



The future of Mediterranean Livestock Farming Systems: Opportunity and efficiency of Crops – Livestock Integration

- ❖ Mediterranean livestock farming systems have evolved in response to the multiple and complex changes that occurred in the past in the area and they must now adapt to current and future pressures, including the strong demographic growth and urbanization in the coastal line and the high competition for land and water.
- ❖ CLIMED aims to assess the technical, economic and socio-ecological viability of crop-livestock systems in the Mediterranean context to help farmers, communities, researchers and decision-makers define management priorities and improve planning so as to deal better with socio-environmental issues. Interactions between livestock husbandry and natural resources (soil, water) through the feeding system vary across farming systems due to farmers' diverse livelihood strategies (e.g. livestock- or crop-focused livelihood) and the resources base. In these systems, biomass management is a pillar of the efficiency of the integrated crop-livestock systems with the important development of cash crops on coastal zones.

Objectives

**Livestock
Ecological
intensification
Adaptation
Vulnerability
Socio-ecological
system**

- ❑ To identify efficient crop-livestock systems in the Mediterranean context in order to make a better use of water, soil, crop residues, rangeland forages, etc. (resource use efficiency), and to increase their production to meet the rising local demand for safe animal products (socio-economic efficiency).
- ❑ To evaluate their adaptive capacity, vulnerability and flexibility in the face of current stresses and changes.
- ❑ To assess their socio-ecological co-viability and resilience with regard to demographic growth and in a historical perspective.
- ❑ To develop future scenarios and priorities for livestock development in the Mediterranean context to increase the capabilities of livestock systems.
- ❑ To strengthen collaboration and interdisciplinary research and innovation between and within national teams from the Mediterranean area through sharing research methods and databases.

Scientific results & innovation potential

- ✓ Based on a literature review of methods and indicators, one of our main achievements is the combination of collecting methods and types of analysis to describe and analyse the crop-livestock integration models in the three countries studied (Egypt, France and Morocco).
- ✓ Data collecting methods extended from global appraisal and family farm surveys to deep follow-ups at the farm and livestock system levels. The analyses of efficiency were based on a multitude of tools ranging from livelihood and micro-economic tools (for economic and social assessment) to environmental tools like the Ecological Network Analysis and Life Cycle Analysis (for environmental assessments).
- ✓ Global results highlighted that livestock at the interface between land management (local) and livelihood diversification (family) plays a vital role in the current rural sustainability although its future will depend on the societal challenges and policy orientation between employment, food security and resources management.
- ✓ Moreover, the function of livestock in biomass management appears crucial for the medium and long term resilience of Mediterranean agrarian systems.

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- UMR Espace-Développement, Institut de Recherche pour le Développement (IRD), **FRANCE**



Data collecting methods

- Using multiple field approaches: from the agrarian diagnostic at the territorial level to deep follow-ups at the level of livestock systems, passing through family farm surveys to relocate livestock changes in the family story in its environment.
- Using qualitative and quantitative data collection systems.
- Crossing official data and primary data.

Efficiency assessment

- Social assessment:** Based on narrative approach and resources dynamics (land and labour); trajectories analysis.
- Economic assessment:** Micro-economics at farm level (productivity; net income).
- Environmental assessment:** 1) Ecological Network Analysis (ENA) to quantify the fluxes between crop and livestock compartments; 2) Life Cycle Analysis (LCA) for an assessment of the potential sustainable use of rangelands; 3) Efficiency indicators based on land and nitrogen management.

Vulnerability, adaptation and resilience

- Livelihood approach:** Between assets and diversification.
- Adaptation:** Based on historical and transversal approach of farms and their environmental situation.
- Resilience :** Social dimension of adaptive co-management of ecosystems and landscapes (rules of users).

Why collaborating?

- To strengthen **synergies** and scientific collaborations between the partners given the multidisciplinary nature of the project and challenges addressed.
- To boost the production of **analysis methods** (disciplinary, interdisciplinary and comparative analysis).
- To present **new science insights** in more accessible and informative ways to stakeholders, especially to policy-makers and producers.

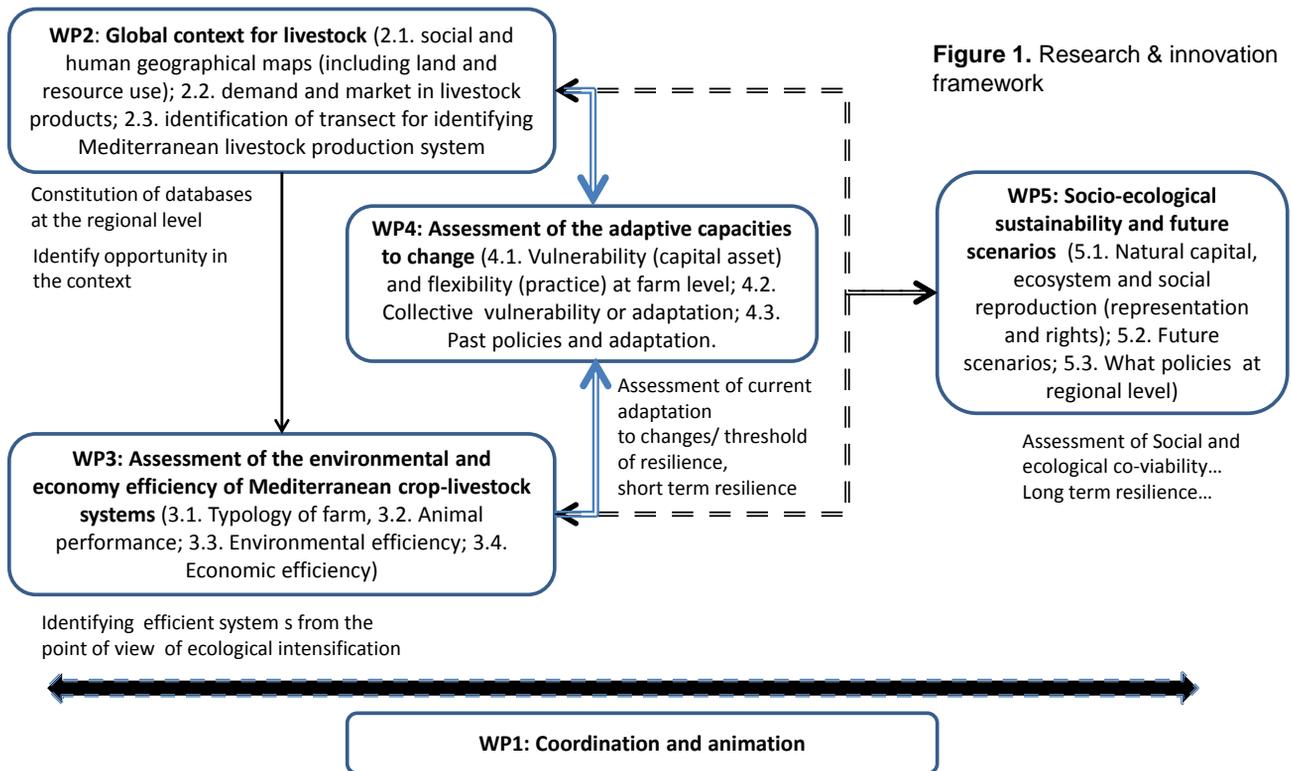


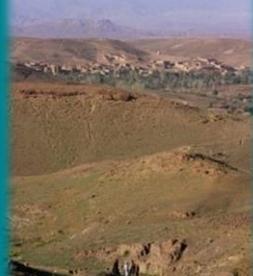
Figure 1. Research & innovation framework

Plain of Gharb, Morocco

Dry highlands, France



Plain of Gharb, Morocco



New reclaimed lands, Egypt



Figure 2. Livestock systems in various Mediterranean contexts

ACHIEVEMENTS

Global context for livestock

- The objective was to perform historical and geographical analyses to characterize the social, economic and geographical context, its recent development, the prospects, constraints, strengths and opportunities that provide scientific evidence relevant to the understanding of future crop-livestock production systems in the region.
- Three research activities were conducted: bibliography review of past or on-going projects in France, farm survey on 175 farmers in Egypt with a family story and territorial approach in Morocco.

We elaborated a typology of the modalities of crop-livestock integration in each location.

Assessment of the efficiency of crop-livestock systems

- In Morocco, in the Gharb plain, three Master theses have been achieved on themes related to family labour constraints, feed availability fluctuation and its impact on milking activity and milk production costs.
- In France, a review of methods and indicators was carried out. In order to characterize crop-livestock integration at farm level, an Ecological Network Analysis (ENA) was performed to quantify the fluxes between crop and livestock compartments and assess the efficiency of recycling. It was combined with a Life Cycle Analysis (LCA) to assess environmental indicators.
- In Egypt, a series of indicators were determined based on the family farm survey (Figure 3).

All these approaches stressed the crucial function of livestock biomass preservation in the Mediterranean context.

Table 1. Adaptive capacities of systems based on coordination models (South of France, Master thesis, 2015)

| Models | Cereal plateau | Agrosilvopastoral system | Plain / Mountain |
|-----------------------|----------------|--------------------------|-------------------|
| Types of relations | Neighbour | Inter-individual | Multi-actors |
| Mode of coordination | Proximity | Mutual agreement | Collective action |
| Temporal coordination | ++ | +++ | +++ |
| Spatial coordination | + | ++ | +++ |
| Social coordination | +++ | +++ | +++ |

Assessment of the adaptive capacity to changes

- In the Haut-Atlas, in partnership with ORMVAO / IAV in Morocco and IRD / CIRAD in France, the analysis of the territorial system based on the characterization of the transhumance systems and the interactions of the different systems (pastoral, agro-pastoral, oasis systems) in link with the spatial and social organization, put in evidence the specific roles of rules of users in the territorial management.
- In France, a master thesis highlighted the differential roles of social, spatial and temporal coordination in the systems' adaptive process along an agro-ecological gradient of integration (Table 1).
- In the West Delta (Egypt), results show how the successful experiences in these harsh environments are highly dependent on livestock activities for cash funding and soil preservation and, more generally, on the diversification.

Adaptive capacity in the Mediterranean area is strongly based on diversification.

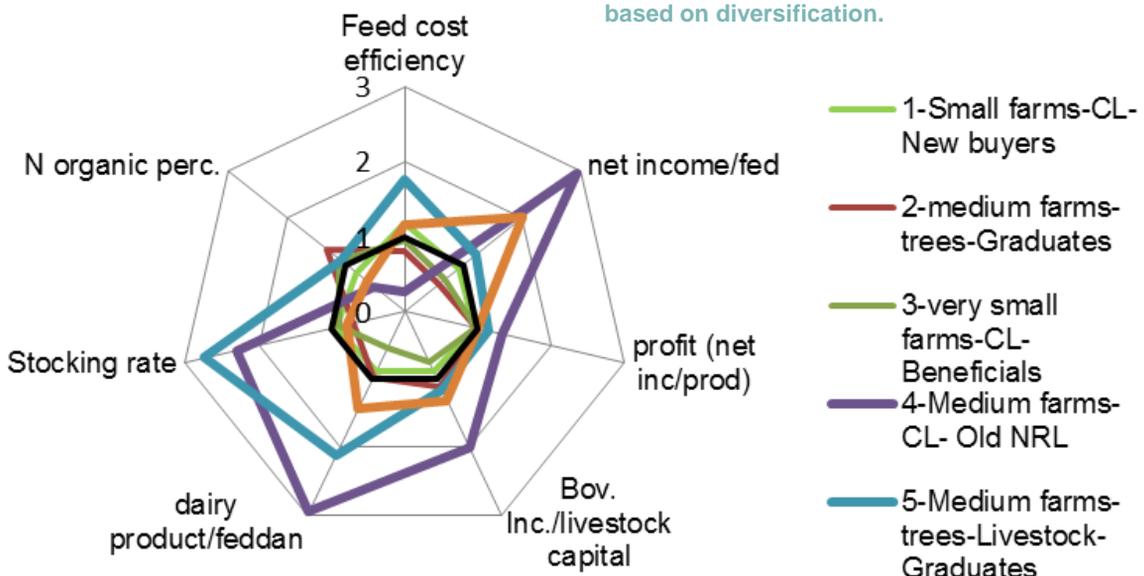


Figure 3. Efficiency profiles according to social categories in reclaimed lands (West Delta, Egypt)



Stakeholder engagement

- ❑ An expected impact of the project was a change of the society's opinion on livestock-related activities.
- ❑ Without underestimating the risks due to livestock intensification (waste management, CO₂ or methane emission, etc..), the project put in evidence the capacities of this activity to adapt to global changes and also to reduce the vulnerability by different pathways embedded with the multifunctional nature of livestock, both an economic activity and a social and biological asset.
- ❑ The impacts on employment, diversification, biomass management are part of the adaptation and vulnerability reduction processes in this Mediterranean environment.

Next steps

- ❖ Some indicators have emerged from the three studied countries related to work and net income. Some comparing analyses will be developed.
- ❖ Due to the variety of databases in each case study we propose to develop a meta-database that will give the main description of the contents of each country's database.
- ❖ This project has allowed to constitute a common knowledge base on crop-livestock integrated systems that can be used for further research projects on the adaptive capacity of these systems as they withstand global changes (especially social and climatic changes).



Figure 4. Sharing of field knowledge between researchers, technicians and farmers (Egypt)

Do you want to know more?

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