LASER*: a “gold standard” method for assessing livestock productivity and quantifying and controlling the impact of livestock farming on ecosystems

POLICY NOTE
August 2024

Key messages

1. Know herd composition to optimize resource management and preserve biodiversity.
2. Establish references on herd productivity, the performance of low-input livestock systems and household income based on reliable demographic data.
3. Contribute to the assessment of the national carbon footprint and propose long-term greenhouse gas emission scenarios.

The essential

Livestock farming in Burkina Faso faces enormous constraints, including mainly climate change and reduction of pastoral areas. Also, the lack of information on cattle herds makes it difficult to manage these spaces and impacts livestock productivity. To this end, demographic monitoring is a research technique with the aim of producing reliable references on domestic herds. Implemented in Burkina Faso within the framework of the CaSSECS project, the LASER method has made it possible to obtain reference data on cattle farms in in Bobo-Dioulasso area. This reference data is the first update on the performance of herds based on field data, essential for technical advisors to ministries to assist in the formulation of appropriate livestock management policies.

Context

Livestock farming is an important sector for socio-economic development of Burkina Faso, where it contributes **more than 18% to the formation of GDP (including 12% for live animals and 6% for leather) and represents nearly 26% of exports (MRA, 2010)**. However, it contributes to greenhouse gas emissions of anthropogenic origin (Gerber et al., 2013).

Beyond these emissions, livestock farming ensures the balance of ecosystems through soil fertilization and indirectly carbon storage at soil and vegetation level.

Herd demographic parameters and herd size are important for assessing the stocking capacity and carbon footprint of pastoral and agropastoral areas in a given territory.

These important data provide decision-makers with essential information for the development and implementation of support programs in the livestock sector and sectoral policies. They are also important for greenhouse gas inventories.

Demographic monitoring is essential for good management of resources and spaces

***Laser:** Information system for studying the production and health of herds based on individual animal monitoring data.*

Find out more about the CaSSECS project

Methodology

As part of the CaSSECS project in Burkina Faso

- Demographic monitoring of the herds was carried out in three real-world sites on the cattle herds (Nasso Fulani camp, Bana Fulani camp and Matourkou village)
- Monthly visits took place on each farm to collect demographic information (deaths, purchases, births, etc.) for each animal individually identified
- The numbers being monitored and the demographic parameters calculated as part of the study are presented in Tables 1 and 2

Table 1: Evolution of numbers during the study period

	Number of herds	Number of animals	Number per herd		
			Means	Minimum	Maximum
2021	6	340	57	18	97
2022	14	720	51	11	103
2023	14	709	51	8	110

Table 2: Definition of demographic parameters presented in the study results

Parameters	Definition
Parturition rate	Average number of parturitions per breeding female over a given period of time
Mortality rate	Instantaneous risk of mortality calculated as the ratio between the number of deaths and the total time the animals are monitored in a given time interval (one year, one quarter, one month, etc.)
Production rate	Instantaneous risk of production calculated as the ratio between the number of animals exploited and the total time the animals are monitored in a given time interval (one year, one quarter, one month, etc.)

Results

Herd reproduction

The results of demographic monitoring showed that females are capable of calving from the age of 4 and are therefore classified as breeders from this age. We observed that breeding females give birth on average every two and a half years. Calvings are commonly between the end of April - beginning of June and between September - beginning of November (Figure 1). The mating periods giving rise to these calvings, correspond to the resumption of fertility of the cows which is often conditioned by the availability of feed resources.

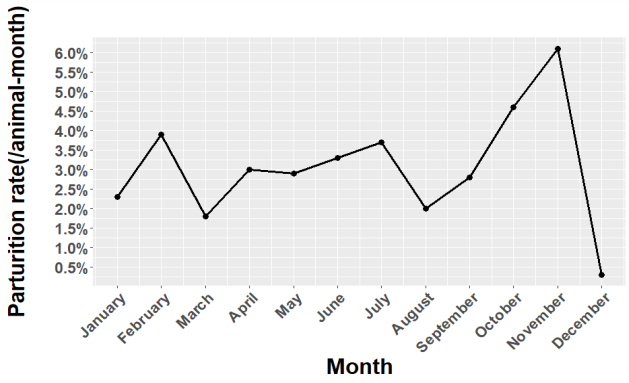

Figure 1: Rate of calving of females over 4 years old according to season

Mortality in herds

Table 3: Evolution of the mortality rate according to the year

	Annual mortality rate (/animal-year)	Variation in mortality rate (95% confidence level)
2021	3.9%	1.4%
2022	4.3%	0.9%
2023	2.3%	0.6%

As an example, for the year 2021 an annual instantaneous mortality rate of 3.9% means that for a herd of 100 animals where each dead animal would be systematically replaced by the entry of a new animal to keep the herd size constant, the number of animals which died over the year would be 4.

Disease and malnutrition are responsible for 83% and 11% of mortality cases respectively.

Animal production

The livestock population changes according to human actions, such as the production of animals mainly for sale during the monitoring period. The annual production rate for males is 15% and 7% for females. Males are sold off before 5 years while females are kept in the herds to ensure their renewal.

Regardless of the year, June has the highest production rate (Figure 2). Indeed, June marks the end of the hot dry season. The animals have been through a bad season and are generally weak. For this reason, they are sold to avoid losses. This sale also allows stakeholders to meet their crop installation needs (purchase of inputs, agricultural labour, etc.) which also reduces the animals' grazing areas.

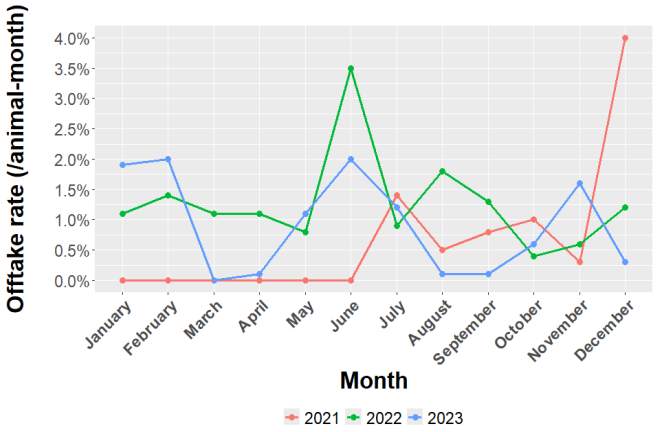

Figure 2: Animal production rate according to season

Conclusion

LASER monitoring is based on repeated monthly surveys of 14 herds over a long period of time, making it possible to generate reference zootechnical data for pastoral areas and to assess annual variations.

The results obtained are original given the lack of information in Burkina Faso on the composition of herds and their renewal potential, which determine the contribution of livestock to carbon emissions in the short term.

Extrapolated to the national scale, these results provide a clear vision of trends in the evolution of Burkinabe cattle herds, their productivity and the volumes of animals placed on the market. Coupled with the assessment of forage resources, it sheds light on the impact of livestock farming on ecosystems, thus paving the way for more effective public policies, particularly for the sustainable management of natural resources and the response to periods of drought. The demographic parameters calculated from LASER and the associated projection models offer the possibility of exploring compromise scenarios between the sustainability of livestock activities and the carbon footprint of pastoral and agropastoral areas, reinforcing Burkina Faso's commitment to the fight against climate change. The LASER method for livestock monitoring then becomes a strategic tool, providing concrete solutions to the structural challenges of Burkinabe livestock farming, while limiting its environmental impact. This method provides decision-makers with the necessary bases to develop sustainable policies, reconciling productivity and preservation of natural resources.

Recommendations

1. Continue and extend demographic monitoring to consolidate existing data, ensure the reliability of analyses, and deepen understanding of ruminant population dynamics
2. Make this data available to livestock regulatory authorities in order to support decision-making (rangeland management, herd size, etc.) within a context of climate and societal changes.

Bibliography

Assouma M.H, Lecomte Ph., Hiernaux P., Ickowicz A., Corniaux C., Decruyenaere V., Diarra A.R. et Vayssières J. 2018. How to better account for livestock diversity and fodder seasonality in assessing the fodder intake of livestock grazing semi-arid sub-Saharan Africa rangelands. Livestock Science 216, 16-23.

Ayantunde A.A., Hiernaux P., Fernandez-Rivera S., van Keulen H. et Udo H.M.J. 1999. Selective grazing by cattle on spatially and seasonally heterogeneous rangelands in the Sahel. Journal of Arid Environment, 42: 261-279

Hiernaux P., Diawara M.O. et F. Gangneron 2014. Quelle accessibilité aux ressources pastorales du Sahel ? L'élevage face aux variations climatiques et aux évolutions des sociétés sahéliennes, Afrique contemporaine, n° 249, p. 21-35. DOI : 10.3917/afco.249.0021

Gandah M., Bouma J., Brouwer J., Hiernaux P. et van Duivenbooden N. 2003. Strategies to optimize allocation of limited nutrient to sandy soils of the Sahel: a case study from Niger, West Africa. Agriculture, Ecosystem & Environment 94: 311-319

Gerber P.J., Steinfeld H., Henderson B., Mottet A., Opio C., Dijkman J., Falcucci A. et Tempio G. 2013. Tackling climate change through livestock: a global assessment of emissions and mitigation opportunities. FAO, Roma, 219 p.

Schlecht E., Hiernaux P., Achard F. et Turner M.D. 2004. Livestock related nutrient budgets within village territories in western Niger. Nutrient Cycling in Agroecosystems, 68: 199-211

van Vliet N., Reenberg A., Rasmussen L.V. 2013. Scientific documentation of crop land changes in the Sahel: a half empty box of knowledge to support policy? J. Arid Environ, 95: 1–13. doi.org/10.1016/j. jaridenv.2013.03.010

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CaSSECS partners

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Sahelian livestock carbon footprint

THE PROJECT

Context

The Paris Agreement strengthened the global climate effort by requiring signatory countries to set climate targets for reducing greenhouse gas (GHG) emissions. Thus, the member states of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) have undertaken to provide national inventories supported by **data reports on their GHG emissions and absorptions from all sectors**. According to current estimation models, **GHG emissions from ruminant livestock farming in (agro) pastoral systems** would represent a **significant share of total GHG emissions** in many developing countries, and they are expected to increase over the coming decades. These systems are indexed as significant emitters in particular due to **insufficient data, benchmarks and reliable scientific and technical skills**. The sustainability of these ecosystems is now threatened even though they offer multiple benefits and services (social, economic, cultural) to the populations of the Sahel.

Areas of work

1. Production of reference data on GHG emissions and carbon storage
2. Improvement of the carbon footprint device at the national level
3. Co-design and dissemination of options for mitigating the impact of livestock farming on climate change
4. Strengthening skills in assessing the environmental impact of livestock farming systems
5. Coordination, dissemination, communication and monitoring-evaluation

In short...

- **Participants involved**

The project involves more than 100 researchers and teacher-researchers. It finances 10 doctoral theses and around forty master's internships.

- **Target groups:** technical agents of States and NGOs, inventory managers, decision-makers, researchers and teacher-researchers, organizations and professional associations of pastoralists and agropastoralists.
- **Final beneficiaries:** pastoral and agro(pastoral) households.

- **Budget**: 5 million euros

- **Duration:** 5 years (2020-2024)

- **Donor:** European DeSIRA Program - EU

Project objectives

General objective

Improve the assessment of the carbon footprint of Sahelian (agro)sylvopastoral ecosystems to better quantify their impacts on climate change for the development of livestock policies adapted to the Sahel.

The results obtained

- National and regional devices for **producing and updating reference data** on GHG emissions and the carbon storage potential of (agro)sylvopastoral ecosystems are strengthened and operational;
- **Multi-scale carbon footprint assessment tools** are developed and contribute to national inventories, to the drafting of IPCC's reports and to livestock development policies;
- **Innovative options for sustainable GHG mitigation** are co-designed, tested and validated with (agro)pastoralists;
- The **skills of stakeholders in carbon footprint assessment are strengthened** and the common vision of interinstitutional dialogue is renewed.

Three target countries:
Burkina Faso, Niger and Senegal
Extension to CILSS countries

Useful and usable results

The attached policy and technical notes are intended to facilitate the circulation of information and exchanges between:

Inventory managers: learn about new measurement and analysis tools to contextualize inventory data and advance the region's technical capacities.

Decision-makers: rely on research to comply with the international transparency framework and have arguments to defend Sahelian (agro)pastoral livestock systems.

Researchers: understand the research underway in the region for more resilient (agro)pastoral livestock systems.

CaSSECS video

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Some tools and devices

GreenFeed® – device for measuring enteric methane emissions

IRS – carbon chemical composition of rations and soils

Drones – study of vegetation dynamics

GPS collars - demographic monitoring of transhumant animals

Modelling of GHG flows

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