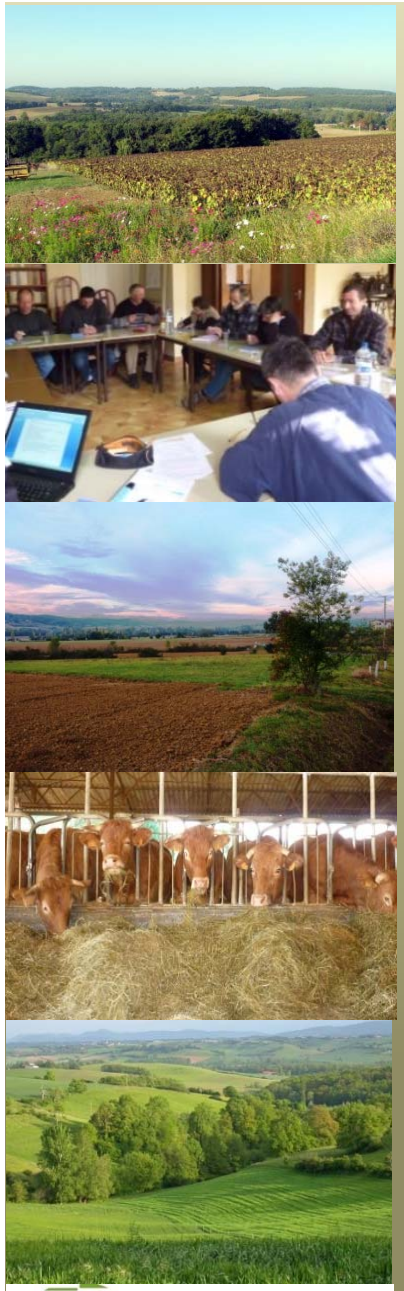


EAAP Session 6 - Mixed Farming systems - does diversity bring any benefits and at what scale?

Belfast, 29th August 2016

Designing integrated crop-livestock systems across scales : toward new agroecological models?

J Ryschawy

INRA INPT-ENSAT, UMR 1248 AGIR, FRANCE

INRA SCIENCE & IMPACT

AGIR UMR 1248 INRA / INPT

AGroécologies - Innovations - Ruralités

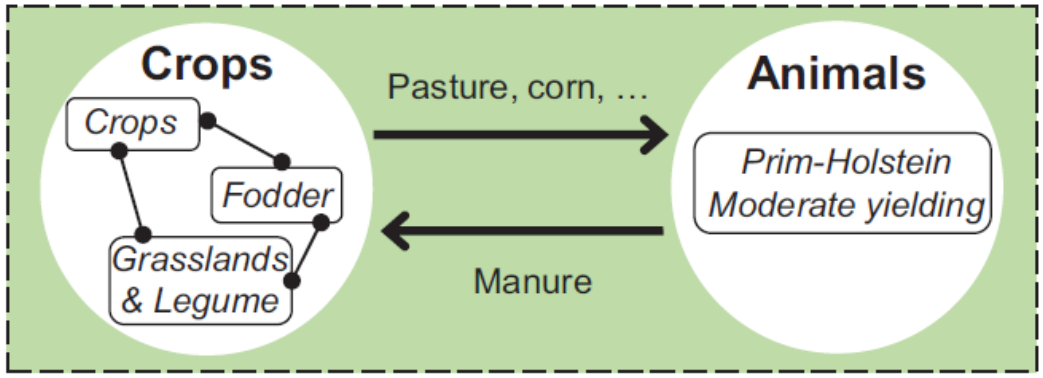
INP TOULOUSE ENSAT

Environmental problems linked to specialisation of farming

A renewed interest on ICLS

- Integrated Crop-Livestock Systems (ICLS) as a theoretical agroecological ideal

➔ICLS should provide multiple ecosystem services

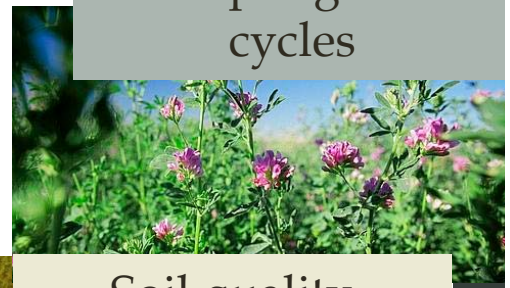


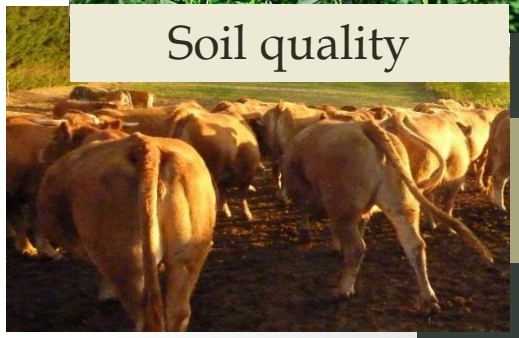
Bonaudo *et al.* (2014)

➔ ICLS have economic and environmental advantages

Landscape heterogeneity

Recoupling N & C cycles



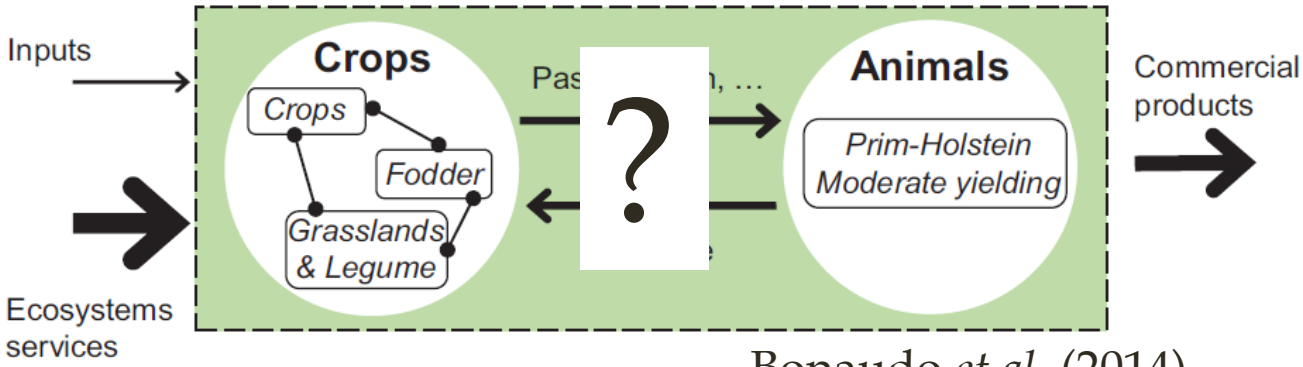


Soil quality

Toward agroecological ICLS?

- **ILCS as a theoretical (!) agroecological ideal**

➔ *Which level of integration to have economic and environmental benefits?*



Bonaudo *et al.* (2014)

- Large decline of ICL farms in Europe

➔ *Tendencial specialisation of farms (market, policies, …)*

➔ *Labour organization constraints*

➔ A need to design agroecological ICLS

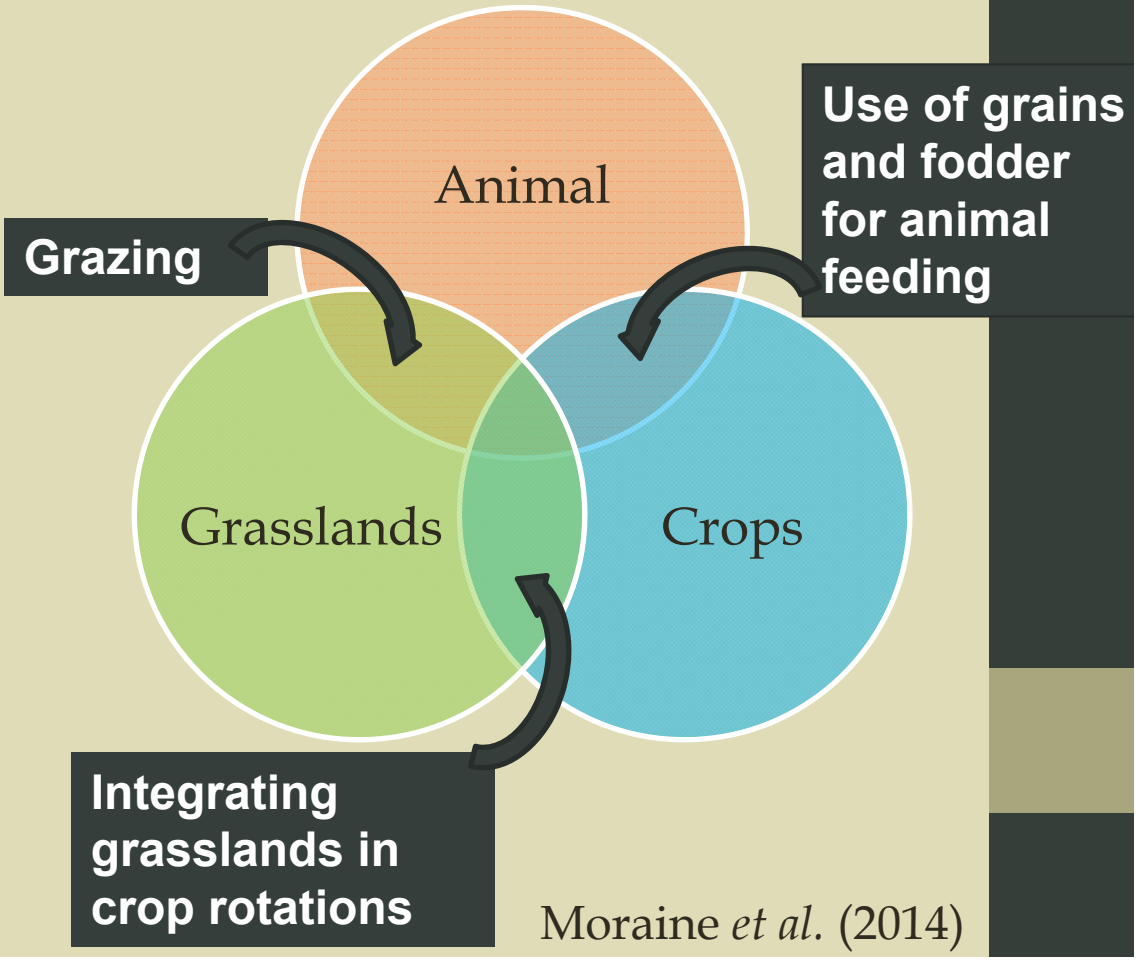
How to describe integration between crops and livestock?

- 3 spheres to describe integration between crops and livestock at different level of organisation (farm, region, …)

- Considering spatial and temporal interfaces

- Describing practices at the interfaces

➔ **Grazed grasslands integrated in crop rotations as an example to integrate the three spheres**



Moraine *et al.* (2014)

Designing agroecological ICLS

- Two options to design ICLS:
  - **Improving** existing ICLS
  - **Reintroducing** new ICL S

Two levels to consider:

Farm level :
farm integrating crops and livestock

Local level :
specialised crop farms and livestock farms exchanging in a local area

➔ ICLS at the local level : goes beyond farm-level workforce constraints

How to design agroecological ICLS?

Focus on three complementray case-studies at different scales :
- farm level considering temporal changes - **case-study 1**
- beyond farm level considering : i) a group of 24 farmers - **case-study 2**
  ii) a subgroup of 6 farmers - **case-study 3**

A methodological framework to design ICLS

Step 1 : Problem definition

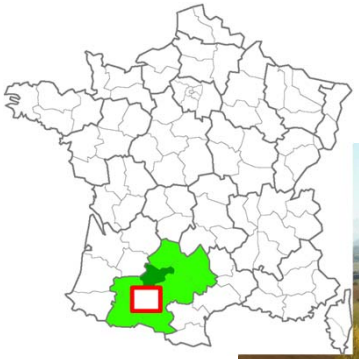
Process combining collective and individual steps

Researchers:

Local actors:

Martin *et al.* (2013)

Case-study 1:
Participative design of ICLS at the farm level



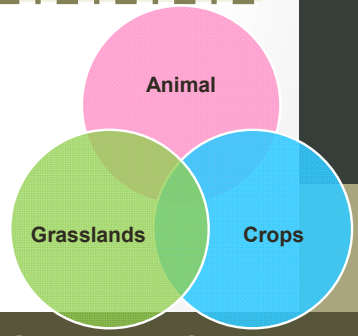
The Coteaux de Gascogne '

A French less-favoured area

➔ Low specialization of agriculture (50% of farms ICLS)

<u>Local actors :</u> Which future for their ICLS farms?

<u>Research :</u>ICLS as agroecological models



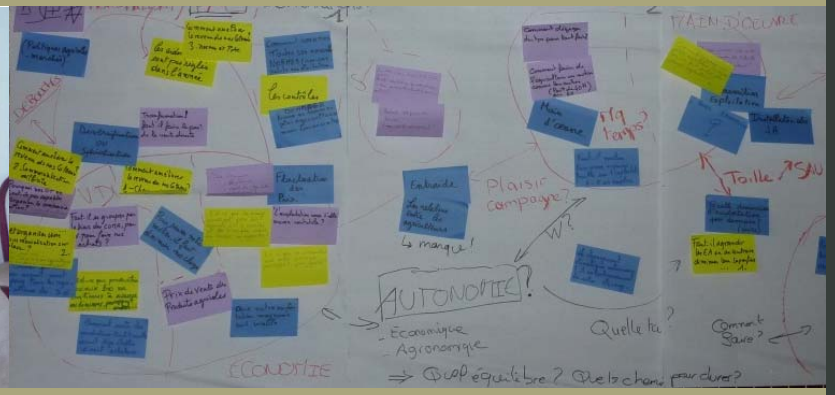
<u>Mutual objective :</u> Designing scenarios including technical innovations to develop agroecological ICL farms.

Ryschawy *et al.* (2014)

Participatory design of scenarios with farmers

A. Studying farmers' long-term strategies as a baseline for future scenarios

B. Collective brainstorming on future scenarios



C. Vote to select two scenarios of technical innovation (and two real-farms)

Type Autonomy-led farmers

➔ **Scenario :** sowing legumes intercrops to achieve feed autonomy for herd

Type Diversified family-farmers

➔ **Scenario :** adding a finishing unit of heifers to achieve direct sales

Major barriers to maintain ICL farms

- Workforce limitations:
  - Higher requirement on labour and management
  - Skills to manage crops and livestock

- Farm economics results:
  - Higher investments required
  - Lower opportunity for economies of scale
  - Few politic incentives favouring ICLS

- Juxtaposition of livestock and crops without real integration

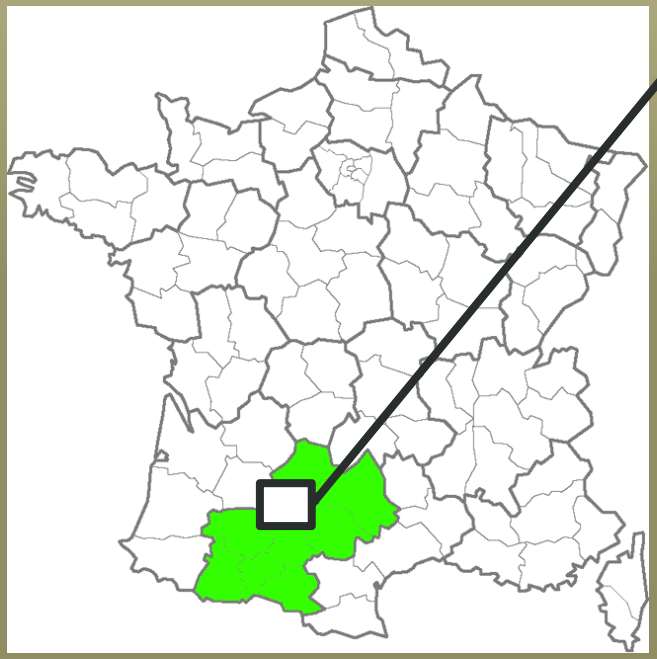
  ➔ not the economic and environmental benefits expected

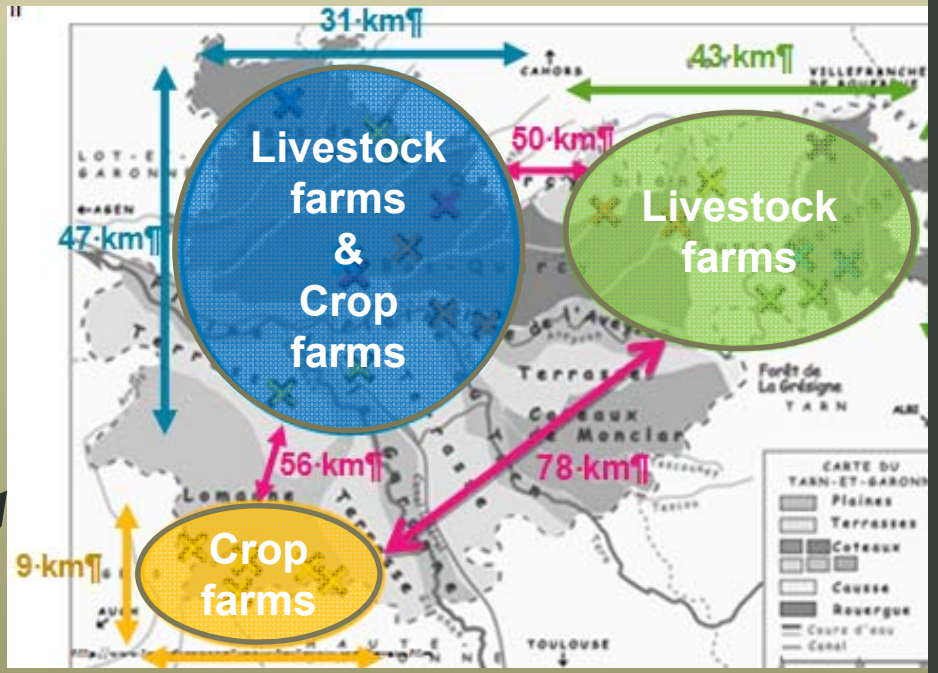
- ICLS at the local level as an alternative option:
  - goes beyond farm-scale workforce constraints
  - while providing comparable environmental benefits.

ICLS beyond farm level

Considering exchanges between specialized farmers

Bio 82 : a group of organic farmers interested in exchanges between specialised farms





Case-study 2 : Analysis considering **24 specialised farmers** interested in exchanges of crop and manure

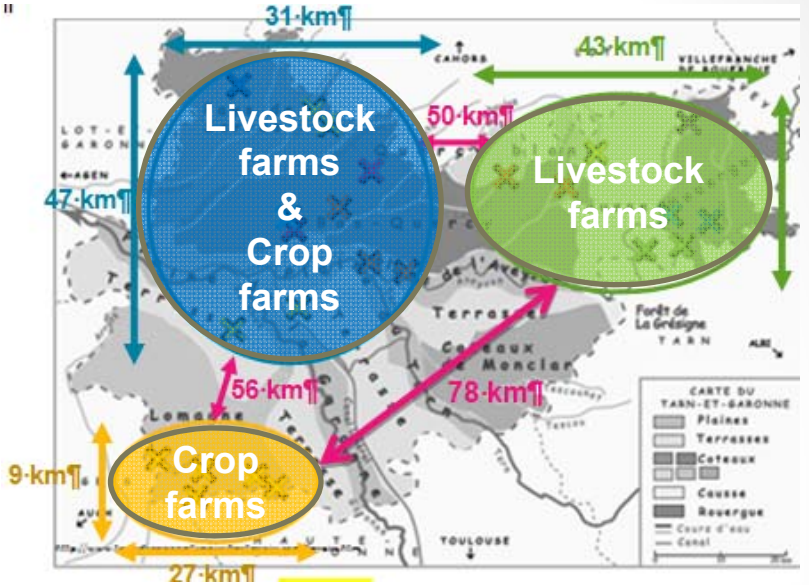
Case-study 3: A subgroup of **6 neighbouring farmers** among them

Case-study 2 :
ICL between 24 specialised farmers

- 14 livestock farmers *(beef/dairy/ovine/poultry)*
- 10 crop farmers

➔ **UAA considered : 1655 ha**

➔ **3 groups identified according to farming systems and localisation**



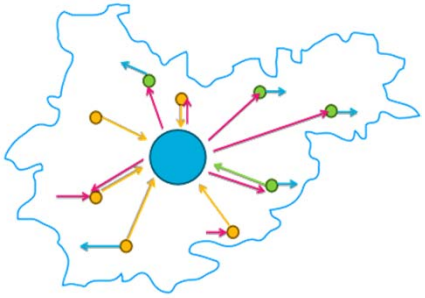
Exchanges between crop farms *(yellow)* and livestock farms *(green)*

- 341 tons alfalfa
- 125 tons mixed cereal-legume crop
- 88 tons straw
- 1059 tons manure

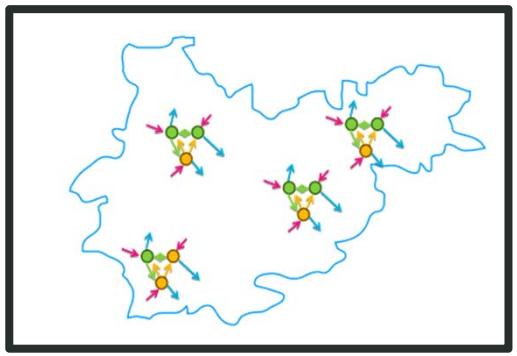
Moraine et al. (2016)

Scenarios designed with local actors

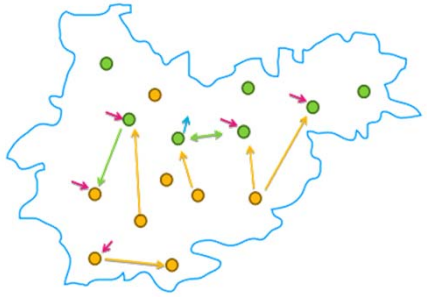
3 organisational options



Centralized



Multicentralized



Multirelated

… crossed with 3 technical options of exchanges

Inserting Alfalfa

Mixed crops

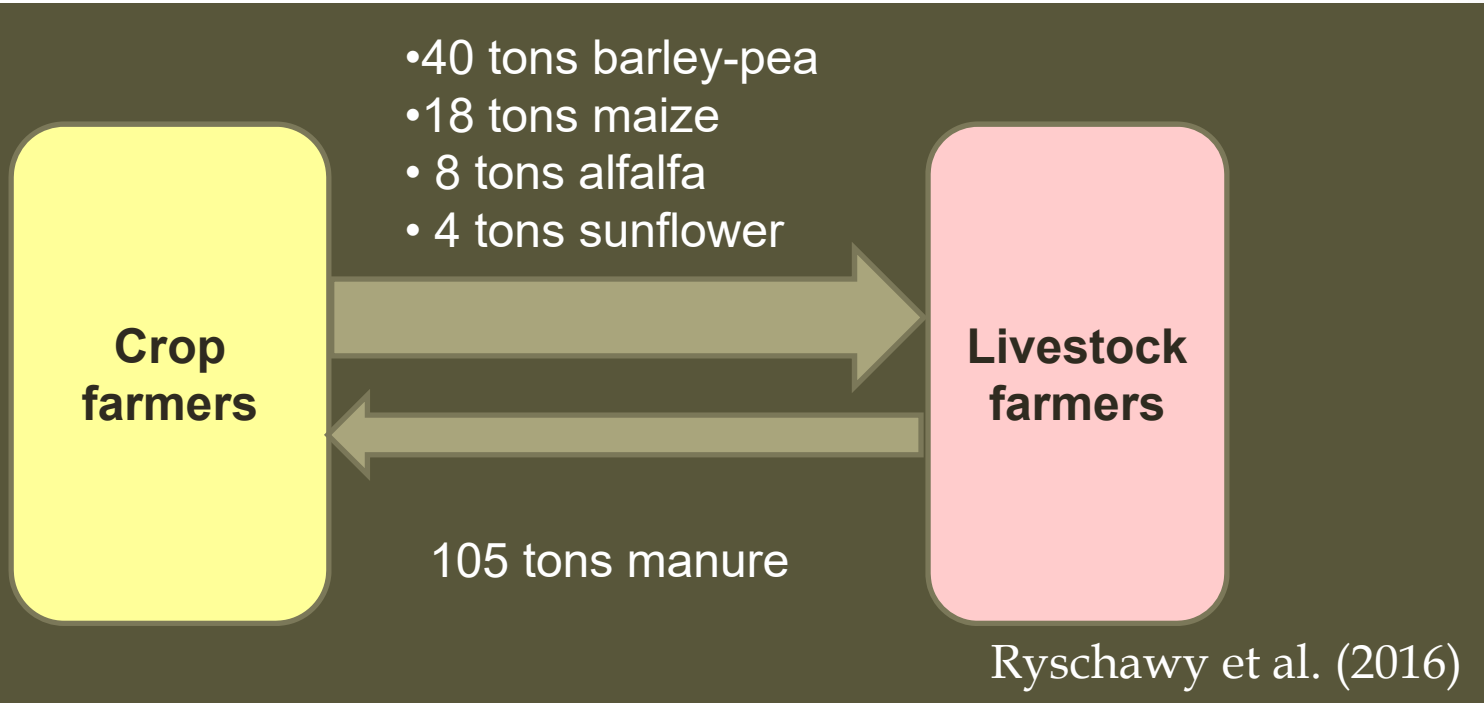
Manure/Straw

Case-study 3 :
A focus on 6 neighbouring farmers

6 farmers in close relationship :

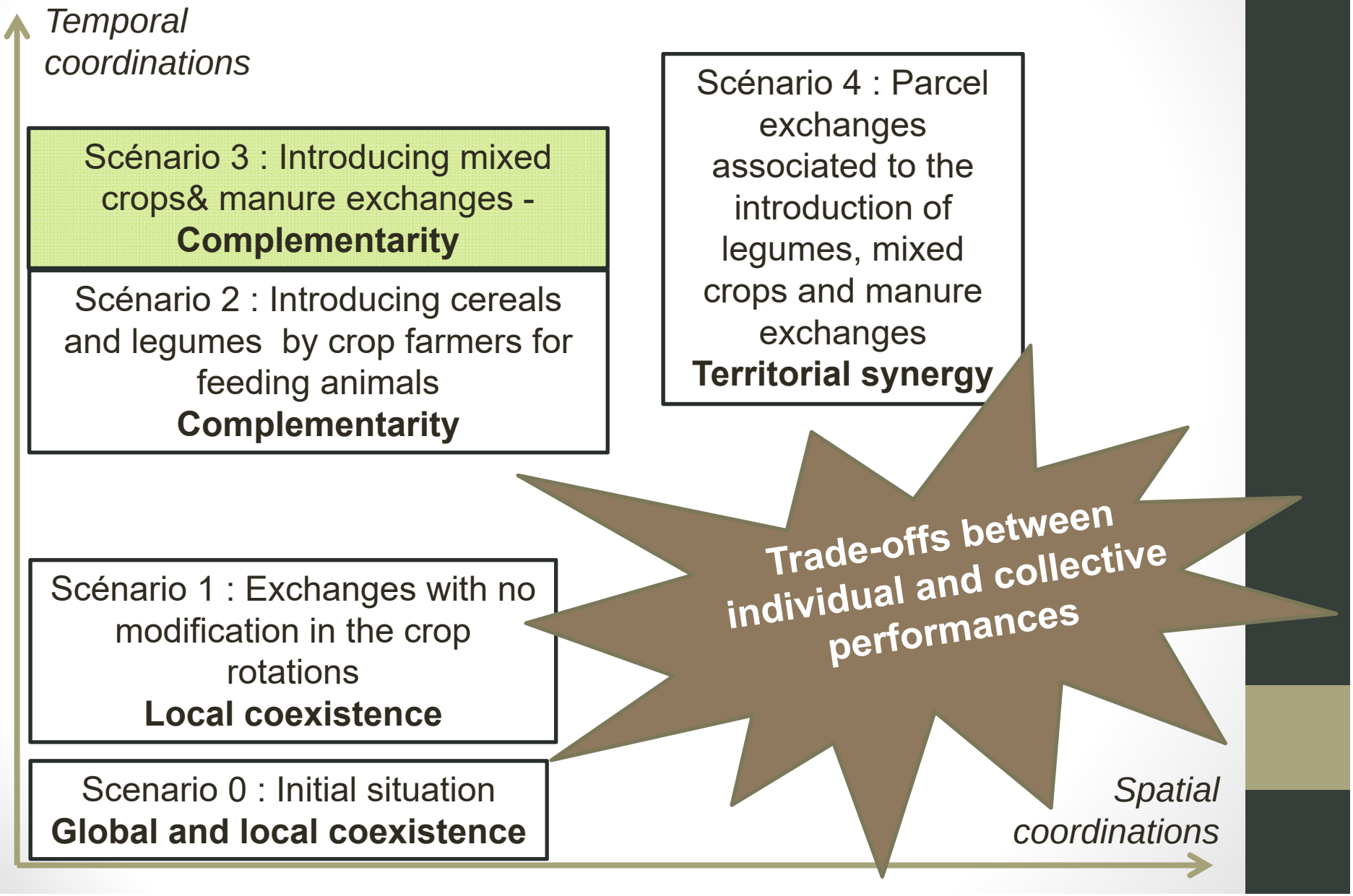
- 2 crop farms
- 4 diversified livestock farms

➔ **UAA considered : 180 ha**



Ryschawy et al. (2016)

Scenarios developed with the 6 farmers



Major barriers to regional ICL

- **Technical**
  - Need to get/share **new practical skills** to combine crops and livestock
  - **Risk aversion** of farmers
    ➔ Feed quality, level of production,...
- **Social**
  - How to build trust between farmers (contracts?)
  - ? Collective organisation?
- **Logistic**
  - Storage availability and transport
  - Sharing equipment
  - Time dedicated to manage exchanges

Adaptation of research advisory & education system needed... ... and specific policies?

More complex than farm level barriers Trade-offs between individual and collective performances ...

Lessons and challenges

- **Decision Support Systems needed to design ICLS**
  - Combine participative studies and simulations
  - Design locally-adapted ICLS considering local history of agroecosystems
  - Lack of expertise and data on ICLS

➔ ***How to combine simulation and case-study methods? A serious game in perspective*!**

Considering the appropriate level implies specific skills:

- Designing ICL at farm level to favour ILCS maintaining
- Designing ICL at local level to go beyond farm level barriers
- Complex collective organization implies interdisciplinarity

➔ ***How to develop multi-level approaches to manage trade-offs? What about outscaling / upscaling ?***

Thank you !