incentives provided by local authorities, government programs, or development projects. These internal and external factors interact in complex ways, and their influence varies across local contexts. Recognizing this interplay highlights the importance of an integrated, place-based approach when analyzing pastoral mobility and designing interventions aimed at reducing mobility.

Agro-ecological factors

The availability of forage resources and water points on site is a key factor that facilitates the reduction of pastoral mobility. When herders have secure and permanent access to water through wells, ponds, boreholes, or developed rivers, they no longer need to travel long distances in search of water points, especially during the dry season. This water stability not only allows livestock to be kept close to the homestead but also reduces risks associated with transhumance, such as land disputes, farmer-herder conflicts, and losses of animals due to disease and theft. Moreover, the availability of locally produced forage plays a critical role in the sedentarization process. "Through the introduction of forage crops, the use of fallow lands, the recovery of harvest residues (such as maize stalks, peanut and rice haulms), and the practice of agro-pastoralism, herders are now able to feed their livestock without relying on seasonal grazing routes", said an officer from the ADP 2. These locally available forage resources enhance the autonomy of livestock systems. For example, Garba, a Fulani herder from Gogounou, recounted that he used to travel long distances with his cattle during the dry season. Since the installation of a borehole in his village and the introduction of *Panicum maximum* cultivation, he no longer migrates. He stated that his animals are better fed and he is now able to stay close to his family. In Banikoara, Moussa explained: "I received Brachiaria and Panicum seeds as part of a project. Thanks to that, I now produce and store forage to feed my animals during the dry season, while also using manure to produce compost for farming. I no longer need to travel as far as southern Benin to feed my animals." Another herder added: "Given the challenges related to poor pasture productivity and long-distance mobility, I decided to establish plots of Andropogon gayanus, a local forage species that is highly resistant to grazing and drought. This now allows me to feed my animals while practicing limited mobility."

In addition, the quality and durability of pastures also represent an important lever in this transition. Agro-ecological factors therefore include not only access to water and local forage production, but also the resilience of pastures to grazing and drought, as highlighted by an MAEP officer during the interviews.

Agro-pastoral infrastructure and land-use planning factors

These refer to infrastructures and arrangements established to support livestock management within a given territory. They include livestock corridors, vaccination parks and veterinary facilities, livestock markets, and land tenure security.

Livestock corridors allow herds to move freely between grazing areas, water points, markets, or veterinary posts without crossing cultivated fields. This infrastructure reduces land-related conflicts, secures herd movements, and minimizes losses due to long treks. A herder from the commune of Nikki shared, "Before, when we crossed farmlands, we often got into fights with farmers. Now with the corridor, we walk peacefully. It makes us want to stay in the area." These corridors also play a role in initiating sedentarization, as routes are now better marked, shorter, and herders can settle nearby. An officer from the Gogounou ADP 2 stated: ". . . the marking and demarcation of livestock corridors in Gogounou have significantly reduced farmer-herder conflicts in recent years."

Vaccination parks, on the other hand, facilitate access to veterinary care by grouping animals into specially designed enclosures. Regular treatments improve herd health, reduce mortality, and increase livestock productivity. With accessible animal care, herders no longer feel compelled to travel long distances in search of disease-free zones, according to a veterinarian based in Tchaourou. Ibrahim, a herder from Gogounou, supports this, stating: "With the vaccination park here, we treat the animals on time. They get sick less often. Before, we had to travel far to avoid disease outbreaks, but now we stay here." These facilities encourage herders to settle around areas offering veterinary services.

Proximity livestock markets provide herders with accessible commercial outlets, reducing the need to travel to large urban centers to sell their animals. By promoting stronger local economic integration, these markets encourage herders to establish themselves permanently around these trading hubs. The profitability of local sales, combined with lower transportation and travel costs, makes staying in place more attractive than practicing transhumance. ". . ..with this market, I sell right here and buy what I need for my family. Going far is no longer profitable", said a herder from Tchaourou.

In addition, land tenure security is a fundamental factor in reducing mobility. By granting clear rights of use or ownership over land (through land titles, Customary Holding Certificates (CHC), local agreements, etc.), herders are able to settle, develop permanent water sources, cultivate forage crops, and build enclosures for their livestock. This territorial stability allows them to envision a sedentary future, enroll their children in school, and diversify their livelihoods through small-scale farming, trade, or stable livestock production. For example, a female herder from Tchaourou stated, "When we have our own land, we can build, plant millet, and grow forage. Why leave when we can do everything here?"

Institutional and policy factors

Institutional and policy factors facilitate the reduction of pastoral mobility by creating favorable conditions for herders to settle permanently within a given territory. These factors are reflected in the establishment of clear legal frameworks for land and pastoral resource management, the implementation of public projects promoting sedentarization, and sustained technical support in veterinary and agricultural domains. When local authorities officially recognize the specific needs of herders, they establish mechanisms to secure their access to natural resources. For instance, the demarcation of grazing areas, supported by municipal, departmental, or national decrees, allows herders to access dedicated land for livestock feeding. According to Romaric, an official from the Banikoara town hall, this land security is sometimes reinforced through the issuance of legal titles or documents such as the CHC, which guarantees pastoral families the right to remain on their land. Assouma, settled in Banikoara, shared: "I received my CHC since 2023. Now I know no one can expel me by saying that a herder has no land. I fenced a plot and planted Panicum to feed my cattle."

In addition, several public programs, such as the ProSeR project, support herders in establishing sedentary pastoral systems. Thanks to this initiative, numerous pastoral zones have been developed, water points constructed, and support provided for forage cultivation. These interventions reduce the need to travel long distances during the dry season, a critical period when access to water and pasture becomes limited. Amadou, interviewed in a pastoral area of Tchaourou, said: "Before, we had to walk more than 20 km to fetch water. Now, with the borehole built by the ProSeR project, the cattle drink right here. We are less exhausted and can stay with our families."

Technical support, especially through public veterinary services, also strengthens this dynamic of reduced pastoral mobility. By ensuring the regular presence of veterinary officers for vaccination and treatment campaigns, health authorities reduce livestock losses, prevent disease outbreaks, and enhance herd resilience. Halidou, a young herder supported by a local project in Gogounou, stated: "When there was no vet, our animals used to die all the time. Today, the veterinary officer comes regularly. We do not have to run around anymore."

Socio-economic and service-related factors

These factors include access to basic social services, local economic opportunities, and the growing desire to secure income and better manage the risks associated with mobile livestock systems. One of the most decisive elements is the pursuit of better educational opportunities for children. Many pastoralist families now wish to ensure continuous schooling for their children. However, traditional transhumance makes regular school attendance difficult, if not impossible. This aspiration for education is prompting several families to settle permanently. ". . .. . .my son had already repeated two school years because of our movements. Since we settled near the village, he goes to school every day. I do not want to leave anymore", explained Salifou, a herder in the municipality of Nikki. For him, as for many others, schooling has become a key factor in the decision to settle. This observation was also made by several members of NGOs involved in local development in northern Benin, such as DEDRAS NGO, SUASON NGO, etc.

Access to healthcare services is another major factor. The proximity of a health center for human care represents a significant advantage. Moussa, a herder in Tchaourou, shared, "When my wife got sick in the bush, it took us hours to find a hospital, and she ended up dying." Such experiences drive families to seek safer living conditions by settling near health infrastructure.

Local economic opportunities, particularly the diversification of income-generating activities, also encourage some herders to reduce their mobility. Settling in one place allows for the combination of livestock farming with agriculture, small trade, or product processing. This diversification helps secure income and reduces reliance on transhumance. One herder stated, ". . .. . .last year, I harvested more than 15 bags of sorghum and maize. Selling those grains gave me enough money to buy a Bajaj motorcycle."

Moreover, the aspirations of younger generations are evolving. More and more young herders want to adopt less precarious lifestyles, access modern communication tools, and become integrated into local society. "My brother left for the city. I prefer to stay, but not like before. I have my Android phone and we talk regularly on WhatsApp. We even do video calls", said Abdou, a young man who gave up transhumance to settle in an agro-pastoral hamlet.

Additionally, the economic pressures related to conflicts and livestock theft are pushing many families to choose more stable and better-controlled forms of livestock production. As a camp leader from the Banikoara area testified, "Last year, we had 12 cattle stolen. That's it. We're staying here now. At least we see our animals every day with our small families."

Socio-environmental and security-related factors

Although these factors are often seen as constraints, they frequently act as triggers that push herders to consider partial or complete sedentarization, as a way to adapt to an environment that has become increasingly hostile to long-distance movements. According to the president of UCOPER Banikoara, recurring conflicts between farmers and herders are one of the primary drivers of reduced mobility. While crossing cultivated areas in search of pasture or water, herds sometimes cause damage, leading to tensions or even violent clashes. ". . .. . .we were in a village X in the municipality of Gogounou. The villagers would constantly

attack us. Even when our cattle did not touch anything, they blamed us. We could not go on like that anymore", testified Abouba, a herder who decided to settle on the outskirts of W National Park in Benin. Tired of repeated conflicts, many herders now prefer to stay in areas where they have established stable agreements with farming communities or have negotiated long-term rights to use a given piece of land.

In addition, land pressure worsens the situation. The reduction of available pastureland due to expanding crop fields, urbanization, or land privatization is making transhumance increasingly difficult. ". . .. . ..even the old livestock corridors have now become fields. Where do they expect us to pass with our cows?" asked Karim, a herder who has been permanently settled for 5 years in the municipality of Tchaourou. Ali D., a forestry officer in Gogounou, stated: "Pasture areas are now being encroached upon by crop fields, raising concerns about the future of pastoralism in Benin". As a result, unable to move as freely as in the past, many herders adapt by reducing their mobility or adopting semi-sedentary livestock systems near water sources or grazing lands they try to secure.

Rising insecurity in some regions also contributes to limiting movement. The presence of bandits, cattle thieves, or armed groups in cross-border or forested areas discourages herders from using certain routes or forces them to abandon long-distance migrations altogether. "My cousin was attacked at the border during a transhumance by unidentified armed men. He was killed. Since that day, I swore never to go far again", recounted Oumarou, a former long-distance herder in northern Benin who now raises a small herd close to home.

Moreover, the gradual degradation of grazing routes due to drought, overgrazing, and desertification has reduced the appeal of traditionally used dry-season areas. Natural pastures are becoming scarce, water points are drying up, and resources are no longer sufficient to sustain large herds over long distances. Boureima, a young herder who has adopted agro-pastoral practices, explained, "Even if you go, you find nothing. The bush is dry, the grass is burned, and you have to feed the animals every day. It's better to stay where you can grow a little maize to feed them."

Cultural and generational factors

Changing mentalities within herding communities, especially under the influence of modernization and emerging aspirations, are leading to a rethinking of the itinerant lifestyle. In the past, transhumance was valued as a marker of identity and prestige, but it is now increasingly viewed by young herders as less ideal. Many of them aspire to a more stable life that allows access to basic social services such as education, healthcare, and modern housing. Similarly, growing access to formal education plays a significant role in this transformation. Many families now choose to remain in place to allow their children to attend school regularly. This leads to progressive settlement and a reorganization of activities around semi-rural or urban areas. Mahamadou, a young herder from Gogounou, explains that his father spent his life walking with cattle and often slept in the bush without food. He says he now wants a house, a field, a motorcycle, and for his children to go to school.

Exposure to media, social networks, and new forms of social achievement is also shaping the life choices of younger generations. Many no longer identify with the traditional lifestyle that involves constant movement and difficult living conditions. They now seek more diversified activities, combining semi-sedentary herding with gardening, small-scale trading, or vocational training. For example, a herder from Tchatchou in the municipality of Tchaourou says he continues to herd cattle but also works as a mechanic. His younger brother has gone to learn electrical work in Parakou. He explains that they no longer want to live as their grandparents did.

The gradual formalization of certain traditional norms, in line with ongoing social change, is also encouraging the evolution of practices. Pastoral mobility is no longer seen as an absolute necessity but rather as a lifestyle choice that many young people now question. These cultural changes, along with a desire for local stability and improved living conditions, are contributing to the emergence of a more settled form of pastoralism that aligns better with the modern aspirations of herders.

Furthermore, some herders view the reduction of pastoral mobility as a loss of their tradition and cultural identity. As one herder interviewed in the municipality of Gogounou explained: ". . .since we no longer practice long-distance transhumance, our children no longer master the traditional skills required to manage livestock during transhumance, competencies essential for assessing a herder's ability to manage a herd." Others expressed that sedentarization limits their autonomy and their ability to manage livestock according to natural grazing cycles, representing a profound change in their way of life.

Discussion

Reduction in pastoral mobility: a hybrid process between strategic adaptation and structural constraint

The reduction in pastoral mobility appears as a hybrid process, blending strategies of adaptation and imposed constraints (Danaher and Henderson, 2012; Fan et al., 2014; Imana and Beyene, 2016; Liao and Fei, 2017). This duality is clearly reflected in the discourse of herders in northern Benin, whose mobility reduction trajectories combine individual aspirations and structural realities. On one hand, some pastoralists have voluntarily adopted sedentarization as an adaptive strategy in response to an increasingly unfavorable environment for traditional mobility. This voluntary

sedentarization has also been observed in several regions of Africa (Korf et al., 2015; Imana and Beyene, 2016; Haji and Legesse, 2017) and in other parts of the world (Liao and Fei, 2017; Dangwal, 2024). For example, in Oromia (Ethiopia), Imana and Beyene (2016) reported that many herders deliberately opted for a sedentary lifestyle in order to secure access to social services, ensure the safety of people and property, or diversify their sources of livelihood. Likewise, in the absence of direct state interventions, the growing proximity to urban centers encourages many herders to adopt sedentarization as a strategy in response to environmental risks and emerging economic opportunities (Herrero et al., 2009; Korf et al., 2015).

On the other hand, the reduction in mobility also appears as a constrained response to a set of structural factors that gradually restrict the options available to herders. Increasing land pressure, recurrent conflicts between farmers and herders, restrictions on access to resources, and the closure of transhumance routes make some pastoral paths either too dangerous or completely inaccessible (Ajala, 2020; Ellison et al., 2022; Adédigba et al., 2023). Among these external factors, one of the most critical drivers is also the progressive loss of pasturage, resulting from farmland expansion, land tenure changes, and environmental degradation. Several respondents emphasized that shrinking grazing areas reduce the feasibility of transhumant practices and force herders to adapt by shortening mobility routes or adopting more settled strategies. This observation resonates with broader studies on sedentarization processes in Africa, which demonstrate how the contraction of grazing spaces, together with climate variability, contributes to a structural decline in long-distance mobility (Korf et al., 2015; Droy and Bidou, 2018; Turner and Schlecht, 2019; Adédigba et al., 2023). Such processes do not necessarily lead to a complete abandonment of mobility but often to hybrid strategies where seasonal movements are progressively limited and complemented by crop cultivation or fodder production. In particular, the national farmland policy, which governs access to and allocation of agricultural land, strongly influences the availability of grazing areas and the capacity of herders to maintain traditional transhumance routes.

Another external factor shaping these changing patterns of mobility is the broader security environment. While local-level risks such as livestock theft already weigh heavily on herders' strategies, the situation is compounded by growing instability and violent conflicts in areas north of Benin's borders (Diogo et al., 2021; Boné et al., 2024). Insecurity in neighboring regions of Burkina Faso and Niger, for instance, constrains traditional cross-border routes and generates additional pressures on herders, further reinforcing the tendency toward reduced mobility.

Thus, the reduction in mobility is neither the result of a fully voluntary choice nor of an absolute constraint. It lies at the intersection of adaptation dynamics and imposed processes, making any simplistic interpretation irrelevant. Any policy aimed at supporting sedentarization or reducing pastoral mobility should avoid a normative approach. It should instead recognize the diversity of trajectories and motivations, and support ongoing dynamics by taking into account the lived realities of herders and the capabilities they are able to mobilize during this transition process (Imana and Beyene, 2016; Wang et al., 2022; Abubakari, 2024).

Structuring role of the institutional and territorial environment in the transformation of pastoral systems

Our results showed that the reduction of pastoral mobility is not merely a response to ecological or social constraints but is also facilitated by increasingly structured institutional and territorial mechanisms. These findings are confirmed by Wang et al. (2022), who showed that the sedentarization of pastoralists is supported by land reforms, infrastructure development, and development projects. In countries where land belongs to the state, such as Benin, China, or Ethiopia, governments implement sedentarization programs driven by modernist visions of development and resource management (Homann et al., 2008; Fan et al., 2015; Tidjani et al., 2025). These programs offer choices and incentives to local herders to make changes in their daily lives (Wang et al., 2022). For example, the provision of documents such as Customary Land Holding Certificates (CHC) helps legitimize the presence of herders in a given area while reducing the risk of eviction. This type of institutional recognition, often supported by local or national decrees, strengthens the sense of stability and encourages long-term investments, as illustrated by Assouma's testimony in Banikoara. Likewise, public action through pastoral development projects such as ProSeR facilitates the settlement of herders by establishing infrastructure such as boreholes, designated pastoral areas, and forage cultivation zones (Tidjani et al., 2025). These investments reduce dependence on seasonal mobility, especially during the dry season, a period of high vulnerability for herders (Wang et al., 2022; Adédigba et al., 2023; Kotchoni and Edja, 2023; Tidjani et al., 2025).

Our study also revealed that strengthening local technical services, especially veterinary services, constitutes another structuring institutional factor. By ensuring the regular presence of personnel for care, vaccinations, or treatments, health authorities contribute to herd stabilization and the reduction of risks related to animal diseases (Turner and Schlecht, 2019). This support limits the need for preventive movements and reinforces the resilience of herders in fixed locations.

Furthermore, public policies also tend to marginalize pastoral systems by implicitly promoting sedentarization as the ideal of modernity (Brobbey et al., 2024; Tidjani et al., 2025). Yet pastoralism often remains absent from major rural development strategies, whether in international programs, national development strategies or local development plans

(Dong, 2016; Ibrahim et al., 2018). This invisibility leads to top-down approaches in which local dynamics of mobility and settlement are neither recognized nor genuinely integrated (Kotchoni and Edja, 2023; Nori and Scoones, 2023). This disconnect between national policies and local realities can increase the vulnerability of herders and hinder the emergence of hybrid models adapted to ecological and social contexts (Droy and Bidou, 2018; Kotchoni and Edja, 2023; Brobbey et al., 2024).

The analysis thus highlights the importance of a flexible, inclusive, and multi-level institutional environment to effectively support pastoral transitions. The findings suggest that pastoral systems often evolve through negotiated arrangements that enable herders to combine mobility and sedentarization according to the constraints and opportunities of their environment. This process involves the recognition of pastoral knowledge, land tenure arrangements adapted to extensive livestock systems, and governance mechanisms that link different levels of action within consultative frameworks (Fan et al., 2014; Korf et al., 2015; Liao and Fei, 2017; Droy and Bidou, 2018; Abubakari, 2024). The sustainability of the transformations observed will largely depend on the ability of institutional frameworks to embrace this complexity and support differentiated and evolving trajectories of contemporary pastoralism (Nori and Scoones, 2023; Brobbey et al., 2024).

Changing identities and reconfiguration of aspirations in pastoral communities

The results of this study reveal that sedentarization processes are accompanied by profound changes in representations, identities, and aspirations within pastoral communities. Among young people, there is a partial questioning of the cultural references associated with pastoral mobility. Far from being a radical break, this questioning is part of a process of identity redefinition. Access to formal education, the pursuit of a valued social status in a changing world, and the aspiration to a more stable life are among the factors reshaping the way young people envision their futures (Stolpe, 2016; Haji and Legesse, 2017; Vidal-González and Nahhass, 2018). Krätli and Dyer (2009) showed that educational aspirations, often perceived as incompatible with mobility, lead many families to settle more permanently, sometimes at the cost of redefining their relationship to livestock rearing. However, this transformation of aspirations is not univocal. It coexists with a persistent valorization of certain identity elements tied to mobile pastoralism, particularly among older generations. For the latter, mobility remains not only an economic strategy but also a fundamental component of their social and cultural identity (Easdale et al., 2023; Fernández-Giménez and Wilmer, 2025). This ambivalence gives rise to tensions within families and communities, where different conceptions of the ideal way of life coexist. These tensions, between attachment to pastoral traditions and the desire to adapt to ongoing changes, show that sedentarization is not only perceived as a technical solution but can also be experienced as an identity disruption (Liao and Fei, 2017; Wang et al., 2022).

Furthermore, the growing diversity of life trajectories observed in pastoral communities reflects a broader social reconfiguration. Some herders now combine livestock rearing with farming, small trades, and even wage labor or commercial activities (Haji and Legesse, 2017; Zampaligré et al., 2019). This plural integration into diverse economic worlds is transforming roles, hierarchies, and forms of social recognition. Nori and Scoones (2023) emphasize that these transformations should not be viewed solely as signs of crisis but also as manifestations of social dynamism, in which pastoral communities reinvent their identities based on an evolving heritage. Sedentarization therefore does not imply the disappearance of pastoral identities but rather their constant reconfiguration. It compels a rethinking of the very notion of pastoralism, no longer as a fixed way of life, but as a set of practices and values in ongoing dialogue with contemporary dynamics (Dong, 2016; Kanne et al., 2024). Recognizing this identity reconfiguration is essential to avoid normative approaches and to support pathways of change rooted in the real aspirations of communities (Kanne et al., 2024).

Furthermore, the interviews revealed that some herders perceive the reduction of pastoral mobility as a loss of their tradition and cultural identity. They explained that staying longer in the same village limits the transmission of ancestral knowledge and their ability to manage livestock according to natural grazing cycles. These findings highlight that pastoral mobility is not solely an economic strategy but also a central component of herders' identity and cultural heritage (Liao and Fei, 2017; Baxter, 2018). Sedentarization can thus be perceived as a disruption in the intergenerational transmission of knowledge and the continuity of traditional practices (Adédigba et al., 2023; Kotchoni and Edja, 2023). These perspectives indicate that any policy or intervention aiming to reduce pastoral mobility should consider cultural and social dimensions, in order to support herders without compromising their identity or traditional knowledge.

Limitations of the study and future research perspectives

This study primarily focuses on pastoralist encroachment on farmland, without giving equal attention to the reverse process of agricultural expansion into pastoral areas. Farmland encroachment, which is often shaped by national land and agricultural policies (Basupi et al., 2017; Nori and Scoones, 2023), also plays an important role in reducing access to grazing resources and in reshaping pastoral livelihoods. Future

research should therefore examine this dual process more explicitly in order to provide a more balanced understanding of land-use tensions.

Conclusion and implications

This study highlighted a range of factors that, at the local level, influence the reduction of pastoral mobility. Far from being solely driven by national policies or narratives around sedentarization, this shift is rooted in concrete dynamics observed in the field. These include the availability of forage and water resources, agro-pastoral infrastructure, institutional support, land tenure security mechanisms, and the socio-economic strategies adopted by herder households. These factors indicate that the reduction in mobility can represent a deliberate and strategic choice made by herders in response to a changing environment. Access to infrastructure, proximity to basic social services, and opportunities for integration into the local economy also contribute to this dynamic. The analysis thus reveals that the transition toward reduced mobility should not be seen as a rupture, but rather as a gradual transformation of pastoral practices. For this transition to be sustainable and equitable, it requires appropriate support based on the recognition of local initiatives and indigenous knowledge. These findings provide concrete avenues for guiding public policies and support programs toward more flexible frameworks, rooted in local realities, and capable of strengthening the resilience of livestock systems in the face of current climatic, economic, and social challenges.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The study protocol and questionnaire were approved by the ethics committee of the Laboratory of Ecology, Botany, and Plant Biology (LEB) at the University of Parakou prior to implementation, as the research involved human participants. Informed consent was obtained from all participants before each interview.

Author contributions

All authors developed the research and discussed the results. Data collection and analysis, and manuscript writing, were performed by AMK. Supervision of the work, manucript review, and editing were performed by SAA, LGH, ASY and IM-M. YT participated in data collection. All authors have read and agreed to the final version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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