

DEXiPM Grapevine[®]: evaluating sustainability of co-designed farming systems in a vineyard watershed

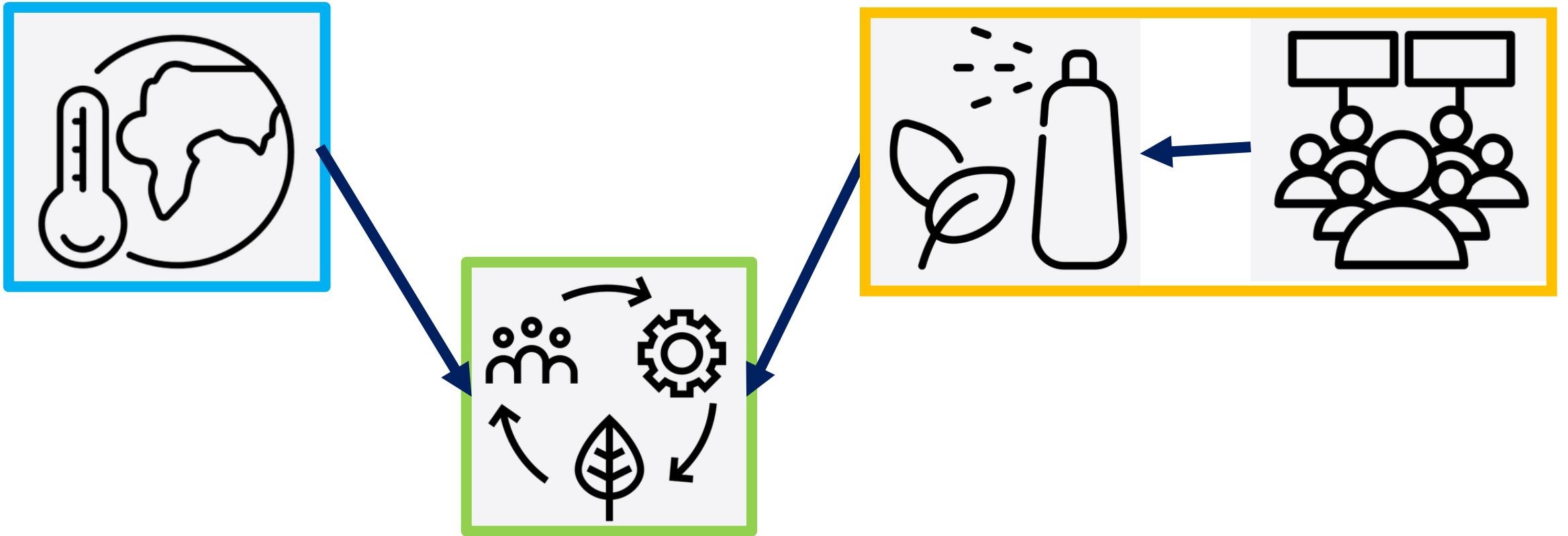
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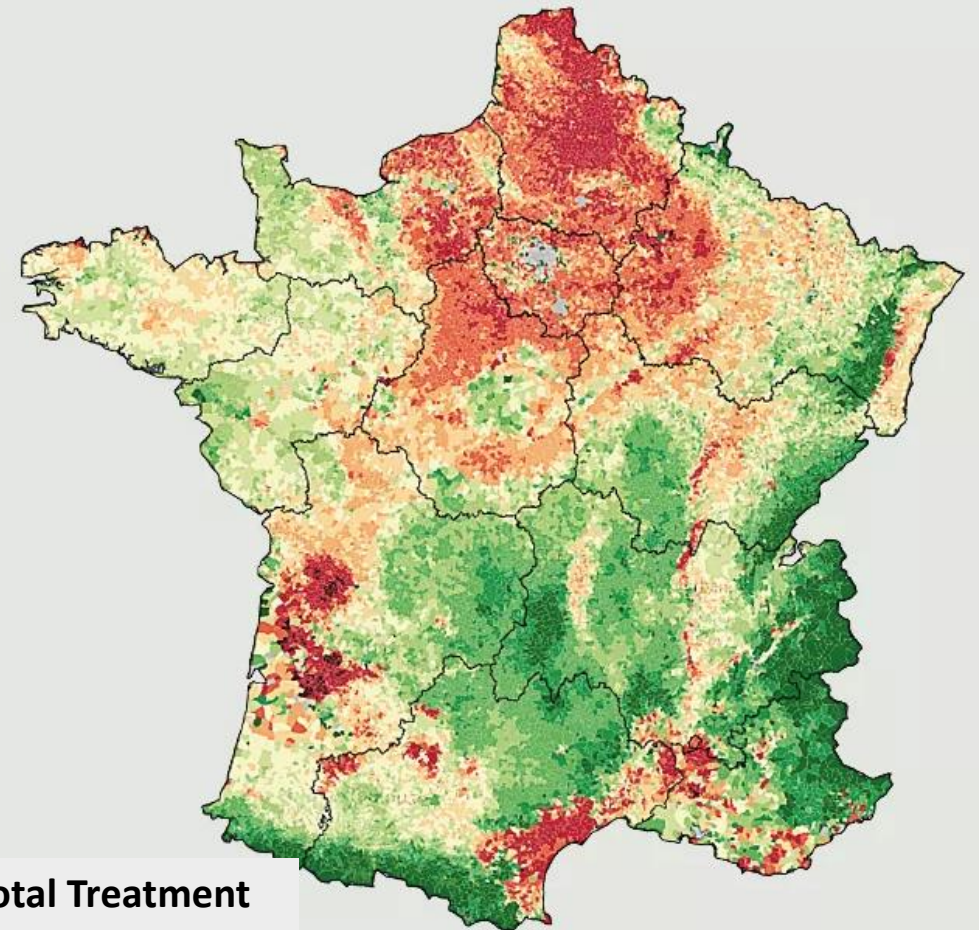
Context and questions



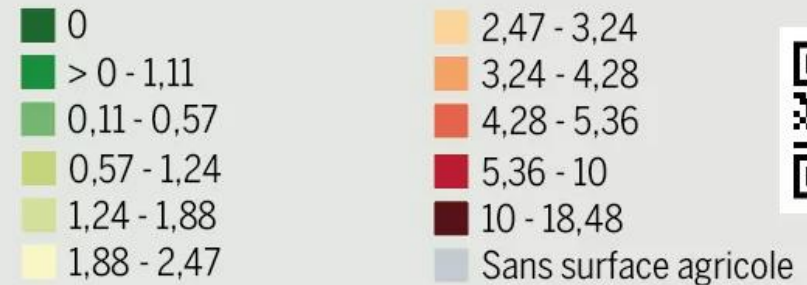
Viticulture is challenged by **climate change** and **social demand for environmentally-friendly practices**, necessitating adaptation for **sustainability**

Context and questions

Grapevine varieties are vulnerable to **fungus attacks, insects, and diseases**, leading to **high pesticide use in vineyards**, posing risks to the environment and human health



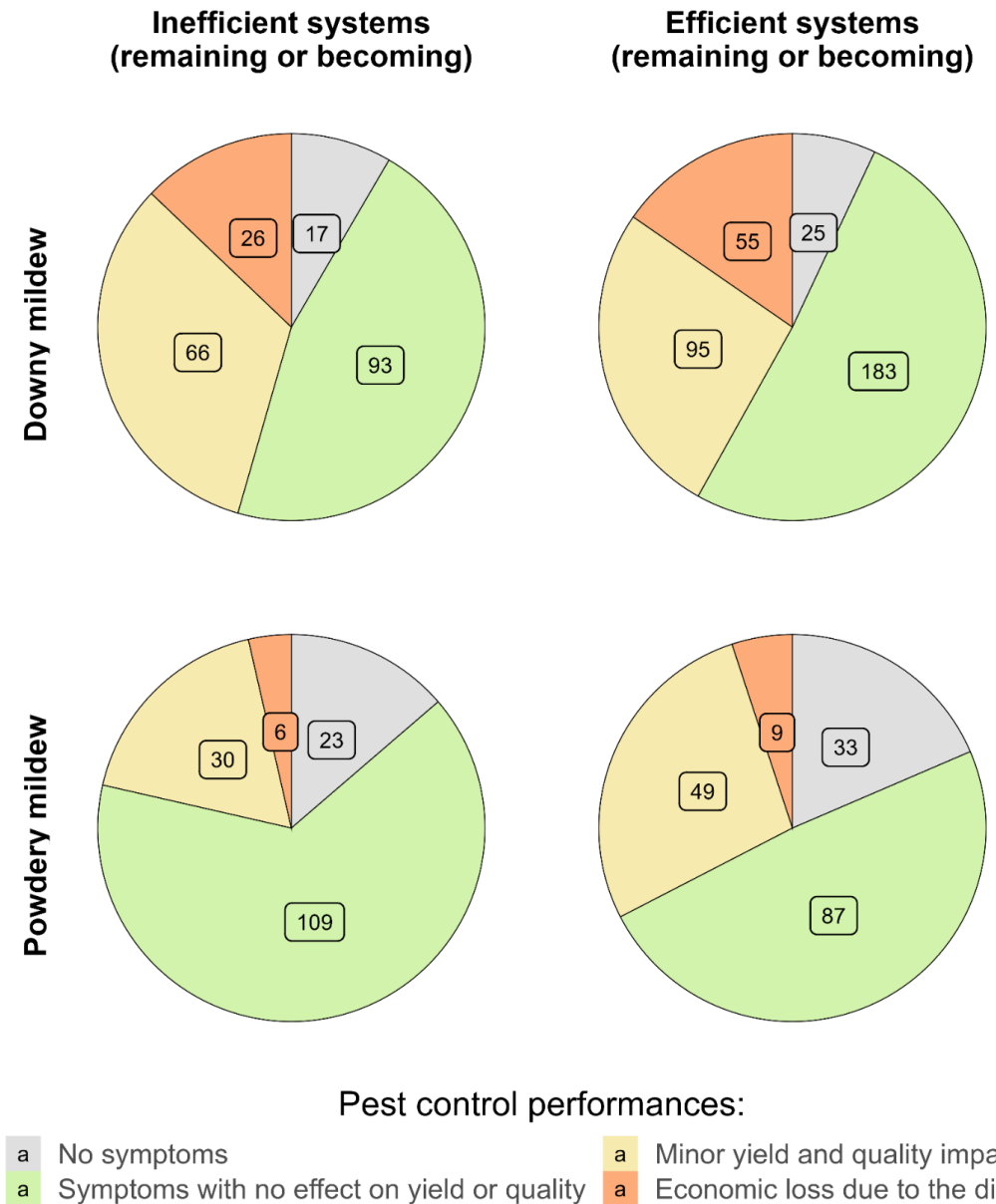
Total Treatment Frequency Index



Sources : RPG 2020 (IGN)/Surfaces "bio" 2020 (Agence bio, Organismes certificateurs)/Casier viticole (Douanes)/RA 2010 (Agreste)/Enquêtes pratiques culturelles en agriculture (Agreste)/Admin express 2022(IGN)/©Solagro

Context and questions

There is an urgent need to **transition to low-input and sustainable viticultural systems** to reduce these risks



Distribution of efficient and inefficient systems over the four control levels of fungal diseases for the years with medium or high pest pressure over the 2017-2020 period. (Nefti et al., 2023)

Case Study

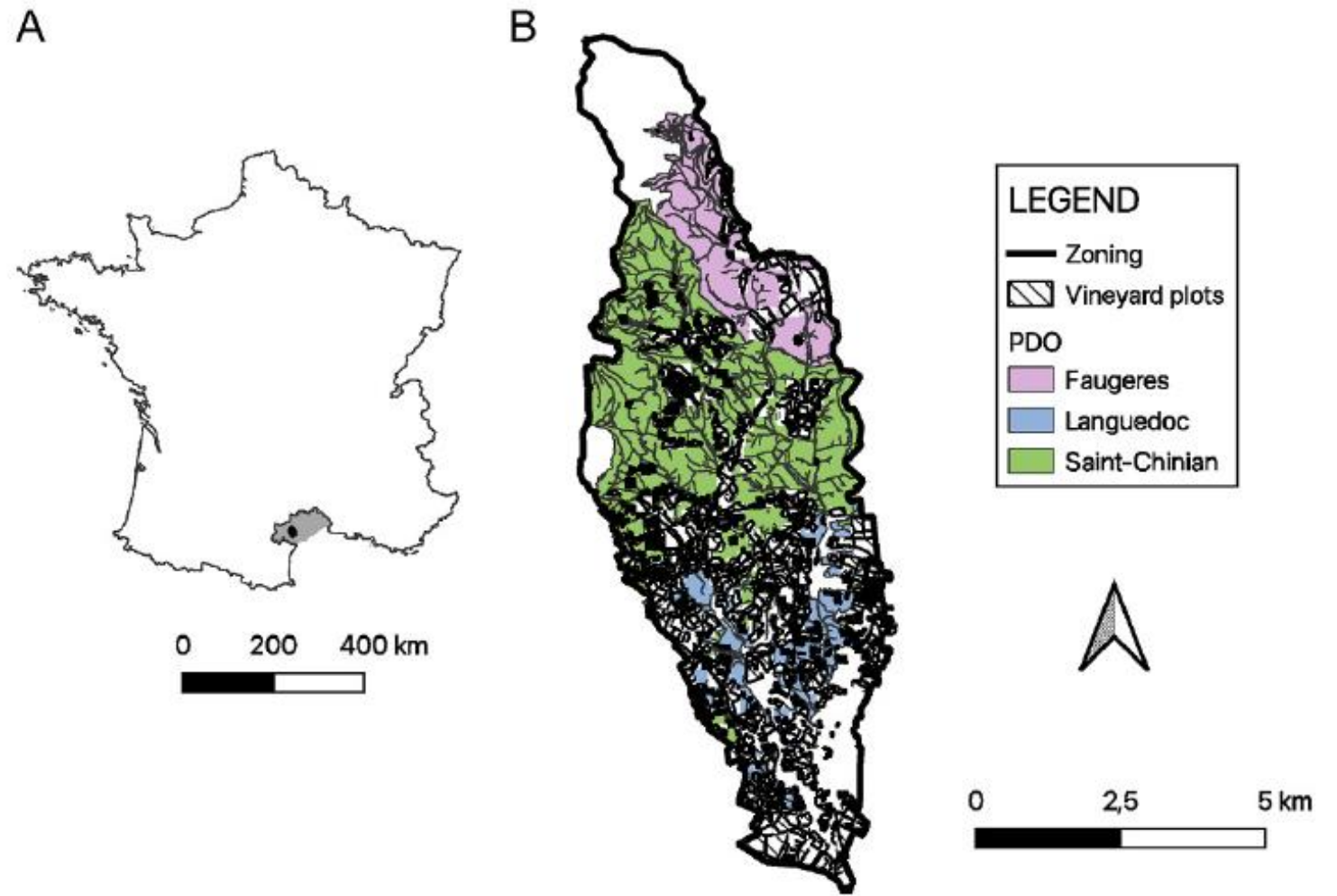
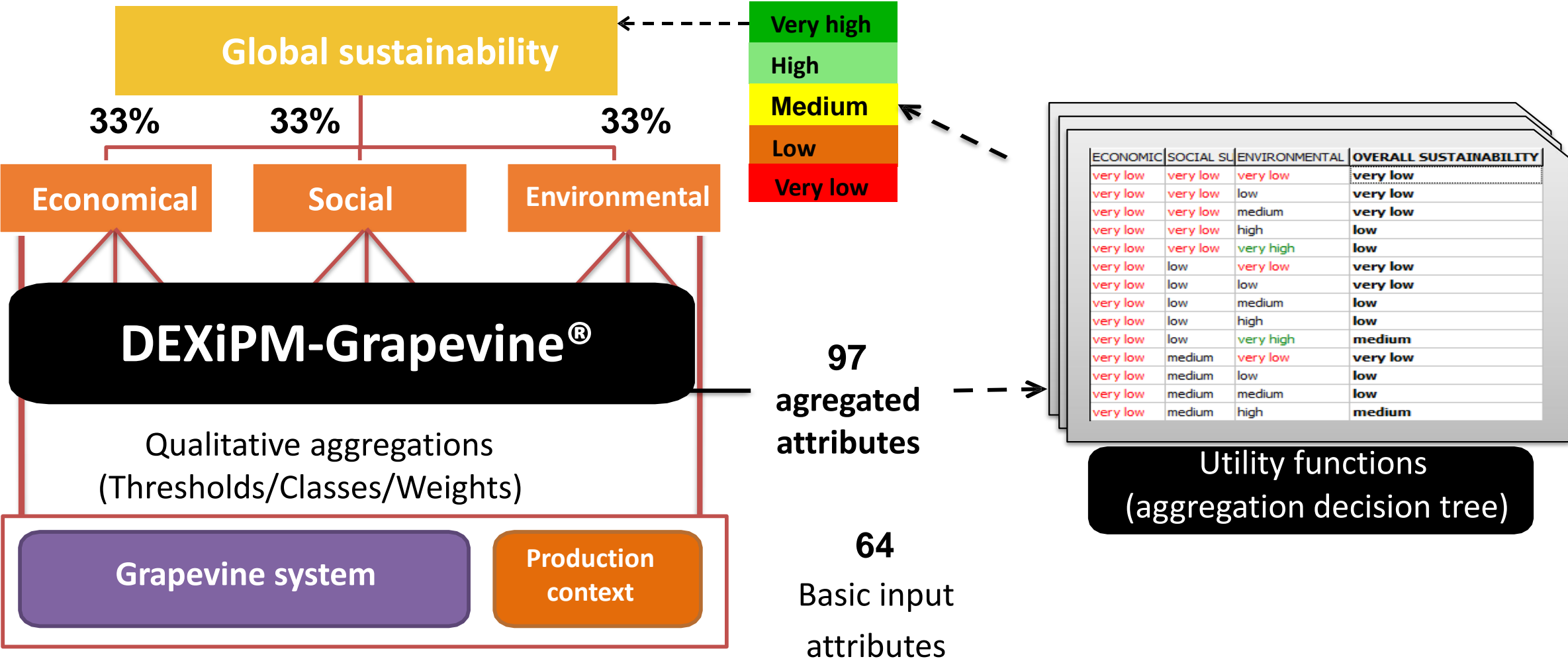


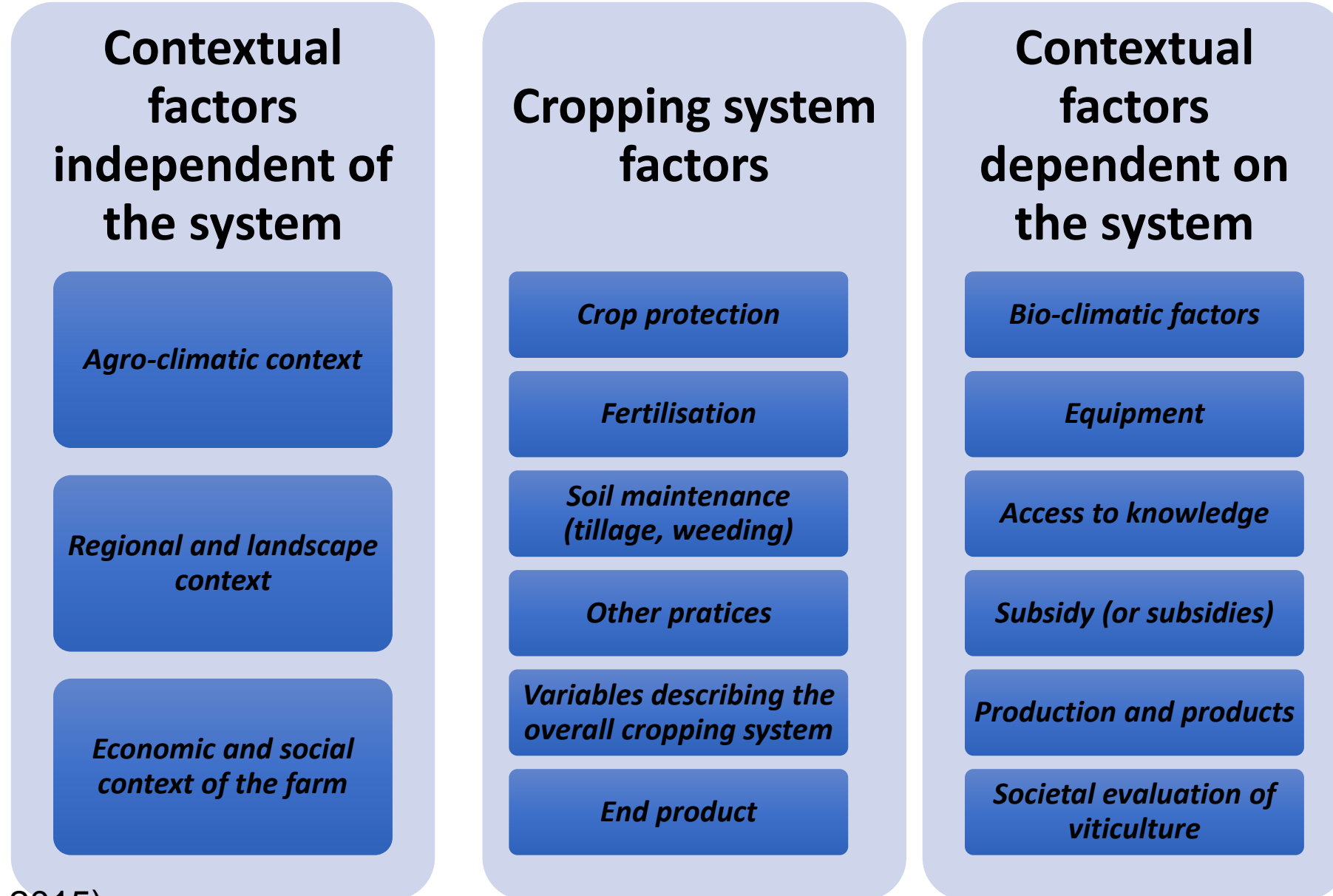
Fig. 2. Case study watershed. A. Location of the Rieutort watershed in Metropolitan France (in grey the Hérault NUT3 region; in black the watershed); B. Rieutort watershed, with vineyard fields (hatched) and associated Protected Designation of Origin (PDO), white fields in the South correspond to Protected Geographical Indication (PGI). Sources: [EPTB Orb et Libron, 2020](#)

DEXiPM Grapevine[®]: a qualitative hierarchical tree



(Metral et al., 2015)

Classification of DEXiPM Grapevine[®] model inputs



Materials and Methods

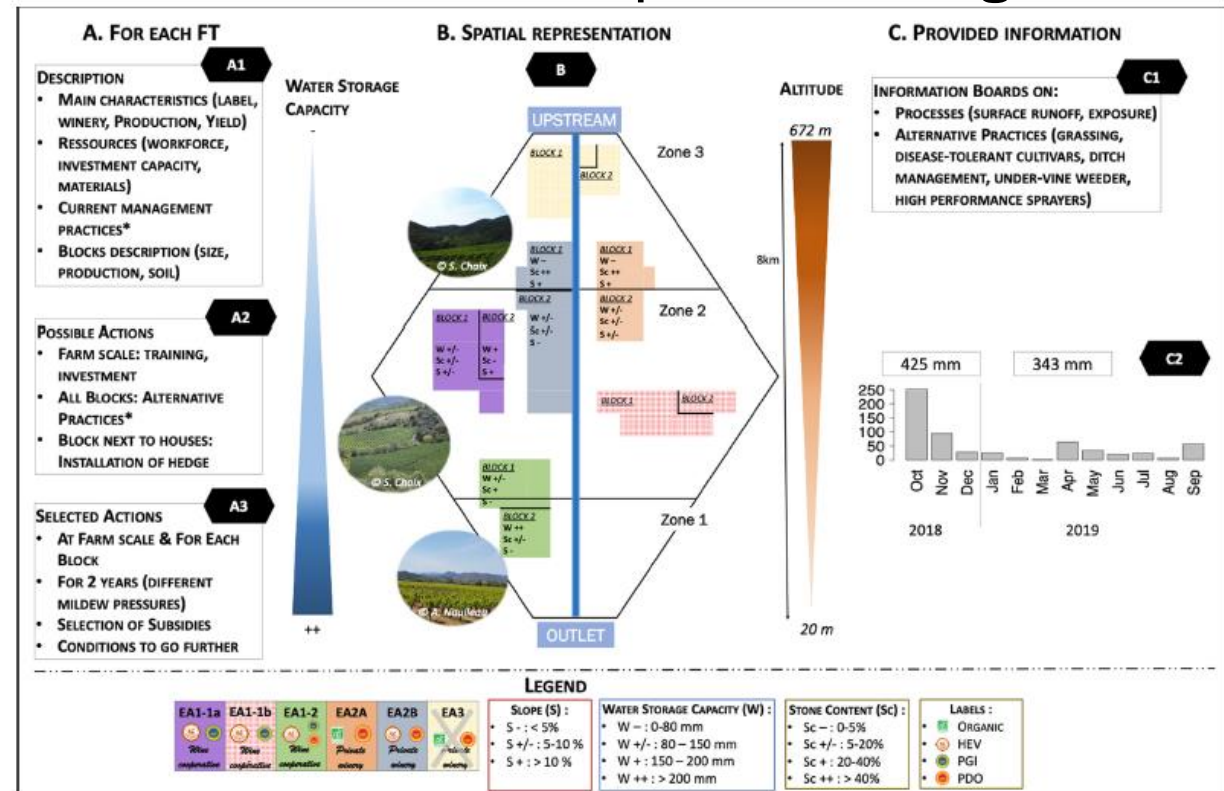
Four types of farms were considered:

- **HEV-Coop mixed,**
- **HEV-Coop 100% PGI,**
- **Organic -Saint Chinian,**
- **PDO-Saint Chinian.**

- Co-designed systems with CAPIPP (Hossard et al., 2022)

Experimental design :

- **experts and local actors**
- location of plots: closed to **houses or standard**
- annual disease pressure: **high or low**

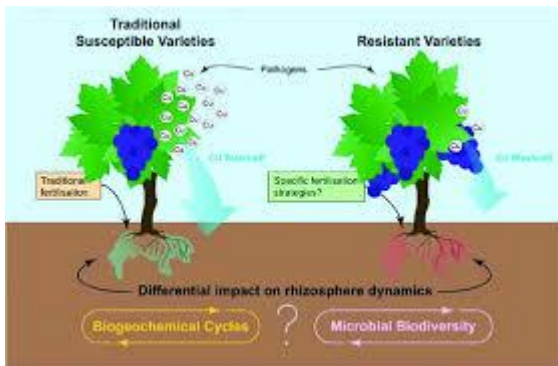


Data from a survey in the Rieutort watershed provided information on 23 vineyards. (Schneider, 2020)

Co-designed systems

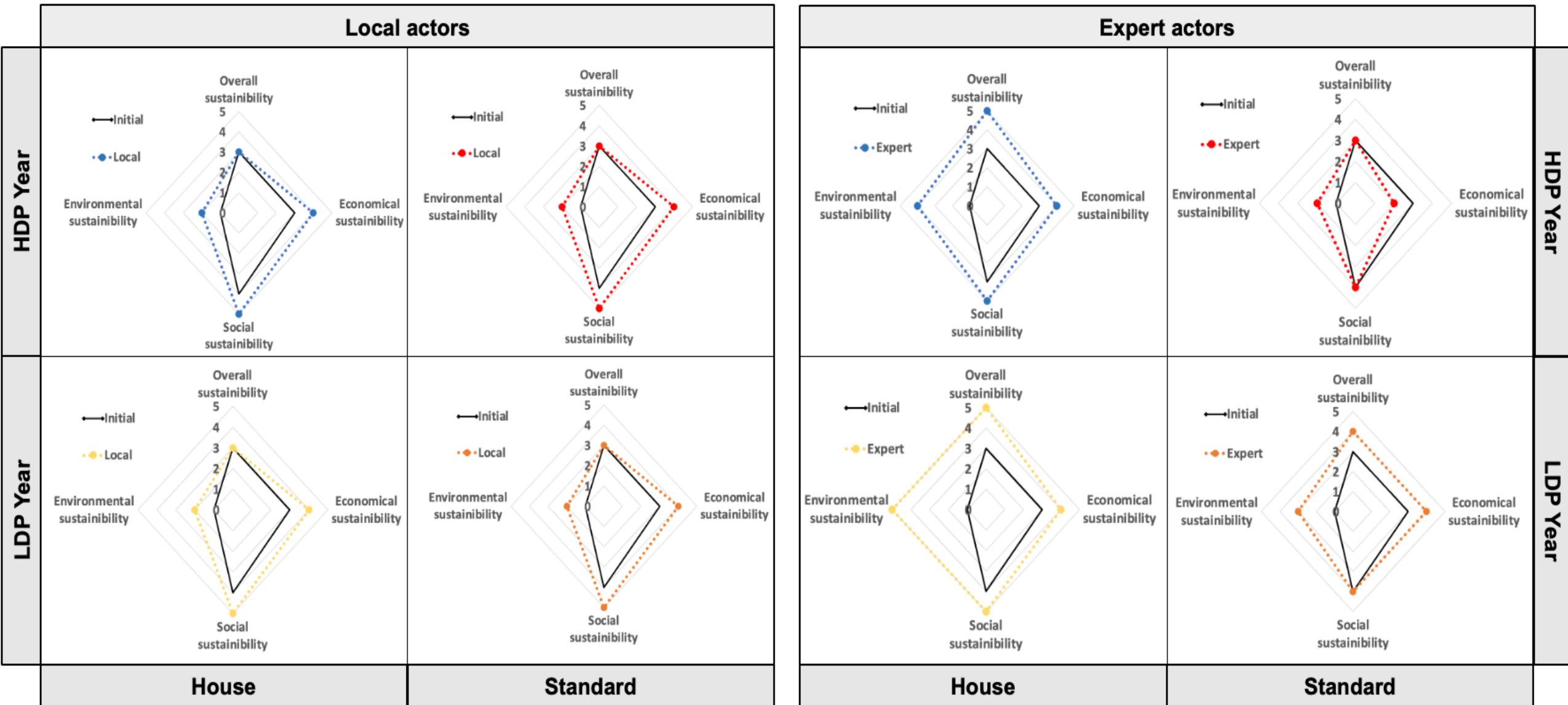


Key practice changes included herbicide elimination, cover crop development, and adopting resistant varieties.



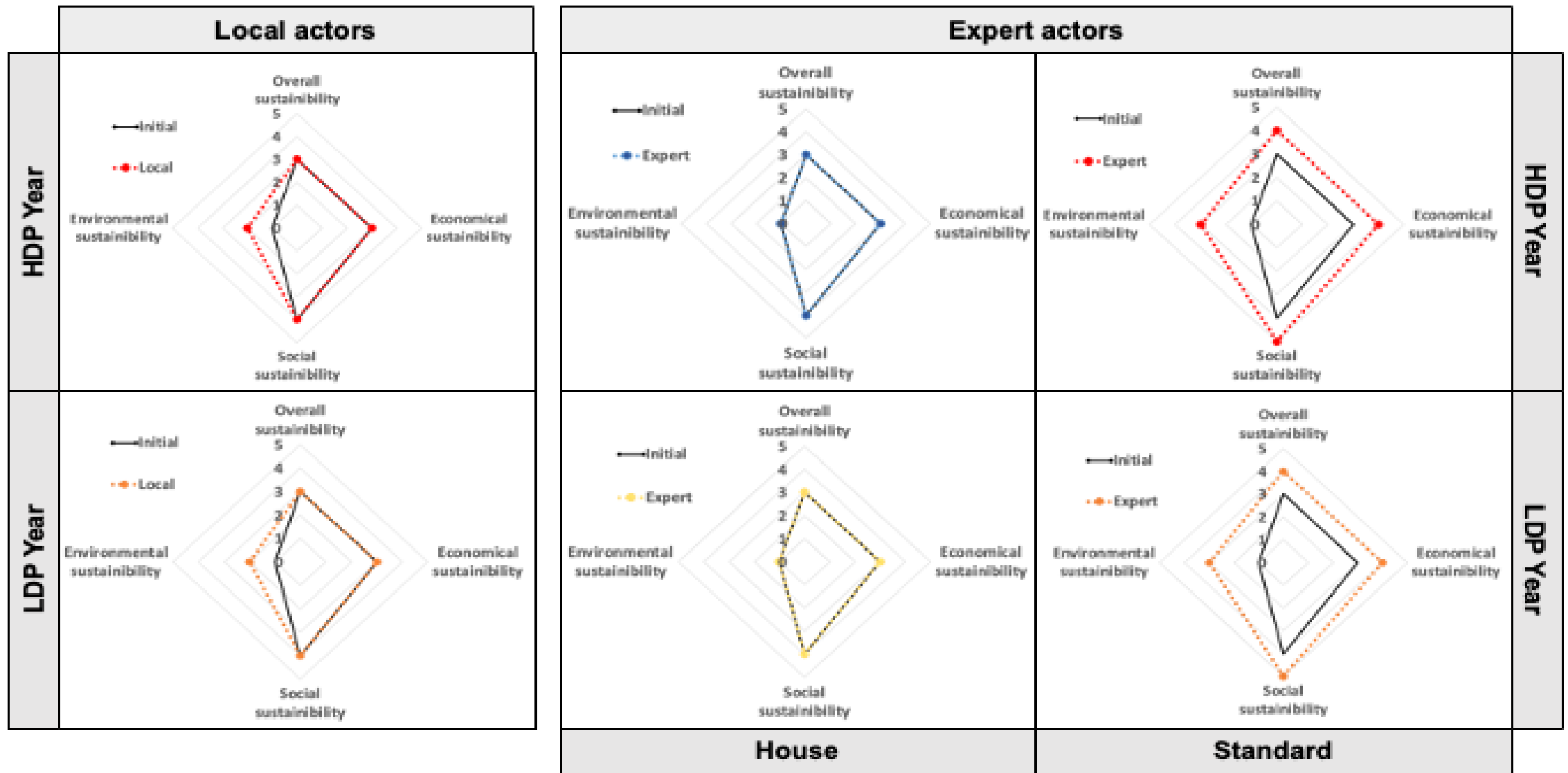
Operation	Expert				Local actors				
	Standard block		House block		Standard block		House block		
	LDP	HDP	LDP	HDP	LDP	HDP	LDP	HDP	
HEV-Coop mixed	Label	OA				IPM50		IPM50	
	Row	no more herbicide				2 glyphosate + intercep		1 glyphosate + intercep	1 herbicide + intercep
	Inter-row		grass 1/2		3 tillage	2 tillage	3 tillage	2 tillage	
	Fungi	organic	resistant varieties						
	Insect	GDHO						GDHO	
	Hedge							hedge	
	Headland	grass						grass	
	Ditch							mow	
	Equipment	optimizes settings						optimizes settings	
HEV-Coop 100% PGI	Label	OCMR							
	Row							1 herbicide	
	Inter-row	grass 1/2 + 3 tillage	grass 1/4 + 3 tillage				3 tillage		
	Fungi	resistant varieties						tolerant varieties	
	Insect	GDHO						GDHO	
	Hedge							natural	
	Headland	grass						grass	
	Ditch							burn	
	Equipment	optimizes settings + anti-drift nozzles						jet sprayer	
Organic -Saint Chinian	Label								
	Row								
	Inter-row	grass 1/4 year round							
	Fungi								
	Insect	GDHO							
	Hedge	hedge							
	Headland								
	Ditch	mow							
	Equipment	recovery panels							
PDO-Saint Chinian	Label	IPM50	OA		OCMR				
	Row	no more herbicide				1 herbicide			
	Inter-row	grass 1/2 + 3 tillage				3 tillage			
	Fungi								
	Insect					GDHO			
	Hedge					hedge			
	Headland								
	Ditch	mow				mow			
	Equipment	recovery panels				jet sprayer			

High Env. Value Label – Mix cooperative winery farm type



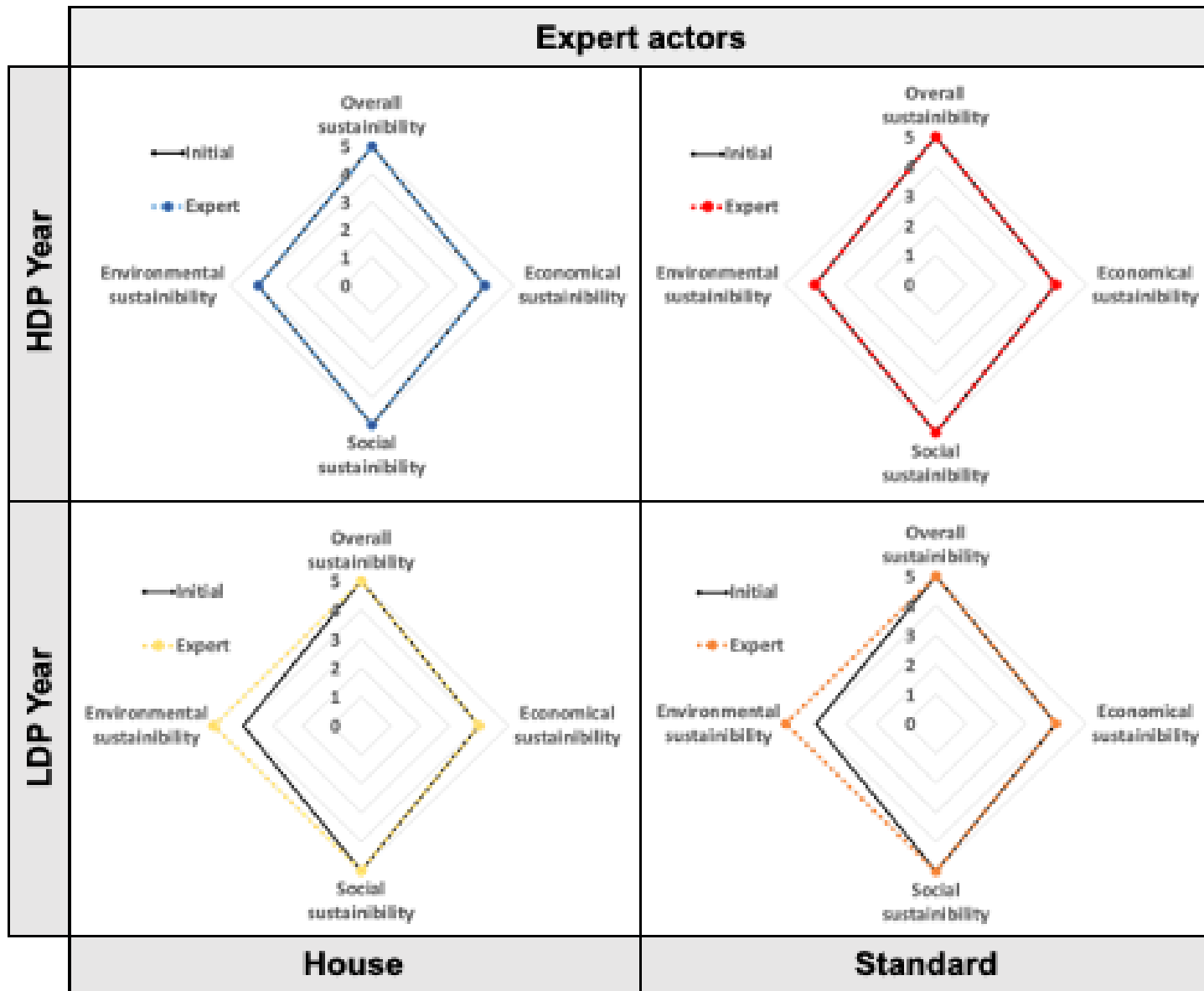
- Initial situations showed low environmental, medium economic, and high social sustainability.
- **Co-designed strategies significantly improved sustainability across all pillars.**

High Env. Value Label – 100% PGI cooperative winery farm type



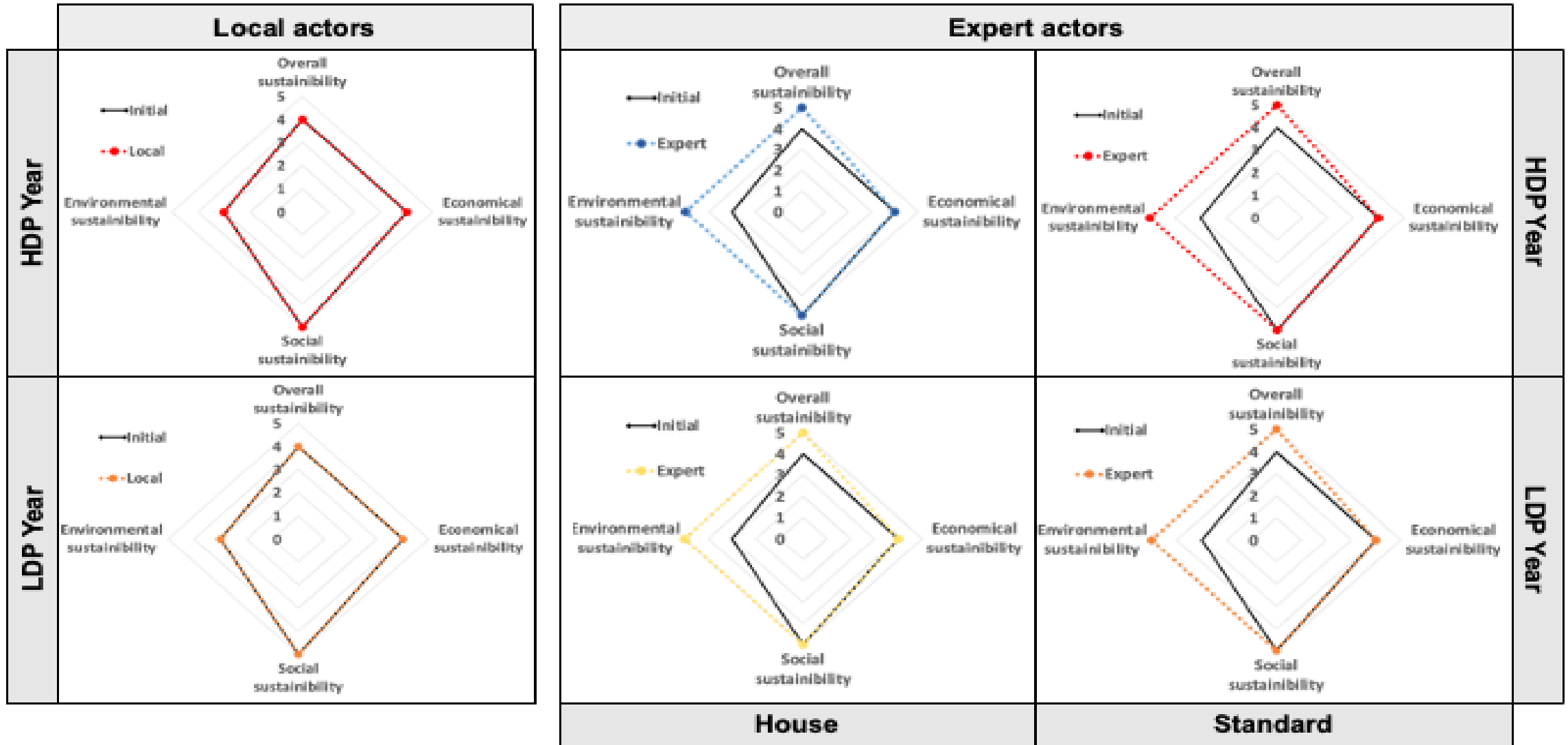
- Initial situations showed low environmental sustainability.
- Co-designed strategies improved environmental and economic sustainability but slightly decreased social sustainability

Organic Label – PDO Saint-Chinian private winery farm type



- Initial situations exhibited high sustainability across all pillars.
- **Co-designed strategies further improved environmental sustainability while maintaining economic and social sustainability.**

PDO Saint-Chinian private winery farm type

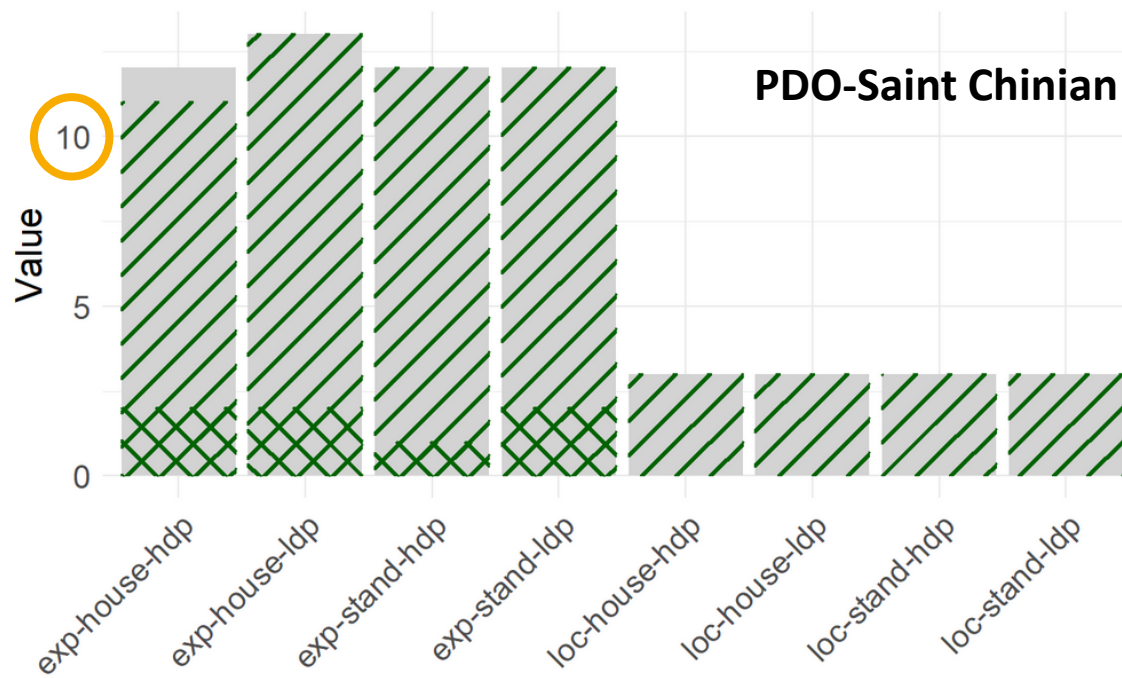
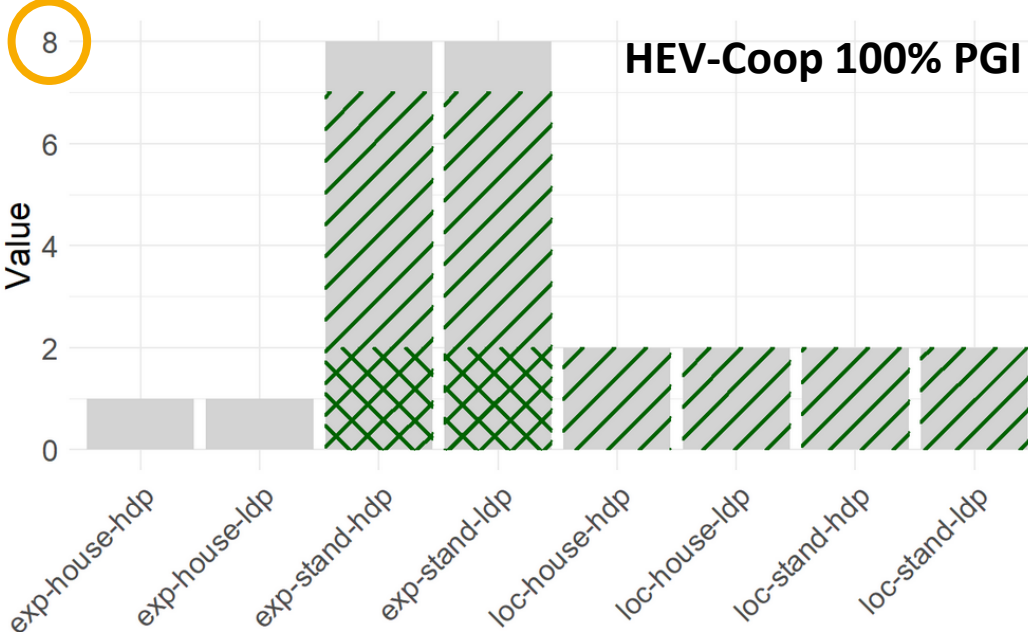
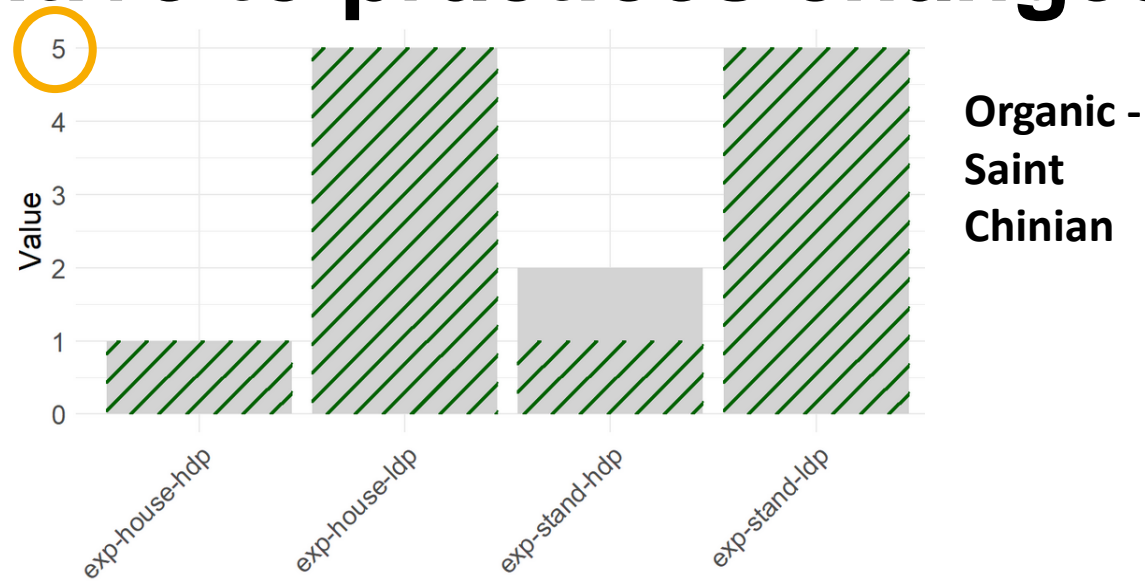
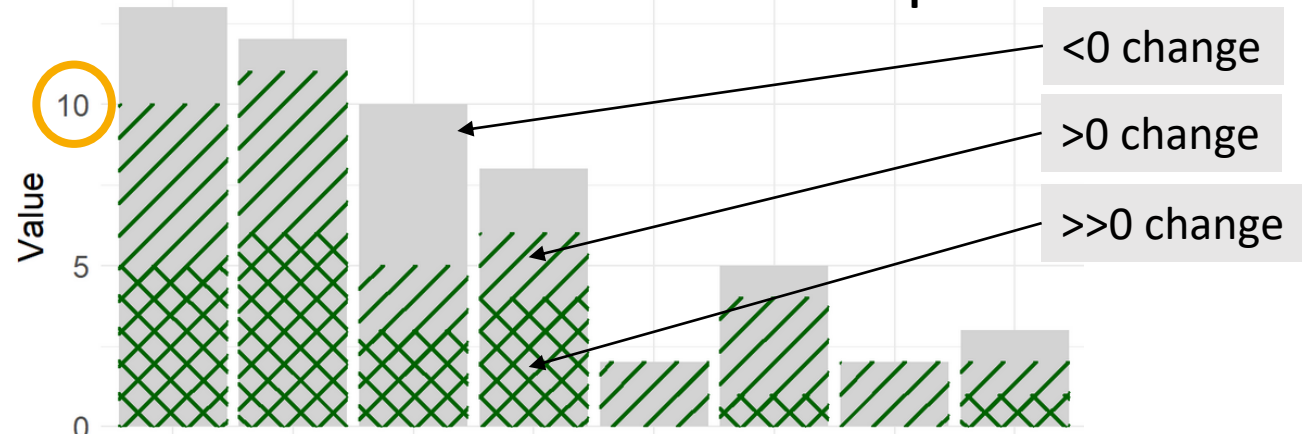


- Initial situations showed medium environmental sustainability and high economic and social sustainability.
- **Co-designed strategies significantly improved environmental sustainability**

DEXiPM Grapevine® is sensitive to practices changes

Number of changes in
DEXiPM Grapevine indicators

HEV-Coop mixed



Conclusion and perspectives

- In Mediterranean Rieutord watershed, DEXiPM Grapevine[®] **highlighted modest sustainability improvements of codesigned grapevine systems**, primarily in environmental pillars across all vineyard types.
- However, DEXiPM Grapevine[®] **only provides qualitative evaluations of system sustainability** (Wilfart et al., 2023) and does not simulate changes in pesticide content or yield outcomes.
- The widespread adoption of proposed agronomic strategies could lead to reduced environmental impacts in vineyard practices.
- DEXiPM Grapevine[®] is **easy to use with survey data but should integrate innovative practices** (biocontrol, etc...) (Padro et al., 2020)

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Thank you!

18th Congress of the European Society for Agronomy in Rennes, France

