

# ➤ Cross-analysis of crop-livestock integration, sustainability and biodiversity on 10 French experimental farms

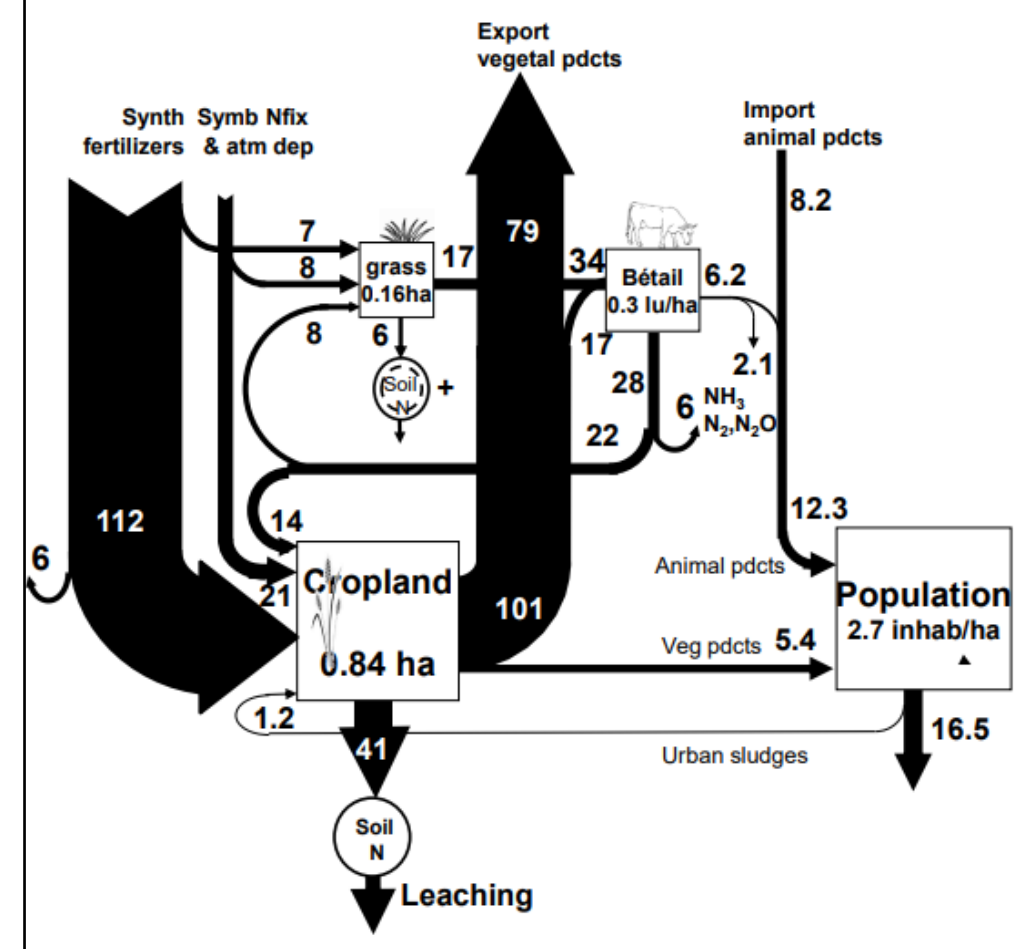
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## ➤ Land and farm specialization

- Many Limitations of specialization:

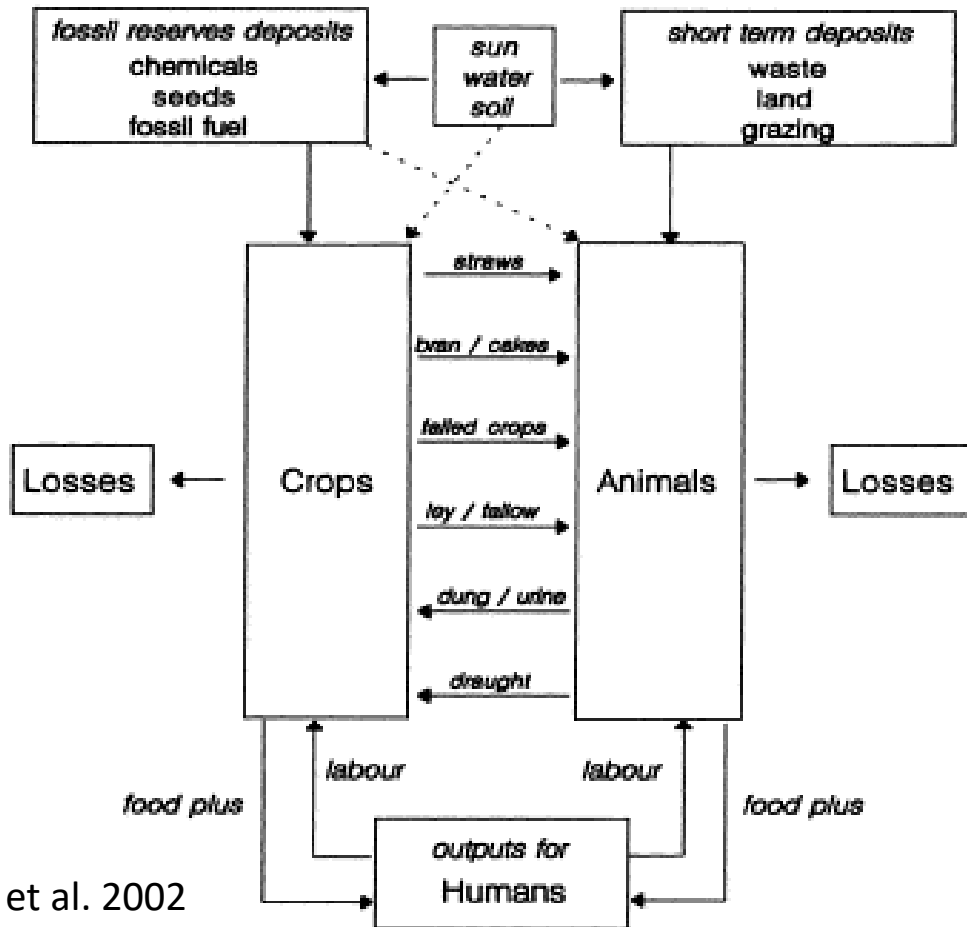
- Inputs dependency
  - Fertilization
  - Crop protection
  - Feed
- Landscape simplification
- Soil and human health
- Price vulnerability...



Source : Billen et al, 2017

# ➤ Crop-Livestock interactions a way to improve farms sustainability ?

- Interactions between crops and livestock limit losses and can provide some economic robustness



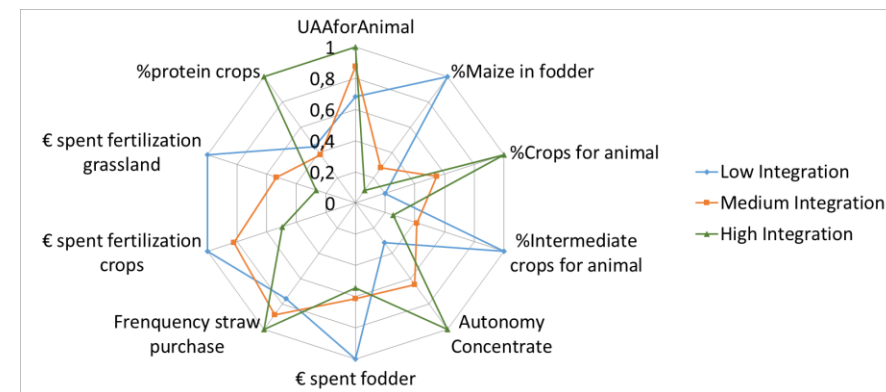
Dimension	Aim
Social	Better valorization of resources: Work, land, capita
	Fullfil the work time available and genete a decent revenue
Economic	Diversify production to secure the revenue
	Increase quantity and quality of farm production
	Lower the inputs and favor autonomy
Envrionment	Maintain natural ressources and grasslands
	Improve cropping plan
	Minimize the exceed of livestock manure

Ryschawy et al. 2014

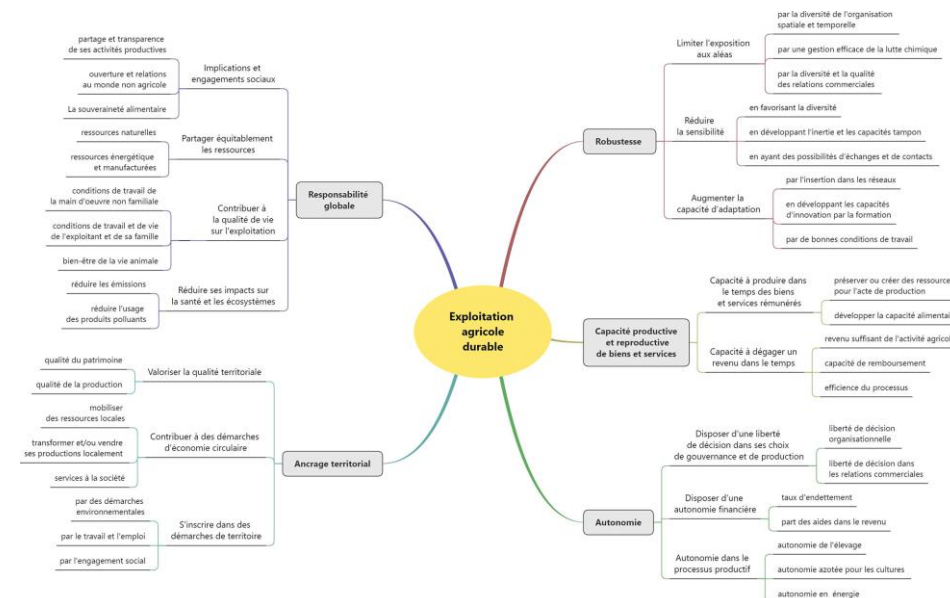
Schiere et al. 2002

# ➤ How to explore the effect of crop-livestock interactions on sustainability ?

- Evaluate the level of interaction between crop and livestock in farms
  - A tool developed on 1190 farms : NiCC'El or Level of Integration (Martel et al. 2021)



- Evaluate the sustainability of farms
  - IDEAv4 methodology (Zahm et al. 2019) considering the 3 dimensions and 5 properties from 53 values







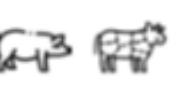















- Evaluate the biodiversity potential of farms
  - BIOTEX methodology (Manneville et al. 2014) exploring 7 dimensions through 51 values



## ➤ Using a network of experimental farms

- Exploring diversity more than the real farms
- Time and data more easily available
- Propose some avenues for future research



La Blanche Maison	Grignon	Les Trinottières	Trévarez	Crécom	Fontaines	Lusignan	Mirecourt	Saint-Laurent-de-la-Prée	Pixérécourt
									
 ③	 ⑥	 ③	 ③	 ⑧	 ⑦	 ①	 ⑬	 ⑪	 ⑤

## ➤ Résultat pour le score et le niveau de couplage culture élevage

<b>Farm</b>	<b>NiCC'El Score</b>	<b>Interaction level</b>	<b>Axis 1 score (Fertilization Autonomy)</b>	<b>Axis 2 score (Feed Autonomy)</b>	<b>Axis 3 score (Protein crops and fodder purchase)</b>
Lowest score observed in the database (Martel et al., 2017)	-23,24	Low	-12,03	-9,53	-8,02
<b>F3</b>	<b>-8,55</b>	<b>Low</b>	1,63	-8,10	-2,09
<b>F9</b>	<b>-7,60</b>	<b>Low</b>	-3,34	-3,41	-0,84
<b>F10</b>	<b>-5,83</b>	<b>Low</b>	-0,98	-4,58	-0,26
<b>F2</b>	<b>-3,75</b>	<b>Low</b>	-0,54	-2,51	-0,70
<b>F1</b>	<b>-1,52</b>	<b>Medium</b>	-0,06	-0,59	-0,88
<b>F4</b>	<b>0,82</b>	<b>Medium</b>	4,22	-2,91	-0,48
<b>F7</b>	<b>1,67</b>	<b>Medium</b>	6,58	-2,24	-2,67
<b>F5</b>	<b>3,51</b>	<b>High</b>	1,79	2,05	-0,33
<b>F8</b>	<b>5,49</b>	<b>High</b>	3,67	2,49	-0,67
<b>F6</b>	<b>5,85</b>	<b>High</b>	6,23	2,34	-2,72
Highest score observed in the database (Martel et al., 2017)	7,96	High	7,82	6,32	0,00

# IDEA (FSI) Dimensions

Economics is a weak point:  
experimental farms

Agroecological dimension is  
closely linked to the interaction  
level

Socio-territorial dimension is good  
for all farms

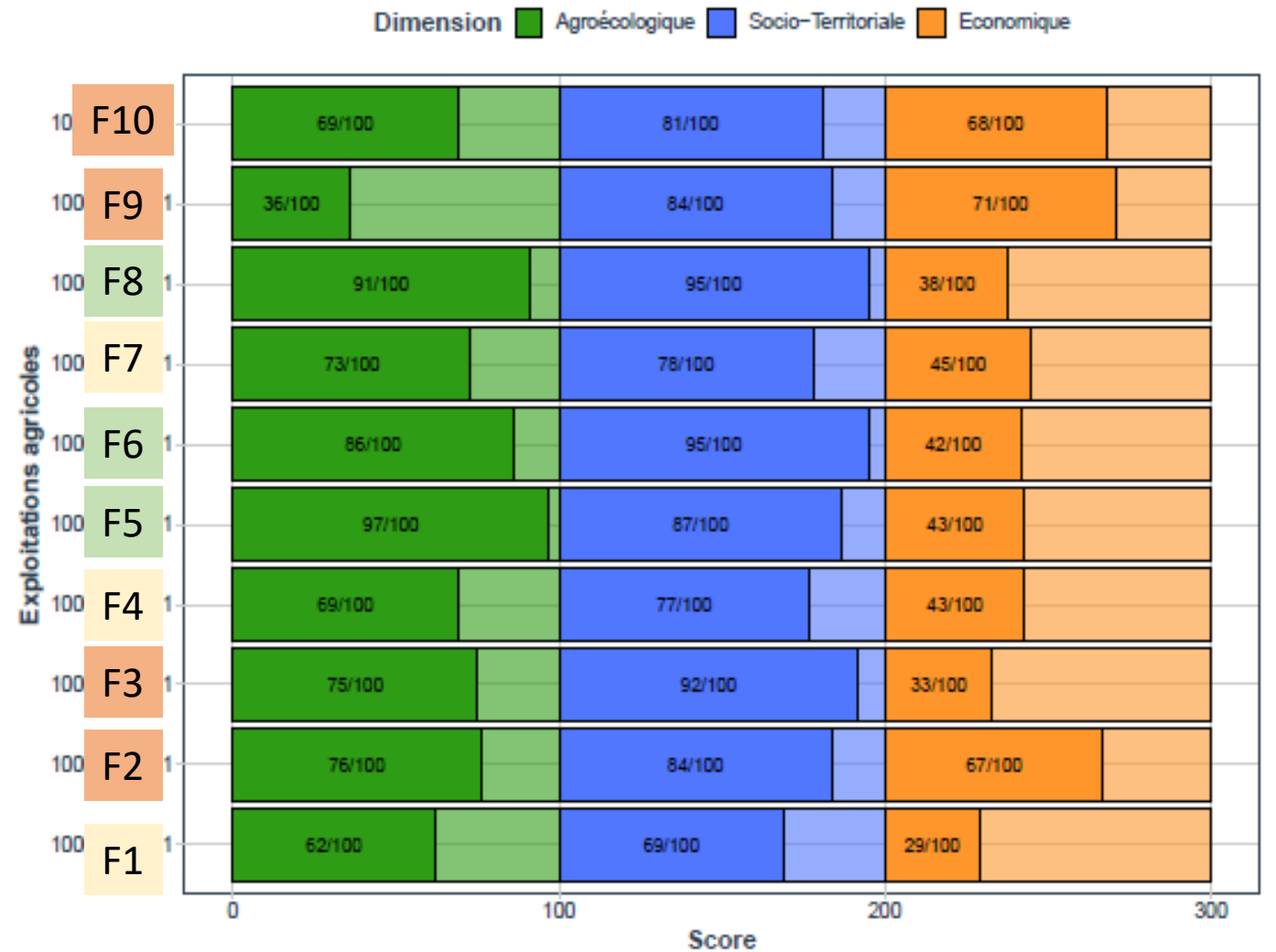


FIGURE 2 – Notes obtenues par chaque exploitation agricole pour chaque dimension de la durabilité



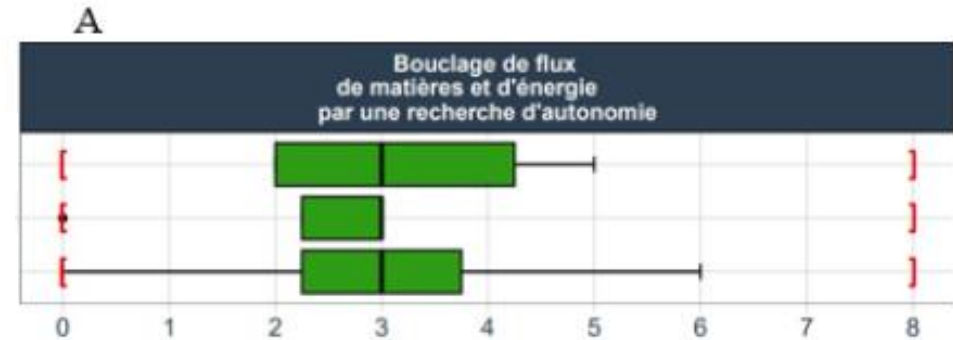
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# ➤ Component « Closing nutrient cycles » in agroecological dimension

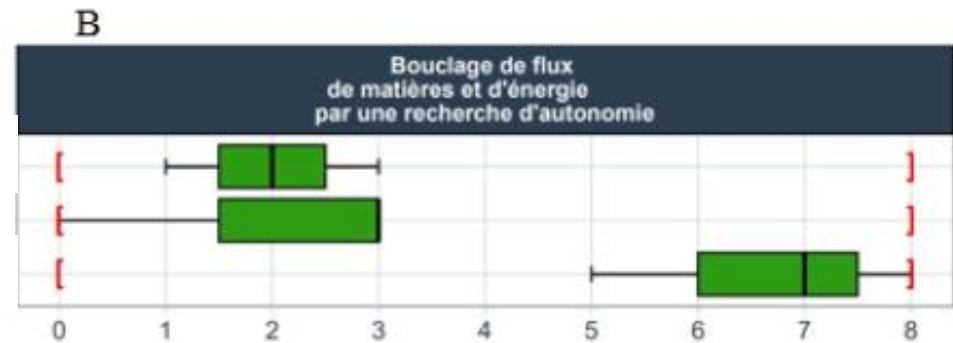
LOW

Energy and seed autonomy  
Feed autonomy  
Fertilization autonomy



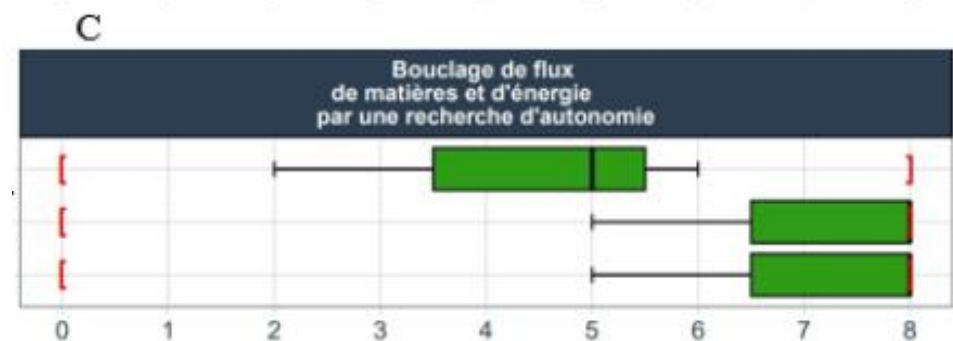
MEDIUM

Energy and seed autonomy  
Feed autonomy  
Fertilization autonomy



HIGH

Energy and seed autonomy  
Feed autonomy  
Fertilization autonomy



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## ➤ Evaluation of the 5 IDEA4 properties

Interaction level	Low			Medium			High		
AUTONOMY	Red	Orange	Light Green	Light Green	Light Green	Orange	Light Green	Light Green	Light Green
PRODUCTIVE CAPACITY	Light Green	Orange	Dark Green	Light Green	Red	Red	Red	Light Green	Orange
GLOBAL RESPONSABILITY	Light Green	Orange	Orange	Light Green	Orange	Orange	Light Green	Dark Green	Dark Green
LOCAL ANCHORAGE	Light Green	Dark Green	Dark Green	Orange	Light Green	Light Green	Orange	Dark Green	Dark Green
ROBUSTNESS	Light Green	Orange	Orange	Light Green	Orange	Light Green	Red	Orange	Dark Green

Global responsibility and autonomy are statistically correlated with the interaction level:

- « Sharing resources fairly » and « Reducing its impacts on health and ecosystems »
- « Autonomy in the production process » and « autonomy of decision-making »

# ➤ Relationship with Biotex

- Biodiversity potential is less directly linked to crop-livestock interaction
  - On the 7 themes explored by Biotex
    - 4 are not different according to the interaction level
    - 1 seems less favourable to biodiversity in highly level of interaction farms : Agricultural land use
    - 2 seem more favourable to biodiversity in highly level of interaction farms :
      - Crop Management (from neutral to biodiversity in low interaction farms to very favourable in high interaction level farms)
      - Grassland Management (from unfavorable to favorable)

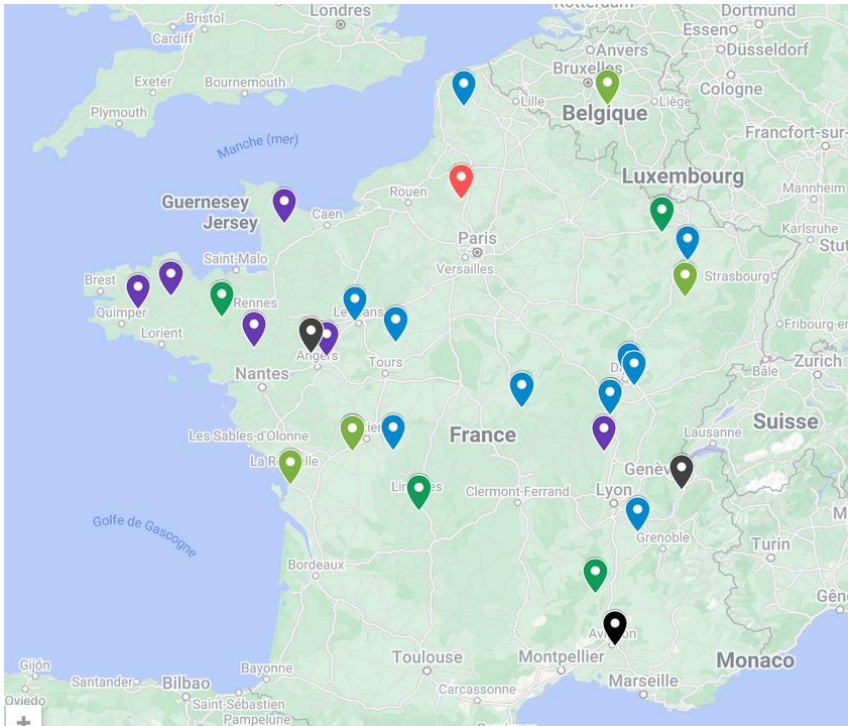


# ➤ Conclusions

- 3 complementary diagnoses
  - But time consuming to implement
- An expected link
  - Autonomy in NiCC'El and IDEEA4 are quite similar
- An unexpected link
  - A socio-territorial score higher for high crop-livestock interaction level
- Biodiversity not directly linked to the interaction level
  - A link to be made with the production diversity ?



➤ Thank you for your attention



Want to join our experimental farm group (meetings in French) ?

Contact me: [gilles.martel@inrae.fr](mailto:gilles.martel@inrae.fr)



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