Individual preferences and public incentives: What agro-environmental scheme for grassland restoration by farmers? The case of the Normandy region in France

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Abstract: *Agro-environmental schemes (AES) play a key role in promoting the production of environmental public goods by European Union agriculture. Although extensive literature has analysed AES, the issues related to grassland restoration remain understudied. This paper performs a discrete choice survey conducted among 119 French farmers from June to September 2017 in the Normandy region in France. Respondents had to choose between conserving their actual farming practices or change towards more plots dedicated to grassland restoration and preservation. Thanks to this stated preference method we analysed the factors influencing farmers' motivations to join or not an AES for grassland restoration. We estimate the relative weight of these factors and we value the willingness to pay/willingness to accept for change in each of these factors. Our contribution shows that, besides including financial compensation the role of the collective participation, the technical support provided to farmers and the area of the farm enrolled in the AES are important.*

Keywords: *Agri-environmental schemes, grassland restoration, choice experiment, biodiversity conservation*

Introduction

Grasslands and forage crops are a main component for the French agricultural area and also represent very high agricultural, productive and environmental stakes with a positive effect on water quality, carbon storage and landscapes (Pottier et al., 2012). These areas are the object of a variety of management strategies which influence of diverse manners both the level and the quality of their ecological performance. Between 2006 and 2010, the area declared as permanent grassland fell by 6.3%, of which 3% in the 2009-2010 period alone, to represent in 2010 the fifth of the utilized agricultural area (UAA). This development affects most agricultural regions, but particularly the north-west and south-east of France and there is a specific need today to answer the question of reconsidering the relationship between farming practices and biodiversity conservation of grasslands.

In the European Union, the agri-environmental schemes (AESs) are the main policy instrument to foster improvements in the relationship between agriculture and the environment (European Commission, 2005). A basic principle of AESs, is that participation is voluntary (European Commission, 2005, European Court of Auditors, 2011). Consequently, farmer's willingness to participate in an AESs is critical to achieving common policy objectives (Wilson, 1996; Espinosa-Goded et al., 2010). In the particular case of grasslands conservation, the last two Common Agricultural Policy (CAP) reforms (2007-2013 and 2014-2022) have proposed financial compensation which does not provide sufficient incentives for farmers to change their behaviours and there is a lack of participation in agro-environmental schemes in this field.

Scientists are required to inform and guide policymakers to define the best approaches to support farmers towards more sustainable and resilient farming practices. Our work contributes to the understanding of this issue by exploring the factors influencing farmers' choices to change their farming practices towards grasslands restoration. This relies on the integrating science, policy, and practice as outlined by the theme three of the conference.

I found the theme proposed really interesting because my research interest about the economic value of biodiversity and its integration in farming systems deals with the conflict between biodiversity conservation and agricultural activities in the agricultural landscape. I developed a specific interest in the evaluation strategies methods and instruments to reconcile such conflicts from an economic and social point of view. My main questions emerge around the creation and the transmission of knowledge in groups (scientific, professional, decision-makers, etc). I am also interested in how field observations (surveys) can help to highlight public policy decisions for biodiversity conservation in the farming system.

In this paper, we first describe in section 2 the case study which is the Normandy region in France, then in section 3, we present our methodological approach based on a survey design and the data collection. Section 4 presents the main results and their interpretation. Concluding remarks and discussion are presented in section 5.

2. Case study description: The Normandy Region

In the Normandy Region, large areas of alluvial grassland have been transformed into crop grassland, and permanent grasslands are continuing to decline in front of the expansion of forage-corn and crops considered to be more interesting from a financial point of view for farmers. We find that this region has not respected its obligations to maintain permanent grasslands at the regional level in 2016. This is one of the three criteria for access to the green payment of the common agricultural policy (CAP).

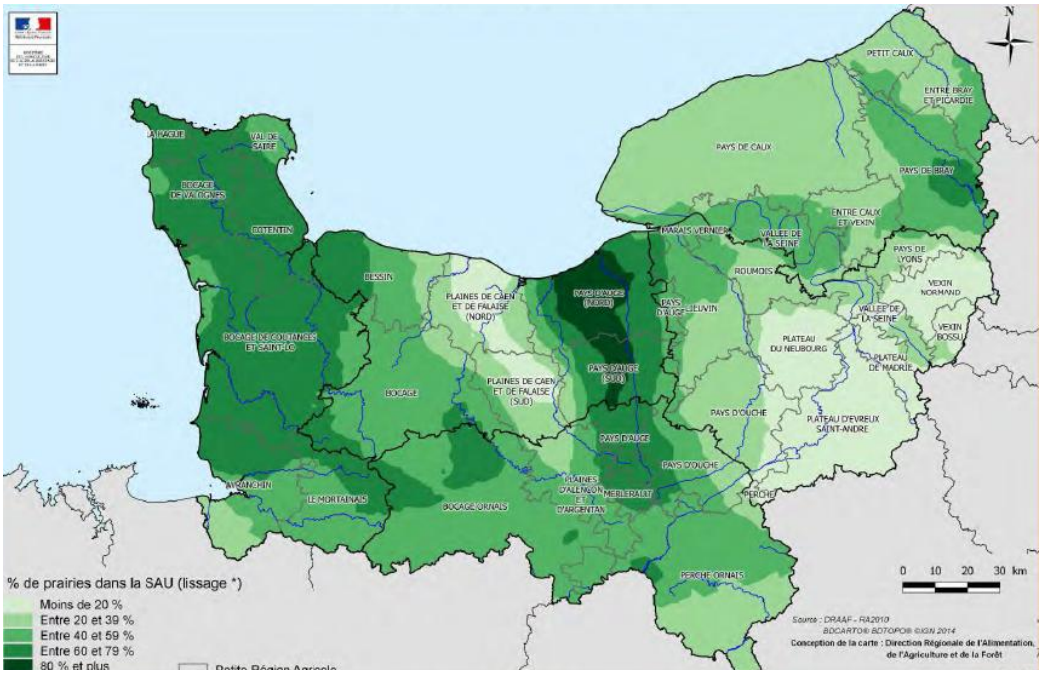

Figure 1- Percentage of grassland area in the total utilized agricultural area (2014)

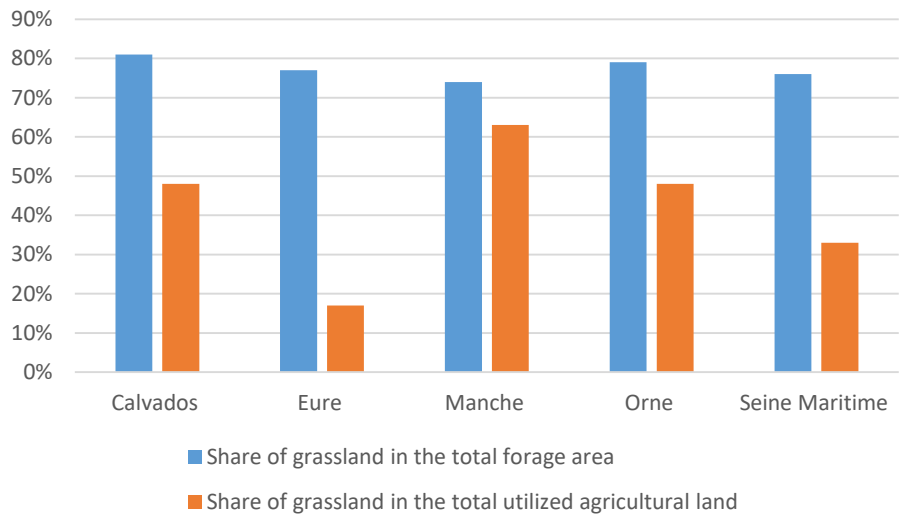

Figure 2 – Share of grassland area in the Normandy region.

By non-respecting the maintenance of grasslands farmers incur the risk of not being eligible for green direct payment that works by providing the farmers with an area-based payment in return for making use of various practices that benefit the environment and the climate. These require actions each year including diversifying crop, maintaining permanent grassland and dedicating 5% of arable land to ecological beneficial elements (ecological focus area).

The last CAP reform (2015-2020) introduced the AES grazing systems that aim to promote agricultural productions committed to the conservation of natural grassland biodiversity.

The main characteristics of AES grazing systems are presented in Table 1.

Table 1 – Main characteristics of AES grazing systems

Eligibility • More than 80% of permanent et temporary grassland on the farmers' land • Number <1.4 per livestock unit (LU) /ha
Requirement • Maintenance of a grassland surface rate superior or equal to 80% • Plough not authorized on the grassland • Absence of phytosanitary treatment • Maintenance of all the geographic features (hedges, patches,) • Maintenance of an ecological focus area on all the grassland
Compensation • 80 euro/hectare/year for grassland area enrolled (celling set to 7600 euro per year)
Environmental benefits • Carbon storage, • Water quality, • Landscape quality

This AES was selected as most suitable to provide the framework for our case study of the grasslands preservation in the Normandy region. This paper uses data collected from 119 surveys to farmers in the Normandy region. In the sample strategy no distinction was made between the farmers who are already enrolled in AES schemes of those who are not yet.

3. Methodology

Discrete choice experiment to estimate the willingness to accept of farmers

In this paper we use a quantitative approach to estimate the relative weight of various decision factors and to provide farmers' willingness to pay (WTP)/ willingness to accept (WTA) for changes in these factors. Our methodology is based on non-market valuation (Adamowicz et al., 1998) using a Discrete Choice Experiment (DCE) which is a stated preference method in which people are asked to state values for items that are not traded in the market (Ciariacy-Wantrup, 1947).

In the last decade, the DCE method has increasingly attracted the attention of environmental economists and has been implemented to examine and understand the demand of quality changes in the environmental attributes in the society as a whole (Carlson and Kataria, 2008; Campbelle, 2007; Scarpa et al. 200, Hanley et al. 2006). However the application to farmers' behavior and the agricultural issues is very limited (Peterson et al., 2007, Roessler et al., 2007; Birol et al., 2006). Recent works by applying the DCE approach intended to analyze farmers' preferences for key elements of the agro-environmental schemes (AESs) design Espinoza-Godded et al., 2009, Peterson et al., 2015).

The voluntary nature of AES means that farmers' decisions to participate, with appropriate distribution across target areas, is central to achieving policy objectives. While there has been a considerable research interest in identifying the factors that influence participation (Siebert et al., 2006), other works have applied the DCE method to understand farmers' preferences for environmentally friendly practices adoption independently of an ago-environmental contract with the public authorities (Jaeck and Lifran, 2014; Birol et al., 2006; Vidogbena et al., 2015).

Generally, the literature highlights that the commitments' flexibility and the potential administrative burden are two major components of farmers' decision to change their practices. Also, only very few contributions have looked into the role of risk in farmers' choices. Price-risk and harvest-risk are two factors that can extremely affect farmers' revenues (Cheze et al., 2017). Particularly, choosing to give up or to limit the extension of areas dedicated to forage corn and wheat, for the grassland restoration can have major impacts on the stability of the farmer revenues.

To our knowledge, this is the first application in which farmers' willingness to accept and willingness to pay – decision – to sign an AES regarding the restoration of the grass on their farm-land. In the continuity of the approach developed by Espinoza-Godded et al. (2009), we focus on one scheme and use actual payments, which will allow us to estimate willingness to accept (WTA). In addition, we account explicitly for preference heterogeneity and the impact of farmer characteristics on WTA estimate for AES attributes.

The questionnaire design and data collection

The questionnaire was designed review of previous research, agricultural structures in the area and discussions with groups of farmers and government agency (Chambre d'Agriculture Normandie). Within this questionnaire, the objective of the experimental design is to choose the scenarios (i.e. the combinations of attributes' levels).

The survey targeted farmers who were not currently enrolled in AES. But before launching the questionnaire was subjected to a pretest with 10 farmers in the Normandy region (Orne, Calvados, and Seine-Maritime) and adjusted accordingly. The pre-test helped to make sure that farmers understood the questions and that the choice tasks were manageable and that each interview lasts no more than 20 minutes.

The first part of the questionnaire was dedicated to general questions regarding the farmer's activity, the size of the farm, the existence of cattle farming (breeding) and other forage crop on the farm area.

The aim of the survey was then shortly described using illustrated slides and explaining in detail the five attributes. We were very careful so as to deliver an objective and neutral information. Basic pieces of information about the socio-economic characteristics of respondents were also collected in the survey.

Table 3 shows a typical choice set presented to respondents in the survey. Data were then obtained from an in-person survey of 119 farmers undertaken in five departments in the Normandy region in France (Orne, Eure, Seine-Maritime, Calvados, and Manche) during June-September 2017.

Table 2 - Example of a choice set

	Alternative A	Alternative B	Alternative C
Land flexibility	50 % Eligible surface	Free to choose	Neither alternative A nor alternative B. I would maintain my current farm management and practices.
Collective participation	No	Yes	
Availability of free technical support and advisory service	No	Yes	
Fixed premium	No	Yes	
Premium level (€ ha $^{-1}$ year $^{-1}$)	80	100	

Choice of the attributes and their levels

The validity, reliability, and applicability of the discrete choice experiment method depends on the explanation of the change to be valued. First will the change to be valued affect specific characteristics of the item as a whole, and what the information needed for the decision maker?
The primary consideration was to choose the attributes composing the options and their corresponding levels. As argued by Hanley et al (2002) the number of attributes have to be limited in order to avoid the cognitive burden related to making complex choices. Attributes selection was made on the base of the literature review from one hand and discussions with farmers as well as scientific experts in the field of agronomy and environment. Also, a pretest of some choice sets was carried out.

Flexibility over the amount of land to be enrolled in the AES was included in our analysis. Indeed, it is already admitted that grassland should be provided with a minimum surface to assure viability and biodiversity development. Therefore, a compulsory enrolment of 50% of the eligible area is included in order to identify the potential cost it would entail.
The choice experiment design includes also a policy design attribute which was in our case a collective participation attribute reflecting the participation of a group of farmers. Consequently, a precise definition of the collective participation was needed. For participation to be considered as collective, a group of at least five farmers whose farms were located in the same municipality had to sign the same AES contract. The five-farmer group was chosen in order to be large enough to require an effort from the farmers to create the group, and small enough to avoid farmers' negative perceptions of large groups. Also, it was explained to farmers that they could freely create the group with those whom they trust the most.
Availability of free technical support and advisory service was also included as an attribute. This attribute reflects the existence of a potential advantage by including technical assistance in the AES. Finally, the relevance of fixed costs as a barrier for adoption, as put forward by

Ducos et al. (2009) is also tested by introducing a fixed payment as part of the contract: about 1000 euro as fixed premium the first year of the contract.
Finally, a monetary attribute related to payment level was included. The attributes and levels used to describe the AES in the choice experiment which is yearly payment per hectare for a 5-year AES contract (80 €/ha, 100€/ha or 120€/ha)

Table 3 - AES attributes and levels used in the CE design

Attributes	Description	Levels	Coding
LandFlex	Flexibility over the surface of land to be enrolled in the AES	Free 50% of the farm land	1 0
CollecPart	Collective participation: Participation of a group of farmers (at least 5) with farms located in the same municipality	No Yes	0 1
TechSupp	Availability of free technical support and advisory service	Yes No	1 0
FixPrem	Availability of a 1000 € on of payment per contract independently of the area enrolled payable on the first year	Yes No	1 0
Premium	Payment level per hectare and per year	80 €/ha 100 €/ha 120 €/ha	80 100 120

How to capture the effect of the status Quo (SQ)? "No variation in farmer's management practice"

As followed by Cheze et al. (2017), we included an alternative specific constant (ASC) in order to capture the effect of eventual unobserved effect (omitted variable) on the utility function. Thus the ASC is specified as a dummy variable that takes the value of 0 if one of the suggested alternatives is selected by the respondent and 1 if not, *i.e*, the Status Quo (SQ) alternative is selected. As argued by Scarpa et al. (2005) "*This approach allows us to consider the SQ effect that it is described as a systematic inclination of respondents to display a different attitude towards SQ alternatives from those reserved to alternatives involving some change, over and beyond what can be captured by the variation of attributes' levels across alternatives'". Thus, t*he ASC determine a context with "*no variation farmer's management practices*" "*no collective participation*", "no technical support", "*no premium payment*" and "*no yearly payment for 5 -years AES contract*". We admit that a statistically significant ASC would mean a high preference for no preferences for grassland restoration. It would indicate the existence of some omitted variables with a positive effect on farmers' utility of preferring to keep their current farming practices. In our case this issue deserves additional consideration as preference for the non-Status Quo alternative actually reflects preference for participation in the AES (Espinoza-Godded, 2010).

4. Results

The aim of our research is to analyze farmers' motivations and current incentives for the restoration of grassland. Also, we intend to estimate the monetary value associated with different farmers decisions components. The discreet choice experiment has been conducted among 119 farmers who had to choose between conserving their actual farming practices – management – or, changing their practices toward the restauration of grassland on their farms' land.

In the following section we will describe the sample of 91 answers (after removing the protest profiles). We will then estimate the econometric model: The random parameter logit (RPL).

Some basic statistics of the questionnaire

The Table 4 shows some descriptive statistics for the final sample composed of 91 respondents. The respondent ages range from 36 to 64 years with an average of 49 years. The mean area of their agricultural area is about 144 hectares. Most of these farmers have acquired their land a long time ago. The installation date range from 6 to 64 years with an average of 35 years. The average area dedicated by farmers to crops for sale purposes is about 30 hectares, while the average area dedicated for permanent grassland is about 49 hectares. But there is a great disparities among farms revealed by the standard deviation (30.3). Farmers having the most area dedicated to grassland are more probably to have livestock and would further benefit from the feed provided by the grass.

Also it is relevant to notice that 25% of the respondent answered that they prefer to maintain their actual practices. Aversion to change is a common funding in the choice experiment (Espinoza-Godded, 2010). This is consistent with both the rational choice theory and observed behavior (Dhar, 1997). Individuals try to avoid changes for numerous reasons (Samuelson and Zeckhauser, 1998), regret avoidance, loss aversion, cost and benefits has also been put forward as an alternative explanation (Kahneman et al. 1991). Indeed, most of the time, farmers are not awarded about the precise costs (and benefits) associated with their engagement in AES. This could be explained by the fact that among participants, 15% have livestock on their plots. Moreover, 80% of the farmers concerned by the survey declare to be concerned about environmental concerns.

Table 4 – Descriptive statistics

Variable	Obs	Mean	SD	Min	Max
Age	91	49.41	6.54	36	64
Utilized agricultural land	91	143.52	33,74	85	223
Temporary grassland area	91	7.23	9.65	0	50
Permanent grassland area	91	49	9.65	0	140
Age of the farm	91	35.17	15.61	6	64

The model results: what significance of the chosen attributes?

The model results reveal that all the attributes of the presented options are significant (the estimated means and standard deviations of the normally distributed coefficients provide information on the proportion of the population that places a positive value on a particular attribute and the proportion that places a negative value. For example 28% of the farmers have a positive preference for the fixed premium attribute. Also 30% exhibit a positive preference regarding the flexibility of surface enrolled in grasslands restoration. Moreover, farmers already developing grassland on their land and using it for feeding the ruminant – cattle – breeding activity already developed on the farmland – These farmers attach attention to the fixed premium, because they don't have already covered the fixed costs barriers and transaction cost related to their engagement in the AES.
Additional sources of heterogeneity in preferences were investigated by estimating the effect of socio-economic and technical factors on preferences for the Status Quo. The result shows that farmers who were exercising their activities for over than 30 years were more likely to choose the Status Quo. This finding is related to the fact that AES implies for the concerned farmers a considerable change. Moreover, the variable indicating a high risk aversion –

RiskAv - of farmers is statistically significant for this category of farmers. This finding is in line with Ilbery and Bowler (1993), Bonnieux et al. (1998) and Wynn et al. (2001). Hypothesis assuming that the age is a significant variable to the extent that young farmers are more willing to take risks and are therefore more inclined to adopt AES.
Our results showed also that, farmers with greater eligible farming area (*EligSurf*) are less willing to participate, reflecting larger farm's greater specialization in cereal crops and consequently greater foregone revenue from land enrolled in AES.
Among the variables analyzed, those describing farmers' attitudes toward environmental and biodiversity preservation, to our astonishment, the respondent declaring that they are concerned about environmental issues are more likely to choose the SQ. Also the farmer's perception of whether the financial compensation fully covers the extra costs also positively affects participation, agreeing with Wossink and van Wenum's (2003) findings in a similar contingent survey.

The Table 5 presents the results for the RPL model. Only the payment attribute - Premium – is modeled as continuous variable, the four other variables, *LandFlex, CollecPart, TechSupp and FixPrem*, are modeled as effect-codded variables.

Table 5 - The RPL model estimations

	Coefficient	*Standard error*	*P-value*
Mean values			
ASC_{SQ}	5.33	0.166	0.000
LandFlex	1.132	0.245	0.000
CollecPart	0.675	0.315	0.001
TechSupp	0.567	0.023	0.000
FixPrem	0.987	0.089	0.001
Premium			
Standard deviations			
LandFlex	1.653	0.254	0.000
CollecPart	1.257	0.165	0.000
TechSupp	0.689	0.268	0.015
FixPrem	1.10	0.265	0.000
Covariates (Socio-economic, environmental attitude, technical variables)			
ASCSQ x Activ30	0.010	0.005	0.000
ASC X RiskAver	0.987	0.642	0.098
ASCSQ X EligSurf	1.653	0.918	0.072
ASCSQ x Biodiv	0.212	0.058	0.008
Log-likehood (β)	-1318.355		
Log-likehood (β_0)	-978.878		
Chi-2 (p-value)	6987.700 (0.000)		
Pseudo-R^2	0.4987		
Number of observations	97		

Activ30 : Farmers that started their farming activities over 30 years ago
EligSurf: Eligible surface of the farm land (hectare)
RiskAver: Risk aversion of the farmer (1 if yes)
Biodiv: Farmers' environmental awareness – Biodiversity preservation concerns (1 if yes)

Financial willingness to accept estimates

Welfare measures can be determined in the form of financial willingness to pay WTP / willingness to accept (WTA). Thus we should estimate the marginal rate of substitution between the changes in an attribute under consideration and the marginal utility of income

represented by the coefficient of the payment attribute which is assumed constant (Hensher and Green, 2003).

Table 6 reports the marginal WTA values for each of the attributes estimated in the previous model using the Wald procedure (Delta method). The Delta method stipulates that the WTA for a unit change of a given attribute can be computed as the marginal rate of substitution between the quantity expressed by the attribute in question and the payment attribute (Louviere et al., 2000). Since utilities are modeled as linear functions of the attributes, the marginal rate of substitution between two attributes is the ratio between the coefficients (as all the attributes are normally distributed and the payment level is fixed, the WTA payments are also normally distributed).

Table 6 - WTA Estimates in € / hectare in the RPL model

Attributes	Mean	Standard Error
LandFlex	28.3	2.33
CollecPart	17.6	4.65
TechSupp	14.3	3.27
FixPrem	46.3	5.36

As showed by the previous table the WTA payment for the *LandFlex* attribute in farmers' sample means that if the AES requires enrolment of 50% of the eligible area (as opposed to no fixed requirement), farmers require an extra 28.3 € ⁄ ha to participate. Alternatively, farmers would be willing to participate in the non-fixed enrollment AES for a premium reduced by this amount provided that they have flexibility on the amount of land to be enrolled.

Also, we can notice that farmers are willing to participate with lower compensation payment if measure are accompanied by technical support and advisory services. This reduction in compensation payment is close to 15€/hectare.

Farmers' heterogeneity is also reflected by attribute ranking the fixed premium of 1000 euro the first year seems to be the most important factor. When this fixed premium is introduced, public expenditure in year one is increased by 1000 euro per contract signed. Indeed the existence of fixed cost not covered the first year discourage farmers of grasslands restoration.

5. Concluding remark and discussion

The main objective of this study is to investigate the role the design of AES can have on encouraging farmers to participate to the specific schemes of grassland restoration in the Normandy region in France. This was achieved by using a choice experiment to investigate farmers' preference and motivations for various important component of AES design. Our main objective were to explore the conditions to put in place for farmer to encourage them to dedicate more area of their plot to grassland restoration. This work was also an attempt to evaluate the willingness to pays or to accept to change their actual practice.

The specific case of changes regarding the grassland restoration remains almost non-existent in the literature. Our contribution can remedy this gap by including beside the financial attributes other attributes regarding the technical support, collective participation,

and land enrollment. Indeed, technical support and financial support are two factors that can drastically affect the farmers' decision to join an agri-environmental scheme. In particular, farmers concerned by our research looked positively to the collective participation with other farmers of the municipality. Also, our results showed how personal attitudes towards biodiversity preservation do not often guide the farmer's decision to join an agro-environmental scheme aiming grassland preservation and restoration. The financial component remains the main guideline of farmers' reasoning and choice behavior.

We can understand that changes in grassland restoration, and abandoning more profitable cropping system can affect the farmer's revenues. Our results suggest that, in general farmers prefer greater flexibility over area of land to be enrolled on a scheme. In addition, they have preference for a fixed payment to access to compulsory technical advisory service. Regarding the socioeconomic variables that are significant for farmer choices, farmers already enrolled in a AES are more willing to participate in the proposed AES alternatives therefore there is a possible improvement in the actual scheme attributes. The fact that the farmers are not expecting to leave their activities in a near future, also appeared to be critical in the decision regarding the status quo choice over the presented AES attributes.

The results show that farmers who are willing to leave their farming activities in a near future have lower utility for enrolling in AES than those who expect to continue their activities for a longer period. Indeed traditional farming practices have been preferred by farmers close to retiring (Drake et al., 1999). For this category of farmers, the fixed payment could be an incentive to overcome the fixed initial coast could be an incentive to overcome the fixed initial costs associated with the scheme enrollment (transaction and investment costs).

In this context, the paper considers how the design the design of agri-environmental schemes may be adopted to improve delivery of a range of ecosystem services. In part, theses question was treated by scientific and researcher as a natural science question of developing an adequate evidence base about the effect of farm land management on ecosystem functions and services at different scale: plot, landscape, etc; and different contexts. However, it is also a social science issue understanding how farmers are likely to react to incentives and identifying appropriate institutional mechanisms that addresses both fairness and efficiency objectives.

To do this future agri-environmental schemes for grassland restoration in the Normandy region could more explicitly link and spatially target incentive to restore grassland on their farm land and facilitate collaboration between farmers and local authority.

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