Case Study

Crop-Livestock Production Systems in the Sahel

Increasing resilience for adaptation to climate change and preserving food security

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UMR SELMET
Research Unit : CIRAD SELMET

- Ruminant livestock systems
- Arch environments (mediterranean and tropical context)

- 3 axes:
  - Livestock and local/territorial development
  - Plant and Ruminant adaptation processes
  - Livestock system innovation

40 researchers

Content

1. Introduction
2. Crop-Livestock PS in Sahel (CLPSS)
3. Various risks faced by CLPSS
4. Vulnerability and adaptation strategies
5. Options to enhance adaptation strategies
6. Conclusion
INTRODUCTION

- Homogeneous agroecological zone in W-C Africa
- Unreliable rainfall (200-600mm/y)
- Rural population: >70% rural
- Mainly crop-livestock systems
- Historically used to adaptation strategies
  - New challenges: Demography; CC; Environment; Global Market
  - Important impacts: are they resilient?
  - How did they adapt or not?
  - What do do to enhance resilience and preserve FS?

Focus on Western Sahel
Crop-Livestock Production Systems in the Sahel (CLPSS)

- Livestock only grazing systems in arid and semi-arid areas (LGA)
- Rainfed mixed crop-livestock systems in arid and semi-arid areas (MRA)
- Irrigated mixed crop-livestock systems in arid and semi-arid areas (MIA)

(Sere and Steinfeld 1996; Robinson et al 2011)
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Burkina Faso, Mali, Niger, Senegal

• 40 million people
• 18 million Cattle
• 24 million Sheep
• 32 million Goats
• more than 55% of WA Livestock
• more than 30% of Agric GDP (# 17.2%)
• decrease population expected by 2050

• Mobile LS
• Rangeland ans crop residues

Fernandez-Rivera et al., 2004
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Trends

• Rapid growth: human and livestock population
• More tension on land and resources
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FUNCTIONS (1/2)

• Economic:

  • 30 % Agr GDP in the Sahel; cash income; savings; draught power; salary employment growing
  • Provide coastal markets;
  • Not sufficient to respond regional demand growth (trade deficit)

• Ecological

  • Some concerns (Livestock’s Long Shadow, FAO 2006): GHG
  • Positive impacts: soil fertility; biodiversity; water cycle; C sequestration
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FUNCTIONS (2/2)

• Social
  • Traditional common resources use and regulations
  • Society organisation on herd/pasture/water
  • Collective risk management; Food Security management; Social Reproduction
  • Growing interactions between MRA and LGA: local organisations (resource management; marketing)

• Food security
  • Pastoral: mobility and reciprocity (weekening): food; savings; income
  • Agropastoral: decreasing revenue from agriculture and land pressure
    > rural exodus
  • Public authorities: low support to local production (export prices; low import taxes; services)
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**VARIOUS RISKS**

- **Climatic risks**
  - An historical profile (CV # 30 %)
  - High spatial variability (20-30 km)
  - Population adapted to this environment: mobility; species; herd size; crop areas; activities
  - Major crisis when 2 successive dry years: stocks run short
  - Sahel regreening
  - Unreliable CC prediction: 1.8-2°C but on rainfall? (Monsoon) (Hiernaux, Soussana 2011)
  - Local differences > global trends; extreme events (Thornton et al 2009)
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VARIOUS RISKS

• Economical risks
  • Cereal and oil price volatility (MTx 2) (HLPE 2011)
  • Few information on animal feed
  • Effect on animal feed market in Sahel (Assani et al 2011)
  • Very heterogeneous national contexts (import taxes; demand; production; exchange rate)
  • National margins

Figure 2.3 – World prices trends of cereals and oil

1995-2011

Wheat
Rice

Maize
Soybean

Diesel

Evolution of the price of ruminant feed by type of seller (xof/kg)
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VARIOUS RISKS

• Economical risks

  • Low local market livestock prices during crisis

  • Effect of « terms of trade » for trade exchanges correlated mainly to harvest and rainfall (Dietvorst and Kerven 1992)

  • Exacerbation with speculation and price volatility (David-Benz et al 2011)

  • Need for harmonized information on markets
  • Need for multidimensional approach of FS: availability, access and use of food

  • CILSS : Harmonized Framework for FS

Interannual comparison of terms of trade goat-millet (2010)
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VARIOUS RISKS

- Land tenure risks
  - High demography in Sahel: 2.5 %/y; x2 in 2030 with 70% rural (100 million inhab)
  - Cultivated land growing rapidly at expense of rangeland: mobility constraint, conflicts
  - Modern legislation recognize collective land management by livestock F but not applied
  - Land appropriation: export crops
  - Decentralization policies: integration of livestock and mobile herders is a challenge
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VARIOUS RISKS

• Sanitary risks
  
  • Historical issue : epizootics control; vaccination
    (Rinderpest; Pleuropneumoniae; Anthrax;…)
  
  • Production losses remain important: young animals (infectious deseases, parasites,…)
    (environmental, feed and sanitary factors)
  
  • Impact of climate change very complex to estimate (Thornton et al. 2009)
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Vulnerability and adaptation strategies

• A model of vulnerability/securisation for livestock farmers (Ancey et al 2009)
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Main adaptation strategies

• Mobility: unreliable resources and marketing; Human mobility
  Pastoralists less exposed to external shocks than export agricultural sector (HLPE 2011)

• Agreements for access to natural resources: reciprocity

• Spécialisation in livestock production and marketing (wealthy farmers)

• Diversification of activities: crop, small trade (small holders)

• Social network and support: share manpower and livestock (poorest)
# Crop-Livestock Production Systems in the Sahel (CLPSS)

## Indicators of vulnerability

<table>
<thead>
<tr>
<th>Level of analysis</th>
<th>National or Agroecological zone</th>
<th>Rural community</th>
<th>Village or Pastoral Unit</th>
<th>Family or Farm</th>
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</thead>
<tbody>
<tr>
<td><strong>Indicators of vulnerability to climatic risks</strong></td>
<td>Water availability in time and space</td>
<td>Water Infrastructures (Not specific)</td>
<td>Access to water, Payment for water, Forage stocks, Mobility ratio, Food Stocks</td>
<td>Type of mobility, Livestock and food sales, Herd size and cultivated area, size family, Livestock feeding practices, Available labor, Diversity of income</td>
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<td>Vegetation and Animal biodiversity</td>
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<td>Natural biomass availability</td>
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<td>Relative Cropping areas related to population</td>
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<td>Pest distribution</td>
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<tr>
<td><strong>Indicators of vulnerability to economical risks</strong></td>
<td>(Not specific) Available financial services: insurance, credit, grants, Revenue structure</td>
<td>(Not specific)</td>
<td>Sales structure modification, Terms of trade, Low food diversity, Market distance, Market dynamics and access, Access to information on markets, Unusual mobility</td>
<td>Diversity of products, High value products, Decreased number of daily meal, Use of high quality inputs, Integration in value chain, Self consumption level, Diversity of income</td>
</tr>
</tbody>
</table>

## Multiscale

## Multistakeholders

## Participatory
Options to enhance adaptation strategies (1/2)

- **Integrated policies:**
  Capacity of farmers to access resources and services at different scales

- **Land tenure options:**
  Collective management in arid areas to secure mobility and common good management with investments
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Options to enhance adaptation strategies (2/2)

• **Other policy options:** Need of multi-level governance
  
  • Regional: WAEMU and ECOWAS. Economic liberalisation > Nat Agr share but ECT for sensible products, common agricultural policies, rural devpt.
  
  • National: State withdrawal, free market, commercial agriculture Need more services for producers/family agricultural systems
  
  • Local: Very diverse among sahelian countries Issue: empowerment of local governance by devpt projects

• **Technical options:**
  
  • Information tools to enhance anticipation
  
  • Agroecological intensification for FS and sustainable development
  
  • System innovation to promote sustainable CLPSS at territorial level
CONCLUSION

• CLPSS are highly adaptable production systems to various risks including climatic risks

• Food security is included in adaptation strategies

• Mobility is one of major relevant factor of adaptation

• More pressure: demography; global market; environment

• Integrated and multiscale policies

• Multistakeholder analysis and policy making

• Combination of (semi)industrial and family livestock systems

• An equilibrium needed to avoid future crisis and jeopardization
THANK YOU