

Livestock, Climate Change and  
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**CONFERENCE  
ABSTRACT BOOK**

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**Sustainable Intensification of Crop Production in agro- sylvo-pastoral Territories through the Expansion of Cattle Herds in Western Africa**

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In agro-sylvo-pastoral villages of West Africa, biomass management ensures the sustainability of mixed-farming systems especially in maintaining soil fertility. Traditionally, agriculture and livestock activities are strongly linked. Cattle herds' mobility leads to a positive nutrient and carbon transfer from rangelands to individual cultivated fields. In some regions, demographic growth and subsequent decline in rangelands lead to herd depletion, a phenomenon that disturbs the traditional system and threatens food security.

The village of Sare Yero Bana is located in sub-humid area, region of High Casamance in Senegal. The aim of this study was to assess the sustainability at village level by comparing the changes in farm functioning and the nitrogen balance between the years 1997 and 2012. In 1997, it was based on measurements of all biomass flows (including the weight and nitrogen content analysis) and in 2012, it was updated on the basis of an exhaustive farm survey.

Total increase in cultivated areas (+35%) from 1997 to 2012 did not significantly affect rangeland available for herds, with more than 200ha still available for 485 tropical livestock units. Total animals increased by +17% over the same period. In both years, crop fields' nitrogen inputs were mainly ensured by manure. Fertility transfers from rangelands to cultivated fields increased; this partially explains a +36% crop production growth. In a context of a relatively stable village population and the development of staple crop market, nitrogen exports via harvest showed an increase of +20% (groundnut principally). These remained globally balanced by important nitrogen inputs corresponding to an increase of fertility transfers by the herds (+9.6 kgN.ha<sup>-1</sup>.yr<sup>-1</sup>), and to the recent use of mineral fertilizers (+6.4 kgN.ha<sup>-1</sup>.yr<sup>-1</sup>). The village nitrogen balance remains stable and close to equilibrium (respectively -4 and -2 kgN.ha<sup>-1</sup>.yr<sup>-1</sup> in 1997 and in 2012).

This study stresses the important role that cattle herds can play towards food security in regions of Western Africa where rangelands still remain. Moreover, in Sub-Saharan Africa, livestock contributes significantly to climate change via greenhouse gas emissions. Thus, the study also underlines the importance of taking into account the indirect positive effects of livestock on other agricultural productions in greenhouse gas balances, such as the input of organic fertilizer.



# Sustainable intensification of crop production in agro-sylvo-pastoral territories through the expansion of cattle herds in Western Africa

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## Introduction

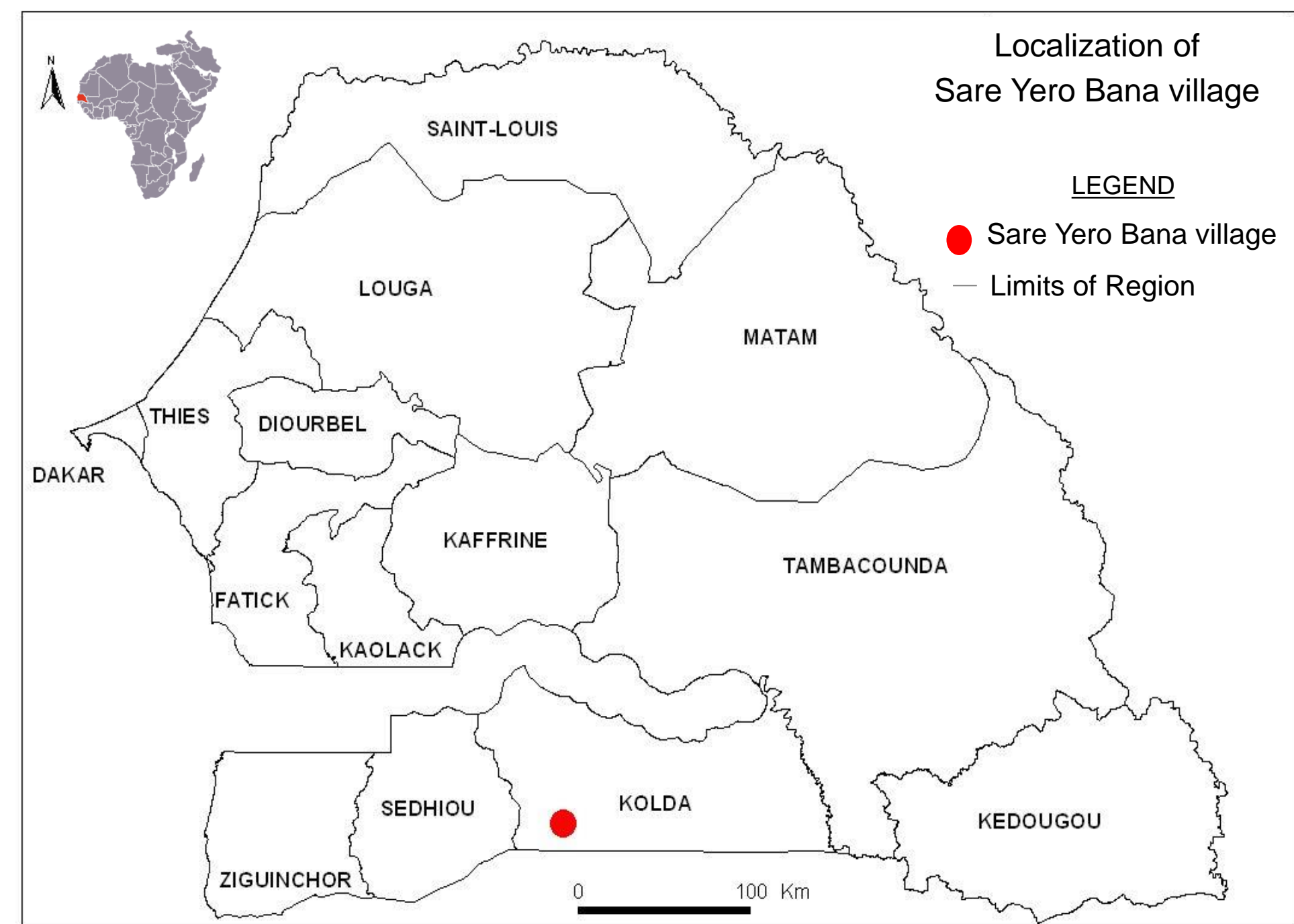
In mixed-farming systems of **West African savannas**, biomass plays an important part in the maintenance of soil fertility.

In order to recycle **biomass resources**, agriculture and livestock activities are strongly linked together and **manure** can be an important source of fertilization.

In these systems, **cattle herds' mobility** leads to a positive **nutrient and carbon transfer** from rangelands to cultivated fields.

*Aim of the study:* assess a mixed-farming system's sustainability, analyzing evolutions in its functioning and its **nitrogen balance** from 1997 to 2012

Village studied: Sare Yero Bana, sub-humid Western Africa, High Casamance region, Senegal.



## Methods

Village trajectory studied from 1997 to 2012 is based on structure and functioning represented by biomass flows which are converted into nitrogen flows.

In both years, information was collected through farm survey and data was then compared to previous studies realized around 1997.

Biomass flows identification

Biomass flows quantification

Conversion into nitrogen

Nitrogen balance calculations

1997: Measurements of all biomass flows (including weight and nitrogen content analysis)  
 2012: Estimation by exhaustive farm survey

INPUTS

- Human food
- Organic fertilizers
- Mineral fertilizers
- Seeds
- Animals
- Animal feed

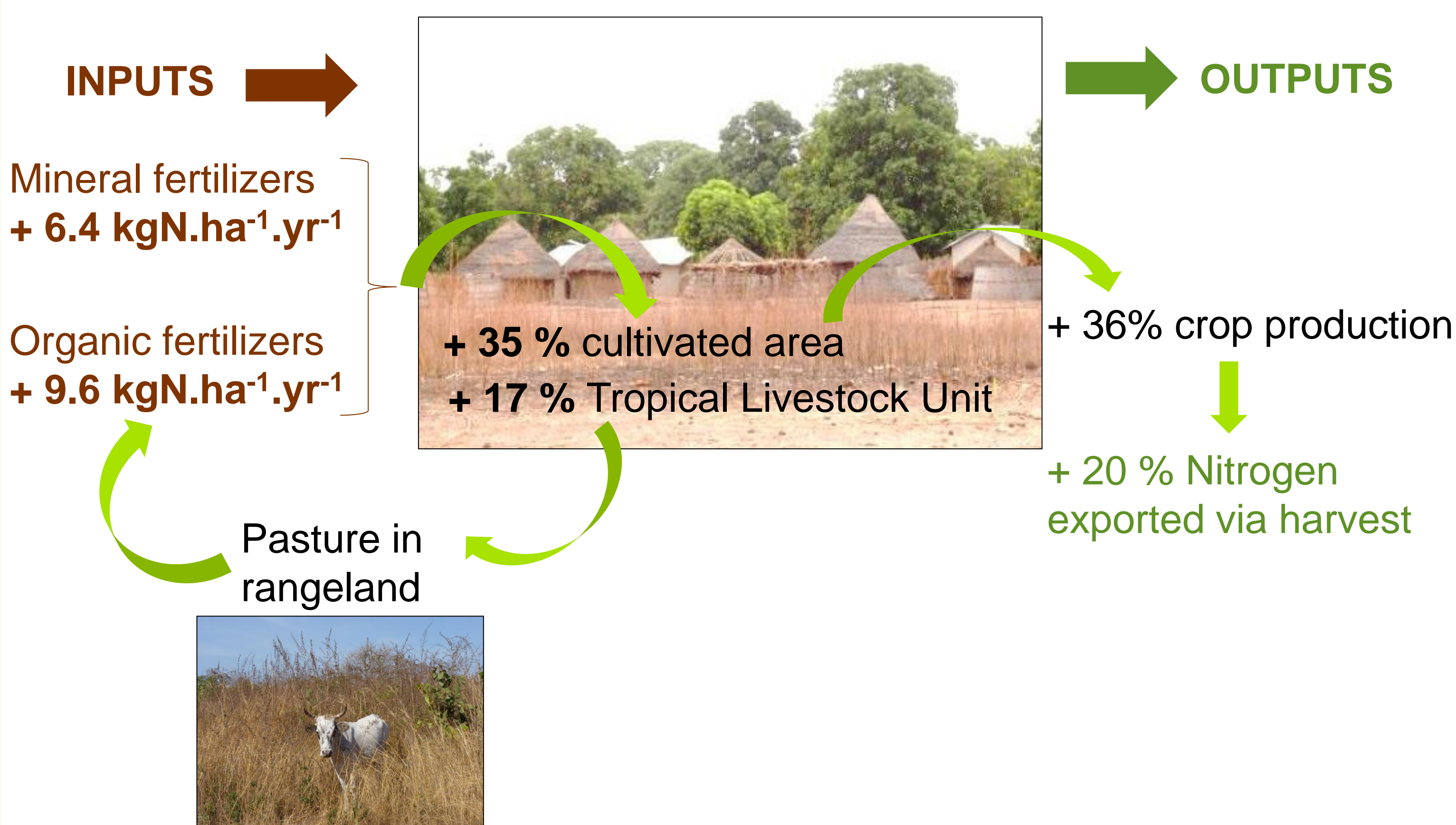


Village scale biomass flows

OUTPUTS

- Cereal & Groundnut
- Groundnut stover
- Animals
- Milk

## Results



Principal changes between the years 1997 and 2012

In both years, crop fields' nitrogen inputs were mainly ensured by manure and crop harvest is responsible of the biggest nitrogen outflow.

Evolutions between 1997 and 2012:

- The village organization did not affect rangeland availability for herds, with more than 200 ha still available for livestock
- Cattle herds expansion increased fertility transfers from rangelands to cultivated fields
- Agriculture practices did not significantly change, except for a recent use of mineral fertilizers and an increase of manure production related to cattle herds expansion

### ↳ Crop intensification

The village **nitrogen balance** remains stable and close to equilibrium with an estimation to **-4.00 kg N.ha<sup>-1</sup>.yr<sup>-1</sup> in 1997** and to **-2.63 kg N.ha<sup>-1</sup>.yr<sup>-1</sup> in 2012**.

→ Intensification does not affect its sustainability

## Conclusion

Results show that mineral fertilizers inputs and an **increase of fertility transfers** through cattle herds allowed to balance the increase in crop production. But most importantly, it intensified it.

In Sub-Saharan Africa regions, **livestock is a very important activity** but also contributes significantly to climate change via greenhouse gas emissions.

Moreover, this study shows that livestock can have also an **indirect positive effect** on other agricultural production related to **the input of organic fertilizer**. Therefore, cattle herds can play an important part towards food security in Western Africa regions where rangelands still remain.