

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

Véronique ALARY (Cirad/Icarda, France), Mohamed Taher SRAIRI (IAV, Morocco), Charles-Henri MOULIN (SupAgro, France), Adel ABOUL-NAGA (ARC-APRI, Egypt), Olivier BARRIERE (IRD, France), JF TOURRAND (Cirad, France)



ARIMNet projects mid-term event
June 11, 2014, Montpellier, France



Brief introduction

Donors, Partners and collaborators



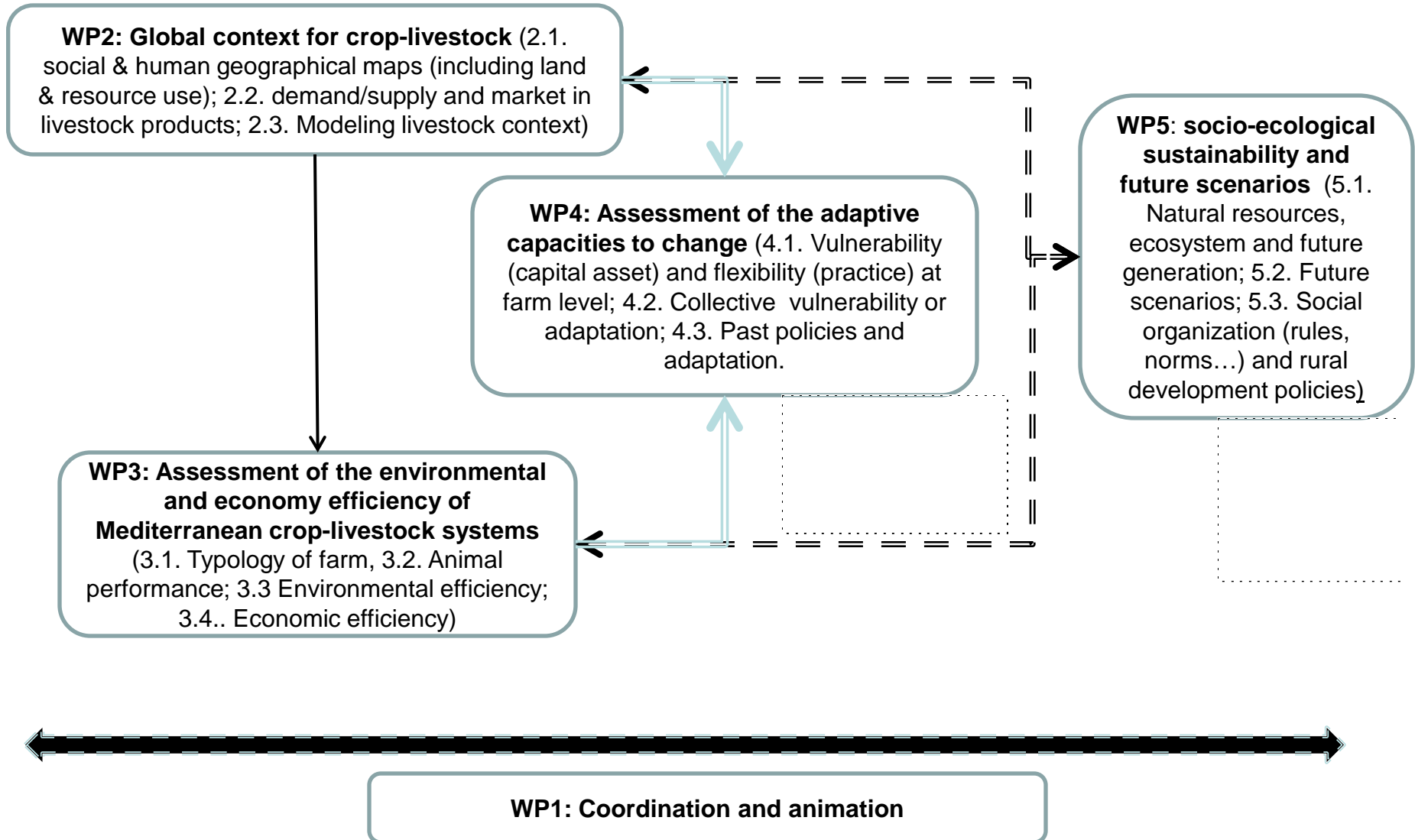
Background in Mediterranean agriculture systems ...

- Strong demographic growth, urbanization and increasing demand for animal products ...
- High competition for land and water => pressures on biomass to feed animals
- Multiple roles of livestock in reducing vulnerabilities in very fragile environments..

Hypothesis are...

- that livestock activities constitute **a pillar of the environmental and social sustainability** in the Mediterranean rural zone both at:
 - the farm level (**biomass management**, soil fertility/manure and feed production, **insurance, income resource**, domestic consumption, diversification, intensification)
 - and regional level (social capital, biodiversity, reduction of fire, cultural aspect, landscape preservation).
- But faced with the demographic growth and increasing demand, the **intensification of livestock systems may damage the agro-ecological system**, especially natural resources (soil & water).
- ➔ There is an urgent **need to assess the past and on-going intensification process of crop-livestock farming systems** and its efficiency or viability... (describing, understanding and modeling)
- ➔ **Ecological intensification (EI)** in crop-livestock farming system is both a pathway and a challenge for Mediterranean countries.

Frame of the Project CLIMED



Expected results

- strengthening of synergies and scientific collaborations between the partners given the interdisciplinary nature of it
- assessing the **bio-economic and socio-ecological viability of crop-livestock systems in the Mediterranean context**
- to help farmers, local communities, researchers and decision markers in thinking for future Mediterranean livestock
- In designing priorities, rules, policies that could better deal with the socio-environmental issues in link with demographic and land pressure, increasing demand and high international competition.

Case studies: a geographical and social transect from the agro-pastoral zones in 3 countries (Ma, Eg, Fr + Lb)

- **Morocco:** From the south side of Haut-Atlas (pastoral mobility) to the plain of Gharb (drip irrigation associated with maize silage → fodder production).
- **Egypt:** From the agro-pastoral system of North West Coastal zone to the NRL in West Delta region that is part of the national Egyptian strategy to increase agricultural production and to enhance its food security.
- **France:** From the mountainous hinterlands to the coastal zones in Mediterranean area in France that knows some significant changes in link with the development of irrigation in the 70s, the demographic pressure, the touristic development and the agricultural policies.
- **Lebanon:** from the Mount Lebanon to Bekaa Plain (in partnership with AUB and CNRS)



On-going Links & in Construction

- CRP1.1- Drylands on Integrated Agricultural Production Systems for the Poor and Vulnerable in Dry Areas (ICARDA)
- Project ELVulmed (ANR CEP&S) on the role of livestock in reducing vulnerability: cf. Pubs in AGSY, World Dev., Autrepart
- Project MOUVE (ANR) on ecological intensification in livestock farming systems and LIFLOD network (www.liflod.org)
- Project AIRD-STDF on *Collective action and agricultural productivity in Egypt's New Lands*
- *Project IRD-Morocco-Haut Atlas on co-viability*
- *Project IMHOTEP CLIMED Egypt on crop-livestock farming systems*
- *AUB and CNRS, Lebanon: PhD Student Mabelle Shedid (indicators of sustainability in crop-livestock farming systems)*

Morocco

Two main research activities



Crop-Livestock efficiency in Gharb Plain
- monthly monitoring over 6 farms types
based on expert typology on feed and
milk productivity

High Atlas / Ouarzazate: Partnerships ORMVAO, IAV, IRD, CIRAD
- Analysis of transhumance systems at the territorial level
- Interaction of the different systems (pastoral, agro-pastoral, oasis)

Gharb Plain: Main ongoing research themes

1. Crop/livestock integration in smallholder farms: the role of work strategies

A study in a sample of 15 farms

The “Work Balance” method developed by Dedieu et al. (2000)



Expected results:

- How do farmers cope with work requirements to manage their farms?**
- Which incomes are generated by crops and livestock, with regards to the work needed?**

Gharb Plain: Main ongoing research themes

2. Dairy cattle farms' economic results

A study in a sample of 20 farms

The structure of milk production costs, according to various scenarios



Expected results:

- What are the current terms of profitability in various types of dairy herds?**
- Which variables affect the most the production cost of milk?**

High Atlas: Resilience & Co-viability

Resilience : Yes

Climate Change
Adaptation

Climate change: reducing
of rainfall and pasture
(quality and quantity),
disappearance of some
plants + overgrazing

Go out to find other pasture in order to preserve
local pasture/rangeland (seasonal migration, ...)

Aoudal System: sustainable rangeland
management based on the control of access

Relationships in the *douar*, including
local settlers (no pastoral households)


Resilience : No

No adaptation to
Climate Change

- No change in the rangeland management
=> Low rainfall + overgrazing = degradation
- No diversified activities = no reducing pressure
- Wood extraction for housing use (juniper trees)
- No restrictive rules for the users (breeders and others)

Aoudal System: conditioned by rainfall (no rain
= no access) and if regular rainfall, access
based on the concurrence between the tribes

Co-viability of socio-ecosystems

- 
- Lack of regulation leads to rangeland practices with negative impacts on natural resources
 - Care the rangeland today to survive tomorrow
 - Viability of pastoral system depends on ecosystem viability
 - Sustainable rangeland management = need to go out the rangeland during winter
 - Great challenge = Control the access to the rangeland according to the ecological cycle and human needs

Local demand: implementation of specific and shared/negotiated regulation, accepted by both local and national groups aiming to sustainable rangeland management as the base of socio-ecosystem (including exogenous mediation)



Socio-ecosystem Pact/Agreement

France

Languedoc-Roussillon and Provence-Alpes-Côte d'Azur

Main on-going research questions

What are the modalities of crop-livestock integration (CLI), in landscapes with various spatial combination of *Ager*, *Saltus* and *Sylva*, at several scales ?

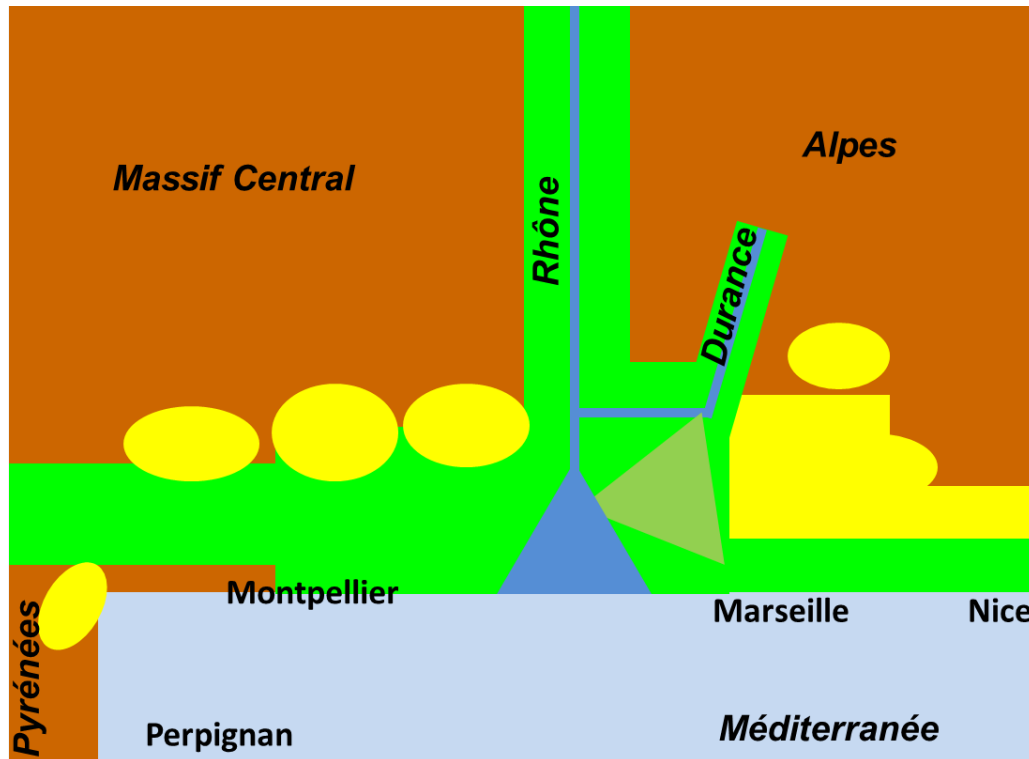
1. *Farm*
2. *Local territory*
3. *Region, with complementarity between local territories (exchanges of feed, manure, mobility of flocks)*

What are the economic and environmental efficiency of those CLI modalities ?

What are adaptive capacities allowed by those CLI modalities to cope with global changes ?

Research framework

- Mountains or altitude plateaus
- Piedmont, hills, small valleys
- Large valleys and littoral plains
- Deltas



Regional spatial analysis from statistical data (RGA 2000 et 2010) + surveys with experts

CLI typology at farm scale and modelisation of farm types (from previous data)

Agrarian systems analysis for 4 local territories, in a diversity of areas

Combination of methods to characterize and appraise CLI efficiency at various scales (LCA, ENA)

Expected results

Characterization of CLI at regional scale (typology of administrative units, main exchanges between local territories)

Combination of methods to characterize and appraise CLI efficiency at farm and local territory

- economic and environmental efficiency (LCA, ENA)
- related to global stakes (climate mitigation...) or local stakes (especially, capacity to maintain open rangelands : biodiversity, fire prevention...)

Appraisal of the various CLI modalities, in terms of efficiency but also adaptive capacities

Types of farms

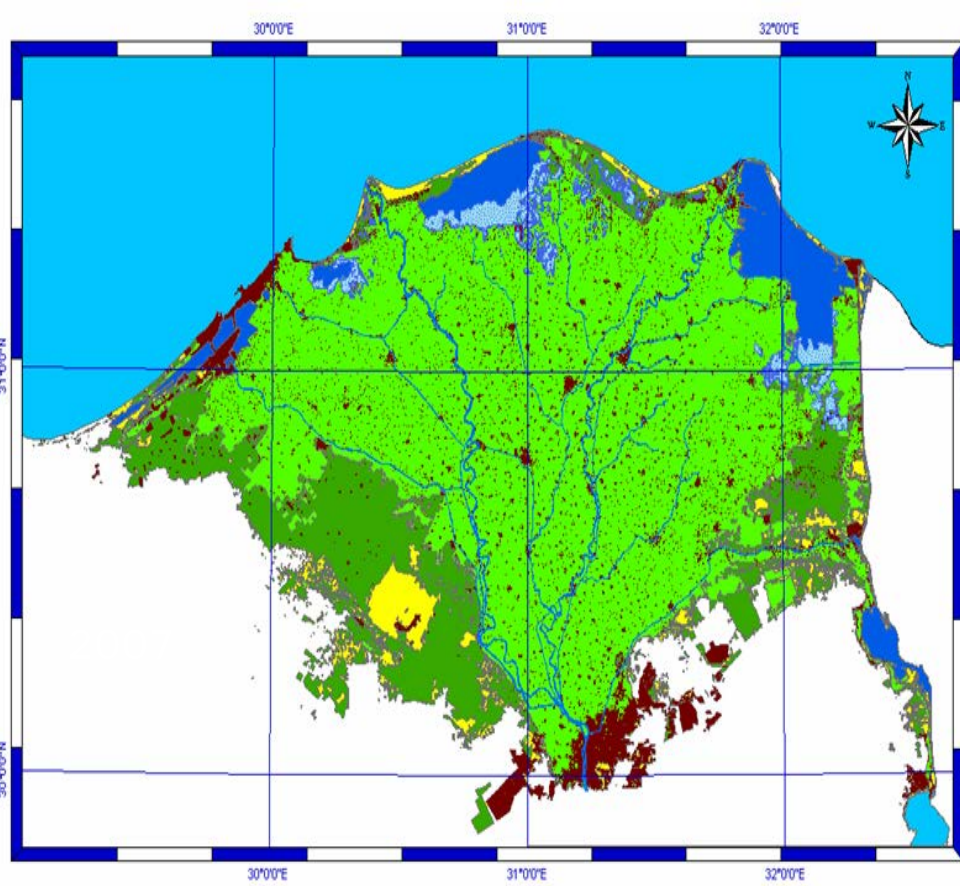
Local territories

Complementarities of local territories

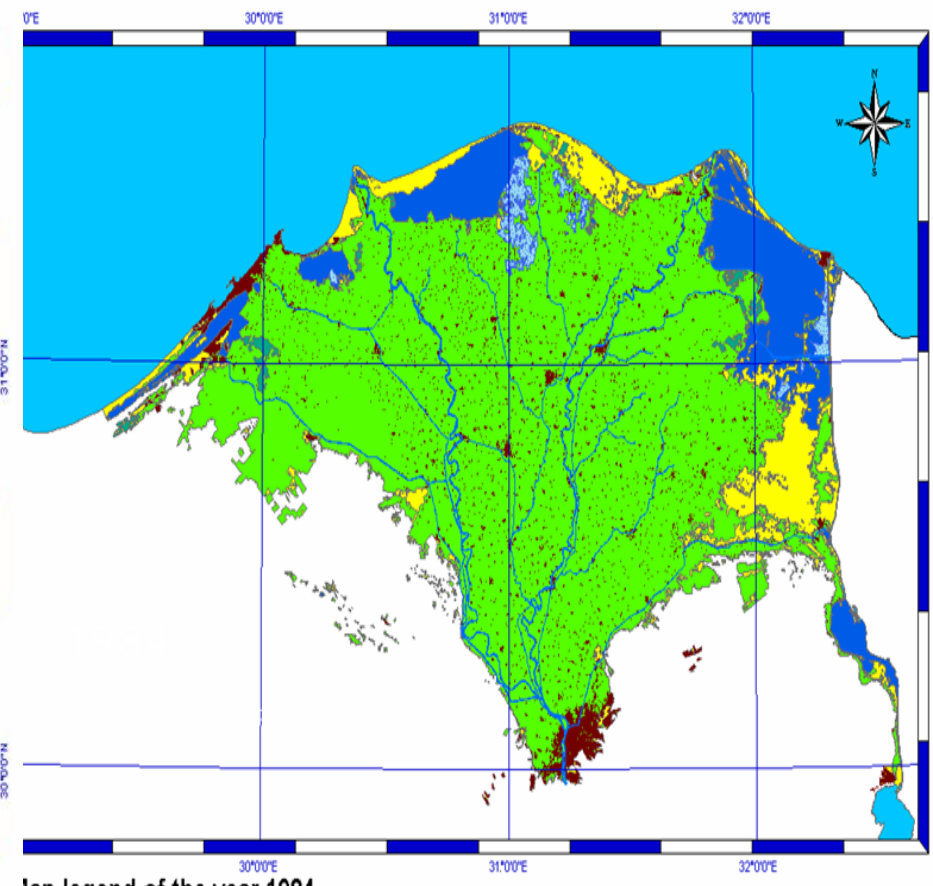
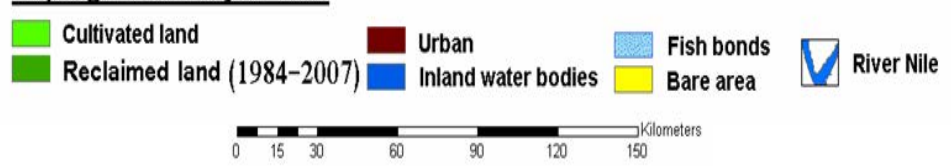
Present situations / simulation of scenarios (interest to reinforced CLI ? At what scale ?)

Egypt

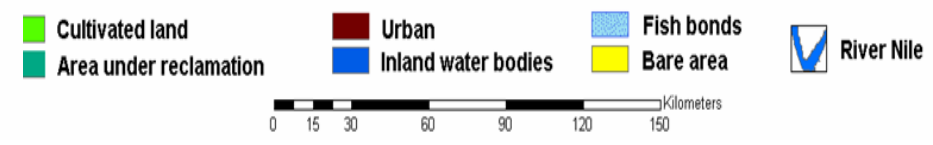
In the New/Old New Reclaimed Lands



Map legend of the year 2007



Map legend of the year 1984



Changes of land use 1984 - 2007

165 family surveys done in 5 zones → 3 villages per zone



Pilot phase from March to June 2014 → Integrated Crop-Livestock management monitoring

Gov: Behira -Zone/Vill: Bustan/Tabarani

Farmer: Mohamed Mabrouck Eler / T1

Area: 2.5 + 2.5 + (2.5 rent)

Labor:

محافظة : البحيرة - منطقة : البستان - قرية : الطبراني

اسم المزارع : محمد مبروك

مساحة الارض 2.5 : فدان + 2.5 فدان مستأجرة



Name: Black

Number: 3 (F)

Age: # July 2009

Mother: White / 2

Entrance: Born

Nb. Calving (2013): 3

Main production: Milk

الاسم: السوداء

عدد: 3 (ف)

العمر: يوليو 2009

الأم: البيضاء / 2

عدد الولادات (2013): 3

الإنتاج الرئيسية: إنتاج اللبن

Feeding system:

Jan: Berseem ad libidum + 1,5kg (bran + crop residues)

Milk production:

Jan: 4+4 (EGP4/Kg)

Reproduction:

Last calving (3rd): 2013, December, 10

Exit:

نظام التغذية:

يناير : برسيم + 1.5 كجم (رصة + بقايا محاصيل)

إنتاج الحليب:

يناير: 4+4 (4 جنيهات / كجم)

الانجاب :

آخر ولادة (الثالثة) : 10 ديسمبر 2013

الخروج:

Design of the protocole for monitoring

- Surveyed species: cattle, buffaloes, sheep and goats
- Follow-up of demography (entries, exits, parturitions and abortions) and production (milk production, liveweight gain) ;
- One visit bi-monthly in each farmer. Given the size of herds and the small number of events during one month, we can decrease the frequency of visits;
- Sample : around 24 to 30 farmers

Integrative approach of the crop-livestock system

Feeding system

Category of animals (Species)	Physiological stage	Nb heads	Unit	Quantity (Number of units) Yesterday morning	Quantity (Number of units) Yesterday evening	Total (Number of units) 1 day Yesterday

Cropping system

Surface et sol	events	Plot 1. Crop : _____		Plot 2 Crop : _____		Plot 3 Crop : _____	
		Technique	Cost	Technique	Cost	Technique	Cost
Operations	Quantity (carts)						
	period						
	origin						
Ploughing (land preparation)	Tractor hours						
	Date (week)						
Seed	Date of seedling						
	Quantity						
	Source?						
Herbicides + pesticide n°1	Name						
	Quantity						
	date						
Herbicides + pesticide n°2	Name						
	Quantity						
	date						
Chemical fertilizer n°1	Name						
	Quantity						
	date						
Chemical fertilizer n°2	Name						
	Quantity						
	date						
Chemical fertilizer n°3	Name						
	Quantity						
	date						
Harvesting (main products)	Production						
	Sold quantity						
	Where sold? Why?						
Harvesting (by-products)	Production						
	Sold quantity						
	Where sold? Why?						
grazing (green fodder; crop residues)	No heads						
	period						
	No days						
	Contrat (Y/N)						
Post harvesting operations and by products	Type of products						
	quantity						
	% sold						
	price						

Biomass

Plot Number	Crops	How many sample	Area of sample (meter)	Fresh weight (kg)	Dry weight
		-	-	-	-
		-	-	-	-
		-	-	-	-



Conclusion

Some orientations

- the main research capitalization is done on the monitoring to assess the efficiency of the crop –Livestock systems in the New Reclaimed Lands (Egypt) and Plaine de Gharb (Morocco) in semi intensive to intensive systems. This monitoring should feed analysis on vulnerability and resilience of systems.
- Establishment of an original partnerships and scientific program to address co-viability (WP5) in haut Atlas (Morocco)
- In France : approach of the resilience of Crop-livestock systems though the interactions between efficiency and vulnerability at different scales.



Thanks for your attention