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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)

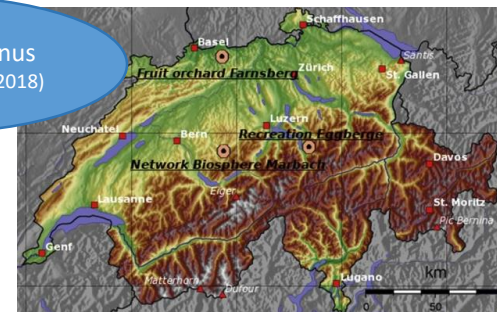


Source: LIFE ALISTER

Payment conditionality

All the payment
Or part of it (bonus)

Swiss network bonus (Krämer and Wätzold, 2018)



Source: Krämer and Wätzold (2018)

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 ε (McFadden, 1974).
- ❖ Account for taste heterogeneity:
 - ❖ Mixed logit model (preferences vary across individuals).
 - ❖ Latent class model (preferences vary across groups of individuals).

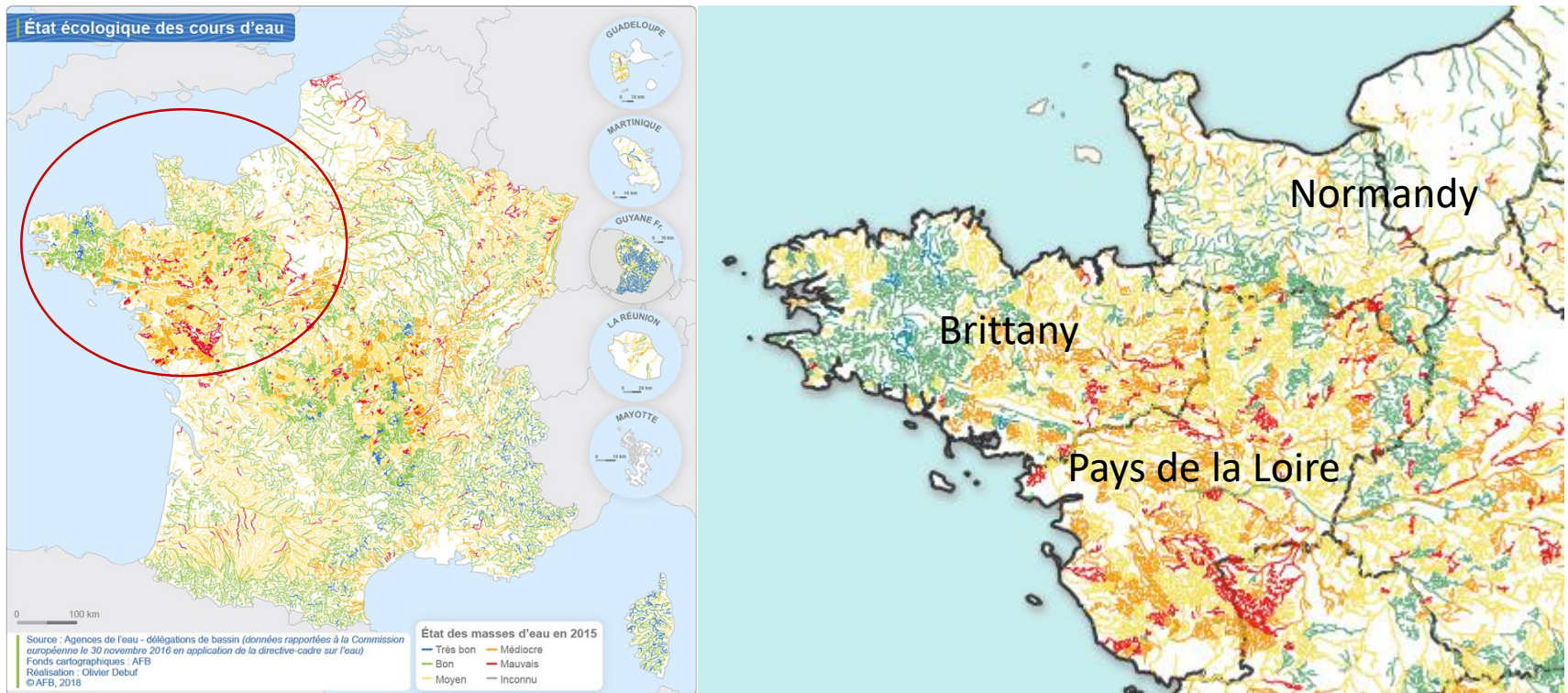
Individual n
Alternative j
Choice set t
Preference β

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

➤ 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"> 1. 85% 2. 90% 3. 95%
Hedgerows	Average density of anti-erosion multi-species multilayer hedgerows at the farm level	<ol style="list-style-type: none"> 1. 20m/ha 2. 60m/ha 3. 100m/ha
Basic payment	Per-hectare individual annual payment	<ol style="list-style-type: none"> 1. 150€/ha 2. 300€/ha 3. 450€/ha 4. 600€/ha
Bonus	<p>Bonuses conditioned to a collective action :</p> <p>A fixed individual sponsor bonus of 450€ that the farmer receives each time he convinces a peer into entering the PES scheme ;</p> <p>A collective result bonus 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"> 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	85% 	85% 	
Basic payment	300€/ha 	150€/ha 	
Bonus	None	Individual bonus : 450€/sponsored peer  + Collective bonus : 50€/ha 	



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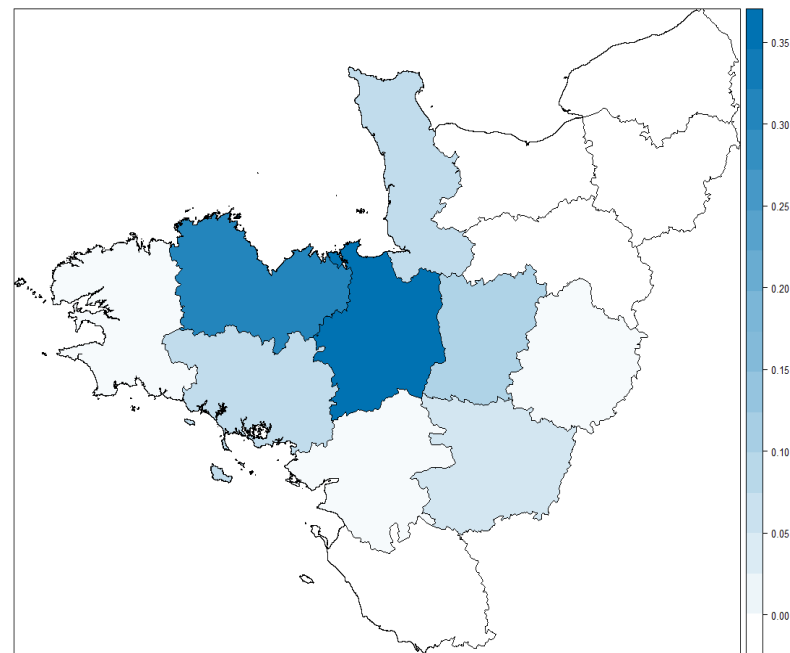


> Data

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
PAYMENT	0.006^{***}
COVER	-0.184[*]
* <i>COVER_{current}</i>	0.248^{**}
* <i>ORGANIC</i>	-0.035^{***}
* <i>SHORT-TERM</i>	0.007
HEDGEROWS	-0.036^{***}
* <i>HEDGEROWS_{current}</i>	0.000^{**}
* <i>ORGANIC</i>	0.040^{***}
* <i>SHORT-TERM</i>	-0.035^{**}
BONUS_{sponsor}	0.379[*]
BONUS_{sponsor/collective result}	-1.472^{**}
* <i>ATTITUDE_{collective payment}</i>	0.467^{***}
* <i>ORGANISATION</i>	0.592
ASC_{sq}	1.615
SD.COVER	0.043^{***}
SD.HEDGEROWS	0.042^{***}
SD.BONUS_{sponsor}	0.036
SD. BONUS_{sponsor/collective result}	1.216^{***}
SD.ASC_{sq}	0.139
Log likelihood	-719.32
Pseudo-R²	0.396
AIC	1476.645
BIC	1571.267
Observations	1075
Number of farms	120

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

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- ❖ 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>	0.003*	0.006***	0.001	0.009***
<i>COVER</i>	-0.006	-0.002	0.072*	0.038
<i>HEDGEROWS</i>	-0.045***	-0.093***	0.025***	0.007*
<i>BONUS_{sponsor}</i>	0.211	0.413	-0.633*	0.955***
<i>BONUS_{sponsor/collective result}</i>	-0.203	0.433	-1.161***	1.371***
<i>ASC_{sq}</i>	-5.068	-4.455	1.575*	-9.747
Probability of class	0.15	0.17	0.18	0.50
Class membership function				
<i>HEDGEROWS_{current}</i>	Ref	-0.009*	0.024***	0.023***
<i>SHORT-TERM</i>	Ref	0.238	-1.801***	-0.950***
<i>ORGANIC</i>	Ref	0.085	1.867***	0.930***
<i>HERBIVOROUS</i>	Ref	1.577***	0.434	0.293
<i>ORGANISATION</i>	Ref	-0.398	-0.757**	-0.220
<i>ATTITUDE_{collective payment}</i>	Ref	-0.098	0.040	0.238**
Log likelihood		-693.44		
Pseudo-R²		0.418		
AIC		1476.879		
BIC		1700.983		
Observations		1075		
Number of farms		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 29TH - SEPTEMBER 1ST 2023
RENNES, FRANCE



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

When
Where
Official Language

August 29th - September 1st 2023
Couvent des Jacobins, Rennes, France
English

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

Video teaser

https://youtu.be/OVglOHP_VWA

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Thank you for your attention!

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