# Perception of the sedentarization of cattle herds by livestock farmers in the Sudanian and Sudano-Guinean zones of northern Benin

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## Abstract

Decision-makers want livestock farmers and their animals to settle down in order to prevent or considerably reduce conflicts with crop farmers and to provide them with support for intensive, sustainable livestock production. This study was carried out for ascertaining herders' perceptions of sedentarization in the localities of Tchaourou, Djougou, Matéri and Gogounou in northern Benin. Using SPSS version 21 software, a descriptive statistical analysis was carried out to determine the different proportions of herders with regard to sedentarization. Overall, 88.33% of farmers were in favor of sedentary farming. Farmers in the Sudano-Guinean zone (48.54%) were more favorable than those in the Sudano-Guinean zone (39.79%). From the point of view of animal production and health, farmers felt that there would be an increase in cattle size (82.71%), animal weight (81.25%), growth of young cattle (76.25%) and a reduction in the number of abortions (81.67%), mortality of young cattle (78.54%) and the frequency of animal diseases (83.13%). On the social front, herders reported a reduction in the frequency of famine (75.83%), a reduction in the phenomenon of hostage-taking or kidnapping of children driving cattle to pasture (83.13%), and conflicts between crop farmers and herders (76.67%). These results also show that there is a fringe of herders who need to be supported for a sustainable adoption of sedentary herding in North Benin.

**Key words:** Animal production; perception; sedentarization; conflicts; crop farmers; cattle farmers.

# Introduction

One of the major challenges facing livestock farming in Benin is the persistence of conflicts with regard to the use of resources and land occupation between farmers and herders (Djohy et al., 2013;Assani et al., 2023; Yarou, 2023). The conflicts are generally accentuated by numerous facts such as drought, lack of pastures and water (Bonnet & Guibert, 2014). All these effects combined with climate change (floods and extreme droughts), seasonal fluctuation in nutritional resources (Montcho et al., 2024) induce major consequences on pastoral activity (Idrissou et al., 2020a) , causing a sudden loss of more than half of the herds, imposing mobility that is difficult to organize (Danne & Musshoff, 2017) and an increase in the cost of cereals essential for food. These pressures result from poverty, lack of agro-pastoral spaces, lack of pastures for livestock (Adédigba et al., 2023), desertification and demographic pressure. Added to this are structural factors such as chronic livestock diseases due to the lack of effective veterinary services, agricultural pressure on land (Sawadogo et al., 2012), difficulties related to access to water, and worrying insecurity linked to local conflicts or cross-border conflicts (Bindelle et al., 2013). These different factors often act chronically on livestock management practices, as well as on herd productivity (Djimon et al., 2024).

In addition, population growth and increased cash crop production have led to the expansion of agriculture into pasture areas, massive movements of transhumant herders from dry to wetter areas, and new forms of herd mobility to adapt to the large spatial and temporal disparity in pastoral and water resources (Touré et al., 2017). Tensions and conflicts between farmers and herders have increased in many parts of the world. Not only do these conflicts directly affect the lives and livelihoods of those involved, they also disrupt and jeopardize the sustainability of agricultural and pastoral production systems (Amegnaglo et al., 2018). Conflicts between herders and farmers are common in many African countries, where interests and practices vary considerably from one region to another. In effect, the competition between livestock farming and agricultural production through the transformation of pasture land into arable land (Häfner et Piorr, 2021) on the one hand, and the extension of irrigated agriculture along water points restricting access to water and pasture in the dry season on the other hand, accentuate these tensions.

In order to reduce conflicts between farmers and herders through the rational management of local resources on the one hand, and to improve the productivity of livestock farms on the other hand, the Beninese State has opted for actions aimed at the sedentarization of herders and their livestock. In this context, the Ruminant Herd Sedentarization Project in Benin (ProSeR) was created. This study aims to contribute to reducing conflicts between farmers and herders and improving livestock productivity. In this study, the aim is to analyze the perception of herders on the sedentarization of cattle herds in northern Benin through its impacts on the environment, the pastoral community, productivity and the health of animals. The aim is to propose actions for the sustainable sedentarization of herders, taking into account their aspirations.

# Methodology

**Study environment**

The study was conducted in two agroecological zones of northern Benin: the Sudanian zone and the Sudano-Guinean zone. The sudanian zone is located between 9°45 N and 12°25 N. Rainfall in this zone varies from 900 to 1100 mm per year. Air humidity is 18% during the harmattan. The average monthly temperature varies from 24°C to 31°C. The Sudanian zone is the domain of hydromorphic soils, drained soils, ferralitic cuirasses and lithosols. The sudano-guinean zone is located between 7°30' N and 9°45' N. Rainfall in this zone varies from 900 to 1100 mm per year. Relative humidity varies from 31% to 98%. Temperatures vary between 25 °C and 29 °C. This area is characterized by poorly evolved, low-fertility mineral soils and ferruginous soils on crystalline basement of variable fertility (Iwaka et al., 2023).

In the sudano-guinean zone, the study took into account the localities of Alafiarou, Bétérou, Tchaourou and Tchatchou for the municipality of Tchaourou; and the localities of Pélébina, Kolokondé, Partago and Bariénou for the municipality of Djougou. As for the sudanese zone, these are the localities of Bagou, Gounarou, Wara and Sougou Kpantrossi in the municipality of Gogounou. Still in the same area, the localities of Gouande, Materi, Nodi and Tchanhoun-Cossi in the municipality of Materi were taken into account (Figure 1).

**Data collection**

The collection was done in two phases: the repair of the survey and the survey itself.

**Preparing the survey**

During this preparatory phase, the localities and the cattle farmers to be surveyed were defined. Interview sessions were conducted with the municipal officials of the Territorial Agencies for Agricultural Development (ATDA), the Departmental Offices of Agriculture, Livestock and Fisheries (DDAEP) and the heads of Livestock Farmers organizations in the municipality.

Thus, four (04) localities were selected per municipality for a total of 16 localities for this study. These localities were selected with the support of stakeholders involved in the cattle breeding sub-sector, namely ATDA technicians, DDAEPs and leaders of livestock farmers' organizations. This choice was made taking into account

the spatial coverage of these localities so that villages in areas with high agropastoral potential, accessible, where there is mobility of cattle herds and therefore exposed to conflicts, are taken into account. These localities were also chosen according to their accessibility during the duration of the study.

After the identification of the localities, focus group discussions were conducted, at the rate of one focus group per locality. This stage enabled to have information on the perception of cattle farmers on sedentarization and the factors that could advocate for its large-scale adoption. During this phase, the questionnaire was tested and corrected for its use in the in-depth survey phase. The interviews conducted during this exploratory phase enabled to randomly select 30 cattle farmers/agro-pastoralists per locality to whom the questionnaire was sent individually for the rest of the study. Thus, 480 people were involved in total by the study. The criteria for choosing the cattle farmers were (i) being a ruminant farmer/agro-pastoralist of cattle; (ii) having at least five heads of cattle and (iii) having at least five years of experience in cattle farming.

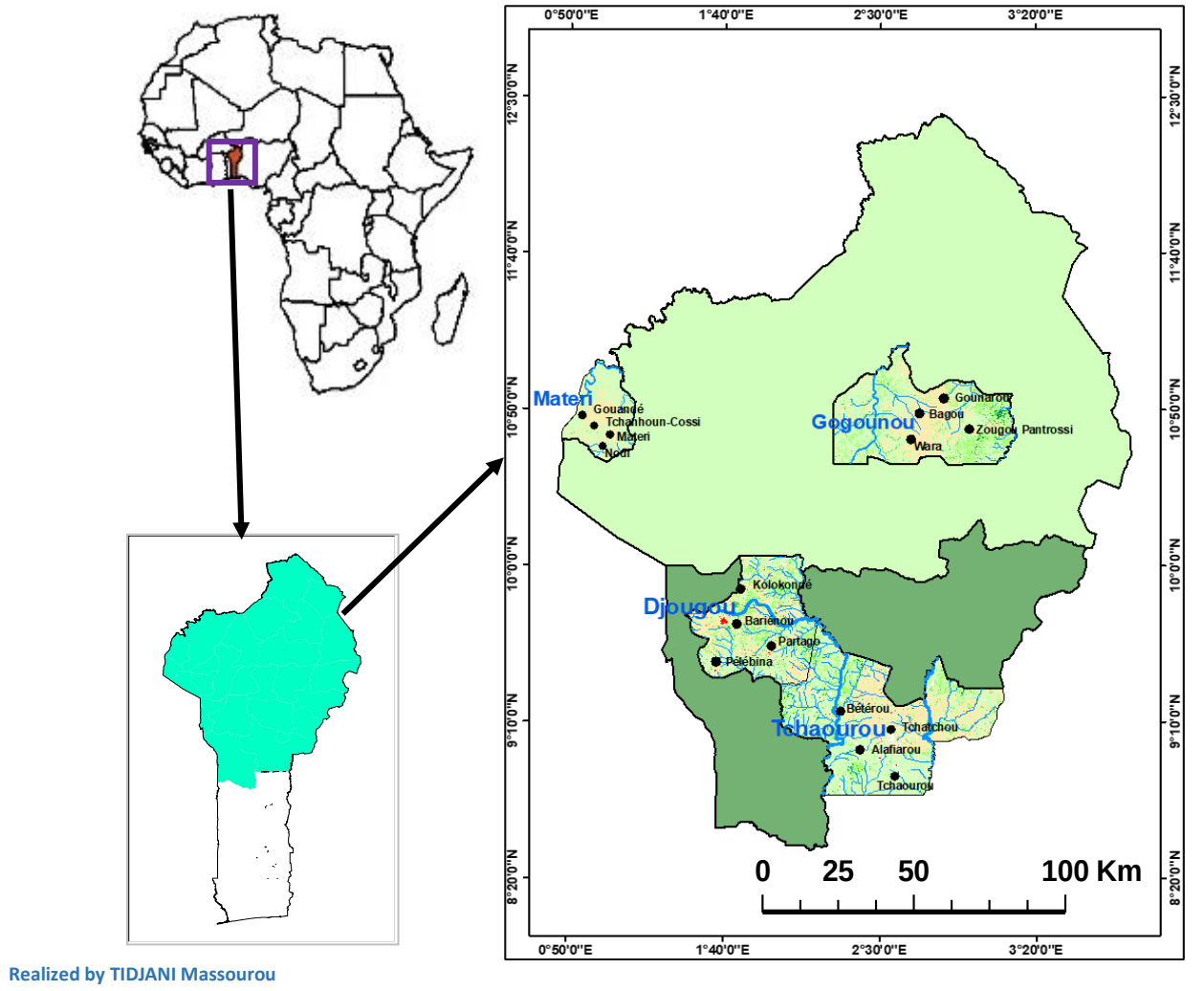


**Figure 1.** Map of study area

**Investigation**

The survey phase took place from April 17th to June 5th, 2023 using individual, semi-structured interviews and direct observations with the support of a local translator. The main data to be collected from cattle farmers/agro-pastoralist related to their demographic characteristics, their involvement in conflicts and their perception of sedentarization. The collection of this data was digitized via the Kobotoolbox platform on smartphones equipped with Android systems. The survey covers 4 municipalities in northern Benin distributed as follows: two in the Sudanian zone (Matéri and Gogounou) and two in the sudano-guinean zone (Tchaourou and Djougou). These areas were selected due to the presence of a high number of cattle herds and also the importance of the influx of transhumant herds from neighboring countries such as Togo, Burkina Faso, Nigeria and Niger (Iwaka et al., 2023). In addition to the location, crop production and livestock farming constitute the main economic activities of 55% of households in these two agroecological zones (Assani et al., 2023).

**Statistical analysis**

The various data collected from farmers in the field were processed using IBM SPSS (Statistical Package for Social Sciences) version 21 and Microsoft Excel 2019®. The responses on the perceptions of the farmers surveyed on the impacts of sedentarization on animal productivity, animal health, the pastoral community and the environment were coded to facilitate the determination of the number and proportion of respondents for each question. These analyses enabled to represent the different relative frequencies in the form of figures and tables. Descriptive statistics enabled to calculate the means, minimum, maximum, median and standard deviation of the data collected on socio-demographic characteristics. The average response rate, which is the percentage of respondents who perceived a particular impact of sedentarization, was calculated and compared using the Chi-square test $(X^2)$ (R Core Team, 2023) and presented in graphical form. The results were considered significant at the 5% level depending on the agroecological zone.

# Results

**Sociodemographic characteristics of the cattle breeders surveyed**

The socio-demographic characteristics of the surveyed cattle farmers are presented in the following table. The results showed that the majority of the people surveyed were male (98.96%), mostly married (98.33%) and of the Fulani ethnic group (83.13%). These farmers mostly practiced Islam (86.04%) and were mostly uneducated (90.42%). Their main activities were livestock farming (78.96%) and agriculture (18.54%). Family labor (88.13%) is the most used. The average size of the cattle herd is 50 ± 2.71 heads (Table 1).

**Cattle farmers' perception of sedentarization**

During the survey conducted among the cattle farmers, 88.33% of the respondents were in favor of the sedentarization of herds for the two agroecological zones (Table 2). Cattle farmers of the sudano-guinean zone (48.54%) were more in favor than those located in the sudanian zone (39.79%) ($P<0.05$).

The majority of farmers thought that sedentarization is a good measure (decision) (89.58%). Cattle farmers' perception rates on sedentarization varied significantly ($p>0.05$) from one climatic zone to another with the exception of "no idea".

**Perception of the impact of sedentarization on the productivity and health status of animals**

The impact that sedentarization could have on the productivity and health status of cattle were mentioned by the respondents (Figure 2). In terms of reproduction, the farmers estimated that with sedentarization, there will be an increase in the size of newborns young ruminants (82.71%), an increase in the weight of animals (81.25%), an increase in the growth of young animals (from weaning to before entering reproduction) (76.25%). They also estimate that there will be a decrease in animal weight loss (83.33%), a decrease in animal weakness (83.96%), a decrease in the number of abortions (81.67%), a decrease in the calving intervals (60.42%) and a decrease in the age at first calving (40.21%). Regarding milk production, the majority of respondents reported a decrease in lactation duration (50.21%), an increase in the quantity (85.00%) and quality of milk produced (81.46%). In terms of animal health, the majority of breeders thought of a decrease in animal mortality at birth (82.29%) with the sedentarization of herds (Figure 3 and 4); a decrease in the mortality of young cattle (from weaning to the start of reproduction) (78.54%); and a decrease in the frequency of animal diseases (83.13%). However, there are some of the respondents who have unchanged opinions or no idea for all these parameters.

**Cattle farmers' perceptions of the impact of sedentarization on the environment**

The impact of sedentarization on the environment were reported by the herders (Figure 5). The majority of the herders reported an increase in access to feed resources (fodder, crop residues, feed concentrate) (68.54%), an increase in access to water (74.38%) and a decrease in deforestation (65.63%).

**Perception of the impact of sedentarization by breeders on the pastoral community**

The perception of the impacts of sedentarization by the herders was reported on the pastoral community (Figure 6). Thus, the main effects listed are related to the reduction in the frequency of famine (75.83%), a reduction in the phenomenon of hostage-taking or kidnapping of children leading cattle to pasture (83.13%), a reduction in losses and thefts of animals (84.17%) and a reduction in conflicts between farmers and herders

**Table 1:** Sociodemographic characteristics of the breeders surveyed

| Variables | Modalities | Climate zone | | Total | $X^2$ | *P-value* |
|---|---|---|---|---|---|---|
| | | SZ | SGZ | | | |
| **Sex** | Female | 1.04[a] | 0.00[b] | 1.04 | 5.05 | 0.024 |
| | Male | 48.96[b] | 50.00[a] | 98.96 | | |
| **Ethnic group** | Gando | 10.00[a] | 0.00b | 10.00 | 65.94 | 0 |
| | Bariba | 0.21[b] | 1.04[a] | 1.25 | | |
| | Yom | 0.00[b] | 2.08[a] | 2.08 | | |
| | Fulani | 37.50[b] | 45.63[a] | 83.13 | | |
| | Others | 2.29[a] | 1.25[b] | 3.54 | | |
| **Marital status** | Married | 49.58[a] | 48.75[b] | 98.33 | 8,033 | 0.018 |
| | Single | 0.00[b] | 1.25[a] | 1.25 | | |
| | Widower | 0.42[a] | 0.00[b] | 0.42 | | |
| **Religion** | Animism | 0.42[a] | 0.21[b] | 0.63 | 48.88 | 0 |
| | Christianity | 1.25[b] | 12.08[a] | 13.33 | | |
| | Islam | 48.33[a] | 37.71[b] | 86.04 | | |
| **Level of education** | No education | 44.38[a] | 46.04[a] | 90.42 | 7.67 | 0.053 |
| | Primary | 2.92[a] | 1.46[a] | 4.38 | | |
| | Secondary | 2.71[a] | 1.67[a] | 4.38 | | |
| | University | 0.00[a] | 0.83[a] | 0.83 | | |
| **Main activity** | Agriculture | 15.83[a] | 2.71[b] | 18.54 | 55.11 | 0 |
| | Breeding | 33,33[b] | 45.63[a] | 78.96 | | |
| | Trade | 0.42[b] | 0.83[a] | 1.25 | | |
| | Other activities | 0.42[b] | 0.83[a] | 1.25 | | |
| **Workforce** | Family | 48.96[a] | 39.17[b] | 88.13 | 44.74 | 0 |
| | Family & employee | 0.63[b] | 7.50[a] | 8.13 | | |
| | Occasional employee | 0.00[b] | 1.67[a] | 1.67 | | |
| | Permanent employee | 0.42[b] | 1.67[a] | 2.08 | | |
| **Mean ± SD** | Cattle herd size | 58±6.75[a] | 47±2.58[b] | 50±2.71 | - | 0.12 |

The indexed values of different letters a and b on the same row are significantly different at the 5% threshold ($p < 0.05$); SZ: Sudanese Zone; SGZ: sudano-guinean Zone; Standard Deviation

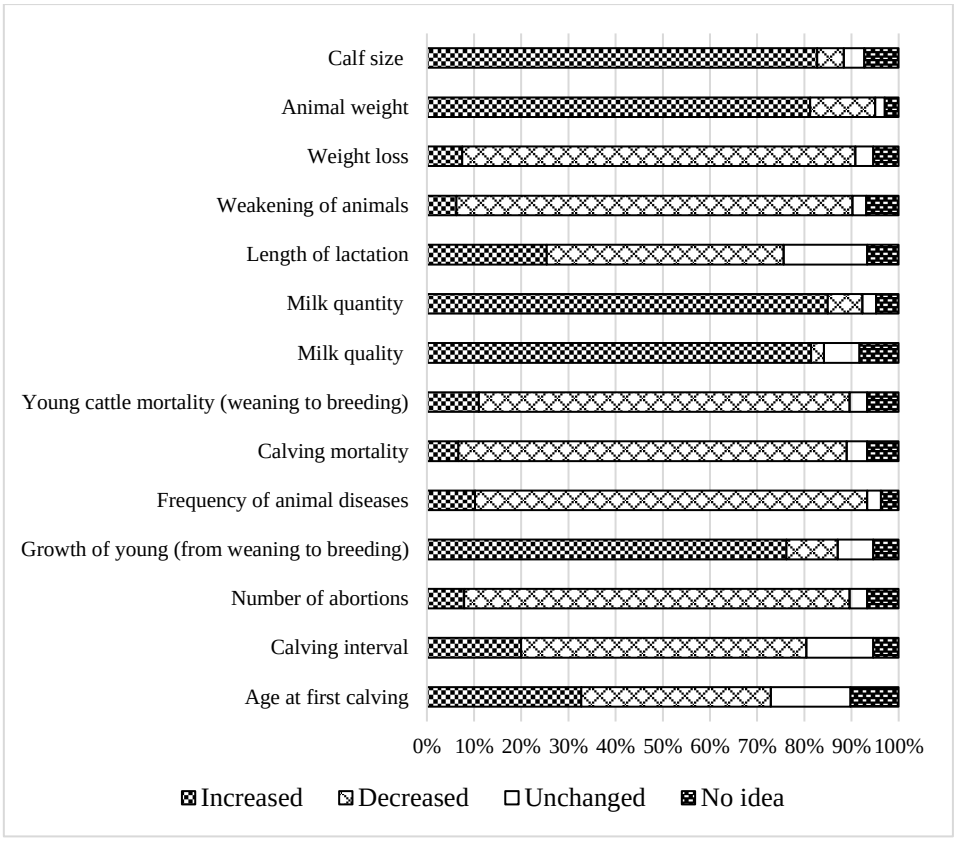


**Figure 2:** Perception of the impact of sedentarization by cattle farmers in the North-West of Benin

**Figure 3.** Sedentary herd grazing in the commune of Gogounou, northern Benin

**Figure 4.** Sedentary herds feeding on a fodder plot in Tchaourou, Benin

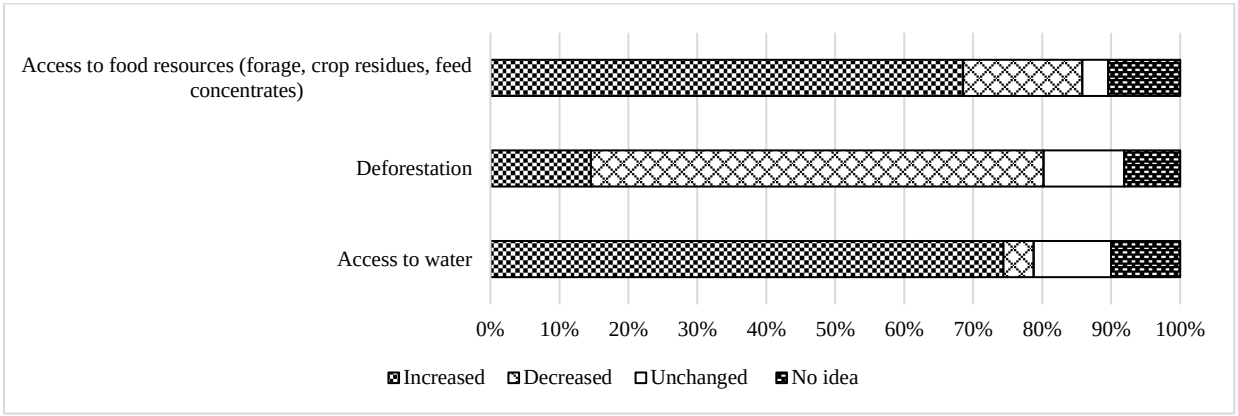


**Figure 5**. Perception of the impacts of sedentarization by cattle farmers on the environment

**Table 2:** Cattle farmers' perception of sedentarization

| Perception rate (%) | SZ | SGZ | Total | $X^2$ | *P-value* |
|---|---|---|---|---|---|
| **Sedentarization** | | | | | |
| **No** | 10.21[a] | 1.46[b] | 11.67 | 35.66 | P<0.05 |
| **Yes** | 39.79[b] | 48.54[a] | 88.33 | | |
| **Opinion on sedentarization** | | | | | |
| **No idea** | 2.08[a] | 1.25[b] | 3.33 | 34.12 | P<0.05 |
| **Good measure** | 41.04[b] | 48.54[a] | 89.58 | | |
| **Wrong measure** | 6.88[a] | 0.21[b] | 7.08 | | |

The indexed values of different letters a and b on the same line are significantly different at the 5% threshold ($p < 0.05$).

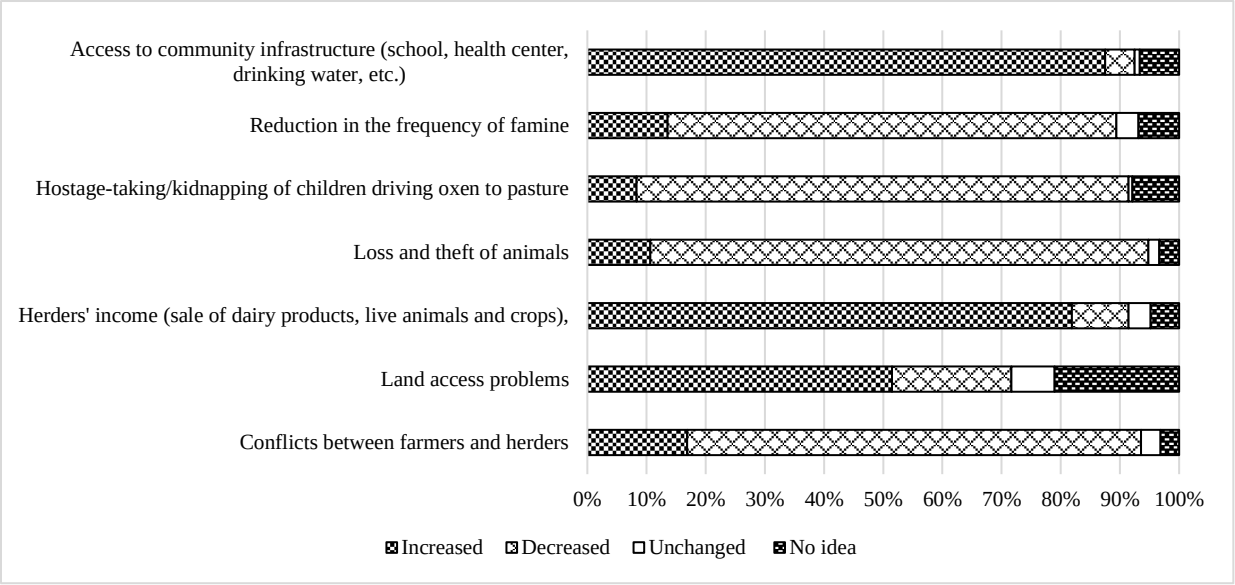


**Figure 6.** Perception of the impacts of sedentarization by cattle farmers on the pastoral community

(76.67%). The rest of the effects cited were related to the increase in access to community infrastructure, namely schools, health centers, drinking water, etc. (87.50%); the increase in income of herders through the sale of dairy products, live animals and harvests (81.88%). However, it should be noted that the increase in problems of access to land/land was reported (51.46%).

# Discussion

**Cattle farmers' perception of sedentarization**

The study revealed that the majority of cattle farmers were in favor of the sedentary livestock farming mode (88.33%). Cattle farmers of the sudano-guinean zone were more in favor than those in the sudanian zone. These results prove that there is a notable advance in the perception of cattle farmers on the conflicts between them and crop farmers. As reported by Sougnabé (2013), several factors can explain the transition to sedentarization by cattle farmers. The author distinguished three factors, namely: structural factors, economic factors and social factors. From a structural point of view, this change can be explained by the perception of cattle farmers of the scarcity of pastoral resources (natural pasture and water) due to increased climatic conditions (Touré et al., 2017) for example in the host areas. This affects the production of the herd and therefore the economy of the livestock farmers. On the social level, the difficulties of accessing and exploiting resources can be mentioned in the host areas due to competition with the natives (crop farmers and herders). Physical insecurity can also be added, which is characterized by cases of kidnapping and abduction that can occur during mobility (Tondel, 2019). These factors are not isolated from each other. Structural factors that have affected the economic and social conditions of herders can lead them to settle down, as Sougnabé (2013) stated in his study on settle down as a means of adapting to reduced rainfall in Chad.

This perception of cattle farmers on sedentarization can also be explained by the effect of the measures taken by the State to reorganize pastoral mobility. In fact, from 2019, various acts and texts of laws that are imposed on cattle farmers today have been taken by the Beninese state to establish the modalities of the exercise of pastoralism. The latest is Decree N°. 2023-303 of June 7$^{th}$, 2023 on the modalities of exercising pastoral monitoring. No longer able to carry out the large-scale seasonal cyclical movements that characterize transhumance (Azalou et al., 2023), cattle farmers are obliged to settle their herd and practice pastoralism at the municipal level at the national level.

**Cattle farmers' perceptions of the impact of sedentarization on animal productivity**

According to the surveyed farmers, sedentarization could facilitate an increase in the size of calves (82.71%), an increase in the weight of animals (81.25%) and an increase in the growth of young animals (76.25%). These results are contrary to what Sounon et al. (2019) reported. These authors reported from the scenarios, the result of a study carried out in 2012, that the sedentarization of mobile herd farmers leads to a decrease in meat production and the breakdown of the complementary links that exist between the mobile and sedentary livestock system. These same authors estimate that, for semi-sedentary livestock farming, combined improvements in the proportion of females, the calving rate and the live weight of all categories of animals will be required to generate a simultaneous increase in numerical production of 12% and meat production of 5%. However, this study noted

its shortcomings by only considering data from 2012 to make this diagnosis. In addition, it seems to highlight the availability of pastoral resources that would benefit mobile herds better than sedentary ones. This is no longer the case today since the context has changed significantly after more than a decade. In fact, a recent study on the assessment of the fodder potential of Benin revealed that the carrying capacity of natural rangelands is less than 01 Tropical Livestock Units (TLU)/ha/year in all departments (DE, 2023).

It is therefore important to develop and implement support actions in terms of feed and genetics in order to improve the productivity of sedentary herds. Some livestock farmers' organizations already present in northern Benin already offer livestock feed through their members (Toselli et *al* ., 2009 ; Badarou et al., 2020; Djohy et al., 2023) because they are well aware of the benefits of providing a food supplement. According to Bonnet et Guibert (2014), animal feed supplements are factors in securing the herd. During drought, cattle farmers will sell their animals to buy enough feed supplements for the livestock (Guidimê et al., 2021). These farmers prefer to stock up to cope with food deficits rather than let their animals starve to death. The state may need to take steps to guarantee livestock feed at the national level and make it accessible through a subsidy.

**Cattle farmers' perceptions of the impact of sedentarization on animal health**

On the aspects related to animal health, the majority of the respondents reported that there could be a decrease in mortality cases and the frequency of occurrence of diseases as an impact of sedentarization. These perceptions of the surveyed persons are consistent with the results of Sounon et *al.* (2019) ; Idrissou et *al.* (2020a) and Adédigba et *al.* (2023) in their various studies.

In fact, a similar study by Gounou et Yabi (2020) reports that the practice of veterinary care allows the animals to be kept in good health and helps reduce the occurrence of diseases in the herd. With sedentarization, access to veterinary care and especially vaccinations and deworming could be easier for cattle farmers. Since the animals no longer go on transhumance, then the risks of contamination (Bisamberg, 2016; Brücker et al., 2021) that could occur during the journeys, due to the encounter with other animals in the grazing areas, are limited. In addition, sedentary animals are less exposed compared to animals that go on transhumance (Blama et al., 2016 ; Assani et al., 2023; Azalou et al., 2019; Djohy et al., 2023) because the long distances covered by animals in search of feed and abundant fodder contribute to weight loss due to daily walks.

**Breeders' perceptions of the impact of sedentarization on the pastoral community and on the environment**

Regarding the results of this study, it is noted that herders in both areas perceived the impact of sedentarization on the socio-economic level. Thus, 81.88% of herders believed that there will be an increase in herders' income through the sale of dairy products, live animals and even harvests. These results are different from those mentioned by Idrissou et al. (2020a) who recorded a decrease in herders' income (92%) on the pastoral community. The difference between these results can be explained by the fact that the work of Idrissou et al. (2020a) focused on the effect of climate change while this study focuses on the impacts of sedentarization on the pastoral community.

On the other hand, Dossouhoui et *al*. (2023) reported that the sedentarization of transhumant herders would lead to a decrease in soil fertility. This decrease in soil fertility would be due to the lack of organic matter (Tittonell et Giller, 2013) which are generally provided by mobile livestock farming. However, the problem should not arise as long as the mobility of the herd is reduced to the scale of its farm. The droppings can be easily mobilized by farmers from sedentary herders following negotiations (Vall et al., 2014).

More than half of the respondents believe that with the settlement, the problem of access to land will increase. These are, in reality, the difficulties that cattle farmers could encounter in the process of asserting their right to land ownership if they were to settle down. Land is an issue for both crop farmers and cattle farmers, as reported by Camaleonte (2003). In several regions, customary rights often govern access to and use of village land. These rules often favor farmers considered indigenous to the detriment of cattle farmers whose right to land is generally contested and subject to controversy. Several studies have approached the same direction by noting that land is a constraint that hinders practices aimed at improving livestock systems (Camaleonte, 2003; Koutou et al., 2016; Liba'A et al., 2010; Soro, 2021). Therefore, in order to prevent conflicts and their effects, it is necessary to find compromises in order to satisfy the specific interests of each category of actors. To do this, it will be necessary to implement a land reform that takes into account both customary and modern law of the so-called landowners. This could lead to a concentration of livestock farms in secure areas for their benefit. Thus settled, they will also be able to claim rights to livestock and community infrastructure.

**Challenges related to the sedentarization of cattle farmers in Benin**

A public policy is underway in Benin for the management of national pastoral mobility. In fact, in order to remedy recurring conflicts between farmers and herders on the one hand and to intensify meat and milk production on the other hand, strategic decisions have been taken by the Beninese State. First, the adoption of various laws aimed at reorganizing or reducing national pastoral mobility. Droy et *al.* (2014) reported that many Fulani who have become sedentary due to structural factors have lost or dispersed their herds and live like their farming neighbors. Others, while cultivating the fields, have kept part of their livestock and practice local and seasonal transhumance. It will then be necessary, beyond political will, that various support actions be initiated to make livestock infrastructure and feed resources available and accessible for livestock (Idrissou et al., 2020b ;

Gautier et al., 2024). The government must identify better strategies for managing pastoral resources and implement participatory infrastructure management approaches and tools to prevent other forms of conflict from arising. These strategies will contribute to a sustainable transformation of livestock systems in Benin.

**Conclusion**

It can be noted that, in view of the current context of pastoral farming on a structural, economic and social level, cattle farmers are in favor of the sedentarization of their herds. They believe that their living conditions have improved because the anticipated positive effects on the animals will have an impact on the socio-economic level. However, it is up to the Beninese State to develop and implement support actions for the benefit of cattle farmers. Anything that guarantees the success of the process. Furthermore, special attention must be paid to the non-favorable fringe through awareness-raising and specific capacity building to enable them to better understand the merits of sedentarization.

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**Consent declaration**

Consent was obtained from all subjects participating in the study.

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