



**HAL**  
open science

## Challenges of achieving biodiversity offsetting through agri-environmental schemes : evidence from an empirical study in Southern France.

Philippe Le Coent, Coralie Calvet, Claude Napoleone, Fabien Quétie

### ► To cite this version:

Philippe Le Coent, Coralie Calvet, Claude Napoleone, Fabien Quétie. Challenges of achieving biodiversity offsetting through agri-environmental schemes : evidence from an empirical study in Southern France.. [University works] auto-saisine. 2017, 50 p. hal-01606297

**HAL Id: hal-01606297**

**<https://hal.science/hal-01606297>**

Submitted on 5 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - ShareAlike 4.0 International License

# Challenges of achieving biodiversity offset outcomes through agri-environmental schemes: evidence from an empirical study in Southern France

**Authorship:** Coralie Calvet<sup>1\*</sup>, Philippe Le Coënt<sup>1</sup>, Claude Napoleone<sup>2</sup>, Fabien Quétier<sup>3</sup>,

<sup>1</sup> Université Montpellier, UMR5474 LAMETA, Campus SupAgro, 2 place Pierre Viala, 34060 Montpellier Cedex 2, France

<sup>2</sup> INRA-UR0767 Ecodeveloppement, Site Agroparc, Domaine St Paul, CS 40509, 84914 Avignon, Cedex 09, France

<sup>3</sup> Biotope, BP58, 22 Boulevard Foch, 34140 Mèze, France

\* Author to whom correspondence should be addressed; E-Mail: coralie.calvet@inra.fr.

## Abstract

Environmental policies increasingly refer to biodiversity offsets (BO) as a way to slow or halt biodiversity losses caused by development projects, including infrastructure and urban development, that could not be avoided or minimized through adequate mitigation. In many cases, ecological gains for offsets are obtained through restoration activities conducted on ecologically degraded land, including agricultural land specifically acquired for this purpose by developers. This leads to competition with other land-uses and social conflicts over land availability. The purpose of this paper is to analyse the opportunity of implementing biodiversity offsets by involving farmers in producing ecological gains through contracts akin to agri-environmental schemes, we call Agri-environmental Biodiversity Offsets Schemes (ABOS). Using actual offsets designed and implemented for a new railway line under construction in Southern France, this paper examines (1) the acceptability of ABOS contracts by farmers, and (2) the effectiveness of ABOS design and actual implementation. A survey carried out with 145 farmers reveals that the main determinants of acceptability are: i) usual economic factors whereby farmers with lowest compliance levels and opportunity costs, as well as farms facing economic difficulty, are more likely to engage, and ii) social factors, such as the importance given to other farmers' decision to engage and the perception of the position of farming organisations (peer pressure). In terms of effectiveness, ABOS is shown to be effective in meeting the legal requirements of the developer, but concerns are raised about additionality and long-term duration of actions, and about non-compliance with contract requirements. We particularly highlight problems with contract enforcement – especially due to weak sanctions and monitoring – and farmers' selection that do not allow minimizing moral hazard and adverse selection which are inherently attached to agri-environmental schemes. We suggest policy improvements and research perspectives to enhance the implementation of offsets through ABOS. Overall, with current implementation arrangements, this analysis leads us to question the use of ABOS in meeting BO objectives.

## Keywords

Agri-environmental schemes; Biodiversity offsets; Conservation; No Net Loss Policies; Behavioral Economics

## 1. Introduction

Biodiversity offsetting (henceforth BO) is increasingly used in environmental policies as a way to halt or slow biodiversity losses caused by the development of infrastructure and urbanization, regarded as one of the major threats on biodiversity due to the species' habitat destruction and fragmentation (Davenport and Davenport, 2006; Quintero and Mathur, 2011). The principle of BO is to achieve a "No Net Loss" (henceforth NNL) of biodiversity by providing ecological gains at least equivalent to residual losses (Bull et al., 2013a). In many countries, as a regulatory requirement, BO is incorporated in a mitigation hierarchy aimed at first avoiding and minimizing residual losses, and then, in a last resort, offsetting residual impacts on biodiversity. BO requirements appeared in environmental legislations of many countries in the 1970s, but they were rarely implemented in practice (McKenney and Kiesecker, 2010; Quétier et al., 2014). Recent regulatory developments and European or international initiatives to achieve NNL of biodiversity have strongly boosted the concept of BO worldwide.

Theoretically, the concept of BO offers a way to overcome the classic contradiction between economic development and biodiversity conservation. But in practice, the recent development of this principle is hampered by technical and operational problems that jeopardize its good application mainly due to problems of access to land (Jacob et al., 2014). In European countries, particularly in France where agriculture occupies a large share of non-urban land, the implementation of biodiversity offsets faces difficulties in finding and acquiring land (Etrillard and Pech, 2015). This leads to conflicts, especially with farmers who try to maintain their activity in this fast-moving environment. In this context, implementing BO objectives through the acquisition of agricultural land is often seen as a major challenge to BO feasibility. Similar challenges are raised in many countries, where BO lead to restrictions on land uses and access to natural resources by local communities.

A possible way out of this problematic situation is to make the implementation of BO compatible with agriculture by involving farmers in BO schemes. The idea is to implement biodiversity offsets through voluntary agri-environmental contracts which we call Agri-environmental Biodiversity Offsets Schemes (ABOS). Indeed, compared to land acquisition by a developer, which is commonly used in BO, ABOS only requires a temporary commitment of

farmers to changing land use or adapting agricultural practices. It does not require either to cease the farming activity or to transfer land tenure rights from farmers to developers.

As compared to land acquisition, ABOS can therefore represent an opportunity for developers (and regulators) to facilitate the implementation of biodiversity offsets and reduce local conflicts. However, the use of agri-environmental schemes in the context of biodiversity offsets raises specific issues and challenges as compared to land acquisition with regard to NNL targets. A general requirement in BO is that, depending on the level of ecological losses that remain after avoiding and reducing the impact of a project, the developer is set by the State a mandatory target of ecological gains to achieve. The acquisition of land by developers provides long-term control over its use (and agricultural practices) that provides more security for the attainment of this mandatory target. However ABOS, which are voluntary short-term contracts with farmers, do not provide the same level of control.

We argue that the attainment of the BO objective of no net loss of biodiversity through ABOS, requires two conditions. The first one is the *acceptability* by farmers of ABOS contracts proposed by developers. The second one is the *performance* of ABOS contracts in terms of effectiveness. This scheme must indeed induce actual practice or land use change that lead to the expected environmental benefits and these must be sustained over time.

ABOS are similar to other contractual agreements widely used in environmental policies: Agri-Environmental Schemes (AES) and Payments for Environmental Services (PES). AES are voluntary contracts in which farmers are offered compensation payments for reducing the negative externalities of agricultural production or for producing positive externalities. AES are implemented in the Common Agriculture Policy (CAP) and are considered as the main policy instrument in the European Union to preserve biodiversity in agricultural landscapes (EEA, 2004). ABOS are a kind of AES designed for implementing BO requirements under NNL policies. ABOS can also be considered as a kind of Payment for Environmental Service (PES) in which a beneficiary (the developer) pays a provider (the farmer) for an environmental service: the compensation of residual biodiversity loss. These forms of contracts have been extensively studied in the literature, from which lessons can be drawn on the challenges of using ABOS to achieve NNL.

This article sheds light on the opportunities and limits of using ABOS in NNL policies by asking the two following research questions:

**Q1.** What are the main determinants that influence the adoption of ABOS by farmers?

**Q2.** What is the performance of ABOS to achieve biodiversity offset objectives?

To address these questions, we conduct an empirical analysis based on a case study located in Southern France. The literature on AES and PES acceptability identifies a diversity of determinants of adoption of contracts. To address our Question 1, we highlight the differences between AES/PES and ABOS and analyse in our empirical analysis whether these differences have an impact on the determinants of contract adoption. To address Question 2, we review the performance challenges faced by agri-environmental contracts in the literature and how they theoretically apply in the context of ABOS. Using a running ABOS programme as a case study, we subsequently analyse the performance of ABOS contracts through the lens of these challenges. While there is an extensive literature on PES and AES programs, to date, there has been no analysis of the use of agri-environmental contracts in the context of biodiversity offsets.

The article is organized into four main sections. First, we present the theoretical background of ABOS's challenges, in terms of acceptability and performance, which allow us to develop two research hypotheses. Then, we present the materials and method used in the empirical analysis to test the hypotheses divided into three subsections: (i) the case-study, (ii) the data collection, and (iii) the data analysis methodology. The third section presents the results of the empirical analysis and discusses these results by examining the opportunities and limits of ABOS in BO policies. The last section finally concludes on policy recommendations for ABOS implementation and research perspectives.

## **1. Background literature and research hypotheses**

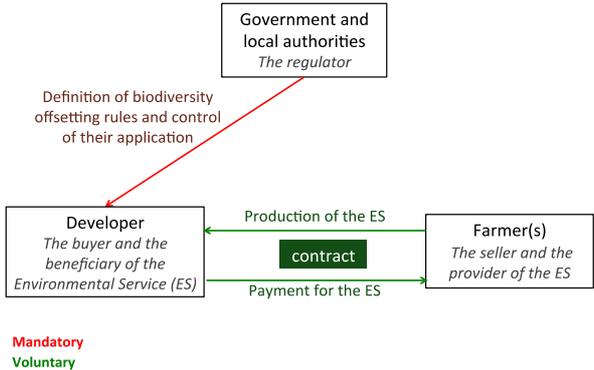
### **1.1. Definition of ABOS**

We define ABOS as one or a set of voluntary contract(s) in which a developer pays one or several farmer(s) for changing their practices to provide ecological gains that will serve to offset residual impacts of one or several development projects. Intermediaries can be involved in establishing or managing the relationship between the developer and farmers. The public

administration is typically involved in approving contracts or monitoring expected ecological gains.

BO policies generally involve a third-party transaction in which there are: 1) a buyer of an environmental service, the developer who legally must carry out biodiversity offsets to compensate for the ecological impacts he has caused, 2) a seller of the environmental service, the provider of ecological gains, and 3) a regulator who requires the purchase of offset and controls its implementation (Scemama and Levrel, 2014).

Thus, in this transaction, the farmer is the provider and the seller of the environmental service, and the developer is the beneficiary and the buyer of this environmental service used to comply with his offset requirements. The offset regulator is usually represented by two entities: at national level, by the Government that defines offset rules and requirements, and at local scale, by local authorities whose aim is to enforce environmental legislations (Figure 1).



**Figure 1.** Schematization of Agri-Biodiversity Offset Schemes (ABOS) as a transaction in biodiversity offset policies.

**1.2. Acceptability of ABOS**

The acceptability of ABOS is a key challenge because developers need to find a sufficient number of voluntary farmers and a sufficient amount of agricultural land in order to reach the legally set BO objectives. In addition, considering that contracts are usually short-term (generally 5 years), the developer must be able do this several time during the legal duration of its biodiversity offset commitments.

The acceptability by farmers of agri-environmental contracts is well documented in the literature. There is particularly an extensive literature on the determinants of farmers' participation in AES proposed in the Common Agricultural Policy (CAP). The acceptability of agri-environmental contracts is influenced by a diversity of determinants that can be classified into four main groups: (1) farmer and farm socio-economic characteristics, (2) contract characteristics, (3) payment level and transaction and implementation costs, and (4) behavioral factors (see details in Appendix 1). Acceptability of ABOS may be influenced by the same determinants but the particularities of this scheme may modulate their importance or even reverse the direction. We present in this section the main determinants that may be particularly important in ABOS adoption:

### ***Flexibility***

The flexibility of contract design is among the key factors that facilitate adoption. Contracts that are more likely to be adopted have a shorter duration (Bougherara and Ducos, 2006; Christensen et al., 2011; Louis and Rousset, 2010; Ruto and Garrod, 2009), leave more flexibility to farmers in plot selection (Bougherara and Ducos, 2006; Ruto and Garrod, 2009) and in technical prescriptions (Bougherara and Ducos, 2006; Christensen et al., 2011; Kuhfuss et al., 2014; Ruto and Garrod, 2009). Besides, easiness to withdraw from the contract is also an important criteria in farmers' participation (Christensen et al., 2011). In the CAP, contract design is generally framed by strict legislative and administrative rules limiting farmers' eligibility and leaving little flexibility for the adjustment of contracts' characteristics to specific contexts. BO programmes are generally operated at a limited geographical scale and ABOS are tailor-made according to a specific development project. ABOS are signed between farmers and a developer. Unlike classic AES, ABOS isn't bound by CAP rules that strongly constrain the flexibility of the contracting. Thus, it is expected that ABOS offer a more flexible way in the establishment of the agri-environmental contracts in accordance with offsets commitments. Likewise, due to this flexibility, contract terms will probably be more easily renegotiated in a context of environmental or farm changes. The higher flexibility offered by ABOS will likely have a positive influence on farmers' acceptability.

### ***Payment/Costs***

The relationship between costs and payment amounts is a key issue to understand the adoption of agri-environmental contracts (Brotherton, 1991; Drake et al., 1999). It is thus expected to similarly play a fundamental role for ABOS. A particularity, compared to AES, is that payments

could theoretically be freely set during the transaction between the developer and farmers. The payment can therefore result from a trade-off between the contracting parties and not be set by public institutions<sup>1</sup>. This agreement can foster the acceptability of ABOS by farmers. In addition, ABOS should generally present less administrative constraints and restrictions than AES, mainly due to simpler procedure and contract terms. This is likely to reduce transaction costs and could be therefore more easily adopted than AES.

### ***Social norms***

The role of social norms in the adoption of AES and pro-environmental practices has been recently highlighted (Kuhfuss et al., 2015). This factor may be an important determinant particularly for the adoption of ABOS and influence farmers' adoption in different ways. On the one hand, BO programmes are linked to the construction of infrastructure that may create local social and economic impacts, and may be associated with expropriation. These factors may create local resistance to any actions associated with the construction project and social pressure not to adopt ABOS. Linked to the opposition to the project itself (or to offsetting as a policy), we anticipate that social norms may modulate farmers' adoption. On the other hand, the large participation of farmers in such a large BO programme can positively influence the enrollment of other farmers in ABOS, through conformity and imitation effects.

### ***Attitude towards the environment***

This factor is one of the prominent factors that have been shown to influence adoption of agri-environmental programmes (Beedell and Rehman, 2000; Defrancesco et al., 2008; Delvaux et al., 1999; Ducos et al., 2009; Morris and Potter, 1995; Mzoughi, 2011), although this importance is debated (Lamine, 2011). Considering that in ABOS the contract is presented as a transaction between a service buyer and a seller for the compensation of biodiversity damages linked to infrastructure development project, it is likely that ABOS are not considered as environmental programmes like in AES or PES, and thus do not involve pro-environmental behaviors to the same extent. We anticipate that the attitude towards the environment may have a rather limited importance in ABOS adoption.

### ***Trust***

---

<sup>1</sup> It is to be noted that in our case study this difference was not observed because a fixed rate payment was used.

Trust between contracting partners also facilitates participation in AES by reducing transaction costs both before and during the transaction (Ducos and Dupraz, 2007; Ducos et al., 2009; Louis and Rousset, 2010; Peerlings and Polman, 2009). In Europe, AES are generally struck between farmers and the State within the CAP framework. In the context of BO, developers that offer ABOS to farmers can also come from the private sector. Establishing trust and good relationships among these new actors is therefore a key challenge for the success of BO programmes. The perception of this trust relationship by individual farmer might therefore be an important factor to predict farmers' participation.

### **1.3. Performance of ABOS**

As mentioned previously, the implementation of ABOS must respect mandatory outcomes in terms of ecological gains, which imposes a high level of effectiveness. This means that i) farmers must comply with contract requirements (*compliance*), ii) contracts must result in a real change of land use or agricultural practices (*additionality*), iii) land-use changes must actually lead to desired environmental outcomes (*link between land use and environmental outcomes*) and iv) changes must be sustained over time (*permanence*) (Bull et al., 2013b; Wunder, 2015). We describe below the main challenges that will confront ABOS in relation to these four components.

#### ***Compliance***

There is an information asymmetry between farmers and the developer in the actual implementation of actions on which they are committed. After the contract has been negotiated, it may be rational for farmers not to respect these terms (moral hazard) if the developer does not invest enough in monitoring compliance or does not impose stringent sanctions (Ferraro, 2008). The implementation of a system of monitoring and control is costly for the developer. He may therefore be tempted to implement a minimal control system that could result in very limited compliance by farmers. Whether or not regulators actually enforce offset requirements on developers will also be a major driver of developers' behaviour in this matter.

#### ***Additionality***

Additionality means that farmers not only adopt land uses or agricultural practices that are contributing to the targeted outcome but ones that they would not have adopted in the absence of ABOS (Wunder et al., 2008). Some farmers under ABOS may indeed adopt practices that

are favourable for a species or habitat, affected by a development project's residual impacts, but that farmers would have adopted anyway. This "windfall effect" should be avoided as much as possible (Chabé-Ferret and Subervie, 2013; Kuhfuss and Subervie, 2015). It does not bring ecological benefits and should not be taken into account in the estimation of NNL achievement. Additionality is a key requirement for BO (Maron et al., 2015). If pre-contract diagnosis is not done properly, selected farmers may even get paid to implement practices that they were already implementing.

In sum, information asymmetries that are inherently associated with the use of agri-environmental contracts, especially moral hazard and adverse selection, pose specific challenges for the use of this tool in BO, mainly for the issues of compliance and additionality (Ferraro, 2008).

### ***Link between land use and environmental outcomes***

Guaranteeing additionality in terms of actual land-use changes may not be sufficient to attain BO targets. It is indeed necessary that the modification of land use practices leads to the ecological gains targeted in the developer's offset commitments. Several aspects need to be considered here. First, changes in land use and practices included in ABOS requirements must actually lead to environmental benefits, which should be adequately quantified. This requires a solid understanding of the ecology of targeted species or habitats. Second spatial coordination may also be required in order to achieve ecological results. For some species, the spatial configuration of habitats is essential (Forman, 1995) and landscape-level approaches need to be included in contracts to achieve improvements in the conservation status (Goldman et al., 2007).

### ***Permanence***

According to the CAP objectives, AES are supposed to help farmers to sustainably adopt pro-environmental practices. But in practice, many farmers do not maintain their practices when the contract ends (Kuhfuss et al, 2015). In the case of ABOS, the main goal is to avoid no net loss of biodiversity. This implies that irreversible losses caused by development projects have to be offset by long-term ecological gains. Likewise, ecological measures usually require significant amounts of time to have significant and visible effects on species. There is therefore a major issue of maintenance of the ecological gains provided by farmers' practices in ABOS. One option could be to offer long-term contracts to farmers (20 years for example, or more) however the literature shows that contracts with long duration are generally not well accepted by farmers

(Bougherara and Ducos, 2006; Christensen et al., 2011; Ruto and Garrod, 2009). For instance, this solution has been rejected in our case study in which 5 year contracts have been offered. This permanence issue therefore implies either that the land-use modifications required in contracts are maintained after the term or that new contracts are periodically being signed with farmers for as long as the ecological impact of the infrastructure remains.

#### **1.4. Research hypotheses**

Based on this literature review, this article explores two hypotheses:

**H1.** Determinants of adoption of ABOS differ from the ones of AES: it is likely that ABOS are more easily adopted due to higher flexibility and limited transaction costs. Social norms and trust may have an important role but that could be either positive or negative. Finally, we anticipate that the attitude towards the environment may not facilitate adoption in ABOS.

**H2.** Information asymmetries associated with agri-environmental contracts limit the performance of ABOS: issues of compliance, additionality and permanence put at risk the achievement of BO objectives through ABOS compared with land acquisition.

## **2. Materials and methods**

In this section, we describe the methodology we have used to analyse our case study. We first present the case study and then we define how we analyse the two main issues of acceptability and performance of ABOS.

### **2.1. Presentation of the case study**

We examine the use of ABOS for the implementation of a part of the biodiversity offsets required to compensate the ecological impact of building and operating a 80 km long mixed high-speed railway line between Nîmes and Montpellier, in Southern France. This project, named “Contournement Nîmes-Montpellier” (henceforth CNM project), was initiated in 2000 and in 2012, the construction and maintenance (25 years) was delegated to a private consortium named “Oc’Via”, including the responsibility for the project’s impacts on biodiversity.

Due to the size and location of the CNM project, there are large ecological impacts. In particular, the railway line crosses two Natura 2000 sites designated as Special Protection Areas

under the European Habitats Directive as they harbour the largest population of Little Bustard (*Tetrax tetrax* L.) in France (Wolff, 2001a). The little bustard is a flagship species for the CNM project and its stakeholders (including the public administration) due to the significance of the impacted area on its conservation status.

To design and size the offsets required for the CNM project, a specific loss – gain metric was used which combines area and habitat quality to determine “compensation units” (CU), defined as a unit change in habitat-quality on 1 hectare. Little Bustard habitat was assessed on a scale of 0 (unfavourable habitat) to 3 (highly favourable habitat), mainly on the basis of vegetation and agricultural practices. Thus, the destruction of a hectare of highly favourable habitat is a loss of 3 CU while the restoration of a hectare of favourable habitat (rated 2) to highly favourable habitat (rated 3) is a gain of 1 CU. In this example, 3 ha would be needed to offset the loss of 1 ha of Little Bustard habitat. Other combinations are possible depending on habitat quality before and after it is affected by the project or its offsets (destruction, degradation, restoration, etc.). This was considered an innovative approach at the time, given the dominance of area-based ratios in offset practice in France. The full method is described in Oc’Via’s permit application and in Quétier et al. (2015).

The permit granted to Oc’Via requires that they offset the loss of 3279 CUs, meaning that he have to generate an extra 3279 CUs relative to a pre-impact baseline and maintain these until 2037. Most of the CUs are for agricultural habitats (95%), reflecting the types of habitats impacted and the importance given to the Little Bustard. The total amount of land required to achieve this depends on the amount of CU provided by the various land-use practices that are actually put in place and maintained by the developer. It was estimated that around 1668 hectares would have to be made more favourable for the Little Bustards, among which 500 hectares would be acquired and 1168 hectares would be contracted with farmers through ABOS. The required land for this could only be sought in specific areas in and around the Natura 2000 site.

The metric and exchange rules were developed only in 2013, several years after a significant number of farmers had been contracted to test the feasibility of ABOS to offset the expected impacts of the CNM project.

## **2.2. Presentation of the ABOS programme**

Oc'Via's ABOS programme was set-up with the assistance by an *ad hoc* consortium formed by a regional nature conservancy / land trust (*Conservatoire Régional des Espaces Naturels*), a local bird conservation group (*Centre Ornithologique du Gard*), and the Chamber of Agriculture of the Gard area (CA30), a farmers' institution at the departmental level strongly involved in the technical and administrative support to farmers. This consortium (offset consortium, henceforth) was in charge of implementing, monitoring and enforcing ABOS, under the supervision of Oc'Via. The annual budget required for the payment of all ABOS is presently of 1564 M€.

The offset consortium defined and proposed a catalogue of 11 agri-environmental measures as possible ABOS contracts. ABOS payments are based on a fixed rate calculated based on average income foregone and additional costs tied to the implementation of the contract, and not negotiated between the parties to the transaction. This agreement, imposed by the local administration and promoted by farmers through the CA30, was set up to avoid excessive competition with other agri-environmental schemes, including AES and the needs of other developers with projects in the area.

In 2010, the offset consortium offered farmers the opportunity to participate in ABOS by sending a letter to 1100 farmers. The programme was opened to farmers for whom farming was their main or secondary activity, with no age restriction, and located in all the municipalities affected by the railway line. Farmers could choose the plots they volunteered to enrol in the program, and the measures they proposed to apply. The consortium received 124 propositions to participate in the offsetting program, corresponding to 2000 hectares among which they wanted to select 1150 hectares for implementing the ABOS. The consortium then set out a selection process to select the best plots to involve in ABOS based on three main criteria: the cost of the measure and an ecological rating of the plots. The ecological rating, which is different from the CU method, is a 1 to 4 score based on the location of plots (areas of known high densities of Little Bustards), plot size ("bigger is better") and the surrounding landscape (e.g. absence of hedges and nearby roads), as Little Bustards prefer large expanses of open habitat unbroken by visual obstacles. There was no clear and precise rule to select plots regarding these criteria; the selection was rather the result of a discussion between the consortium members and the buyer, Oc'Via. Following this selection process, the consortium selected 510 plots managed by 100 farmers and corresponding to 1160 ha.

In our case study, ABOS contracts have a five-year duration. Payments are given to farmers each year. The consortium set up a three-year monitoring and control plan of plots in which they are controlled without preliminary notice only once in three years. Enforcement rules are also very flexible. In case of non-compliance with requirements, farmers can receive lower payments, but no sanctions are foreseen. In case of technical problems related to the implementation of the technical specifications, farmers can renegotiate contract terms and even change measures. In worst cases, farmers can withdraw from the contract even during the contract duration. When the contract ends, farmers can decide to renew it or not on the same plots or to engage other plots. Compared to classic AES contracts, ABOS contracts are therefore much more flexible in terms of eligibility criteria, monitoring and enforcement.

### **2.3. Data collection and data analysis**

The empirical study aims both at analysing determinants of farmers' acceptability and the performance of ABOS implemented for the BO programme of the CNM project. The methods used to analyse our two hypotheses are presented below.

#### **2.3.1. Farmers' acceptability of ABOS**

- **Survey design**

The issue of the acceptability of ABOS was analyzed through a survey carried out in early 2015. The survey questionnaire was designed to determine factors that may explain two variables: i) whether farmers have adopted or not an ABOS, and ii) their intention to adopt an ABOS in the coming years. Survey questions were chosen based on factors that are considered to have an effect on the adoption of ABOS from the literature review on AES (see appendix 1 and section 2.1). The questionnaire covered the following topics: i) farmer and farm socio-economic characteristics, ii) contract flexibility, iii) transaction costs associated with the contract, iv) level of difficulty of the adoption of ABOS prescriptions, v) contract payment and their relation with costs, vi) attitude towards the environment, vii) social norms, viii) trust in the institutions involved in the contract, and ix) attitude towards BO. In most of the questions, farmers had to express their level of agreement with a statement ( "strongly disagree", "disagree", "agree", "strongly agree" or "do not know"). We deliberately avoided including a neutral point in our scales in order to prevent farmers from not expressing an opinion. The questionnaire is presented in appendix 2.

The questionnaire was designed in discussion with the stakeholders of the CNM project. It was tested in face-to face interviews with 4 farmers. The questionnaire was subsequently sent to all farmers that had been initially contacted by the Chamber of Agriculture of the Gard in 2010 when they were searching for voluntary farmers. It was sent to 1169 farmers by postal mail and by e-mail to those for which we had an e-mail address. Farmers were invited to fill the questionnaire on paper and send it back by postal mail or to fill the questionnaire directly online using *Limesurvey*. We received 39 questionnaires online and 106 questionnaires via postal mail. This 12.4% return rate is considered good for this type of survey in this field. Among the 145 questionnaires, 24 had to be discarded because they were very incompletely filled. Thus, 121 questionnaires could be analysed, among which 40 farmers had adopted the ABOS contract (henceforth referred as “adopters”) and 81 had not (henceforth referred as “non-adopters”).

- **Analysis of acceptability**

In our survey, two variables can be analyzed: the actual decision to adopt an ABOS and the intention to adopt one in coming years. The decision to adopt an ABOS was taken 5 years before the survey for most farmers, in 2010. The analysis of the determinants of adoption may therefore suffer from a strong endogeneity problem, i.e. it will not be possible to determine whether farmers adopted the ABOS because they were different or if they became different because they have adopted the ABOS. We therefore decided to focus our investigation on the intention of farmers to adopt an ABOS in the future, as we considered this to present less endogeneity issues and because the intention to perform a behavior is considered as one of the main predictors of behavior (Ajzen, 1991). It captures the motivational factors that influence behavior, in other words it is an indication of “how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior” - the stronger the intention, the more likely the behavior will be performed (Ajzen, 1991). It was evaluated through the question “Do you intend to sign an ABOS in the coming years?” with the answer options “very unlikely” “rather unlikely” “rather likely” and “very likely” (see appendix 2). This variable however suffers from the limitations and biases of all stated preferences methodologies.

In this study, intention is an ordered variable (henceforth called  $y$ ) coded from 1 to 4, however the difference between the different levels may not be constant. One option would be to turn

this scale into a binary variable but it would partially collapse the diversity of intentions among farmers. We therefore decided to analyze this diversity using an ordered logit model.

We define a latent variable  $y^*$ , which is unobservable and defined by:

$$y^* = X'\beta + \epsilon$$

where  $X$  is a vector of variables that are considered to explain the intention to adopt an ABOS. The intention  $y$  takes the value  $j$  if the latent variable is comprised between two thresholds:

$$y = j \text{ if } \alpha_{j-1} < y^* \leq \alpha_j$$

The probability to choose level  $j$  can be defined by:

$$p(y = j) = p(\alpha_{j-1} < y^* \leq \alpha_j) = F(\alpha_j - X'\beta) - F(\alpha_{j-1} - X'\beta)$$

where  $F$  is the logistic cumulative distribution function. This model produces one set of coefficients with  $(j-1)$  intercepts (3 in our case). The underlying ordered logistic assumption is that the relationship between each pair of outcome groups is the same. This is called the proportional odds assumption or the parallel regression assumption. An approximate likelihood-ratio test will be performed in order to verify that this assumption is verified. The description of the explanatory variables used to predict the intention to adopt is provided in appendix 3. Considering that there were missing values, the ordered logit estimation could only be done with 91 individuals out of the 121.

- **Sample description**

Descriptive statistics of our sample are provided in table 1. Compared to farmers of the Gard area, the sample presents a number of particularities. The sample has a higher proportion of organic farmers, of farms with more land and of cattle and field crop farm and less horticulture and fruit growing farms. These peculiarities could be due to contracts being offered only in certain areas of the Gard area. The population surveyed is therefore rather the farmers of these areas, but specific data on these farmers were not available. Another possibility is that farmers that had more interest in ABOS were more inclined to respond to the survey. This self-selection may partially bias responses. A way to manage this would have been to first estimate the probability to be part of the sample (Vella, 1998), but we do not have access to individual data of farmers of the area for 2015.

Variable	Modality	N	% of the 121 respondents	Reference (%)	Variable	Modality	N.	% of the 121 respondents	Reference
<b>Gender</b>	Male	99	81.8	73.8	<b>Main farm activity</b>	Field crops	16	13.6	4.5
	Female	22	18.2	26.2		Horticulture	10	8.6	10.9
<b>Age</b>	Less than 40	22	18.2	16.9		Vine growing	61	52.1	53.8
	From 40 to 49	24	19.8	25.0		Orchard	4	3.4	13.2
	From 50 to 59	45	37.2	30.6		Livestock	17	14.6	6.6
	60 or more	30	24.8	27.6	Other	9	7.7	11.0	
<b>Farm size</b>	Less than 20 ha	38	31.4	67.5	<b>Education</b>	Primary	17	14.2	21.5
	From 20 to 50 ha	43	35.5	21.6		Secondary short	27	22.5	33.9
	From 50 to 100 ha	17	14.1	7.0		Secondary long	40	33.3	21.2
	From 100 to 200 ha	17	14.1	2.6		Superior	36	30.0	23.3
	200 ha or more	6	5.0	0.6	<b>Organic agriculture</b>	Yes	26	21.5	12
Principal	100	84.8		No		95	78.5	88	
<b>Importance of farming activity</b>	Secondary	17	14.4						
	Retired	1	0.9						

**Table 1.** Descriptive statistics of the survey sample compared to the Gard Reference (Source: General Agriculture Census Agreste 2010).

### 2.3.2. ABOS performance

We analyzed the performance of ABOS in two ways. First, based on the survey, we studied the different challenges highlighted in the literature: compliance, additionality, link between land use and environmental outcomes, and permanence. These issues were addressed through a specific section in the farmers' questionnaire for the farmers enrolled in ABOS programme (see appendix 2). Questions mainly dealt with i) the level of modification of agricultural practices following contract adoption, ii) the criteria used by farmers to select the enrolled plots, and iii) farmers' intentions after the end of contract regarding reenrollment and maintenance of agriculture practices. Data analysis of the enrolled farmers' response is mainly based on descriptive statistics, in order to report their diversity of views. The ambition is therefore not to quantitatively analyze the impact of the programme but rather to identify challenges related to the programme's effectiveness. The issue of links between land use and environmental outcomes were mainly addressed during interviews with implementing partners and through the analysis of the database they provided.

The second approach we used to address ABOS performance is based on the analysis of the plot selection process. Considering that since the beginning (from 2011 to 2015) of the programme, we have information on 908 plots volunteered to be enrolled in the programme and that the consortium selected 510 of these plots, we decided to reconstruct the criteria that intervened in the plot selection through a statistical analysis. We especially wanted to determine the weight of ecological effectiveness (maximization of ecological benefits, in CU, and ecological rating) and economic efficiency for the developer (attainment of BO requirement at minimal cost ) in this selection. We collected data from the offset consortium on plots that farmers volunteered to enroll. Information available on these plots is the following: previous crop, ecological rating (see section 2.2), land area offered by the farmer, measure that the farmer proposed to adopt and associated payment. The plot database contains 908 plots that were submitted by farmers for enrolment. Among these, we have information for 829 plots. The remaining plots were rejected before field assessments were conducted.

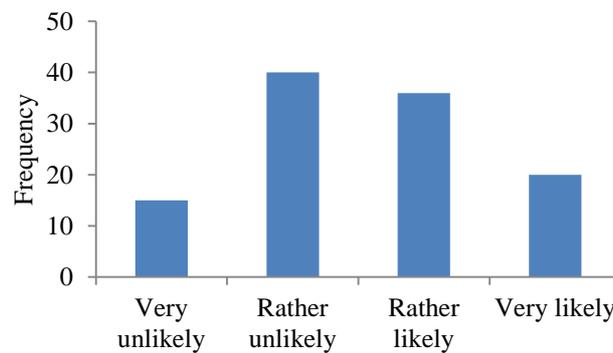
We ran a logistic regression to estimate the probability of a plot to be selected based on the following explanatory variables: i) land area of the plot (SURF), ii) two effectiveness indicators, the ecological rating (ECORATE) and the amount of CU/ha brought by a plot (CU) and iii) an a cost-effectiveness criterion that is the cost per ha for a CU (COSTCU).

### 3. Results and Discussion

In this section, we present and discuss the results in two parts: first we analyze the determinants of farmers' acceptability of ABOS, and second, the performance of ABOS.

#### 3.1. Determinants of farmers' acceptability of ABOS

The intention to adopt an ABOS is characterized by a normal-shaped distribution that is well suited for the use of an ordered logit model (Figure 3).



**Figure 3.** Frequency of farmers according to their intention to adopt an ABOS in the future (Obs: 111).

The results of the ordered logit model are presented in table 2.

Ordered logit model on intention	Coef.
AGE	-0.42*
EDUC	1.00**
SURF	-0.93
ORGA	-0.10
PROFIT	-1.15**
NEWACTIVITY	1.06*
ACTIVITYRED	2.03**
SUCCESSOR	0.04
ADOPT	1.39**
FLEX	-0.28
TC	-0.11
EASE	0.41**
PAYMENT	1.29**
ENV	-0.70
NATURE	1.01**
RESP	0.31
INSTOPINON	1.20**
NORMDESC	1.14**
TRUST	-0.02
TRUSTDEV	0.53
ATTITBO	0.87*
EFFIC	-1.62**
Cut 1	-1.38
Cut 2	2.17
Cut 3	4.70
Nb. of observations	91
Pseudo R2	0.31
Log Likelihood	-82.1
LR Chi2 (5)	73.17***
Proportionality of odds likelihood ratio test	NS

\*\*\*and \* refer to significance at the levels of 5% and 10%, respectively.

**Table 2.** Logit estimation of the intention to adopt an ABOS in the coming years.

The results show that **economic motivations** play a crucial role in the intention to adopt ABOS as this is generally the case in AES. Farmers that perceive that it is easy for them to adopt (variable EASE) are more likely to have a high intention to adopt an ABOS in the future. The reasons are that the required practices fit well into their farming system, or because it is an opportunity to them to exploit an unused field plot or yet, or at the extreme, because they already have adopted this practice. In the same line high intenders perceive that the payment level proposed in contracts is interesting (PAYMENT).

Surprisingly, some advantages of ABOS, as compared to classic AES, such as higher flexibility (FLEX) and to a lesser extent lower transaction costs (TC), do not come out as significant

determinants of the intention to adopt. This lack of influence may be due to different reasons. First it could simply mean that flexibility is not fundamental for farmers in their choice to enroll. Farmers may have not have been well informed of the advantages of ABOS contracts as compared to AES. This may partially be due a lack of information of farmers on some of the contract advantages.

**Farmers and farm socio-economic factors** also intervene in the adoption. Farmers with higher education (EDUC) have stronger intention to adopt an ABOS. Considering that most ABOS measures require an extensification of agriculture activities, it is not surprising to see that farmers that are in a phase of activity reduction (ACTIVITYRED), such as land area reduction or planning to retire, generally have a stronger intention to adopt an ABOS (as compared to farmers that have not had significant change in the last 5 years). Similarly, farmers that suffer from a low profitability (PROFIT) of their farming activity may consider contract payment as an opportunity to have more regular revenues and are therefore in favor of adopting. Other factors have a less significant influence: younger farmers (AGE) and farmers that are in a new development project (NEWACTIVITY), such as a new production, the conversion to organic farming or farm size increase, are more susceptible to adopt an ABOS. Finally, farmers that had already enrolled in ABOS at the time of the survey are expectedly more likely to enroll in the future.

This study does not only consider the influence of socio-economic factors but also investigates the potential impact of behavioral factors. As anticipated, **social norms** especially seem to intervene in farmers' adoption. Farmers that consider important the enrollment of other farmers (NORMDESC) and farmers that think that the Chamber of Agriculture has a positive opinion on ABOS are more likely to participate (INSTOPINION). This large BO programme has led to the contracting (and acquisition) of a large area of farmland. Because of its size and its impact on local agriculture activities, the BO programme has also raised oppositions from some farmers' cooperatives and councilors. This maybe had a negative influence on the personal attitude of some farmers towards the programme (ATTITBO) and probably on their intention to adopt ABOS. Farmers that have a better general opinion of BO are more likely to adopt an ABOS.

Considering that the developer is a new stakeholder in agriculture contracting and that this type of scheme was new in the area, it was anticipated that trust variables (TRUST and TRUSTDEV)

would play a significant role in adoption. However, it does not appear to be the case. As shown in psychology literature, peer influence is recurrently highlighted in empirical studies about farmer behavior (e.g. Burton, 2004). So, we think that the use by the developer of an offset consortium in which the CA30 had a strong involvement has limited the effect of this variable on the intention to enroll.

As we expected, the role of the attitude towards the environment (ENV) and the feeling of responsibility by farmers for the protection of threatened bird species (RESP) do not come out as significant determinant of the intention to adopt ABOS. The only variable that is positively linked with adoption is the fact to be member of an environmental association or to carry out nature activities, such as hiking, hunting or fishing (NATURE). This relatively low influence of environment susceptibility indicators may be due to the fact that farmers predominantly responded positively to environmental sensitivity questions: 89% agreed that protecting threatened bird species is a priority for the area and 85% that it is their responsibility to protect them. A more discriminating indicator of environmental susceptibility may have been necessary. Another interpretation could be that for ABOS, in contrast to AES, adopting a contract may be strictly considered as a service transaction by farmers that therefore mobilize lower environmental considerations.

Finally, farmers that perceive that the programme will lead to an effective protection of threatened bird species are less likely to have a strong intention to adopt. This result is the only effect that goes against expectations. A possible interpretation may be that farmers that have the most positive opinion on the results of the programme may consider their future participation superfluous.

To conclude, this analysis of the determinants of the intention to participate in ABOS highlights the role of traditional factors known from studies of AES: high intenders tend to have a low profitability, to be more educated, to positively judge payments, to consider the implementation of ABOS requirements easy on their farm or to have already adopted a similar contract. Factors that differentiate ABOS and AES such as the perception of the flexibility of the contracts and transaction costs didn't have the expected influence. Behavioral factors such as the perception of social norms and the personal attitude towards BO, however, are key factors in the adoption of ABOS. However, the feeling of trust in contracting institutions does not seem to be critical.

Finally, the susceptibility to environmental issues does not seem to be a key factor in farmers' adoption of ABOS.

**3.2. Performance of ABOS**

In this section, we analyse the performance of ABOS in two different ways. We first present the results of the survey carried out with the enrolled farmers in ABOS based on the analysis of additionality, compliance, link between land use and environmental outcomes and permanence. Second, we analyse the influence of the plot selection process on the effectiveness and efficiency of the BO programme.

**3.2.1. Analysis of the survey of farmers engaged in the AES programme**

- **Additionality and compliance**

In this section, we analyze questions that bring information on the magnitude of the change undertaken by farmers following their adoption of the contract. Replies to the question “How would you qualify the magnitude of the change of agricultural practice that you’ve had to undertake following your enrollment in the ABOS” are presented in table 3.

Intensity of practice change following ABOS adoption	% of respondents
No change	19%
Low change	39%
Medium change	36%
High change	6%

**Table 3.** Intensity of practice change following ABOS adoption. (N=36)

The results show that 58% of the enrolled farmers have declared not having made changes (19%) or low modifications (39%) to their practices following the adoption of the ABOS. In light of these results, the real additional effect of these ABOS on biodiversity is questionable. We can suppose that the few changes declared by respondents did not produce the desired gains in habitat quality for the Little Bustard. This very low level of practice change for a majority of farmers can be due to the fact that farmers that were selected already implemented the practice before they enrolled (additionality issue) or can be due to the fact that farmers did not follow the requirements of the contract (compliance issue). Monitoring by the offset consortium in 2013 indicated only 75% conformity with the requirements of the ABOS, including 10% involuntary technical difficulties and 15% deliberate non-compliance (CEN-LR et al., 2013). These results are confirmed by the responses to the question “how did you select the plot that you submitted for enrollment”, which are presented in table 4.

Farmers' plot selection criteria	% of respondents
Plots that seemed ecologically relevant	61%
Plots on which it seemed easy to implement the required practices	61%
Plots on which I was already implementing the practices	78%
Plots with low productivity	2%
Plots far away from the farm	5%

**Table 4.** Criteria quoted by farmers for farmers for the selection of plots they offered

These results confirm that a high proportion of farmers did not implement much change in their plots. Indeed, 78% of the adopting farmers indicated that they were already implementing the required practices on the plots before they enrolled them. Although qualitative, these results confirm that additionality and compliance issues that we theoretically emphasized in section 2.2 are indeed challenges for the use of ABOS to achieve BO objectives. For developers to deliver the ecological gains required to achieve the NNL objectives set by regulators, it is crucial that these challenges be addressed in future ABOS programmes. The analysis of the plot selection process that we conduct in the following section 4.2.2 sheds further light on this point.

- **Link between land use change and the provision of ecological gains**

As a condition to its permit, the developer, Oc'Via, had to generate 3079 CU by April 2015. This was achieved with 500 ha of land directly acquired by the developer (generating 1015 CU + a bonus of 1 CU/ha for land it had under direct control through acquisition) and 1168 ha through ABOS contracts (generating 1550 UC).

However, this does not guarantee the attainment of ecological objectives in terms of conservation of the Little Bustard in and around the Natura 2000 site (Devoucoux, 2014). Indeed, it is difficult to estimate whether the adoption of ABOS has actually led to an increase of the population of birds on enrolled plots and if it has compensated losses caused by the CNM project. Preliminary results show that the local landscape is reaching carrying capacity (Devoucoux, 2014) which makes it all the more important for offsets to maintain that carrying capacity as the railway line cuts through the Natura 2000 site. Simply displacing individual birds to favorable but unoccupied habitats won't be possible in those circumstances. The metric and exchange rules used to design and size the offset requirements for Oc'Via focus are suited to this challenge (with a focus on increases in habitat favorability per unit area) but remain based in expert judgement and the quantitative relationship between favorability and bird

densities remains uncertain. It is premature to fully evaluate the actual ecological gains linked to ABOS in our case study.

Another way to analyze the link between land use change and ecological is to compare the two ecological indicators used in the process. Specifically, the ecological rating takes into account local ecological characteristics (distance to a road or an urban area, presence or absence of population of little bustard before the enrollment, distance to other plots with favorable practices, presence or absence of hedges, plot area) while CUs is a broad indicators that focuses on land-use change within the plot.

Our analysis of the plot selection database demonstrates the loose relationship between CU and ecological rating (Table 5). Somewhat surprisingly, plots with the lowest ecological rating do not lead to lower amounts of CU than plots with higher ratings.

Ecological rating	Number of plots	Average CU/ha
1	37	1.53
2	243	1.20
3	503	1.27
4	46	1.64

**Table 5.** Average CU/ha benefits for the different level of ecological rating.

Depending on the final plot selection, different levels of final ecological favorability can therefore be obtained with the same level of CUs. This simple table questions the idea of setting BO objectives on a “simple” generalized metric, such as CU. Although this metric can help determining the size of the BO efforts, it should be assorted with requirement on how to maximize ecological gains at the plot level.

- **Permanence**

Considering that contracts are signed for a period of 5 years and that the BO programme is legally supposed to ensure ecological benefits for a period of 25 years, the durability of benefits obtained through ABOS is a key issue. Two main dimensions of permanence are analyzed here: 1) whether farmers plan to sign a new contract after the end of their current contract (table 6), and 2) what they plan to do in case their current contract ends and is not renewed (table 7).

Farmers' intentions after their current contract ends regarding the signature of a new contract	% of respondents
Stop ABOS	6%
Sign again for the same area	56%
Sign again for a smaller area	12%
Sign again for a larger area	26%

**Table 6.** Farmers' intentions after their current contract ends regarding the signature of a new ABOS contract (N=34)

Farmers' intentions regarding their agricultural practices in the absence of ABOS	% of respondents
Abandon the practices	36%
Maintain the practices	36%
Adopt other favorable practices	24%

**Table 7.** Farmers' intentions regarding their agricultural practices in the absence of ABOS (N=33)

Farmers generally seem to be satisfied with the contracts and 92% of the farmers plan to maintain or increase the land area under contract after their current contract ends. Thus, maintaining farmers under contract, during the period in which the developer needs to ensure offsets are effective is critical but seems achievable. However, only 36% of farmers would maintain the practices included in the requirement of their contract in the absence of ABOS. This result raises the issue of the permanence of the ecological benefits obtained through ABOS after the legal period of 25 years.

### 3.2.2. Analysis of the plot selection process

When ABOS was launched in 2011 and in the following contracting phase in 2015, the amount of land that farmers volunteered to enroll was superior to the programme's target. To avoid competition with existing AES, a fixed price payment was chosen and plots were selected based on a multicriteria approach. This approach included the ecological rating and criteria that affect the cost of the programme for developers such as the relationship between the level of payment and the CU/ha<sup>2</sup>. The interests of the offset consortium and the developer were most likely not fully aligned and our results show which criteria prevailed in the plot selection process (Table 8).

---

The CU criteria was not used in the contractual phase in 2011 but was used in latter contractual phases. We nevertheless reconstruct the weight of these criteria throughout the selection process.

Logit model estimation plot selection	Coef.	Marginal effects
SURF	-0.08***	-0.0143***
ECORATE (Ref=1)		
2	0.093	0.1976
3	0.902**	0.1756**
4	2.849***	0.3962***
CU	0.261	0.0458
COSTCU	-0.002***	-0.0004***
Nb. of observations		829
Pseudo R2		0.17
Log Likelihood		-437.7
LR Chi2 (5)		184.88***
Percentage of adequate predictions		76.60%

\*\*\* and \*\* refer to significance at the levels of 1% and 5%, respectively.

**Table 8.** Logit estimation of the plot selection choice

As expected, the ecological rating strongly intervened in the selection choice: plots rated at 3 or 4 had a significantly higher probability to be selected. However, we also show that the bigger the plot offered by a farmer the less chance it had to be end up being selected. This is unexpected considering that bigger plots were *a priori* more interesting from an ecological point of view and size was one of the criteria used in the selection process.

The amount of CU that a plot yielded does not have a significant effect on the probability of a plot to be selected. Cost-effectiveness (the cost to yield a CU), however, did have a significant effect: plots that generated costlier CU had a lower probability of being selected.

Using marginal effects, we can estimate that a plot that has the highest Euro/CU rate (1000€/CU) has 41.5% less chance to be selected than the plot that has the lowest rate (70 €/CU), while the plot that has an ecological rating of 4 has 45.8% more chance to be selected than a plot with an ecological rating of 1. Both criteria had similar effects on plot selection process. Furthermore, budget simulations show that, for the same CU target, if only the plots with highest ecological rating (4) had been chosen, the budget would have increased by 32%, while the budget would have decreased by 41% if only the cost-efficiency criteria would had been used.

From a purely economic standpoint, minimizing the cost of the programme should be the objective, as long as the CU target is achieved. In this case, the option of selecting plots based on cost-effectiveness, as would be done in an agri-environmental auction, would be the best option. On the other hand, considering the limits of CU as an ecological effectiveness indicator

and reserves that we highlighted on additionality and compliance, a safe option to have more chance to reach NNL objectives would be to maximize the ecological favorability of selected plots. Indeed, in both cases the legal target in CU would have been attained, however the habitat created in the latter case would be much more favorable for the Little Bustard. The solution that was found is one that partially satisfies all parties but does not reflect a clear-cut political decision between minimizing costs and ensuring the attainment of BO objectives.

#### **4. Conclusion and political implications**

The main objective of this article was to analyse the opportunities and challenges of using agri-environmental schemes in biodiversity offset implementation. Compared to land acquisition and management, ABOS present a number of advantages. First, it may be better accepted by farmers as it reduces pressure on the land market and represents an opportunity of additional revenue. Second, the use of ABOS reduces upfront costs for the developer, especially in context where the price of land is high. Third, the use of contracts allows greater flexibility and better adaptability of the offsetting system in case of environmental or institutional changes.

The main challenge of ABOS, as compared to land acquisition, is that the control of land use passes through a contract between the developer and farmers and is not under direct management. Yet, regulators require that developers achieve set targets of ecological gains, tied to the “No Net Loss” principle. Achieving BO objectives through ABOS therefore requires that i) a sufficient number of farmers accept to enrol in the programme and ii) that the contracts and their implementation are effective. However, information asymmetries that are inherently associated with agri-environmental contracts pose specific challenges for the use of this tool in BO, mainly in terms of compliance and additionality. In this paper, we identified the magnitude of these challenges through an empirical analysis of the ABOS programme put in place for a new railway line currently being built in Southern France. A survey of 145 farmers among those enrolled in the programme gave us insights into the determinants of their participation and into the effectiveness of the programme.

Our results suggest that the main determinants of acceptability are: i) classic economic factors (farmers with least compliance and opportunity costs, as well as farms in economic difficulty, are more likely to adopt), and ii) moral and social norms (the personal opinion on BO, the importance given to others’ decision and the feeling that this decision is accepted by farmers’ representatives). The importance of norms in the acceptability of ABOS is an aspect that should be considered in the implementation of ABOS. BO are a relatively new component in the permitting regime that is debated amongst farmers, farmer unions and politicians. Improving the general opinion on BO through continuous engagement by public authorities and environmental groups could strengthen and broaden support by other members of rural communities, which in turn may be an important element of success of future ABOS programmes.

The analysis of ABOS effectiveness reveals issues related to additionality. It would be interesting to undertake a quantitative impact evaluation in order to precisely quantify the magnitude of this problem. Additionality issues essentially stem from an adverse selection issue, which leads to the identification of farmers that cannot produce the environmental benefit in the most cost-effective way. Ferraro (2008) proposes 3 solutions to overcome this problem: (1) acquire information on the environmental benefits that farmers can potentially offer and select them on this basis; (2) offer to farmers a menu of screening contracts; and (3) allocate contracts through agri-environmental auctions. In our case study, the first solution was privileged through a plot selection process that probably improved the additionality of the programme. However, due to the fixed-payment system calculated on foregone profits and additional costs, the payment system does not allow the payment of farmers according to the environmental, or BO, service they provide. Considering that there was a greater offer of plots by farmers than the final demand from the developer, the selection of plots and farmers could have been made through an auction mechanism (e.g. Latacz-Lohmann and Van der Hamsvoort, 1997). A system with differentiated payment such as an auctioning mechanism would probably have improved additionality. Indeed, by paying less for contracts to low opportunity cost landowners, who are the most likely to adopt the practice even in the absence of a programme, the developer saves money to contract with higher opportunity cost landowners, who are more likely to participate and generate the desired biodiversity gains (Ferraro, 2008).

The analysis of the effectiveness of contracts also emphasized relatively high rates of non-compliance. Dealing with the issue of non-compliance would require a modification of the monitoring and enforcement system. Different theoretical contributions have studied how to determine the trade-off between environmental benefits, the cost of monitoring and the level of penalty. This trade-off essentially depends on farmers' risk aversion, with less monitoring efforts needed for risk averse farmers than for risk neutral ones when the level of sanctions is held constant (Choe and Fraser, 1999; Fraser, 2002; Latacz-Lohmann and Webster, 1998; Ozanne et al., 2001). In our case study, the high rate of non-compliance suggests that the level of penalty and the intensity of monitoring may not be sufficient. This could be due to the same consortium being in charge of design, implementation, monitoring and enforcement of the programme. It would therefore be necessary to raise monitoring efforts and strengthen enforcement to ensure compliance, possibly through third-party auditing. Another option that is frequently proposed in the literature is to shift from action-based contracts to result-rented

contracts. This approach has been implemented in a number of countries, including for the protection of bird species (Burton and Schwarz, 2013). This approach would help solve the compliance issue but it shifts the risks of failure from the developer to farmers (or the offset consortium). This risk transfer is generally not well accepted by farmers (Burton and Schwarz, 2013).

In previous recommendations on compliance and additionality, we refer to research results in which agri-environmental contracts are modelled as a simple principal-agent model between farmers and the State. However, in our case, there is a principal-agent relationship between the developer and farmers, in the framework of ABOS, but there is also one between the regulator and the developer. In order to ensure that the developer actually cares about issues of additionality and non-compliance, the regulator must ensure that the incentives of the developer are aligned with the common society's interest. For example, the developer objective may not be to find a balance between farmer's compliance and monitoring costs but only to minimize the costs of monitoring. A monitoring and sanction system should therefore also be implemented by the State to ensure that developers adequately implement ABOS contracts. This idea of a cascade of principal-agent relationship for the implementation of BO through agri-environmental contracts, and the need to determine appropriate incentives for farmers and developers, could be the object of future theoretical developments.

Ensuring that additional land-use changes obtained thanks to ABOS actually lead to the required ecological gains is another important challenge. Knowledge is often limited and ecological equivalence and targets cannot be precisely set. The use of Compensation Units, based on the change of land use and practice modification, as in our case study, is an interesting approach to size BO requirements. However, because it does not take into account the local favourability (proximity to roads, presence of other groups of the same species, proximity of other favourable habitats), targets in terms of CU can be attained with very different levels of favourability of the resulting habitats and therefore different levels ecological gains. In the CNM case study, the selection of plots to be included in ABOS was based both on a local ecological indicator and the costs for the developer of the CUs this plot would yield. This equilibrium was found, probably due to the diversity of interest of the institutions involved in the plot selection process. Considering the uncertainties that still weigh on the sizing of biodiversity offsets, relying exclusively on metric approaches such as CUs would be hazardous. It is therefore important that the State and/or ecological organizations are involved, in order to

ensure ecological interests are taken into account to maximize the impact of the BO programmes.

Finally, our results show that although farmers may be ready to maintain their contractual agreements in the next period, very few would maintain their practice in the absence of financial support. In our case study, BO objectives are set for a period of 25 years, after which there is no guarantee from any party that offset measures will be sustained, although the loss of habitat is largely irreversible. Whilst it may be unreasonable to expect developers to finance compensation measure *ad infinitum*, such arrangements would place a considerable burden on public finances if every offset were to fall back on public funding once private sector obligation are through. The long-term financing of offsets is yet to be addressed in France.

## **Acknowledgments**

The authors wish to thank regional permitting authorities, RFF, Oc'Via, Biositiv and the offset consortium for their willingness to engage with the research and the questions raised here. Specifically, the Chamber of Agriculture of the Gard must be thanked for giving us access to farmers and data on the enrolled plots. We also wish to thank all the farmers who took precious time to fill our questionnaire.

This research was co-funded by the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement 308393 'OPERAs' and by the ONEMA in the framework of the 2011 call for research projects "Changer les pratiques agricoles pour préserver les services écosystémiques", supporting the implementation of the French National Action plan Ecophyto 2018 under grant agreement 1073/2012 'Coud'Pouce'.

The authors also wish to thank Naufel Mzoughi, Sophie Thoyer and Raphaële Préget and Thomas Menut for useful discussions.

## References

Ajzen I. (1991), « The theory of planned behavior », *Organizational Behavior and Human Decision Processes*, vol. 50, n°2, pp. 179-211.

Allaire G., Cahuzac E. et Simioni M. (2009), « Contractualisation et diffusion spatiale des mesures agro-environnementales herbagères », *Revue d'Etudes en Agriculture et Environnement*, vol. 90, n°1, pp. 23-50.

Banerjee P. et Wossink A. (2015), « Social rewards and the design of voluntary incentive mechanism for biodiversity protection on farmland », 17th Annual BIOECON Conference Experimental and Behavioural Economics and the Conservation of Biodiversity and Ecosystem Services, Cambridge, September 2015.

Beedell J.D.C. et Rehman T. (1999), « Explaining farmers' conservation behavior: Why do farmers behave the way they do? », *Journal of Environmental Management*, vol. 57, n°3, pp. 165-176.

Beedell J. et Rehman T. (2000), « Using social-psychology models to understand farmers' conservation behaviour », *Journal of Rural Studies*, vol. 16, n°1, pp. 117-127.

Bonnieux F., Rainelli P. et Vermersch D. (1998), « Estimating the Supply of Environmental Benefits by Agriculture: A French Case Study », *Environmental and Resource Economics*, vol. 11, n°2, pp. 135-153.

Bougherara D. et Ducos G. (2006), « Farmers' preferences over compensation contract flexibility and duration: an estimation of the effect of transaction costs using choice experiment », 1ère Journée de l'European School on New-Institutional Economics.

Brotherton I. (1991), « What limits participation in ESAs? », *Journal of Environmental Management*, vol. 32, n°3, pp. 241-249.

Bull J.W., Suttle K.B., Singh N.J. et Milner-Gulland E.J. (2013), « Conservation when nothing stands still: Moving targets and biodiversity offsets », *Frontiers in Ecology and the Environment*, vol. 11, n°4, pp. 203-210.

Calvet C., Napoléone C. et Salles J.-M. (2015), « The Biodiversity Offsetting Dilemma: Between Economic Rationales and Ecological Dynamics », *Sustainability*, vol. 7, n°1, pp. 7357-7378.

CBD et UNEP (2010), « Biodiversity Offsets : A tool for CBD Parties to consider and a briefing on the Business and Biodiversity Offsets Programme (BBOP) », Conference of the parties to the convention on biological diversity, Tenth meeting Nagoya, Japan.

CEN-LR, COGARD, CHAMBRE D'AGRICULTURE, SAFER-LR, 2013. « Mise en œuvre de mesures compensatoires en faveur de l'Outarde canepetière dans la ZPS Costières nîmoises – Rapport final du programme 2009-2013 ».

Chabé-Ferret S. et Subervie J. (2013), « How much green for the buck? Estimating additional and windfall effects of French agro-environmental schemes by DID-matching », *Journal of Environmental Economics and Management*, vol. 65, n°1, pp. 13-27.

Choe C. et Fraser I. (1999), « Compliance Monitoring and Agri-Environmental Policy », *Journal of Agricultural Economics*, vol. 50, n°3, pp. 468-487.

Christensen T., Pedersen A.B., Nielsen H.O., Mørkbak M.R., Hasler B. et Denver S. (2011), « Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones--A choice experiment study », *Ecological Economics*, vol. 70, n°8, pp. 1558-1564.

Cimon-Morin J., Darveau M. et Poulin M. (2013), « Fostering synergies between ecosystem services and biodiversity in conservation planning: A review », *Biological Conservation*, vol. 166, pp. 144-154.

Chanel, O., L. Delattre and C. Napoléone (2014). "Determinants of Local Public Policies for Farmland Preservation and Urban Expansion: a French Illustration." *Land Economics* 90(3), pp. 411-433

Coggan A., Buitelaar E., Whitten S. et Bennett J. (2013), « Factors that influence transaction costs in development offsets : who bears what and why ? », *Ecological Economics*.

Dauguet B. (2015), « Biodiversity offsetting as a commodification process: A French case study as a concrete example », *Biological Conservation*.

Davenport J. et Davenport J.L. (2006), *The ecology of transportation: managing mobility for the environment*, J. Davenport et J.L. Davenport (dir.), Springer Netherlands, 393 p.

Defrancesco E., Gatto P., Runge F. et Trestini S. (2008), « Factors affecting farmers' participation in agri-environmental measures: A northern Italian perspective », *Journal of Agricultural Economics*, vol. 59, n°1, pp. 114-131.

Delvaux L., Henry de Frahan B., Dupraz P. et Vermersch D. (1999), « Adoption d'une MAE et consentement à recevoir des agriculteurs en région wallonne », *Économie rurale*, vol. 249, n°1, pp. 71-81.

Devictor V., Swaay C. van, Brereton T., Brotons L., Chamberlain D., Heliölä J., Herrando S., Julliard R., Kuussaari M., Lindström Å., Reif J., Roy D.B., Schweiger O., Settele J., Stefanescu, C. Van Strien A., Turnhout C. Van, Vermouzek Z., WallisDeVries M., Wynhoff I. et Jiguet F. (2012), « Uncertainty in thermal tolerances and climatic debt », *Nature Climate Change*, vol. 2, pp. 638-639.

Drake L., Bergström P. et Svedsäter H. (1999), « Farmers' attitudes and uptake », in Guido Van Huylenbroeck et Martin Whitby (dir.), *Countryside Stewardship: Farmers, Policies and Markets*. Oxford: Elsevier Science Ltd, Pergamon, Elsevier Sci ltd, pp. 89-111.

Drechsler M., Wätzold F., Johst K. et Shogren J.F. (2010), « An agglomeration payment for cost-effective biodiversity conservation in spatially structured landscapes », *Resource and Energy Economics*, vol. 32, n°2, pp. 261-275.

Ducos G. et Dupraz P. (2007), « The asset specificity issue in the private provision of environmental services: Evidence from agri-environmental contracts », 8th International Meeting of the Association for Public Economy Theory, Vanderderbilt University, Nashville, 25 p.

Ducos G., Dupraz P. et Bonnieux F. (2009), « Agri-environment contract adoption under fixed and variable compliance costs », *Journal of Environmental Planning and Management*, vol. 52, n°5, pp. 669-687.

EEA, 2004. « High Nature Value Farmland – Characteristics, Trends and Policy Challenges. » European Environment Agency Report 1/2004, Copenhagen, 26p

Etrillard C. et Pech M., « Mesures de compensation écologique : risques ou opportunités pour le foncier agricole en France ? », *Vertigo - la revue électronique en sciences de l'environnement* [En ligne], Volume 15 Numéro 2 | Septembre 2015, mis en ligne le 05 octobre 2015, consulté le 14 juillet 2016. URL : <http://vertigo.revues.org/16450> ; DOI : 10.4000/vertigo.16450

European Commission (2011), « Our Life Insurance, Our Natural Capital: An EU Biodiversity Strategy to 2020. », 244p.

Falconer K. (2000), « Farm-level constraints on agri-environmental scheme participation: a transactional perspective », *Journal of Rural Studies*, vol. 16, pp. 379-394.

Ferraro P.J. (2008), « Asymmetric information and contract design for payments for environmental services », *Ecological Economics*, vol. 65, n°4, pp. 810-821.

Fielding K.S., Terry D.J., Masser B.M., Bordia P. et Hogg M.A. (2005), « Explaining landholders' decisions about riparian zone management: the role of behavioural, normative, and control beliefs. », *Journal of environmental management*, vol. 77, n°1, pp. 12-21.

Forman R.T.T. (1995), « Some general principles of landscape and regional ecology », *Landscape Ecology*, vol. 10, n°3, pp. 133-142.

Fraser R. (2002), « Moral Hazard and Risk Management in Agri-environmental Policy », *Journal of Agricultural Economics*, vol. 53, n°3, pp. 475-487.

Fraser R. (2004), « On the Use of Targeting to Reduce Moral Hazard in Agri-environmental Schemes », *Journal of Agricultural Economics*, vol. 55, n°3, pp. 525-540.

Gaillard, G. (2014). « Rapport législatif n° 2064 du 26 Juin 2014 sur le projet de loi relatif à la biodiversité ». Assemblée Nationale, Commission du Développement Durable et de l'Aménagement du Territoire. 287 p.

Gardner T. a, Hase A. VON, Brownlie S., Ekstrom J.M.M., Pilgrim J.D., Savy C.E., Stephens R.T.T., Treweek J., Ussher G.T., Ward G. et Kate K. Ten (2013), « Biodiversity offsets and the challenge of achieving no net loss. », *Conservation biology : the journal of the Society for Conservation Biology*, vol. 27, n°6, pp. 1254-1264.

Gibbons, P., Lindenmayer, D.B., 2007. « Offsets for land clearing: No net loss or the tail wagging the dog? » *Ecol. Manag. Restor.* 8, 26–31.

Goldman R.L., Thompson B.H. et Daily G.C. (2007), « Institutional incentives for managing the landscape: Inducing cooperation for the production of ecosystem services », *Ecological Economics*, vol. 64, n°2, pp. 333-343.

IUCN, 2011. « La Liste rouge des espèces menacées en France ». 28 p.

Jacob C., Quétier F., Aronson J., Pioch S. & Levrel H. (2015): Vers une politique française de compensation des impacts sur la biodiversité plus efficace : défis et perspectives. *Vertigo - la revue électronique en sciences de l'environnement [En ligne]*, Hors-série 20 | Décembre, mis en ligne le 12 janvier 2015, consulté le 14 juillet 2016. URL : <http://vertigo.revues.org/15385> ; DOI : 10.4000/vertigo.15385.

Jack B.K., Kousky C. et Sims K.R.E. (2008), « Designing payments for ecosystem services: Lessons from previous experience with incentive-based mechanisms », *Proceedings of the National Academy of Sciences*, vol. 105, n°28, pp. 9465-9470.

Karsenty, A., Sembres, T. & Randrianarison, M. (2010) « Paiements pour services environnementaux et biodiversité dans les pays du sud. *Tiers Monde* », 202, 57.

Kuhfuss L., Jacquet F., Préget R. et Thoyer S. (2013), « Le dispositif des MAEt pour l' enjeu eau : une fausse bonne idée ? », *Review of Agricultural and Environmental Studies*, vol. 93, n°4, pp. 395-422.

Kuhfuss L., Preget R. et Thoyer S. (2014), « Préférences individuelles et incitations collectives : quels contrats agroenvironnementaux pour la réduction des herbicides par les viticulteurs ? », *Revue d'Études en Agriculture et Environnement*, vol. 95, n°01, pp. 111-143.

Kuhfuss L., Préget R., Thoyer S., Hanley N., Coent P. Le et Désolé M. (2015), « Nudges, social norms and permanence in agri-environmental schemes », 7th Annual BIOECON Conference Experimental and Behavioural Economics and the Conservation of Biodiversity and Ecosystem Services, Cambirige, September 2015.

Kuhfuss L. et Subervie J. (2015), « Do agri-environmental schemes help reduce herbicide use ? Evidence from a natural experiment in France », n°DR n°2015-02.

- Lamine C. (2011), « Anticiper ou temporiser : injonctions environnementales et recompositions des identités professionnelles en céréaliculture », *Sociologie du Travail*, vol. 53, n°1, pp. 75-92.
- Latacz-Lohmann U. et Webster P. (1998), « Moral hazard in agri-environmental schemes », *Agricultural Economics Society Annual Conference*, Reading, pp. 25-28.
- Latacz-Lohmann U. et Hamsvoort C. Van der (1997), « Auctioning Conservation Contracts: A Theoretical Analysis and an Application », *American Journal of Agricultural Economics*, vol. 79, n°2, pp. 407-418.
- Le Coent, P., Préget, R., Thoyer, S., 2014. « Why pay for nothing? An experiment on a conditional subsidy scheme in a threshold public good game ». *Econ. Bull.* 34, 1976–1989.
- Louis M. et Rousset S. (2010), « Coûts de transaction et adoption des contrats agroenvironnementaux Le cas des MAE territorialisées à enjeu DCE en Poitou-Charentes », *Colloque SFER Cemagref*, pp. 27 p.
- Masden B., Carroll N., Kandy D. et Bennett G. (2011), « 2011 Update: State of Biodiversity Markets: Offset and Compensation Programs Worldwide. »
- McKenney B.A. et Kiesecker J.M. (2010), « Policy Development for Biodiversity Offsets: A Review of Offset Frameworks », *Environmental Management*, vol. 45, pp. 165-176.
- Morris C., Pottert C. et Potter C. (1995), « Recruiting the New Conservationists: Farmers' Adoption of Agri-environmental Schemes in the U.K. », vol. 11, n°1, pp. 51-63.
- Muradian R. (2001), « Ecological thresholds: a survey », *Ecological economics*, vol. 38, n°1, pp. 7-24.
- Mzoughi N. (2011), « Farmers adoption of integrated crop protection and organic farming: Do moral and social concerns matter? », *Ecological Economics*, vol. 70, n°8, pp. 1536-1545.
- Ozanne A., Hogan T. et Colman D. (2001), « Moral hazard, risk aversion and compliance monitoring in agri-environmental policy », *European Review of Agricultural Economics*, vol. 28, n°3, pp. 329-348.
- Parkhurst G.M., Shogren J.F., Bastian C., Kivi P., Donner J. et Smith R.B.W. (2002), « Agglomeration bonus: an incentive mechanism to reunite fragmented habitat for biodiversity conservation », *Ecological Economics*, vol. 41, n°2, pp. 305-328.
- Pattanayak S.K., Wunder S. et Ferraro P.J. (2010), « Show Me the Money: Do Payments Supply Environmental Services in Developing Countries? », *Review of Environmental Economics and Policy*, vol. 4, n°2, pp. 254-274.

- Peerlings J. et Polman N. (2009), « Farm choice between agri-environmental contracts in the European Union », *Journal of Environmental Planning and Management*, vol. 52, n°5, pp. 593-612.
- Perrier-Cornet, P., 2004. « L'avenir des espaces ruraux français. » *Futuribles*, n°299, 19 p.
- Perrings C. et Pearce D. (1994), « Threshold effects and incentives for the conservation of biodiversity », *Environmental & Resource Economics*, vol. 4, n°1, pp. 13-28.
- Quétier F., Regnery B. et Levrel H. (2014), « No net loss of biodiversity or paper offsets? A critical review of the French no net loss policy », *Environmental Science & Policy*, vol. 38, pp. 120-131.
- Quétier F., Rufroy X. et Boulnois R. (2013), « Compensation Units? The Requirement for Ecological Equivalence. », Working group « Impacts » of the DREAL Languedoc-Roussillon, pp. 49
- Quintero J.D. et Mathur A. (2011), « Biodiversity offsets and infrastructure. », *Conservation biology : the journal of the Society for Conservation Biology*, vol. 25, n°6, pp. 1121-1123.
- Ribaudo M., Greene C., Hansen L. et Hellerstein D. (2010), « Ecosystem services from agriculture: Steps for expanding markets », *Ecological Economics*, vol. 69, n°11, pp. 2085-2092.
- Ruto E. et Garrod G. (2009), « Investigating farmers' preferences for the design of agri-environment schemes: a choice experiment approach », *Journal of Environmental Planning and Management*, vol. 52, n°5, pp. 631-647.
- SAF (2012), « Changement d'attitude pour les agriculteurs: des chefs d'entreprise stratégiques, autonomes et innovants. »
- Scemama P. et Levrel H. (2014), « L'émergence du marché de la compensation aux États-Unis: changements institutionnels et impacts sur les modes d'organisation et les caractéristiques des transactions », *Revue d'Economie Politique*, vol. 123, n°6, pp. 1-32.
- Slangen, L. (1997). « How to organise nature protection by farmers. » *European Review of Agricultural Economics*, vol. 24, pp. 508-529.
- Sumpsi, J., Iglesias, E. and Garrido, A. (1998). « An integrated approach to agricultural and environmental policies: a case study of the Spanish cereal sector ». In: Dabbert et al. (eds.), *The Economics of Landscape and Wildlife Conservation*. CAB International.
- Tilman, D., Fargione, J., Wolff, B., D'Antonio, C., Dobson, A., Howarth, R., Schindler, D., Schlesinger, W.H., Simberloff, D., Swackhamer, D. (2001). « Forecasting agriculturally driven global environmental change ». *Science*, Vol. 292, pp. 281-284.

Vanslebrouck I., Huylenbroeck G. Van et Verbeke W. (2002), « Determinants of the Willingness of Belgian Farmers to Participate in Agri-environmental Measures », *Journal of Agricultural Economics*, vol. 53, n°3, pp. 489-511.

Vatn A. (2010), « An institutional analysis of payments for environmental services », *Ecological Economics*, vol. 69, n°6, pp. 1245-1252.

Vella F. (1998), « Estimating Models with Sample Selection Bias: A Survey », *The Journal of Human Resources*, vol. 33, n°1, pp. 127-169.

Wolff A., 2001a : « Changements agricoles et conservation de la grande avifaune de plaine : Etude des relations espèce-habitats à différentes échelles chez l'Outarde canepetière ». Thèse de doctorat, Université Sciences et Techniques du Languedoc, Montpellier. 105 p.

Wolff A, Paul JP, Martin JL, Bretagnolle V. 2001b. « The benefits of extensive agriculture to birds: the case of the Little Bustard. » *J Appl Ecol.* 38(5): 963-975.

Wunder, S. 2005. « Payments for environmental services: Some nuts and bolts. » *CIFOR Occasional Paper*, number 42. Bogor, Indonesia: CIFOR. [http://www.cifor.org/publications/pdf\\_files/OccPapers/OP-42.pdf](http://www.cifor.org/publications/pdf_files/OccPapers/OP-42.pdf)

Wunder S., Engel S. et Pagiola S. (2008), « Taking stock: A comparative analysis of payments for environmental services programs in developed and developing countries », *Ecological Economics*, vol. 65, n°4, pp. 834-852.

Wynn G., Crabtree B. et Potts J. (2001), « Modelling Farmer Entry », vol. 52, n°1, pp. 65-82.

Zakine C. (2014), « Les paiements pour service environnementaux (PSE) appliqués à l'agriculture. » ,Collectif Agri'Idées, SAF, Paris, 14 p.

## Appendix

**Appendix 1:** Main determinants of adoption of agri-environmental schemes in the literature

Determinants	Effect	Reference
<b><i>Farmer and farm socio-economic factors</i></b>		
Area	+	Allaire <i>et al.</i> , 2009; Falconer, 2000; Morris and Potter, 1995; Wilson, 1997
Age	-	Bonnieux <i>et al.</i> , 1998; Chabé-Ferret and Subervie, 2013; Ducos <i>et al.</i> , 2009; Morris and Potter, 1995; Ruto and Garrod, 2009; Vanslebrouck <i>et al.</i> , 2002; Wynn <i>et al.</i> , 2001
	+ (for measures with extensification)	(Drake <i>et al.</i> , 1999)
Education	+	Allaire <i>et al.</i> , 2009; Chabé-Ferret and Subervie, 2013; Louis and Rousset, 2010; Wilson, 1997
<b><i>Contract characteristics</i></b>		
Short duration	+	Bougherara and Ducos, 2006; Christensen <i>et al.</i> , 2011; Louis and Rousset, 2010; Ruto and Garrod, 2009
Flexibility on plot selection by farmers	+	Bougherara and Ducos, 2006; Ruto and Garrod, 2009
Flexibility on technical prescriptions	+	Bougherara and Ducos, 2006; Christensen <i>et al.</i> , 2011; Kuhfuss <i>et al.</i> , 2014; Ruto and Garrod, 2009
<b><i>Payment level and costs</i></b>		
Payment superior to costs	+	Brotherton, 1991; Drake <i>et al.</i> , 1999
Low compliance and opportunity costs	+	Delvaux <i>et al.</i> , 1999; Louis and Rousset, 2010; Vanslebrouck <i>et al.</i> , 2002; Wynn <i>et al.</i> , 2001.
Transaction costs	-	Ducos and Dupraz, 2007; Falconer, 2000; Peerlings and Polman, 2009; Vatn, 2010
Asset specificity	-	Ducos and Dupraz, 2007; Rorstad <i>et al.</i> , 2007
Previous participation in similar schemes	+	Allaire <i>et al.</i> , 2009; Chabé-Ferret and Subervie, 2013; Louis and Rousset, 2010; Kuhfuss <i>et al.</i> , 2013
<b><i>Behavioral factors</i></b>		
Attitude towards the environment	+	Beedell and Rehman, 2000; Defrancesco <i>et al.</i> , 2007; Delvaux <i>et al.</i> , 1999; Ducos <i>et al.</i> , 2009; Morris and Potter, 1995; Mzoughi, 2011
Participation in environmental association and nature hobbies	+	Beedell and Rehman, 2000.
Social norms	+	Fielding <i>et al.</i> , 2005; Beedell and Rehman, 1999
Trust between contracting partners	+	Ducos and Dupraz, 2007; Ducos <i>et al.</i> , 2009; Louis and Rousset, 2010; Peerlings and Polman, 2009
Risk aversion	+ (because AES bring a secured revenue)	Fraser, 2004, Karsenty, 2010

Determinants	Effect	Reference
	- (uncertainty) regarding the future of AES)	Slangen, 1997, Sumpsi et al, 1998
Trust in the results of the programme	+	Gibbons et al., 2007, Karsenty et al., 2010

**Appendix 2:** The questionnaire sent to farmers.

### Enquête sur les mesures MAERFF (mesures outardes) proposées aux agriculteurs suite au projet de contournement ferroviaire de Nîmes-Montpellier

Dans ce questionnaire, il vous est demandé de répondre aux questions selon votre situation ou votre opinion. Pour répondre aux questions, il vous suffit de cocher une ou plusieurs case(s) selon les questions. Nous vous prions de bien vouloir répondre à TOUTES les questions qui vous concernent. L'absence de réponse à certaines questions pose en effet des problèmes dans le traitement des données. Merci d'avance de votre contribution !

#### I. Renseignements concernant votre exploitation

<p>1. Quelle est la Surface Agricole Utile (SAU) de votre exploitation (incluant les parcelles non exploitées) ?</p> <p>SAU = _____ ha dont _____ ha de luzerne</p>	<p>2. Quel est le statut de votre exploitation ?</p> <p><input type="checkbox"/> Exploitant individuel</p> <p><input type="checkbox"/> GAEC</p> <p><input type="checkbox"/> Autres formes sociétaires</p>								
<p>3. Quelle est l'activité principale de l'exploitation ? (une seule réponse souhaitée)</p> <p><input type="checkbox"/> Grandes cultures    <input type="checkbox"/> Arboriculture</p> <p><input type="checkbox"/> Viticulture            <input type="checkbox"/> Elevage</p> <p><input type="checkbox"/> Maraîchage            <input type="checkbox"/> Production fourragère</p> <p><input type="checkbox"/> Autres, préciser : _____</p>	<p>4. Comment qualifieriez-vous le type d'agriculture que vous pratiquez sur votre exploitation ? (une seule réponse souhaitée)</p> <p><input type="checkbox"/> Agriculture conventionnelle</p> <p><input type="checkbox"/> Agriculture raisonnée</p> <p><input type="checkbox"/> Agriculture biologique</p>								
<p>5. En quelle année vous êtes-vous installé(e) sur votre exploitation ? : _____</p>	<p>6. Quel est le nombre de personnes qui travaillent sur l'exploitation (vous compris) ? _____</p>								
<p>7. Comment jugez-vous la rentabilité économique de votre exploitation ?</p> <table border="1" data-bbox="204 1641 783 1758"> <thead> <tr> <th>Pas du tout rentable</th> <th>Peu rentable</th> <th>Assez rentable</th> <th>Très rentable</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </tbody> </table>	Pas du tout rentable	Peu rentable	Assez rentable	Très rentable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>8. Avez-vous effectué d'importants changements dans votre système d'exploitation ces 5 dernières années ? (plusieurs réponses possibles)</p> <p><input type="checkbox"/> Pas de changement notable</p> <p><input type="checkbox"/> Développement d'une nouvelle activité</p> <p><input type="checkbox"/> Agrandissement</p> <p><input type="checkbox"/> En cours de cessation d'activité ou de transmission de l'exploitation</p> <p><input type="checkbox"/> Autre, préciser : _____</p>
Pas du tout rentable	Peu rentable	Assez rentable	Très rentable						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						

#### II. Renseignements vous concernant

9. Vous êtes : <input type="checkbox"/> Une femme <input type="checkbox"/> Un homme	10. Quel âge avez-vous ? _____
11. Quel est votre niveau d'étude ? <input type="checkbox"/> Primaire (certificat d'études, BAA, CAPA) <input type="checkbox"/> Secondaire court (CAP, BEP, BEPC ; BEA, BEPA) <input type="checkbox"/> Secondaire long (Bac, BTA, BP) <input type="checkbox"/> Supérieur (BTS, DUT, Ingénieur, BTSa)	12. Etes-vous exploitant agricole à titre : <input type="checkbox"/> Principal <input type="checkbox"/> Secondaire
13. Etes-vous membre d'une organisation agricole type syndicat des éleveurs ou cave coopérative (hors syndicat FNSEA ou confédération paysanne) ?  <input type="checkbox"/> OUI <input type="checkbox"/> NON	14. Faites-vous ou avez-vous fait partie d'une association environnementale ou participez-vous à des activités de nature (type randonnée, chasse, pêche, etc.) ?  <input type="checkbox"/> OUI <input type="checkbox"/> NON
15. Code postal du siège de l'exploitation :  _____	16. Pensez-vous que quelqu'un reprendra votre exploitation après vous ?  <input type="checkbox"/> OUI <input type="checkbox"/> NON

Affirmations	Niveau d'accord				
	Pas du tout d'accord	Plutôt pas d'accord	Plutôt d'accord	Tout à fait d'accord	Je ne sais pas
La diversité des mesures proposées dans les contrats MAERFF est un avantage	<input type="checkbox"/>				
Les rémunérations proposées dans les contrats MAERFF sont intéressantes	<input type="checkbox"/>				
Les règles et les exigences des contrats MAERFF sont faciles à comprendre	<input type="checkbox"/>				
Les mesures proposées dans les contrats MAERFF sont faciles à mettre en œuvre sur mon exploitation	<input type="checkbox"/>				
Il y a beaucoup de contrôles de la mise en œuvre des mesures des contrats MAERFF	<input type="checkbox"/>				
Les sanctions en cas de non respect des règles et des engagements des contrats MAERFF sont raisonnables	<input type="checkbox"/>				
Il est facile de trouver de l'aide auprès des personnes en charge des contrats MAERFF en cas de problème	<input type="checkbox"/>				
Il est possible de renégocier les engagements des contrats MAERFF en cas de difficultés rencontrées ou d'évolution de la situation de l'exploitation	<input type="checkbox"/>				
Il est facile de se désengager des contrats MAERFF	<input type="checkbox"/>				

Le fait que d'autres agriculteurs s'engagent également dans les contrats MAERFF est important pour moi	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
--	--	---	---	--	--

### III. Renseignements concernant les contrats MAERFF

<p>17. Avez-vous été informé(e) de la possibilité de signer un contrat MAERFF ?</p> <p><input type="checkbox"/> OUI <input type="checkbox"/> NON</p> <p>Si OUI, par qui ? (plusieurs réponses possibles)</p> <p><input type="checkbox"/> Chambre d'agriculture</p> <p><input type="checkbox"/> Autre(s) agriculteur(s)</p> <p><input type="checkbox"/> Coopérative ou organisation agricole</p> <p><input type="checkbox"/> Autre, préciser : _____</p>	<p>18. Avez-vous signé un contrat MAERFF ?</p> <p><input type="checkbox"/> OUI <input type="checkbox"/> NON</p> <p>Si OUI, en quelle année ? : _____</p> <p>19. Avez-vous l'intention de signer un nouveau contrat MAERFF ou MAEOC dans les prochaines années ?</p> <table border="1" data-bbox="927 741 1481 860"> <tr> <td>Pas du tout probable</td> <td>Peu probable</td> <td>Assez probable</td> <td>Très probable</td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>	Pas du tout probable	Peu probable	Assez probable	Très probable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Pas du tout probable	Peu probable	Assez probable	Très probable								
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
<p>20. Comment évaluez-vous les montants proposés dans les contrats MAERFF par rapport aux coûts des actions prévues dans les cahiers des charges ?</p> <table border="1" data-bbox="161 1010 807 1122"> <tr> <td>Très inférieurs</td> <td>Plutôt inférieurs</td> <td>Egaux</td> <td>Plutôt supérieurs</td> <td>Très supérieurs</td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>	Très inférieurs	Plutôt inférieurs	Egaux	Plutôt supérieurs	Très supérieurs	<input type="checkbox"/>	<p>21. Avez-vous vendu des terres agricoles dans le cadre de la construction de la ligne LGV (incluant les expropriations) ?</p> <p><input type="checkbox"/> OUI <input type="checkbox"/> NON</p>				
Très inférieurs	Plutôt inférieurs	Egaux	Plutôt supérieurs	Très supérieurs							
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							

Affirmations	Niveau d'accord				
L'engagement dans les MAERFF nécessite pour vous d'investir dans du matériel spécifique ou d'en louer (machine ou matériel agricole, clôtures, etc.)	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
L'engagement dans les MAERFF nécessite beaucoup de temps pour les démarches administratives (dossier à remplir, signature contrat, etc.)	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
L'engagement dans les MAERFF nécessite de se former (suivre des formations, participer à des réunions)	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
La mise en œuvre des mesures des contrats MAERFF nécessite d'avoir recours à des personnes extérieures à l'exploitation (autres agriculteurs, prestataires de service)	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
Les mesures proposées dans les MAERFF s'intègrent bien dans mon système d'exploitation	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
Les mesures MAERFF représentent une opportunité de valoriser des parcelles non exploitées	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
Les mesures MAERFF représentent une opportunité de mettre en œuvre des actions que je faisais déjà ou que j'allais faire prochainement sur l'exploitation	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
Il est important que la chambre d'agriculture participe à l'animation des MAERFF	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
Les actions mises en œuvre dans le dispositif des MAERFF permettront de protéger les oiseaux menacés	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
La protection des populations d'oiseaux menacés est importante pour notre territoire	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
Le statut foncier de mes parcelles est un obstacle à mon adhésion aux contrats MAERFF	Pas du tout d'accord <input type="checkbox"/>	Plutôt pas d'accord <input type="checkbox"/>	Plutôt d'accord <input type="checkbox"/>	Tout à fait d'accord <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>

22. Pouvez-vous indiquer si vous êtes en **accord** ou en **désaccord** avec les affirmations suivantes : (une seule réponse souhaitée par affirmation)

23. Pouvez-vous indiquer si vous êtes en **accord** ou en **désaccord** avec les affirmations suivantes : (1 réponse/affirmation)

24. Pensez-vous que les institutions qui financent les contrats MAERFF (RFF et Oc'Via) honoreront leurs engagements ?

Pas du tout d'accord    Plutôt pas d'accord    Plutôt d'accord    Tout à fait d'accord    Je ne sais pas  
                                                                               

25. Etes-vous en accord ou en désaccord avec les affirmations suivantes :

« J'ai confiance dans les institutions en charge du suivi et de la mise en œuvre des contrats MAERFF (le Conservatoire des Espaces Naturels (CEN), le Centre Ornithologique du Gard (COGARD) et la Chambre d'agriculture du Gard) »

Pas du tout d'accord  Plutôt pas d'accord  Plutôt d'accord  Tout à fait d'accord  Je ne sais pas

« J'ai confiance dans la gestion des politiques agro-environnementales par les pouvoirs publics (Services de l'Etat, Europe) »

Pas du tout d'accord  Plutôt pas d'accord  Plutôt d'accord  Tout à fait d'accord  Je ne sais pas

26. Pensez-vous qu'il est de votre responsabilité en tant qu'agriculteur d'agir pour la protection des oiseaux menacés ?

Pas du tout d'accord  Plutôt pas d'accord  Plutôt d'accord  Tout à fait d'accord  Je ne sais pas

27. Selon vous, quel est le principal acteur qui devrait se mobiliser pour agir en faveur des oiseaux menacés ? (une seule réponse souhaitée)

- Les acteurs publics (Etat, collectivités territoriales, etc.)  Les agriculteurs
- Les acteurs privés (entreprises, aménageurs, etc.)  Les citoyens
- Les associations environnementales  Autres, préciser :

#### IV. Opinions sur les MAERFF

28. Quelle est votre opinion sur la <u>compensation par des actions agricoles</u> de dommages environnementaux occasionnés par la construction d'infrastructure ?	Opinion très négative <input type="checkbox"/>	Plutôt négative <input type="checkbox"/>	Plutôt positive <input type="checkbox"/>	Très positive <input type="checkbox"/>	Je ne sais pas <input type="checkbox"/>
---	--	--	--	--	---

29. Pouvez-vous indiquer l'opinion des personnes ou organisations suivantes sur les contrats MAERFF et l'influence de cette opinion sur votre décision de signer un contrat MAERFF :

Personnes / Organisations	Quelle est l' <b>OPINION</b> des personnes ou organisations suivantes <u>sur les contrats MAERFF</u> ?	Est-ce que cette opinion a eu une <b>INFLUENCE</b> sur votre <u>décision de signer un contrat MAERFF</u> ?
Chambre agriculture	<input type="checkbox"/> Positive <input type="checkbox"/> Sans opinion / Je ne sais pas <input type="checkbox"/> Négative	<input type="checkbox"/> OUI <input type="checkbox"/> Je ne sais pas <input type="checkbox"/> NON
Coopératives agricoles	<input type="checkbox"/> Positive <input type="checkbox"/> Sans opinion / Je ne sais pas <input type="checkbox"/> Négative	<input type="checkbox"/> OUI <input type="checkbox"/> Je ne sais pas <input type="checkbox"/> NON
Services de l'Etat locaux (DREAL, DDTM)	<input type="checkbox"/> Positive <input type="checkbox"/> Sans opinion / Je ne sais pas <input type="checkbox"/> Négative	<input type="checkbox"/> OUI <input type="checkbox"/> Je ne sais pas <input type="checkbox"/> NON
Associations environnementales	<input type="checkbox"/> Positive <input type="checkbox"/> Sans opinion / Je ne sais pas <input type="checkbox"/> Négative	<input type="checkbox"/> OUI <input type="checkbox"/> Je ne sais pas <input type="checkbox"/> NON
Elus locaux	<input type="checkbox"/> Positive <input type="checkbox"/> Sans opinion / Je ne sais pas <input type="checkbox"/> Négative	<input type="checkbox"/> OUI <input type="checkbox"/> Je ne sais pas <input type="checkbox"/> NON
Autres agriculteurs	<input type="checkbox"/> Positive <input type="checkbox"/> Sans opinion / Je ne sais pas <input type="checkbox"/> Négative	<input type="checkbox"/> OUI <input type="checkbox"/> Je ne sais pas <input type="checkbox"/> NON

## V. Participation à d'autres programmes agro-environnementaux

<p>30. Avez-vous déjà contractualisé un CTE ou CAD par le passé?</p> <p><input type="checkbox"/> OUI    <input type="checkbox"/> NON</p>	<p>31. Avez-vous été informé(e) de la possibilité de signer une MAEt Natura 2000 dans le cadre de votre dossier PAC ?</p> <p><input type="checkbox"/> OUI    <input type="checkbox"/> NON</p>
--	---

32. Etes-vous actuellement en contrat MAEt Natura 2000?

OUI     NON

33. Si NON, pourquoi avez-vous choisi de contractualiser une MAERFF plutôt qu'une MAEt Natura 2000 ? (plusieurs réponses possibles)

- Plus grande flexibilité des contrats (durée, contrôles, sanctions...)
- La chambre d'agriculture m'a conseillé de plutôt signer une MAERFF
- Je ne suis pas éligible pour la signature d'une MAEt Natura 2000
- Je n'ai pas constitué de dossier PAC et la signature d'une MAEt Natura 2000 aurait été trop compliquée
- Les mesures proposées dans le cadre des MAEt Natura 2000 ne convenaient pas à mon exploitation
- Je n'ai pas confiance dans les institutions qui financent et gèrent les contrats MAEt (Union européenne, Services de l'Etat)
- Autres. Préciser : \_\_\_\_\_

## VI. Renseignements sur votre/vos contrat(s) MAERFF

34. Quelle est la surface totale que vous avez engagée dans les contrats MAERFF ?  
\_\_\_\_\_ ha

35. Merci de cocher les mesures pour lesquelles vous vous êtes engagé(e) dans les contrats MAERFF :  
(plusieurs réponses possibles)

- 1- Création et entretien d'un couvert favorable à l'Outarde
- 2- Amélioration par sur-semis d'un couvert herbacé et entretien
- 3- Entretien d'un couvert herbacé avec retard de pâturage
- 4- Entretien d'un couvert herbacé avec retard de fauche
- 5- Réouverture d'une parcelle embroussaillée et girobroyage annuel
- 6- Gestion mécanique de friches herbacées
- 8- Implantation d'enherbement inter-rang en vigne
- 9- Maintien et entretien de l'enherbement inter-rang en vigne
- 10- Maintien des chaumes après récolte
- 11- Implantation d'une culture intermédiaire annuelle (comme le colza)
- 12- Suppression de haie

36. Comment qualifieriez-vous l'importance du changement de vos pratiques suite à votre engagement dans les contrats MAERFF ? (une seule réponse souhaitée)

- Aucune modification
- Faible
- Moyenne
- Forte

37. Pouvez-vous décrire succinctement les changements principaux de pratique ou de système d'exploitation que vous avez opérés suite à la signature des contrats MAERFF (en plus de ceux prévus dans le cahier des charges des MAERFF) ?

---

---

38. Quelle surface était cultivée en luzerne sur votre exploitation avant de signer la MAERFF :  
\_\_\_\_\_ ha

39. A quelle fréquence échangez-vous avec les personnes en charge du programme de contractualisation MAERFF ? (une seule réponse souhaitée)

- Plusieurs fois par mois
- Quelques fois par an
- Moins d'une fois par an
- Plutôt une fois par mois
- Une fois par an

40. Etes-vous en accord ou en désaccord avec l'affirmation suivante :

« Je suis convaincu(e) que les actions que je mets en œuvre dans le cadre de mes engagements MAERFF sont favorables à la protection des oiseaux menacés »

Pas du tout d'accord  Plutôt pas d'accord  Plutôt d'accord  Tout à fait d'accord  Je ne sais pas

41. Sur quels critères avez-vous sélectionné les parcelles que vous avez proposées pour les contrats MAERFF ?

(Cocher les 2 principaux critères de la liste suivante)

Critères de sélection	Choix des 2 critères principaux
Des parcelles qui me semblaient intéressantes d'un point de vue écologique	<input type="checkbox"/>
Des parcelles sur lesquelles il était facile pour moi de mettre en œuvre les pratiques	<input type="checkbox"/>
Des parcelles sur lesquelles je réalisais déjà les pratiques demandées dans le cahier des charges	<input type="checkbox"/>
Des parcelles peu productives	<input type="checkbox"/>
Des parcelles éloignées de mon exploitation	<input type="checkbox"/>

42. Si vous avez rencontré des difficultés pendant la durée de votre engagement, pouvez-vous préciser à quel niveau se trouvaient-elles ? (plusieurs réponses possibles)

- Pas de difficultés particulières
- Difficultés techniques et/ou agronomiques pour le respect du cahier des charges des MAERFF
- Difficultés dans l'organisation de l'activité agricole
- Manque de temps pour réaliser les actions
- Rentabilité insuffisante des parcelles engagées dans les MAERFF
- Valorisation difficile des cultures introduites (luzerne, colza)
- Autres.

Préciser : \_\_\_\_\_

43. Suite à ces difficultés avez-vous renégocié certains éléments du contrat ?  OUI  NON

44. Si OUI, sur quels éléments ont porté ces renégociations ? (plusieurs réponses possibles)

- Adaptation des actions de la mesure (par exemple modification des dates d'intervention)
- Changement de mesures
- Diminution des surfaces engagées
- Abandon du contrat
- Suspension temporaire du contrat
- Autres. Préciser : \_\_\_\_\_

45. Que pensez-vous faire à la fin de votre contrat MAERFF ? (une seule réponse souhaitée)

- Signer un nouveau contrat pour les mêmes superficies
- Signer un nouveau contrat pour une superficie plus importante
- Signer un nouveau contrat pour une superficie moins importante
- Ne pas signer de nouveau contrat

46. Que pensez-vous faire en ce qui concerne vos pratiques, si à l'avenir vous n'êtes plus en contrat MAERFF ? (une seule réponse souhaitée)

- Maintenir les pratiques prévues dans le contrat MAERFF
  - Adopter d'autres pratiques favorables à la protection des oiseaux menacés
  - Ne pas maintenir les pratiques prévues dans le contrat MAERFF
  - Autres : préciser
- 

47. Pouvez-vous décrire succinctement les bénéfices que vous avez retirés de votre engagement dans les MAERFF ?

---

48. Merci de nous indiquer vos éventuelles remarques ou propositions d'amélioration du dispositif de contrats MAERFF :

---

### Appendix 3: Description of the variables used in the econometric model.

Variable	Description	Unit
<i>Farmers and farm socio-economic characteristics</i>		
AGE	Age of the farmer	Years
EDUC	Education	1=Superior or Secondary long 0= Primary or secondary short
SURF	Size of the farm as compared to other farmers with the same type of production	1 (resp. 0)=farm size superior (resp. inferior) to the average farm with the same type of production;
ORGA	Type of farming	1=Organic; 0=Other types
PROFIT	How do you judge the profitability of your activity?	1=Rather or very profitable 0=Not profitable or low profitability
ACTIVITY	Have you had important change in your farm in the last 5 years?: No modification Development of a new activity or size increase Activity decrease or retirement close	NEWACTIVITY=1 (0 otherwise) ACTIVITYRED=1 (0 otherwise)
SUCCESSOR	Do you believe someone will carry on farm activities after you retire?	1=Yes; 0=No
ADOPT	Have you already signed an ABOS contract?	1=Yes; 0=No
<i>Contract flexibility</i>		
FLEX	Flexibility perception index: sum of replies to: The diversity of measures is an advantage There are a lot of control Sanctions are reasonable It is possible to renegotiate the contract It is easy to disengage	Continuous: sum of variables below 1=Agree; 0=Disagree or no opinion 1=Disagree; 0=Agree or no opinion 1=Agree; 0=Disagree or no opinion 1=Agree; 0=Disagree or no opinion 1=Agree; 0=Disagree or no opinion
<i>Transaction costs</i>		
TC	Transaction costs perception index There is a need to invest in equipment Requires a large amount of time for administrative procedures Rules and requirements are easy to understand There is a need of a third person for implementation	Continuous: sum of variables below 1=Agree; 0=Disagree or no opinion 1=Agree; 0=Disagree or no opinion 1=Disagree; 0=Agree or no opinion 1=Agree; 0=Disagree or no opinion
<i>Intensity of change</i>		
EASE	Ease to change perception index. The proposed measures are: easy to implement on my farm fit well in my farming system an opportunity to exploit unused fields ...an opportunity to be supported for practices I had already adopted or planned to adopt	Continuous: sum of variables below 1=Agree; 0=Disagree or no opinion 1=Agree; 0=Disagree or no opinion 1=Agree; 0=Disagree or no opinion 1=Agree; 0=Disagree or no opinion
<i>Contract payment</i>		
PAYMENT	The proposed payment level is interesting	1=Agree; 0=Disagree or no opinion
<i>Attitude towards the environment</i>		
ENV	The protection of threatened bird species is a priority for our area	1=Agree; 0=Disagree or no opinion

NATURE	Do you practice nature activity or are you member of a nature association?	1=Yes; 0=No
RESP	It is my responsibility, as a farmer, to act for the protection of threatened bird species	1=Agree; 0=Disagree or no opinion
<b><i>Social Norms</i></b>		
INSTOPINON	What is the opinion of the Chambre d'Agriculture on ABOS, according to you?	1=Positive; 0=Negative or no opinion
NORMDESC	The fact that other farmers adopt ABOS is important to me.	1=Agree; 0=Disagree or no opinion
<b><i>Trust in institutions</i></b>		
TRUST	I trust the institutions involved in the monitoring and implementation of ABOC	1=Agree; 0=Disagree or no opinion
TRUSTDEV	I trust that the developers that fund ABOS will respect their engagement	1=Agree; 0=Disagree or no opinion
<b><i>Attitude towards biodiversity offsets (BO)</i></b>		
ATTITBO	What is your opinion on BO through agriculture?	1=Positive; 0=Negative or no opinion
<i>Other</i>		
EFFIC	ABOS will lead to the protection of threatened bird species	1=Agree; 0=Disagree or no opinion