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### ► To cite this version:

Fanny Le Gloux, Pierre P. Dupraz, Alice Issanchou, Carole Ropars-Collet. Payments for environmental services with provision thresholds: farmers' preferences for a conditional bonus. 9. EAAE PhD WORKSHOP, Jun 2022, Parme, Italy. 15 p. hal-03879781

**HAL Id: hal-03879781**

**<https://hal.inrae.fr/hal-03879781v1>**

Submitted on 30 Nov 2022

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 817949



## ➤ 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)

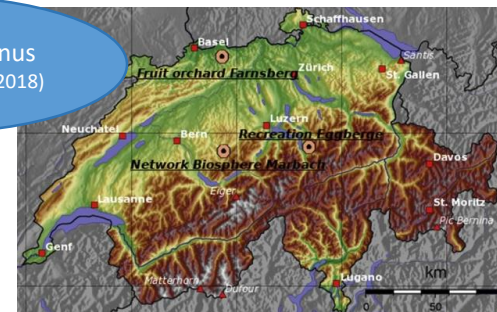


Source: LIFE ALISTER

Payment conditionality

All the payment  
Or part of it (bonus)

Swiss network bonus (Krämer and Wätzold, 2018)



Source: Krämer and Wätzold (2018)

Individual-level collaboration requirement

Landscape-scale requirement

Regular meetings

Spatial configuration of uptake with neighbour(s)

Cooperation

Group-level contracting

Minimum level of uptake

Environmental result

# ➤ 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). 



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# ➤ 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).

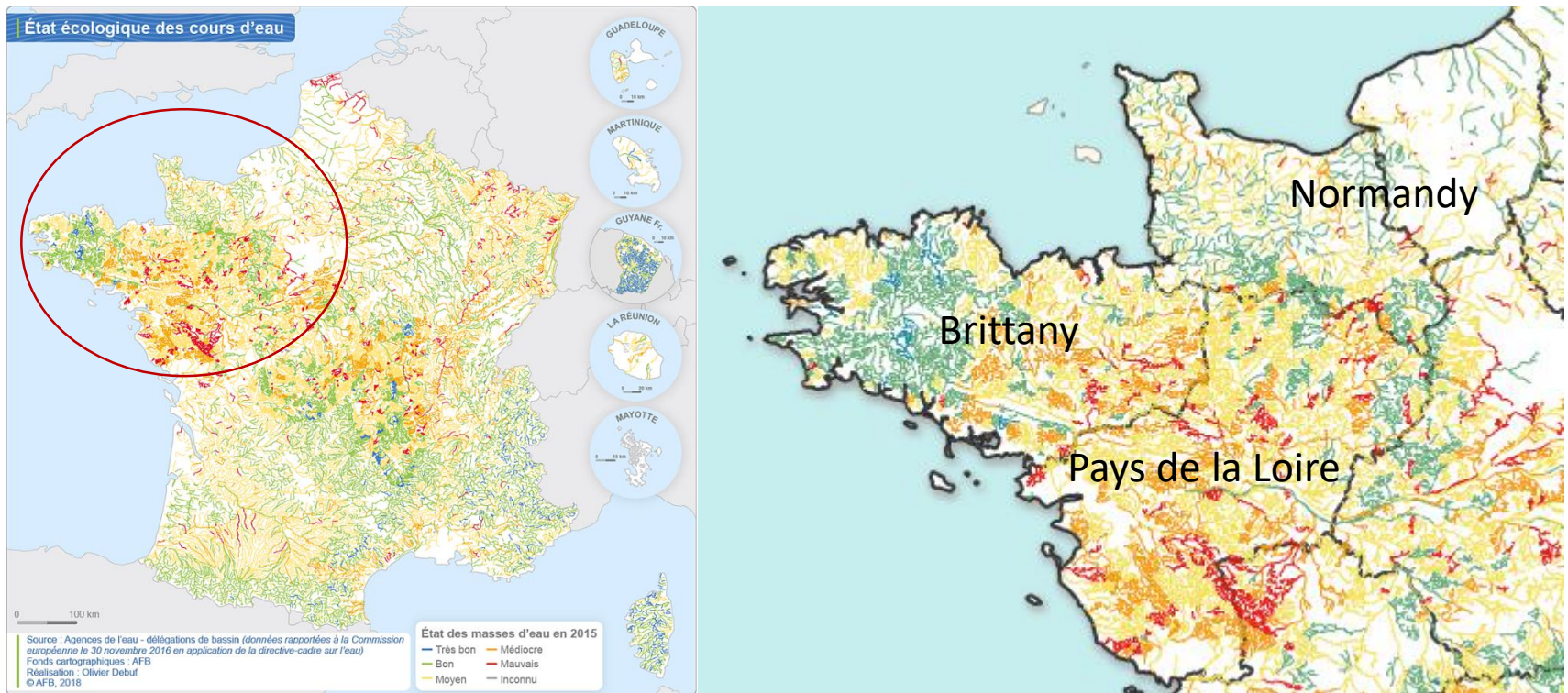
Individual  $n$   
Alternative  $j$   
Choice set  $t$   
Preference  $\beta$

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

# ➤ 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)  | <ol style="list-style-type: none"> <li>1. 85%</li> <li>2. 90%</li> <li>3. 95%</li> </ol>  |
| Hedgerows     | Average density of anti-erosion multi-species multilayer hedgerows at the farm level  | <ol style="list-style-type: none"> <li>1. 20m/ha</li> <li>2. 60m/ha</li> <li>3. 100m/ha</li> </ol>  |
| Basic payment | Per-hectare individual annual payment   | <ol style="list-style-type: none"> <li>1. 150€/ha</li> <li>2. 300€/ha</li> <li>3. 450€/ha</li> <li>4. 600€/ha</li> </ol>                                      |
| Bonus         | <p>Bonuses conditioned to a collective action :</p> <p>A fixed individual <b>sponsor bonus</b> of 450€ that the farmer receives each time he convinces a peer into entering the PES scheme ;</p> <p>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</p> | <ol style="list-style-type: none"> <li>1. None</li> <li>2. Individual sponsor bonus</li> <li>3. Individual sponsor bonus + collective result bonus</li> </ol> |

# ➤ 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<br> | 60 m/ha<br>  | I prefer to keep my current practices |
| Soil coverage | 85%<br>      | 85%<br>  |                                       |
| Basic payment | 300€/ha<br>  | 150€/ha<br>  |                                       |
| Bonus         | None  | Individual bonus : 450€/sponsored peer<br><br>+<br>Collective bonus : 50€/ha<br> |                                       |



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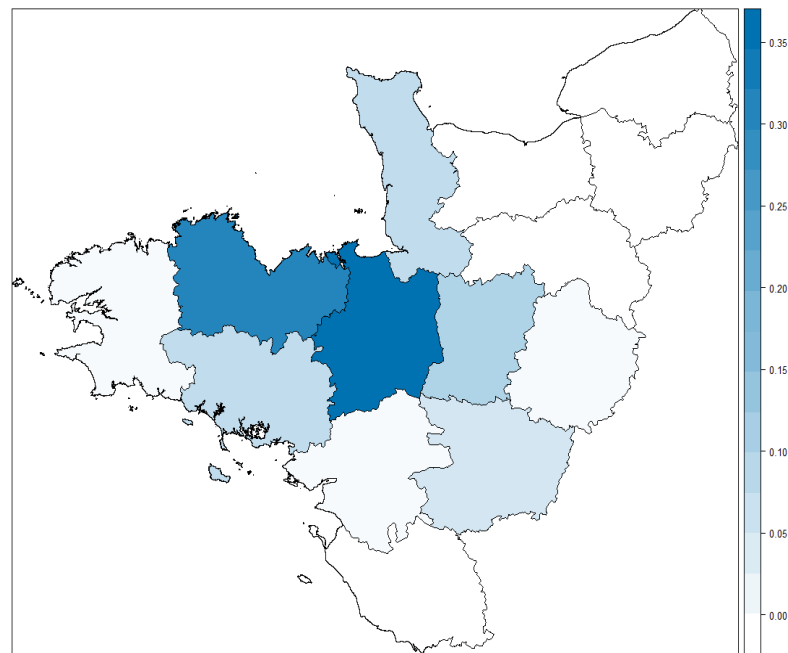


# > Data

## 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<sup>***</sup></b>  |
| <b>COVER</b>   | <b>-0.184<sup>*</sup></b>   |
| *COVER <sub>current</sub>                            | <b>0.248<sup>**</sup></b>   |
| *ORGANIC   | <b>-0.035<sup>***</sup></b> |
| *SHORT-TERM  | 0.007                       |
| <b>HEDGEROWS</b>                                     | <b>-0.036<sup>***</sup></b> |
| *HEDGEROWS <sub>current</sub>                        | <b>0.000<sup>**</sup></b>   |
| *ORGANIC   | <b>0.040<sup>***</sup></b>  |
| *SHORT-TERM  | <b>-0.035<sup>**</sup></b>  |
| <b>BONUS<sub>sponsor</sub></b>                       | <b>0.379<sup>*</sup></b>    |
| <b>BONUS<sub>sponsor/collective result</sub></b>     | <b>-1.472<sup>**</sup></b>  |
| *ATTITUDE <sub>collective payment</sub>              | <b>0.467<sup>***</sup></b>  |
| *ORGANISATION  | 0.592                       |
| <b>ASC<sub>sq</sub></b>                              | 1.615                       |
| <b>SD.COVER</b>                                      | <b>0.043<sup>***</sup></b>  |
| <b>SD.HEDGEROWS</b>                                  | <b>0.042<sup>***</sup></b>  |
| <b>SD.BONUS<sub>sponsor</sub></b>                    | 0.036                       |
| <b>SD. BONUS<sub>sponsor/collective result</sub></b> | <b>1.216<sup>***</sup></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          |
|--|------------------|------------------|------------------|------------------|
| <i>PAYMENT</i>                                   | <b>0.003*</b>    | <b>0.006***</b>  | 0.001            | <b>0.009***</b>  |
| <i>COVER</i>                                     | -0.006           | -0.002           | <b>0.072*</b>    | 0.038            |
| <i>HEDGEROWS</i>                                 | <b>-0.045***</b> | <b>-0.093***</b> | <b>0.025***</b>  | <b>0.007*</b>    |
| <i>BONUS<sub>sponsor</sub></i>                   | 0.211            | 0.413            | <b>-0.633*</b>   | <b>0.955***</b>  |
| <i>BONUS<sub>sponsor/collective result</sub></i> | -0.203           | 0.433            | <b>-1.161***</b> | <b>1.371***</b>  |
| <i>ASC<sub>sq</sub></i>                          | -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>                 |                  |                  |                  |                  |
| <i>HEDGEROWS<sub>current</sub></i>               | Ref              | <b>-0.009*</b>   | <b>0.024***</b>  | <b>0.023***</b>  |
| <i>SHORT-TERM</i>                                | Ref              | 0.238            | <b>-1.801***</b> | <b>-0.950***</b> |
| <i>ORGANIC</i>                                   | Ref              | 0.085            | <b>1.867***</b>  | <b>0.930***</b>  |
| <i>HERBIVOROUS</i>                               | Ref              | <b>1.577***</b>  | 0.434            | 0.293            |
| <i>ORGANISATION</i>                              | Ref              | -0.398           | <b>-0.757**</b>  | -0.220           |
| <i>ATTITUDE<sub>collective payment</sub></i>     | 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**



## 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

<https://eaae2023.colloque.inrae.fr>

Video teaser

[https://youtu.be/OVglOHP\\_VWA](https://youtu.be/OVglOHP_VWA)

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<https://console-project.eu/>

# Thank you for your attention!

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