



Exploratory study for implementing a Global Burden of Animal Diseases case study in Senegal

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Summary

Senegal is a West African country with both extensive animal production systems, representative of the environmental, economic and animal health constraints specific to the Sahel region, and thriving commercial poultry and dairy production. An exploratory study was conducted in Senegal between 2021 and 2022 as a prelude to a case study of the Global Burden of Animal Diseases (GBADs) programme. An overview of existing animal production systems as well as the main priorities and issues in animal health on a national level was developed. A national workshop gathering representatives from the livestock production and academic sectors took place in Dakar in June 2022 with the objective of jointly developing a case study. The participants prioritised pastoralist production systems for cattle and agropastoral systems for small ruminants for the application of the GBADs programme. Through a series of activities, the participants highlighted the health, environmental, economic and socio-political challenges surrounding these systems, all of which limit their contribution to the well-being of pastoralist households, consumers and other stakeholders. While Senegal has in the past hosted a large number of research and cooperative projects on these two livestock systems, participants noted difficulties in obtaining, centralising and harmonising the existing data. This exploratory study led to the funding of a focused case study of the agropastoral small-ruminant sector that was carried out in 2023 in partnership with national and international organisations.

Keywords

Agricultural development – Animal health – Animal production – Cattle production system – GBADs – Global Burden of Animal Diseases – Poultry production system – Senegal – Small ruminant production systems – Socio-economic impact – Veterinary epidemiology.

Introduction

According to United Nations projections, sub-Saharan Africa will account for more than half of the world's human population growth between 2020 and 2050 [1]. In 2014, the region was home to 19% of the global cattle population, 20% of the global sheep population and 34% of the global goat population. These figures are expected to increase over the coming decades as the demand for products of animal origin, especially meat and milk, rises sharply.

However, the region is struggling to satisfy this increasing demand for animal protein. For example, although the production of beef doubled between 1974 and 2014, the human population of sub-Saharan Africa tripled over the same period [2]. Many of the main producer countries are found in the Sahel, including Burkina Faso, Chad, Mali, Mauritania, Niger and Senegal [3,4]. The ruminant farms in these countries supply not only their own markets but also those of the densely populated countries that border the Gulf of Guinea, in particular Nigeria, Côte d'Ivoire and Ghana.

A large majority of ruminants are farmed by pastoralist and agropastoral households using extensive farming based on local breeds, with few external inputs or investments [5]. Poultry is commonly farmed in extensive small-scale systems, commonly described as backyard farming [6,7]. The animals in these systems contribute to the well-being of households by providing stable income, a subsistence diet, stored wealth and social capital [8]. In contrast, an intensive farming model, relying on the use of efficient breeds and external inputs, is starting to develop but remains largely in the minority in most of these countries.

The low productivity of extensive ruminant farming is becoming all the more problematic as the area available for pasture decreases. This threat is due to a combination of factors, such as the increasing insecurity of rural zones, climate change affecting vegetation through the lengthening of drought periods, and competition with cultivators for access to land [5].

Livestock productivity is limited by many factors, infectious diseases and parasites being among the major causes. Animal health problems are probably one of the key factors restricting the capacity of Sahel livestock systems to make the best use of their limited resources to satisfy the growing demand for animal protein. Farmers have only limited access to veterinary services and technologies, whether private or public [9], and their animals are regularly affected by contagious diseases such as peste des petits ruminants, contagious bovine pleuropneumonia and Newcastle disease in poultry [10,11]. Emerging diseases and zoonoses among livestock, such as Rift Valley fever, which affects ruminants, are also a threat to public health and to the economic and political stability of countries in the Sahel [12,13]. However, to date, there has been no objective assessment of the gap between actual production and potential production if animal health problems were better controlled, nor of the societal impacts of such an improvement in the animal health situation.

The French Agricultural Research Centre for International Development, known as CIRAD, and the National Laboratory for Animal Husbandry and Veterinary Research of the Senegalese Institute for Agricultural Research successfully completed an exploratory study as a prelude to a case study of the Global Burden of Animal Diseases (GBADs) programme in Senegal, a coastal country in the Sahel, with the support of the World Organisation for Animal Health (WOAH) and the University of Liverpool. Senegal has many characteristics that make it a natural choice for a case study, including the presence of several agro-ecological zones representative of the agricultural conditions of West Africa and an institutional and political environment suitable for the collection of and access to livestock and animal health data.

In accordance with the framework suggested by Smith *et al.*, this exploratory study aimed to provide a better understanding of:

- the Senegalese ecosystem, namely the stakeholders and the animal health and production issues involved, as well as the institutional framework;
- the end users of the GBADs programme and their most pressing needs;
- the solutions that GBADs could provide to respond to these expectations, in line with existing resources [14].

To respond to these objectives, the exploratory study was executed in two separate phases:

- a review of animal production, animal health and production stakeholders, the legislative and institutional framework governing animal health, and the priority animal health issues in Senegal, conducted through an examination of the literature and by seeking expert opinions;
- organisation of a preparatory workshop for the GBADs case study, with a representative sample of animal health and production stakeholders. This workshop aimed to determine the current situation through a review of existing data sources that could be used in the GBADs case study and to define the priorities of this study in terms of production systems and activities to carry out, taking into account stakeholder needs and the accessible data and studies.

The animal health and husbandry situation in Senegal

Animal production in Senegal

Livestock contributed up to 3.8% of the gross domestic product of Senegal in 2017, representing 25.4% of production in the agricultural sector [15]. However, this figure does not take into account the prominent place of livestock in Senegalese households, as while 28.2% of households raise livestock, according to a 2013 census, they do so mostly in a small-scale family system.

According to agricultural census surveys from 2015, the dominant species are cattle (3.5 million head); sheep (6.5 million head); goats (5.5 million head); and poultry, the majority of which are chickens (59.9 million head) [16]. Most chickens are bred in family farming systems, generally for domestic consumption or nearby sale [17]. Cattle and small ruminants are mainly raised through extensive farming, in silvopastoral (in the dry regions of the north) or agropastoral (in the more humid areas of the south-east) systems [18]. In silvopastoral systems, farmers use natural vegetation as the only food source, while agropastoral systems combine crop

production and ruminant livestock, using crop residues as well as travel zones to provide food for the animals.

Senegal's significant cattle population consists mainly of dairy cattle, adapted to Sahelian climatic conditions. The development of a dairy sector capable of supplying large cities has historically been impeded, in particular by competition from imports of milk powder, mainly from Europe. Semi-intensive and intensive production systems for cattle and broiler chickens have nevertheless undergone rapid development in response to the strong demand for animal protein in urban centres, particularly for dairy and poultry products (Fig. 1). The large intensive farms are located mostly around urban centres, mainly Dakar, and in the Niayes region [17,19].

National political priorities for livestock and animal health and barriers to disease control

The development of the livestock sector is one of the policy priorities included in the Emerging Senegal Plan for the period of 2014–2023, intended to strengthen Senegal's food security and reduce its dependence on imports of basic necessities, such as dairy products [20]. The government emphasises the control of priority contagious livestock diseases, principally through vaccination or vector control. Among the government-listed priority animal diseases, five were selected for large-scale vaccination programmes: contagious bovine pleuropneumonia (cattle), lumpy skin disease (cattle), peste des petits ruminants (sheep and goats), Newcastle disease (poultry) and African horse sickness (equines) [21]. However, vaccination coverage remains limited in the case of poultry and small ruminants. Among the success stories is the eradication of trypanosomiasis in the Niayes region through the release of sterile tsetse flies [22].

According to the Animal Health Protection Division of the Directorate of Veterinary Services (DVS) of Senegal, the main obstacles to obtaining a high level of vaccine coverage in ruminant populations include:

- the considerable mobility of pastoralists, both in the interior of the country and across borders, which complicates the local livestock census and the allocation of human and material resources [23,24];
- the necessity of a cold chain to supply vaccines to remote areas, which has a significant effect on logistical costs and human resources [25];
- the absence of a reliable livestock identification system.

In the sector of small poultry farms, the main difficulties reported are weak vaccination coverage against Newcastle disease and the strong prevalence of parasitic infestations [17].

Preparatory workshop for a Global Burden of Animal Diseases case study

A joint workshop with animal production stakeholders and Senegal's animal health officials was held in Dakar from 15 to 17 June 2022, using a hybrid format. A total of 39 people took part in the workshop, including DVS representatives (3) and members of the Order of Veterinary Doctors of Senegal (2), representatives from livestock associations (8), members from the Senegalese academic sector (9), a representative of a non-governmental organisation (1), members of international organisations (7), representatives from WOAHA (3) and the University of Liverpool (1), and potential donors (5). More detailed information on the workshop participants can be found in Annex 1.

The goals of the first two work days were as follows:

- introduce the GBADs programme and methodology to the participants;
- survey the potential strengths and weaknesses of Senegalese livestock systems in order to define the scope and parameters of the GBADs case study in Senegal;
- map the existing data;
- write a first concept note to present to donors.

Choice of livestock systems

The attendees began by identifying those animal production systems considered to be priorities for applying the GBADs methodology. From a discussion with the participants, nine systems were identified. The systems were defined according to the animal species being raised (small and large ruminants, poultry) and the type of husbandry: the extensive pastoralism typical of the Sahel region, extensive agropastoralism combining livestock and crop production, intensive production or village (traditional) production.

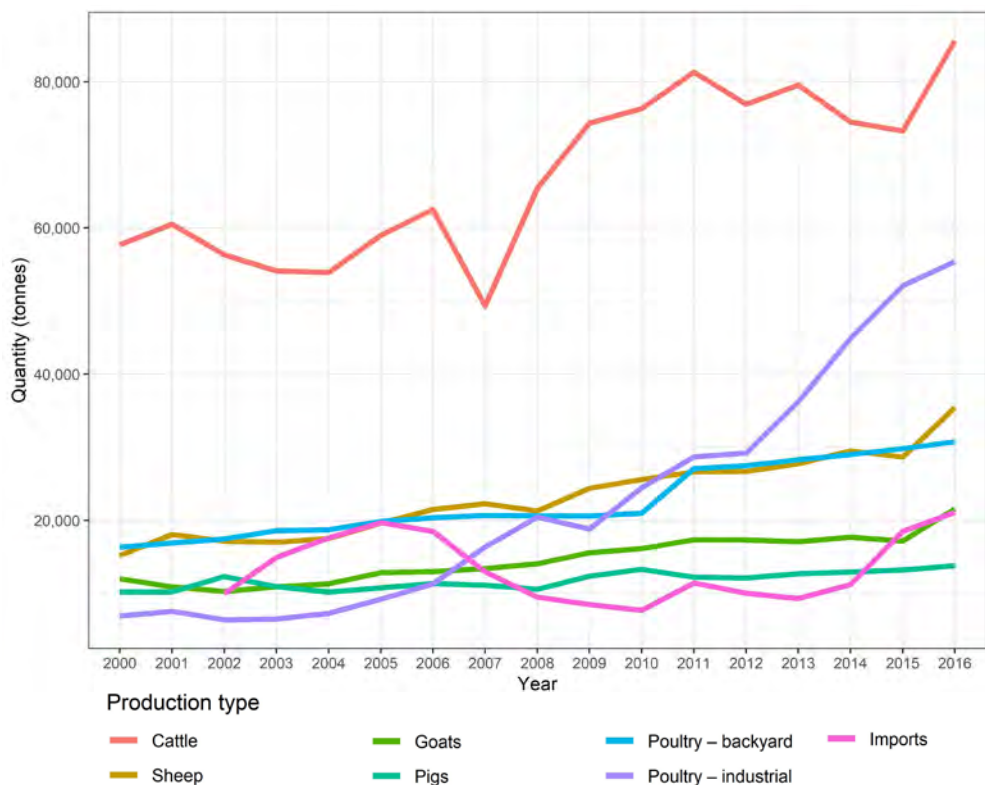
Two of these systems were chosen by a vote whose results are presented in Figure 2: raising small ruminants in an extensive agropastoral system and raising cattle in an extensive pastoralist system. Workshop activities thus focused on these two livestock systems.

Identifying weaknesses and drivers of livestock systems

The participants were divided into two groups, each working on a specific livestock system. Each group worked on identifying the major causes of the gap between ideal and actual production of the livestock system chosen, as well as the key causes of this gap and its impact on society.

A. Meat and offal

Trends in the production of meat and offal from livestock in Senegal, 2000–2016



B. Dairy products

Milk supply trends in Senegal, 2000–2016

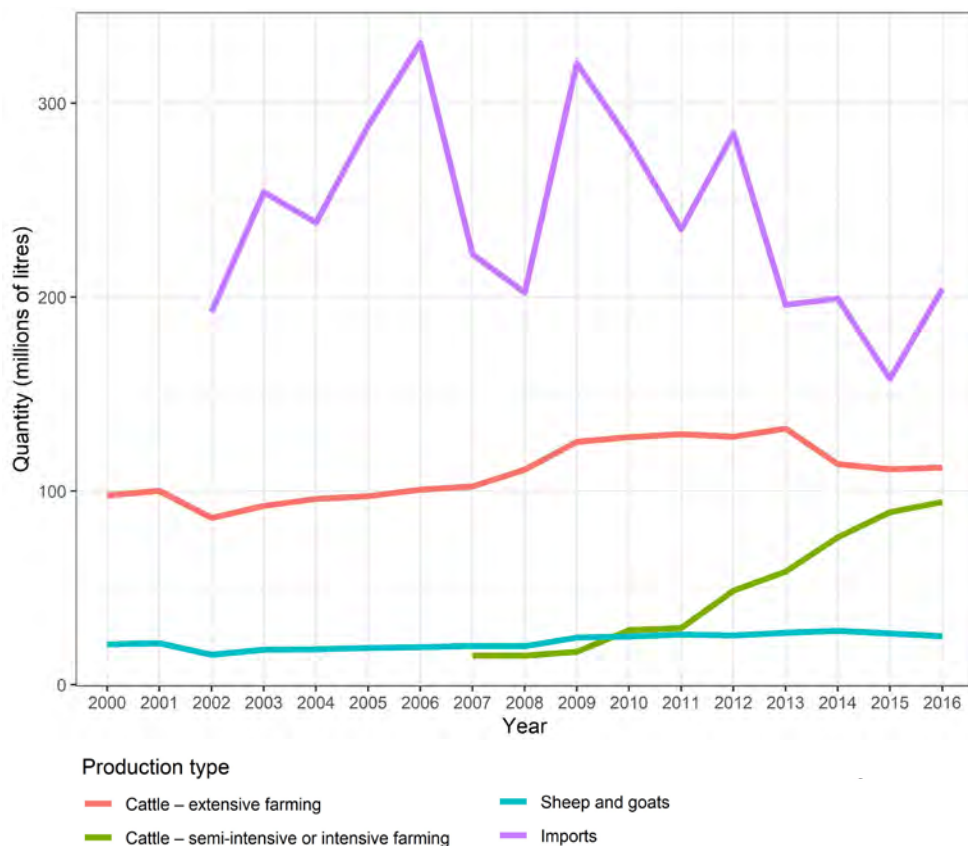


Figure 1

Changes in the quantity of meat and offal (A) and dairy products (B) sold on the Senegalese market, by origin, 2000–2016

Note: the volume of imported milk reported in the national statistics is an under-estimate because it does not account for dominant imports of fat-filled milk powder, which have risen sharply since 2012

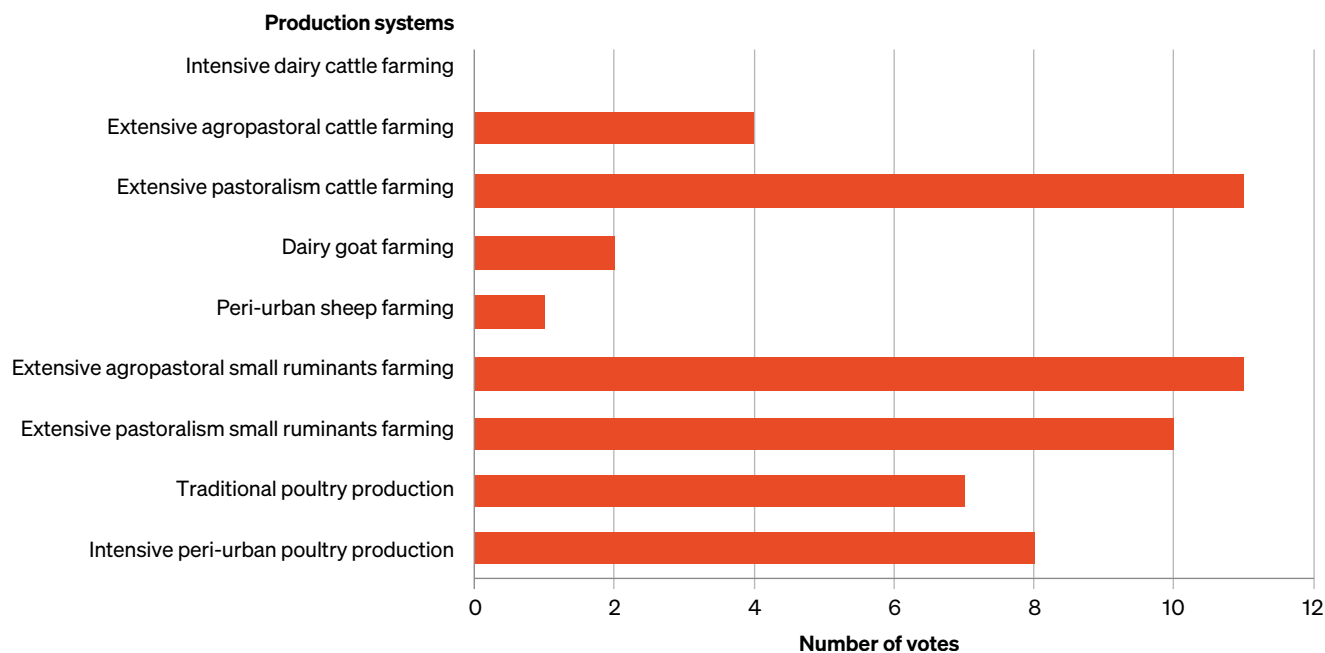


Figure 2
Results of the vote on priority issues for the Global Burden of Animal Diseases case study in Senegal

The results are presented in [Figure 3](#) in the form of problem trees.

Among the drivers of the gap between ideal and actual production, the participants identified:

- climate-related factors (such as drought and bushfires) that affect forage production and thus the nutritional and health status of the animal. Climate risks are reinforced by long-term trends such as climate change and desertification;
- economic and institutional factors, including limited access to land and credit (in the case of pastoralist cattle production), limited access to the market or insurance and the difficulty of developing animal products;
- production losses due to animal diseases, which, in the two systems, were partly attributed to a lack of access to veterinary care, as a result of the cost of veterinary services or a lack of animal health personnel;
- security problems, including cattle theft (in the case of pastoralist cattle production) and conflicts between pastoralists and farmers over the use of agricultural land (in the case of agropastoral small ruminants production).

In the case of pastoralist cattle production, the high cost of inputs and the lack of adequate pastoral equipment were also mentioned. For both systems,

the role of the State was noted, underlining the lack of support or recognition of the livestock sector by public authorities.

In terms of social impact, both groups showed that animal production benefits a large number of actors that are directly or indirectly linked to ruminant value chains. Production losses have consequences on farming households in terms of income security, nutritional intake, sending children to school, community life and mental health.

Mapping existing data

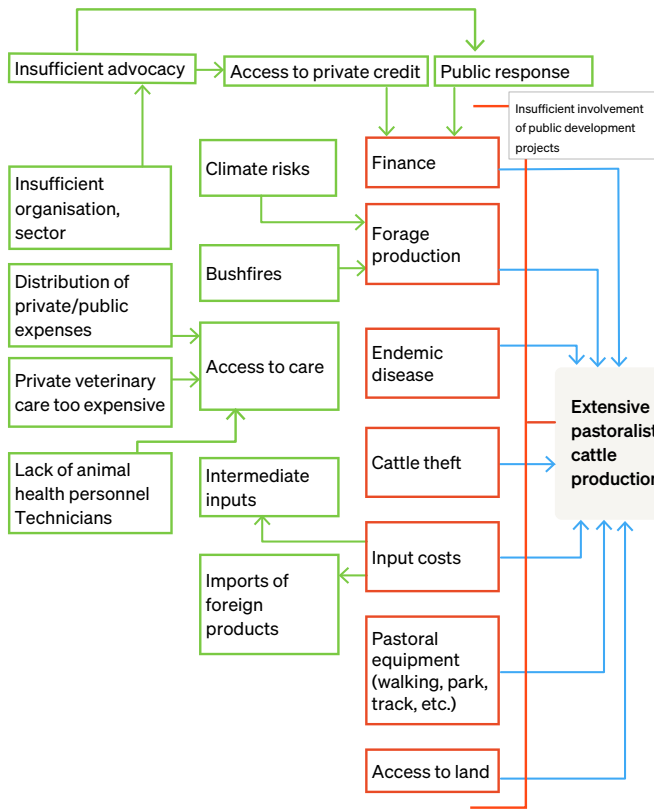
The purpose of this activity was to identify useful data sources for applying the GBADs method in Senegal in the production systems that have already been identified, their accessibility, their limits and the potential data gaps to fill.

Different types of data were addressed in turn for each of the two systems:

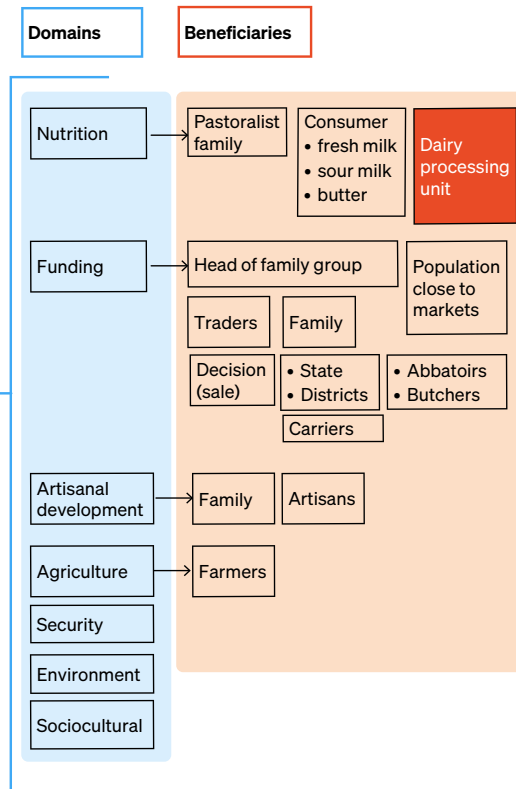
- animal populations and their demographic dynamics (birth rate, calving intervals, mortality, age at first calving);
- animal production (meat, milk, eggs, hides, traction) and production value (market price for animals, their products and by-products);
- animal health and animal production expenses;
- prevalence or incidence of animal diseases.

A. Extensive pastoralist cattle system

DRIVERS OF THE GAP BETWEEN IDEAL AND ACTUAL PRODUCTION

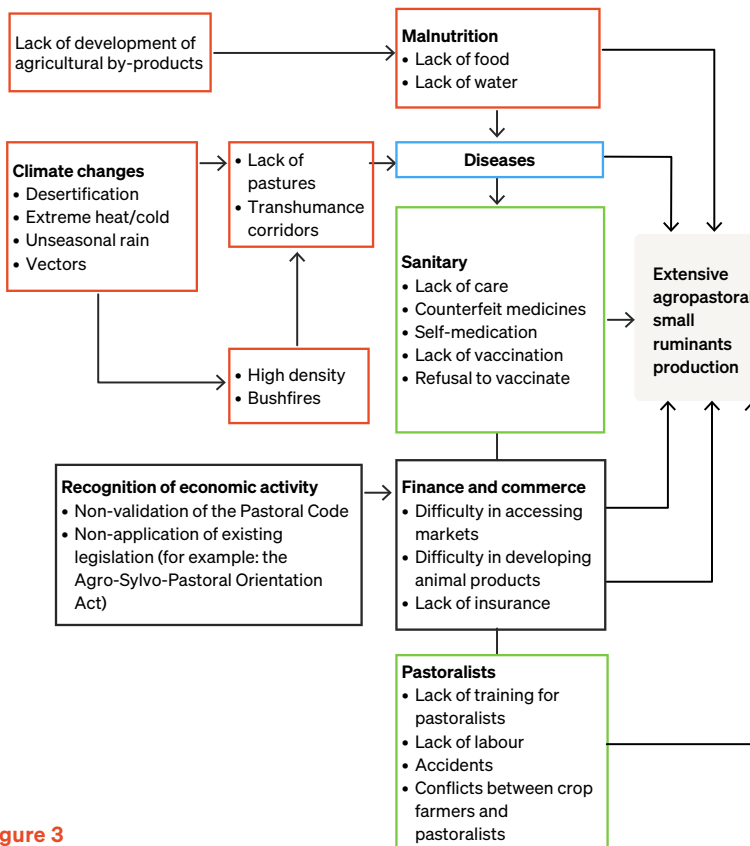


SOCIETAL IMPACT



B. Extensive agropastoral small ruminants system

DRIVERS OF THE GAP BETWEEN IDEAL AND ACTUAL PRODUCTION



SOCIETAL IMPACT

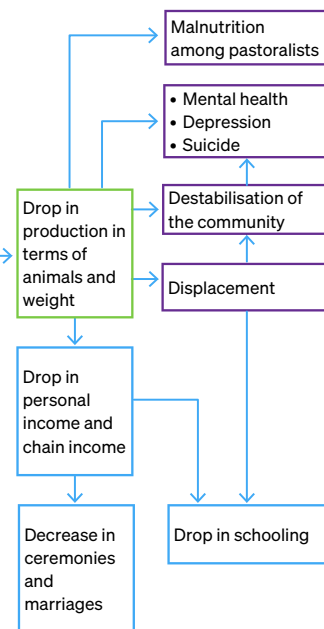


Figure 3

Problem trees

At the centre of each tree is the production system concerned; on the left are the possible causes of production gaps and on the right their societal impacts

For each data source identified, information on its availability, the geographic zone involved, and the project associated with it was written on adhesive notes that were stuck on a large-format administrative map of Senegal, in the zone where the activity took place, to give an idea of the quantity and resolution of the available data. Different coloured notes corresponded to each of the four types of available data listed on the previous page.

Many data-gathering activities, past and present, have been recorded in Senegal because of the country's large number of research and development projects concerning livestock and animal health: 45 for pastoralist cattle production and 53 for agropastoral small ruminants production (with many common activities between the two systems). Nevertheless, the participants observed that these data are difficult to obtain, to centralise and to make available to the consortium, either for intellectual property reasons or for reasons of access to these data, which are often stored on personal computers.

Identification of activities and needs: conceptual note

Drafting of the conceptual note for the GBADs case study took place in the afternoon of the second day of the workshop. The conceptual note project aimed to define the principal needs identified during the workshop, namely to:

- centralise the relevant secondary data used by the GBADs methodology and make them accessible;
- complete an assessment of the socio-economic burden of animal diseases for the two priority sectors identified;
- strengthen the capacity of animal health and production actors in economic evaluations;
- disseminate the knowledge generated on the burden of animal diseases to a wider public;
- engage with other countries in the Sahel region.

The need for resources, particularly human resources, was also raised. In addition, it was suggested that the data be centralised on the data-sharing platform hosted by the DVS.

The final half-day was dedicated to presenting the workshop's conclusions to an invited gathering of representatives of international donors.

Conclusions

This exploratory study as a prelude, part of the implementation of a case study of the GBADs programme in Senegal, was welcomed by both private (livestock organisations) and public (DVS) stakeholders, who expressed an interest in being able to produce and promote science-based measures of the economic impact of animal diseases. Senegal is a country in the Sahel region where extensive farming of ruminants and traditional farming of poultry dominate, but where the livestock sector is undergoing rapid transformation with the development of industrial cattle and poultry production aimed at urban consumers. Pastoralist cattle and agropastoral small ruminant livestock systems were prioritised by the workshop participants, probably because of the over-representation of stakeholders in extensive ruminant production. In these systems, animal health problems cannot be separated from the environmental, economic and political risks confronting livestock households.

A large number of activities were carried out in Senegal to collect relevant data for the GBADs programme. These data were put to use during the case study itself, which was conducted in 2023 with funding obtained from this exploratory study. The case study, which was focused on the agropastoral sector for small ruminants, was carried out by the University of Liverpool and the Senegalese Institute for Agricultural Research–National Laboratory for Livestock and Veterinary Research, in partnership with the DVS, WOAAH and the Inter-State School for Veterinary Sciences and Medicine.

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Annex 1

Institutions represented at the preparatory workshop for the Global Burden of Animal Diseases case study in Senegal

Type of institution	Name of institution		Number of participants
Public	DSV	Directorate of Veterinary Services of Senegal	3
	ODVS	Order of Veterinary Doctors of Senegal	2
Academic	ISRA-LNERV	Senegalese Institute for Agricultural Research–National Laboratory for Animal Husbandry and Veterinary Research	7
	ISRA-BAME	Senegalese Institute for Agricultural Research–Bureau of Macro-economic Analysis	1
	EISMV	Inter-State School for Veterinary Sciences and Medicine	1
Livestock associations	RBM	Billital Maroobé Network	2
	CNMDE	National Council of Livestock Breeders of Senegal	2
	APESS	Association for the Promotion of Livestock Breeding in the Sahel and Savannah	2
	DINFEL	National Directorate of Women Livestock Breeders	2
Non-governmental organisations	AVSF	Agronomists and Veterinarians Without Borders	1
International organisations	CIRAD	French Agricultural Research Centre for International Development	3
	FAO	Food and Agriculture Organization of the United Nations	2
	ILRI	International Livestock Research Institute	2
Donors	CDC	Centres for Disease Control and Prevention	1
	FCDO	Foreign, Commonwealth and Development Office	1
	USAID	United States Agency for International Development	1
	IDRC	International Development Research Centre	1
		World Bank	1
Coordination of GBADs		University of Liverpool	1
	WOAH	World Organisation for Animal Health	3

GBADs: Global Burden of Animal Diseases