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## ➤ Payments for environmental services with provision thresholds: farmers' preferences for a conditional bonus

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# > Introduction

## Payment for environmental services (PES) design for public goods with provision threshold

- ❖ Environmental services: **human interventions** contributing to the preservation of ecological functions (Duval et al., 2016).
- ❖ PES: “voluntary transactions between service users and service providers, **conditional on agreed rules** of natural resource management for generating **offsite services**” (Wunder, 2015).
- ❖ Designing efficient incentive mechanisms often involves **trade-offs** between **environmental ambition** and **large acceptance**.
- ❖ Water quality/biodiversity: **ecological thresholds** → high participation and spatial continuity of environmental commitments at the landscape scale to observe environmental improvements (Dupraz et al., 2009).
- ❖ Favouring **collaboration/coordination of actions** among land managers + high uptake to increase the **environmental effectiveness** of farmers’ actions and the **cost-effectiveness** of PES (Zavalloni et al., 2019).

# ➤ Literature review

## Collective components in PES design

- ❖ Categories of collective action: Uetake (2013), Kuhfuss et al. (2019).

Dutch environmental  
cooperatives  
(Franks, 2011)



Source: ENRD

Group-level  
requirement



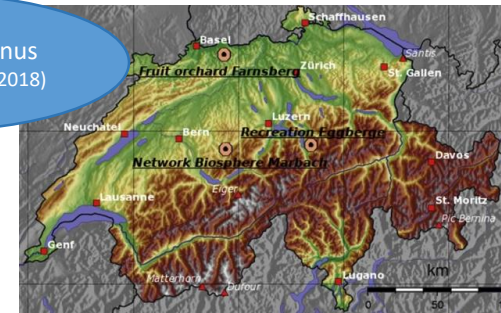
Protection of European  
Hamster in France  
(Eichhorn et al., 2020)

Source: LIFE ALISTER

**Payment  
conditionality**

All the payment  
Or part of it (bonus)

Swiss network bonus  
(Krämer and Wätzold, 2018)



Source: Krämer and Wätzold (2018)

Landscape-  
scale  
requirement

Individual-level  
collaboration  
requirement

Regular meetings

Spatial configuration of uptake with neighbour(s)

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# ➤ Literature review

## Farmers' acceptance of collective action incentives

- ❖ Reluctant when collective requirements are conditioning the full payment...
  - ❖ Individual contracting is preferred, especially among older farmers with little experience of participating in cooperatives ([Villanueva et al., 2017](#)).
  - ❖ Minimum participation requirement at the landscape scale → farmers anticipate transaction costs ([Le Coent et al., 2017](#)).
  - ❖ Collaboration with neighbouring farms → anticipated transaction costs and beliefs that other farmers would not be willing to cooperate ([Villamayor-Tomas et al., 2019](#)).
- ❖ ...but favourable to a bonus conditioned to collective action, to top up an individual basic payment
  - ❖ Positive preferences for a bonus conditioned to reaching a minimum share of enrolled area at the landscape scale ([Kuhfuss et al., 2016](#)).
- ❖ Peer effect: more likely to accept a PES scheme recommended by other farmers ([Villamayor-Tomas et al., 2019](#)).

Transaction costs



Free-riding



Uncertainty



Risk



Reward



Social norm



# ➤ Contribution

## New elements on farmers' preferences for bonus mechanisms

- ❖ Little evidence on farmers' attitude towards bonus payment mechanisms promoting collective approaches, apart from [Kuhfuss et al. \(2016\)](#) (winegrowers, water quality, south of France)
- ❖ Research objectives:
  - ➔ Confirm or nuance acceptability in other contexts.
    - ☐ Choice experiment (CE) to measure preferences for a PES targeting the improvement of water quality in northwest France.
  - ➔ Test new types of bonuses designed to meet high participation rates and environmental efforts at the landscape scale.
    - ☐ Individual bonus for sponsoring a peer (reward collaboration).
    - ☐ Collective result bonus distributed to all participants if the water quality of the river is improved (reward landscape-scale achievement).



# ➤ Material and method

## Choice Experiment approach

- ❖ Survey-based method to elicit stated preferences of individuals (Louviere et al., 2000).
  - ❖ Respondents are successively asked to choose their preferred option among a small number of hypothetical alternatives, which differ according to several **attributes**.
  - ❖ Estimate ex-ante the marginal utility of different characteristics (attributes) of policy design.
- ❖ Choice modelling:
  - ❖ Lancaster's theory : consumption decisions are determined by the utility derived from the attributes  $X$  of the good being consumed (Lancaster, 1966).
  - ❖ Random utility theory decomposing utility  $U$  into a deterministic part  $V$  and a random part  $\varepsilon$  (McFadden, 1974).
- ❖ Account for taste heterogeneity:
  - ❖ Mixed logit model (preferences vary across individuals).
  - ❖ Latent class model (preferences vary across groups of individuals).

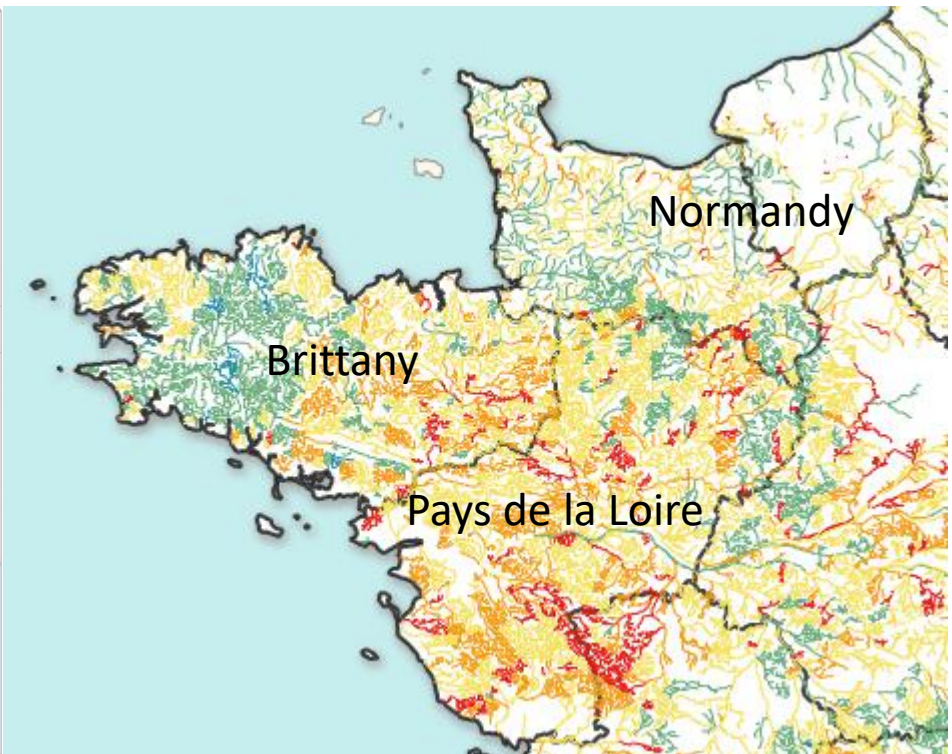
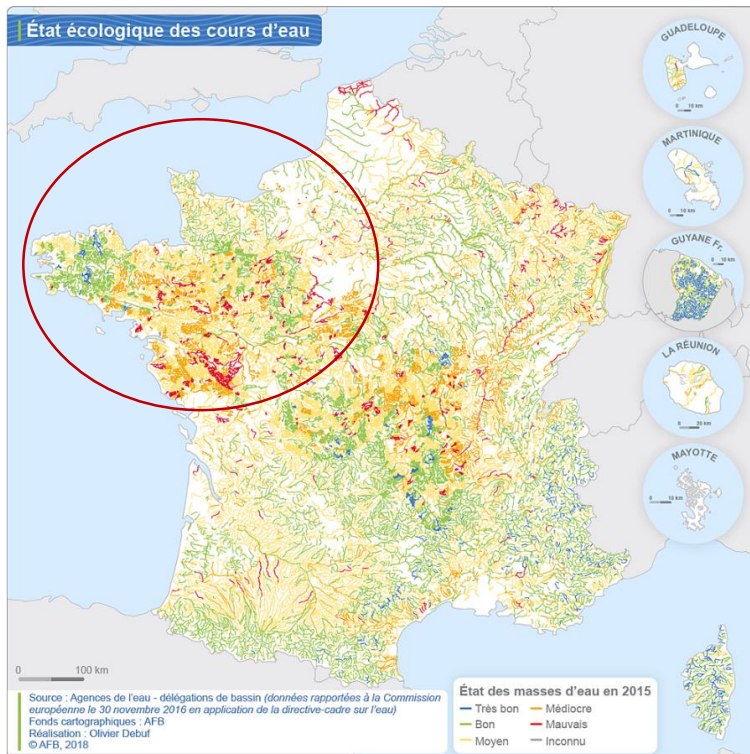
$$U_{njt} = V_{njt} + \varepsilon_{njt} = \beta X_{njt} + \varepsilon_{njt} \quad (1)$$



# ➤ Material and method

## Study area

- ❖ Environmental target: water quality.





# > Material and method

## Experimental design









❖ Fixed PES design characteristics: 5 years, entire farmland

Attribute	Description	Levels
Soil cover	Average agricultural soil coverage throughout the year at the farm level (no bare soil, starting from seeding)	1. 85% 2. 90% 3. 95%
Hedgerows	Average density of anti-erosion multi-species multilayer hedgerows at the farm level	1. 20m/ha 2. 60m/ha 3. 100m/ha
Basic payment	Per-hectare individual annual payment	1. 150€/ha 2. 300€/ha 3. 450€/ha 4. 600€/ha
Bonus	Bonuses conditioned to a collective action : A fixed individual <b>sponsor bonus</b> of 450€ that the farmer receives each time he convinces a peer into entering the PES scheme ; A <b>collective result bonus</b> of 50€/ha distributed to all participants if the river's status reaches a higher step of the water quality scale	1. None 2. Individual sponsor bonus 3. Individual sponsor bonus + collective result bonus

# ➤ Material and method

## Experimental design

- ❖ D-efficient design of 36 choice sets to be divided into 4 blocks of 9 choice cards
- ❖ Face to face interviews in spring 2021

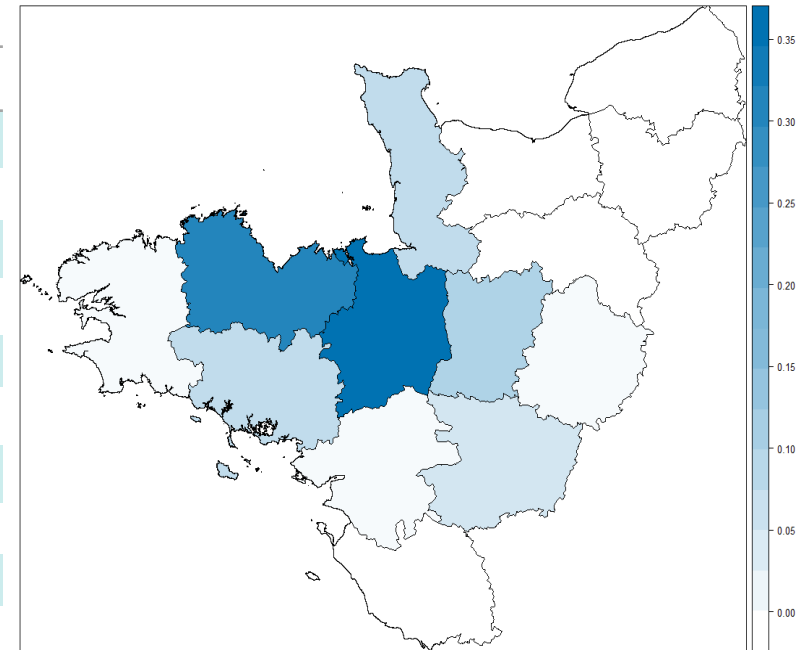
Attribute	Contract A	Contract B	Status-quo
Hedgerows	100 m/ha 	60 m/ha 	I prefer to keep my current practices
Soil coverage	Bare soil ← 85% → 	Bare soil ← 85% → 	
Basic payment	300€/ha 	150€/ha 	
Bonus	None	Individual bonus : 450€/sponsored peer  + Collective bonus : 50€/ha 	

# > Data

## Description of the respondents

❖ N=130

Variable	Mean
UAA (ha)	100.3
Share of permanent grasslands (%)	35.7 (4na)
Specialised in dairy (%)	50.8
Specialised in cattle meat (%)	9.2
Specialised in crops (%)	6.2
Organic farming (%)	39.2
AES participant in 2020 (%)	40.8
Plan to stop managing farm in 5 years or less (%)	20.0
Higher education (%)	63.1
Participate in a farmer or environmental organisation (%)	70.0



# ➤ Results

## Mixed logit model

	Estimate
<b>PAYMENT</b>	<b>0.006***</b>
<b>COVER</b>	<b>-0.184*</b>
*COVER <sub>current</sub>	<b>0.248**</b>
*ORGANIC	<b>-0.035***</b>
*SHORT-TERM	0.007
<b>HEDGEROWS</b>	<b>-0.036***</b>
*HEDGEROWS <sub>current</sub>	<b>0.000**</b>
*ORGANIC	<b>0.040***</b>
*SHORT-TERM	<b>-0.035**</b>
<b>BONUS<sub>sponsor</sub></b>	<b>0.379*</b>
<b>BONUS<sub>sponsor/collective result</sub></b>	<b>-1.472**</b>
*ATTITUDE <sub>collective payment</sub>	<b>0.467***</b>
*ORGANISATION	0.592
<b>ASC<sub>sq</sub></b>	1.615
<b>SD.COVER</b>	<b>0.043***</b>
<b>SD.HEDGEROWS</b>	<b>0.042***</b>
<b>SD.BONUS<sub>sponsor</sub></b>	0.036
<b>SD. BONUS<sub>sponsor/collective result</sub></b>	<b>1.216***</b>
<b>SD.ASC<sub>sq</sub></b>	0.139
<b>Log likelihood</b>	-719.32
<b>Pseudo-R<sup>2</sup></b>	0.396
<b>AIC</b>	1476.645
<b>BIC</b>	1571.267
<b>Observations</b>	1075
<b>Number of farms</b>	120

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Significance levels: \*\*\* p-value <0.001, \*\* p-value <0.01, \* p-value<0.05.

June 24th 2022 / 9th EAAE PhD WORKSHOP Parma/ Fanny Le Gloux

- ❖ Ceteris paribus, a farmer accepts 63€ less of payment per hectare with the sponsor bonus of 450€/peer.
  - ❖ A farmer with 100ha would need to convince at least 14 new peers each year to compensate.
  - ➔ Introducing a bonus option can **improve the cost-effectiveness** of PES (confirms Kuhfuss et al. , 2016).

# Results

## Latent class model

	Class 1	Class 2	Class 3	Class 4
<b>PAYMENT</b>	<b>0.003*</b>	<b>0.006***</b>	0.001	<b>0.009***</b>
<b>COVER</b>	-0.006	-0.002	<b>0.072*</b>	0.038
<b>HEDGEROWS</b>	<b>-0.045***</b>	<b>-0.093***</b>	<b>0.025***</b>	<b>0.007*</b>
<b>BONUS<sub>sponsor</sub></b>	0.211	0.413	<b>-0.633*</b>	<b>0.955***</b>
<b>BONUS<sub>sponsor/collective result</sub></b>	-0.203	0.433	<b>-1.161***</b>	<b>1.371***</b>
<b>ASC<sub>sq</sub></b>	-5.068	-4.455	<b>1.575*</b>	-9.747
<b>Probability of class</b>	<b>0.15</b>	<b>0.17</b>	<b>0.18</b>	<b>0.50</b>
<b>Class membership function</b>				
<b>HEDGEROWS<sub>current</sub></b>	Ref	<b>-0.009*</b>	<b>0.024***</b>	<b>0.023***</b>
<b>SHORT-TERM</b>	Ref	0.238	<b>-1.801***</b>	<b>-0.950***</b>
<b>ORGANIC</b>	Ref	0.085	<b>1.867***</b>	<b>0.930***</b>
<b>HERBIVOROUS</b>	Ref	<b>1.577***</b>	0.434	0.293
<b>ORGANISATION</b>	Ref	-0.398	<b>-0.757**</b>	-0.220
<b>ATTITUDE<sub>collective payment</sub></b>	Ref	-0.098	0.040	<b>0.238**</b>
<b>Log likelihood</b>		-693.44		
<b>Pseudo-R<sup>2</sup></b>		0.418		
<b>AIC</b>		1476.879		
<b>BIC</b>		1700.983		
<b>Observations</b>		1075		
<b>Number of farms</b>		120		

### Classes 1 & 2 : “hedgerows averse”

- ❖ Preferences for low hedgerows density requirements.
- ❖ Non-significant effects of bonuses.

### Class 3: “pro-environment individualists”

- ❖ Farms preferring the status-quo or PES with high management requirements.
- ❖ Prefer no bonuses.

### Class 4 : “pro-incentive”

- ❖ Financial incentives seem to drive their choice more than technical constraints.
- ❖ Higher levels of per-hectare payment.
- ❖ Positive preferences for both types of bonuses.

## ➤ Discussion

- ❖ **Heterogeneous preferences** towards the bonus options.
  - ❖ Bonuses distributed according to an **individual effort for attracting more farmers** could be a promising way to increase participation and PES cost-effectiveness.
  - ❖ Collective bonuses **distributed to all might be counterproductive**.
- ❖ **Sponsor bonus** → can increase scheme's **cost effectiveness**.
- ❖ *Latent class model: how to interpret class 3?*
  - ❖ *Over-representation of organic farmers → possible overestimation of the negative attitude towards the combined sponsor/collective result bonuses.*
- ❖ Combined **sponsor/collective result bonus** → could be **cost-effective as long as the total amount of financial incentive is attractive enough** to effectively boost participation and collective action.
- ❖ Beyond income foregone: **new contributors?** → bonus-mechanisms rewarding a landscape result or high participation could be of **particular interest for stakeholders benefiting directly** from the improvement of rivers' water quality (water bottle companies, water agencies).



# XVII EAAE CONGRESS

AGRI-FOOD SYSTEMS IN A CHANGING WORLD:  
CONNECTING SCIENCE AND SOCIETY

**AUGUST 29<sup>TH</sup> - SEPTEMBER 1<sup>ST</sup> 2023**

**RENNES, FRANCE**

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## Agri-food systems in a changing world: connecting science and society

When  
Where  
Official Language

**August 29<sup>th</sup> - September 1<sup>st</sup> 2023**  
**Couvent des Jacobins, Rennes, France**  
**English**

Website

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Video teaser

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# Thank you for your attention!

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