Farmers' preferences for grassland restoration: Evidence from France

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Paper prepared for presentation at the 172nd EAAE Seminar *'Agricultural policy for the environment or environmental policy for agriculture?'*

May 28-29, 2019.

Brussels.

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Abstract

Grasslands are a crucial component of the agricultural landscape of most French regions. They contribute to human well-being through the provision of a wide range of ecosystem services such as ruminantfeeding. In this way, they have an impact upon the quality of animal production. Grasslands also support biodiversity conservation by promoting pollination, climate regulation, water quality regulation, landscape quality, etc. Despite these multiple benefits, grassland areas have been rapidly and constantly shrinking over the last 50 years in the face ofthe extension of forage corn considered a more profitable crop. Agri-environmental schemes (AES) have been identified to date as playing a pivotal role in the promotion of a more sustainable and environmentally friendly agricultural practices within the European Union. In this paper, through the application of the Choice Experiment (CE) method, we intend to analyze the factors that influence farmers' preferences and motivations to join or not an AES involving grasslands restoration in Normandy. We estimate the relative weight of these factors, and we evaluate the willingness to accept changes related to each factor. In addition to the evaluation of the financial contribution, our objective lies in highlighting the role of the collective participation, the technical support and the area of the farm enrolled in the AES. Hence, our study contributes to a better understanding of factors that might alter famers' behaviour towards new restoration practices. Potential policy implications that emerged from our data are briefly discussed.

Keywords: Agri-environmental scheme, farmers, grassland restoration, choice experiment.

Introduction

For manycenturies, humans have maintained grasslands by grazing and mowing, creating a unique habitat type containing very high plant diversity (Habel et al., 2013; Kull and Zobel, 1991; Wilson et al., 2012). However, due to agricultural intensification and land-use changes, extensive areas of grasslands have been abandoned (Hansson and Fogelfors, 2000; Stoate et al., 2009; Willems and Bik, 1998) or transformed into arable land or forest plantations (Cousins, 2009; Fuller, 1987; Pärtel et al., 1999; Poschlod and Wallis De Vries, 2002). Practical solutions for integrating agricultural development and conservation of biodiversity scale remain to be found in order to mitigate the steadily increasing loss of these areas. The European Union has a goal to restore 15% of the degraded ecosystems and their services by 2020. However, the management of these areas depends on farmers willingness to restore them.

Agri-environmental schemes (AESs) stand out as one of the most critical Common Agricultural Policy (CAP) tools to foster biodiversity conservation in agroecosystems. In thisrespect, farmers are offered a financial incentive aimed atpromoting continued sustainable management (Roellig et al., 2016; Sandberg and Jakobsson, 2018). These schemes are multiannual and may act as an incentive for farmers to provide and enhance environmental public good. The level of payment depends on the activities undertaken and the potential of the agricultural production of the land.Moreover,, it is by considering forgone income and the additional costs associated with the requirement of the scheme (Espinosa-Goded et al., 2010). Furthermore, a fundamental principle of AESs is that participation is voluntary (European Commission, 2005, European Court of Auditors, 2011). Afarmer's willingness to participate is critical to achieving common policy objectives (Wilson, 1996; Espinosa-Goded et al., 2010). In the specific case of grasslands

conservation, the previoustwo CAP reforms (2007-2013 and 2014-2022) have proposed financial compensation that does not provide sufficient incentives for farmers to change their behavior toward more sustainable agricultural practices. Thisexplains the lack of participation in this field. To the best of our knowledge, few researchers have addressed the design of the AES concerning permanent grassland maintenance and the measurable attributes, in particular those which can help to design AESs.

Our work contributes to the understanding of this issue by exploring farmers' preferences for grasslands restoration. By using a quantitative approach, we aim to estimate the relative weight of various decision factors and to provide farmers' willingness to accept (WTA) changes in these factors. Our methodology is based on non-market valuation (Adamowicz et al., 1998) using a Choice Experiment (CE) recognized as a stated preference method in which people are asked to state values for items that are not traded in the market (Ciariacy-Wantrup, 1947). It should be pointed out that in the last decade, the CE method has been implemented to examine and understand the demand forquality changes in the environmental attributes in 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 remains rare (Peterson et al., 2007, Roessler et al., 2007; Birol et al., 2006). Few recent works have applied the CE approach, for example Espinoza-Godded et al. (2009) and Peterson et al. (2011) while there has been considerable research interest in identifying the factors that influence participation (Siebert et al., 2006). These authors have intended to analyze farmers' preferences for key elements of the design of agri-environmental schemes (AESs),. Other works have applied the CE method in order to understand farmers' preferences for the adoption of environmentally friendly practices, independently of any subscription to an agri-environmental contract (Jaeck and Lifran, 2014; Birol et al., 2006; Vidogbena et al., 2015).

In general, the literature highlights that the economic rewards are still the primary motivation for most farmers (Burton et al., 2008; Home et al., 2014; Roellig et al., 2016; Siebert et al., 2006). Furthermore, lack of influence on following commitment and the potential administrative burden are two major components of farmers' decision to change their practices. Only very few studieshave investigatedthe role of risk in farmers' choices. Revenue loss is a major factor that can have an extreme effect onfarmers' practices (Cheze et al., 2017). In particular, a choice to give up or to limit the extension of areas dedicated to financially profitable cropping systems such as forage corn and wheat, and to foster grassland restoration can have significant impacts on the stability of the farmer revenues.

As far as we are aware the first study that demonstrates how discrete choice experiment survey methods can be used to estimate the willingness to pay (WTP) for different attributes of restored grassland ecosystem was published in 2014 by Sahan et al. This study may guide public decision for ecosystem restoration Besides, one of the existing studies on the AES concerning permanent grassland maintenance focuses only on result-based agri-environment measures in Germany (Russi et al., 2016 reference). This type of measure requires that farmers are eligible for payment only if they have achieved certain environmental objectives. In contrast to this study we focus on action-based agri-environment measures which exist in Normandy.

Moreover, to the best of our knowledge, our study is the first application in which farmers' willingness to accept and to pay – decision – to joinan AES regarding the restoration grasslands on their farm-land in Normandy.

Firstly, section 2 describes our method, the survey design, and the data collection. Then, in section 3, we present an econometric model related to the CE approach. Section 4 presents the main results and their interpretation. Concluding remarks and discussion are presented in section 5.

Method

The Choice Experiment Approach

The choice experiment (CE) approach relies on the economic theory of consumer choice and non-market valuation. In a CE survey, respondents have to make choices between several scenarios defined by their attributes (i.e. fundamental characteristics of the respondents' situation). Several choice sets are typically presented to respondents, each composed of three options: the situation if nothing is changed (i.e. the status quo) and two fictional options (Cheze et al. 2017). The questionnaire must describe the type and the extent of potential change for each valuation option, using language that is accurate and clear. Scenario description also requires information on the mechanism that will generate the changes to be evaluated by farmers. Farmers then choose their favorite option amongst these three. An option is defined by a set of attributes taking different values according to the option. One of these attributes usually represents the monetary reward thatrespondents may receive. Other attributes can include environmental or social implications for the considered issue (Louviere et al. 2000). The econometric basis of the approach lies in Random Utility Theory (McFadden, 1974). CE is suitable to measure the marginal value of the attributes of a good or a policy instrument (Rutto and Garrod, 2009), with the underlying assumption being that farmers' choices among voluntary policy schemes depend on the specific consisdered attribute – of these schemes (Christensen et al., 2011). In the case where one of these attributes is financial (cost or price), the marginal rate of substitution could be interpreted as a willingness to pay or a willingness to accept changes in levels of attributes. The use of this approach to support policy-making, particularly with respect to AES design, has sharply increased during the last decade. (Villanueva et al., 2015).

Case study attributes and levels

Grasslands are an essential component of French agricultural landscapes (Puyderieux and Devaux, 2013). In Normandy, these areas cover 1 million hectares (around 35% of the regional territory) (Atlas Agricole 2015). Their pictures are often selected to be used for advertisements to illustrate the quality of food products. In this way, these products are usually associated with the serenity and tranquilityof these landscapes. Despite being public goods with multiple benefits, Normandy's grassland areas are continuously shrinking. Over the last 50 years areas of alluvial grasslands have been transformed into croplands, and therefore, permanent grassland areas have continued to decline in the faceof the expansion of crops considered to be more financially appealing such as sweet corn. Indeed, since2016, the region has not been respecting its obligations in terms of maintaining and preserving grassland. The annual ratio of permanent grasslands has deteriorated by 3 % compared to the national reference ratio i.e., 2.5%, using 2012 as a baseline year. This land use change has several negative consequences on the ecosystem services. Ecologists and conservation biologists are engaged in restoring grassland habitats to protect endangered flora and fauna. Restoration ecologists can structure the restoration in order to emphasize particular attributes in restored ecosystems, but until now only the physical, biological, and ecological sciences contribute to the scientific knowledge of grassland ecosystem restoration (Hatch et al. 1999; Howe and Brown 1999; Fletcher and Koford 2002; Martin, Moloney, and Wilsey 2005; Martin and Wilsey 2006).

From a policy-making point of view, the most recent CAP reform (2015-2020) introduced the AES grazing systems that aimed at promoting agricultural productions committed to the conservation of grassland biodiversity. The main characteristics of the AES include requirements such as the maintenance of a grassland surface rate superior or equal to 80%, the absence of phytosanitary treatment, the maintenance

of an ecological focus area on all the grassland, as well as the financial compensation of 80 € per hectare enrolled in grasslands preservation per year (with a limit set to 7600 € per year).
Today, this AES has proved to be ineffective from a financial point of view to encourage farmers to engage actions and favor more grass on their land. Thus, it is reasonable to focus on securing revenue while designing the AES. However, It is also essential to consider farmers' response to incentives, assessing demand and supply for ecosystem services, and identifying appropriate institutional mechanism that address both fairness and efficiency objectives (Glenketal.,2014; Martin Ortega et al.,2014).
In any case, the level of production of ecosystem services derived from grassland preservation in the agricultural system depends on the area covered by the grass. Accordingly, the area covered by permanent or temporary grasslands is a related attribute included in the CE. Two levels are considered for the *land flexibility* attribute (LandFlex): the farms choose freely the amount of the area to be enrolled in grassland preservation or the farmers choose to enroll at least 50% of his farmland in grassland preservation (see Table 1). Furthermore, the CE implementation also includes three policy design attributes: collective participation, technical support and a fixed premium allocation.
Concerning the 'collective participation' attribute (CollecPart), the two established levels are straightforward, that is collective and individual participation. To define the collective participation, we have followed the study by Villanueva et al. (2015) who have defined the collective participation in an AES as a group of at least three farmers whose farms are in the same municipality and who sign the same AES contract. The three -farmer threshold was chosen in order to avoid farmers' negative perceptions of large groups. It was explained to farmers that they could freely create the group with those whom they trust the most. it was also specified that if a farmer of the collective was monitored and found not to comply with the scheme requirements, in addition to regular sanctions being imposed on that farmer (calculated, as per usual, according to the nature and gravity of the infringement), the other farmers in the collective would be monitored to ensure their compliance with requirements.
Regarding the 'availability of free technical support and advisory service' attribute (TechSupp) two levels were set for farmers who accept the technical support – Yes – and those who refuse it – No. Concerning the '*Fixed Premium' attribute,* the levels were set based on the estimated fixed costs involved ias a result of) the change of cropping practices during the first year of the contract (Ducos et al., 2009). Farmers who choose to benefit from the availability of a 1000 € fixed premium paid during the first year per signed contract and independently of the amount of enrolled area – yes – or No.
The last attribute, 'premium level per hectare and per year' (Premium) is the payment attribute included in the analysis to derive the willingness to accept of farmers associated with each studied attribute. The first levels was sent according to the current payment scheme as mentioned above – 80 € per hectare and per year – and it is considered as a minimum level. The two other levels 100€/ hectare and 120€ / hectare were set in line with this payment.
Lastly, it is worth mentioning that other policy design attributes were not considered explicitly in this choice experiment design. the contract length of the AES was set at 5 year with no exit option available.

Table 1 - AES attributes and levels used in the CE design

Attributes	Description	Levels	Coding
LandFlex	Flexibility in deciding on the area of the land to be enrolled in the AES	Free 50 of the farmlands	1 0
CollecPart	Collective participation: Participation of a group of farmers (at least 3) whose farms are 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 € payment per contract independently of the enrolled area paid during the first year	Yes No	1 0
Premium	Payment level per hectare and per year	80 €/ha 100 €/ha 120 €/ha	80 100 120

Experimental design and data collection

Considering the number of attributes and levels, many AES profiles can be constructed – 240 profiles resulting in 2910 combinations for a two-option choice set design. Choice set was presented, and farmers were asked to choose between two alternatives, in addition to a possible no-choice (*Statut Quo* or *SQ*) option under which the farmer choose to continue with his current practices.

A specific questionnaire was designed and tested to implement an *ad hoc* survey including six sets of questions. 1. Structural characteristics of the farm (farm size, cropping systems, animal husbandry practices, income, working force…) 2. characteristics of the farmers (gender, age, education); 3. knowledge, attitude and perception toward overall environmental issues related to agriculture (biodiversity loss, commitments for biodiversity preservation, the urgent need to act…etc.) 4. Knowledge about grasslands features (ecosystem services provided, financial added value, farmers, etc.) 5. Knowledge, attitude and perception toward AES in grassland preservation and 6. choice set as shown in Appendix A.

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

Model specification model: The Random Parameter Logit (RPL) Model

The choice experiment method is based on Lancaster's consumer theory which argues that individuals' consumption decisions are derived from the utility or the value of the goods' attributes being consumed (Lancaster, 1966). The econometric foundation of this approach lies on the framework of the random utility theory (McFadden, 1974). Different econometric models are used to analyze the discrete choice data, depending on the assumption related to the unobserved components of the random utility. Statistical analyses of the obtained responses from the choice experiment can be used to derive the

marginal values for attributes of a good or policy (Heyne et al., 2008). According to Lancaster's theory, the value of a good consists of the sum of the value of all its characteristics or attributes. By applying this theory to a choice experiment approach, we assume that each attribute is associated with a utility level and that (the indirect) utility of each respondent *n* for an alternative *i* in a choice set *C*, $V_{n,i}$, is derived from its *K* attributes, that is the sum of its utilities obtained from each of the *K* attributes.

Globally, the representative utility of an alternative *i* for respondent *n* is specified as a linear-in parameter function:

$$V_{n,i} = V(X_i, Z_n) = \sum_{k=1}^{K} \beta_{ik} x_{ik} + \sum_{a=1}^{A} \alpha_{an} z_{an} \forall n \in \{1,.....,N\}; \forall i \in \{1,.....,I\} \quad (1)$$

At this stage McFadden (1974) makes an assumption that individuals make choices according to a deterministic component along with some degree of randomness. By combining both theories: Lancaster (1966) and McFadden (1974), we suppose that the i-th alternative for each individual n - $U_{n,i}$ integrates a deterministic component, $V_{n,i} = V(X_i, Z_n)$ and a stochastic element $\varepsilon_{n,1}$

$$U_{n,i} = V(X_i, Z_n) + \varepsilon_{n,i} \quad (2)$$

The error term $\varepsilon_{n,i}$ is a random variable that captures the unsystematic and unobservable random elements of individual's choice (Hanley et al., 2005; Louvière et al., 2000). Assuming individual rationality, respondents are supposed to associate each alternative *i* with a utility level of i - $U_{n,i}$; and choose the option that provides them with the greatest utility level. An individual *n* will choose an alternative *i* from a finite set of alternatives C if its indirect utility of *i*, $U_{n,i}$, is greater than the indirect utility she/he could have obtained from any other alternative *j*, $U_{n,j}$:

$$U_{n,i} > U_{n,j} \Rightarrow V_{n,i} + \varepsilon_{n,i} > V_{n,j} + \varepsilon_{n,j} \forall j \neq i; i, j \in C \quad (3)$$

Furthermore, the probability that an individual chooses alternative *i*, is the same as the probability that the utility of the alternative *i* is higher than the utility of any other alternative of the choice set (Adamowicz et al., 1998). According to Train (2009), the probability that an individual *n* chooses alternative *i* in a choice set *C* is:

$$P_{n,j} = P\{U_{n,i} > U_{n,j} \forall j \neq i; i, j \in C\} (4)$$
$$\Rightarrow P_{n,j} = \{V_{n,i} + \varepsilon_{n,i} > V_{n,j} + \varepsilon_{n,j} \forall j \neq i; i, j \in C\} (5)$$
$$\Rightarrow P_{n,j} = \{\varepsilon_{n,j} < V_{n,i} - V_{n,j} + \varepsilon_{n,i} \forall j \neq i; i, j \in C\} (6)$$

Different discrete choice models are obtained from different assumptions of the random terms.The *Random Parameter Logit* – RPL - (McFadden and Train, 2000; Train, 2000) also called the mixed logit model was chosen because of its usefulness to overcome many drawbacks that can be found with other models like the conditional logit model. In particular, this model is used to solve issues related to the variation of preferences amongst respondents – βs are not considered to be fixed (Train, 2003). This model solves accurately the problem related to the independence of irrelevant alternatives and uncorrelated unobserved components hypotheses. Indeed, in this model the parameters β can vary across respondents, only their distribution needs to be known. For a given β we can define the logit probability as follows:

$$L_{n,i}(\beta) = \frac{e^{V_{n,i}(\beta)}}{\sum_j e^{V_{n,j}(\beta)}} \quad (7)$$

If *f(β)* is the density function describing the distribution of individual preferences, then the probability is:

$$P_{n,j} = \int L_{n,i}(\beta) f(\beta) d\beta \quad (8)$$

As explained above, in the parameter logit model, the random utility of the *i*-th alternative for each individual is composed of a deterministic component $V_{n;i} = V(X_i;Z_n)$, and a stochastic component $\varepsilon_{n,1.}$

Moreover, heterogeneity of farmers can be investigated by integrating individual specific characteristics with attributes or alternative specific constants (ASC). We apply an error component random parameter logit (EC_RPL) approach to account for correlation between utilities from different alternatives.

Indeed, the EC_RPL model is a special case of the RPL model in which a random error component is used in addition to other random parameters to identify correlations between utilities from different alternatives on the one hand, and to identify correlation between the non-Status Quo options on the other hand.

We include an *alternative specific constant* (ASC) in order to capture the effect of potential 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'"*

The ASC determines the 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*". A statistically significant ASC would mean a high preference for no preferences for grassland restoration. It will indicate the existence of some omitted variables with a positive effect on farmers' utility of keeping their current farming practices.

As the Status Quo was defined as a current form of agricultural practices, we have to specify different ASC for the AES participation (farmers who have already subscribed in the AES) and non-participation. The utility function can be specified as:

$$U = \beta'\gamma + \mu_{Non-SQ} + \varepsilon \quad (9)$$

$$U_{SQ} = ASC_{SQ-NonPar} + ASC_{SQ-Par} + \beta'\gamma + \delta_{NonPar}\, S + \delta_{NonPar}\, S + \varepsilon \quad (10)$$

wheere $ASC_{SQ-NonPar}$ and ASC_{SQ-Par} are the non-random Status-Quo alternative specific intercepts for non-participants and participants respectively; γ is the vector of AES attributes, μ_{Non-SQ} is the error component which identifies correlation between the non-Status Quo options and it is assumed to be normally distributed $\mu_{Non-SQ} \sim N(0, \sigma^2)$.

The coefficient vector β_i represents individual tastes – preferences and it- is unobserved and varies randomly across the population; and δ_{NonPar} and δ_{NonPar} capture systematic preference heterogeneity

as a function of farmers' socio-economic and farm characteristics (i.e.., the interaction effects with the $ASC_{SQ-NonPar}$ and ASC_{SQ-Par} ,respectively.

The random term ε is the Gumbel-distributed error that is specified to be the same for all choices made by the same individual (panel structure). This breaks away from the assumption of independence in the error structure across choices made by the same respondent (Scarpa et al., 2005)

Results and interpretation

The aim of our research is to analyze farmers' motivations and current incentives for the restoration of grassland. we also intend to estimate the monetary value associated with different components of farmers decisions. The discreet choice experiment has been conducted. In total, 119 farmers have completed the survey. Participants 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). Then, we will present our estimates of the econometric model: The random parameter logit (RPL)

Some basic statistics of the questionnaire

Table 4 shows some descriptive statistics for the final sample composed of 97 observations. The respondents ages range from 36 to 64 years with an average of 49 years old. The mean of the agricultural area is about 144 hectares. Most of the farmers in our sample have acquired their land a long time ago. The installation date ranges from 6 to 64 years with an average of 35 years. The average area dedicated to crops for sale purposes is about 59 hectares, while the average area dedicated for permanent grassland is about 49 hectares. (there is a great disparity among farms revealed by the standard deviation (30.3). The farmers having the most area dedicated to grassland are most probably keep livestock and would further benefit from the feed provided by the grass.

Table 2– Descriptive statistics

Variable	Obs	Mean	SD	Min	Max
Age of the farmers	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

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

The Error Component RPL models results

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

Table 3 – The Error Component RPL model estimations

	Coefficient	*Standard error*	*P-value*
Mean values			
ASC_{SQ_NoPAR}	5.8	0.715	0.000
ASC_{SQ_PAR}	Ns	Ns	Ns
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	0.055	0.021	0.000
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
μ_{Non_SQ}	1.785	0.187	0.000
Covariates (Socio-economic, environmental attitude, technical variables)			
ASCSQNonPar x Activ30	0.010	0.005	0.000
ASCSQNonPar X Eligarea	1.653	0.918	0.072
ASCSQNonPar 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 more than 30 years ago
- Eligarea: Eligible area of the farm land (hectare)
- Biodiv: Farmers' environmental awareness – Biodiversity preservation concerns (1 if yes)

All the attributes of the options presented are statistically 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 (FixPrem) attribute. 30% exhibit a positive preference regarding the flexibility of the areas enrolled in grasslands restoration (LandFlex). Furthermore, farmers who have been developing grassland on their land and have been using it for feeding the ruminants – cattles – and breeding activities pay attention to the fixed premium. One of the possible explanations is that they have not already covered the fixed costs barriers and transaction cost related to their engagement in the AES.

Additionally, sources of heterogeneity in preferences have been investigated by estimating the effect of socio-economic and technical factors on preferences for the Status Quo. The result shows that farmers who have been exercising their activities for more than 30 years are more likely to choose the Status Quo. This finding is related to the fact that AES implies a considerable change for the farmers that might be related to a reluctance effect that we can also understand as a risk aversion. This finding is in line with Ilbery and Bowler (1993), Bonnieux et al. (1998) and Wynn et al. (2001). Their hypothesis assumes 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. Furthermore, aversion to changes from the status quo is a common finding in CEs consistent with both rational choice and observed behavior theories (Dhar, 1997). Individuals tend to avoid changes in practice for several reasons misperceived as sunk costs, regret avoidance and desire for consistency (Samuelson and Zekhouser, 1998). In addition, loss aversion or asymmetric expectations of costs and benefits have also been put forward as a possible explanation for this effect (Kahnaman et al., 1991). Our results have also shown that, farmers with greater eligible farming area (*EligArea*) are less willing to participate, reflecting larger farm's specialization in cereal crops and, consequently higher foregone revenue from the land enrolled in the AES. Amongst the analyzed variables are those describing farmers' attitudes towards environmental and biodiversity issues. Unexpectedly the respondents declaring that they are concerned about environmental issues are more likely to choose the Status Quo. The farmer's perception of whether the financial compensation fully covers the extra costs also positively affects the participation.This is in line with Wossink and van Wenum's (2003) findings who used a contingent valuation method.

Willingness to accept estimates

Marginal rates of substitution between non-monetary (NM = LandFlex, CollecPart, TechSup) and the monetary attributes (ie: M =Premium) were estimated by calculating the negative ratio of the coefficient of non-monetary attribute to the coefficient of monetary attribute [$WTA_{NM} = -(\beta_{NM}/\beta_M)$]. These are also called "the implicit prices", representing the WTA for a 1% or 1 unit increase in the quantity of the attribute in question if it is quantitative (e.g. eligible area), or for a discrete change in the attribute if it is qualitative (e.g from individual to collective enrollment in the AES). We apply the Delta Method to determine analytically the variance and the standard error of WAT, which is the commonly used method in CE application (Beleimer and Rose, 2013).

Besides, to provide a broader view of the required payments for different AES scenarios and to estimate the adoption rates in terms of farmers and area, the compensating formula can be used (Hanneman, 1984):

welfare changes related to hypothetical policy options or scenarios (U1) that change several attribute levels simultaneously with respect to the status quo (U0)

$$CS = -\frac{U_0 - U_1}{\beta_M}$$

This formula reflects welfare changes related to hypothetical policy options or scenarios (U_1) that change several attribute levels simultaneously with respect to the status quo (U_0).

As Villanueva et al (2015) we have assumed linearity and separability properties in the utility function.

Table 3reports the marginal WTA values for each of the attributes estimated in the previous CR-RPL model.

Table 3 - WTA Estimates in € / hectare in the CR-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

The WTA payment for the LandFlex attribute 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 if they have flexibility in deciding on the amount of land to be enrolled. We can also notice that farmers are willing to participate with lower compensation payment if technical support and advisory services are provided. This reduction in compensation payment is around 15€/hectare. Farmers' heterogeneity is also reflected by attribute ranking of the fixed premium of 1000 euro paid during the first year. The fixed premium seems to be the most important factor. When this fixed premium is introduced, public expenditure in year one is increased by 1000 euro per signed contract. Indeed, the existence of fixed cost that is not covered over the first year discourages farmers of grasslands restoration.

Concluding remarks and discussion

The goal of this article was to investigate the heterogeneity of farmers' preferences and motivations for dedicating more area of their plot to grassland restoration and to evaluate the willingness to accept changes to their current practices.

In order to better understand the factors that affect the farmers' decision and their relative importance, we chose to apply a discrete choice experiment method. Usually, the literature reveals that the flexibility of their decision and the administrative burden are two major components of farmers' decision-making process (Defrancesco et al., 2008).

The literature on the specific land use changes related to grassland remains almost non-existent. Our contribution lies in filling this gap by including non-monetary attributes, namely the technical support, collective participation, and land enrollment in addition to the monetary attribute. Indeed, technical support and financial support are two factors that can drastically affect the farmers' decision to join an agri-environmental scheme.

Farmers involved in our research have a positive attitude towards the collective participation together with other farmers of the municipality. While transaction cost can be reduced if collective contracts are signed, in this study we have only focused on potential improvement in social engagement and interaction as a result of collective participation. This explain why our results differ from earlier studies. Several authors indicate that financial compensation can be vital for providing an incentive for farmers to participate collectively in the AES (A.J. Villanuevaa, J.A. Gómez-Limónb, M. Arriazaa, M. Rodríguez-Entrenaa, 2015). There are several possible explanations for this result. Riley et al. (2018) state that even if farmers have established collegiate relations with other farmers, certain events in the past might have brought about a change towards '*land management being depicted as a squarely individual rather than collective issue'*, p. 635. Moreover, Villanueva et al. (2015) indicate that farmers are not willing to be controlled by members of the group in addition to the administration. One of the possible policy design implications of our result in tandem with recent findings is that financial inducement might be worth

offering to increase participation in the AES. However, it is not recommendrd to impose collective contracts.

Our model provides interesting resuls, one of these is that is the farmers concerned by biodiversity preservation do not often join an agro-environmental scheme aiming the grasslands preservation and restoration. Our data showed that the financial component remains the main farmers' incentives . It seems that changes in grassland restoration, and abandonment of more profitable cropping system affecting the farmer's revenues could offset the farmers' environmental concerns This result is consistent with previous findings by Russi et al. (2016). The authors have concluded that farmers are unlikely to change their practices this would impact substantially the level of income. The evaluation study on the greening measure confirms that profitability is an important factor behind farmers' implementation choice. Moreover, the authors conclude that the pressure of increasing opportunity cost may lead to non-enrollment in the schemes despite a high level of intrinsic motivation (Alliance Environnement and the Thünen Institute, 2017). Indeed, our paper shows that environmental consideration is not the key driver behind farmers' preferences. This partially might explain our results.

The random parameter logit model results show that, in general, farmers prefer greater flexibility over the area of land that comes with enrollement in a scheme. They also have a positive preference for a fixed payment and an access to a technical advisory service. Even though the result-based agri-environment measures involve comparatively low transactions costs. Our findings support some previous studies in this area concerning the need for technical support and advisory services (Alliance Environnement and the Thünen Institute, 2017; Russi et al., 2014).

The installation date of the farm installation is also a determinant of farmers' choice to participate in a the agri-environmental scheme. The results suggest that the established farmers have lower utility for participating than new farmers. These findings could be explained by the fact that the considered AES for grassland restoration implies a significant change in farm management, as the traditional farming practices have been preferred by "old farmers" (Potter and Loblet, 1992; Drake et al., 1999).

Regarding the faremers' age and participation in the AES, our results are in line with previous researchs on the participation in the different AES in the EU. For example. Pavlis et al. (2016) have found that there is a correlation between changes in land management practices and age. These changes concern mostly young farmers. One of the possible explanations is the capacity of young farmers to gain new knowledge. Besides, the report by the European Commission (2016) demonstrates that organic farmers in the EU are, on average, younger than conventional farmers. These result show that farmers' characteristics explain their decisions to participate in the AES. Additional measures can be recommended in order to encourage established farmers.

Several studies have shown that the key factors determining long-term success in agri-environemental payment are effecient planning, participation and communication of a long-term monitoring (Burke and Mitchell, 2007). Moreover, the existence of farmers' preferences and motivations heterogeneity should be considered in the design of successful agri-environmental schemes towards grasslands restoration. Future research ought to compare the marginal cost of technical advisory services and the fixed payment provisions with the farmers' implicit price for these services to see whether net benefits would be derived from this new institutional arrangement. We are aware that our research may have some limitations. One of the possible limitations is the sample size. Our results can be validated by a larger sample size. Despite this we believe that our study could improve the knowledge about factors that influence farmers decisions on grassland restoration in Normandy and that this approach can be further applied to study the willingness to accept to change in land management practices.

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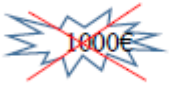
Annex A

	Mesure A	Mesure B	Mesure C	Je conserve mes pratiques actuelles
% de terre engagée				
Participation collective (minimum 3 personnes)				
Support technique	**Non**	**Non**	**Oui**	
Bonus premium la première année				
Montant d'aide pour la remise en herbe	80€/ha/an	100€/ha/an	120€/ha/an	