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# Making bird numbers count: Would Dutch farmers accept a result-based meadow bird conservation scheme?

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ABSTRACT

Current management contracts under agri-environmental schemes (AES) are often action-based. This means that farmers are reimbursed for the costs incurred when implementing conservation measures but are not paid based on actual improvements in environmental outcomes. In theory, result-based schemes with payments for outcomes can improve the cost and ecological effectiveness of AES. This article analyses farmers' acceptance of a hypothetical meadow bird management scheme that includes payments for results. The tested scheme was developed together with a Dutch farmer collective and resulted in a hybrid scheme including both result-based and action-based elements. In a discrete choice experiment, farmers were offered (1) a bonus payment that depended on the collective's nature conservation success, and (2) an individual bonus payment that rewarded farmers implementing measures that are expected to contribute more to the success of conservation. Results show that the acceptance of the hypothetical hybrid scheme is high (75%). The collective bonus was evaluated positively when the collective bonus on offer was high (€ 1000/farmer), but a latent class analysis indicates that this does not apply uniformly to all farmers.

## 1. Introduction

Agricultural production strongly depends on ecosystem services such as fertile soils and pollinators. At the same time, intensive agricultural production is described as the main driver of biodiversity losses (Benton et al., 2021). This puts pressure on policy and farmers to adapt farm management practices and maintain biodiversity on agricultural land (Campbell et al., 2017). To increase the sustainability of agriculture, agri-environmental schemes (AES) were introduced as part of the second pillar of the EU's Common Agricultural Policy (CAP). AES aim to stimulate farmers to fulfill voluntary agri-environmental measures and offer compensation payments in return (Batáry et al., 2015; Burton and Schwarz, 2013). However, the effect of the efforts has been limited, and thus policymakers and researchers are exploring options to improve AES (Sidemo-Holm, 2022).

Result-based schemes that pay farmers for a quantifiable environmental result are one option to improve the schemes' effectiveness (Sidemo-Holm, 2022). This article explores Dutch farmers' acceptance of a hypothetical, result-based scheme for meadow bird protection. Existing AES for meadow birds are action-based. This means that farmers are compensated for their AES management practices regardless of the actual results (Burton and Schwarz, 2013). An advantage of action-based AES is that they are easier to monitor than result-based AES. In addition, farmers may favor action-based schemes because they guarantee payments. However, among others, Bartkowski et al. (2021) and Burton and Schwarz (2013) highlight that equal payments across farmers and the lack of connection to the actual goal, such as the improvement of biodiversity, cause inefficiencies. Result-based schemes improve scheme effectiveness, because first, only farmers that expect to be able to deliver the result would apply for a result-based AES (Bartkowski et al., 2021). Second, farmers are expected to treat biodiversity as a product and will try to provide it cost-effectively by choosing the most suitable management practices to achieve a certain result (Matzdorf et al., 2008). This can improve environmental and cost-effectiveness because regional conditions are better accounted for (Burton and Schwarz, 2013; Zabel and Roe, 2009). However, result-based AES are difficult to implement in reality because adequate measurement methods for results are not always available, and measuring results is costly (Bartkowski et al., 2021; Allen et al., 2014; Burton and Schwarz, 2013; Zabel and Roe, 2009). Furthermore, results may be

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affected by external factors such as predators (Barghusen et al., 2021) and weather (Wätzold and Schwerdtner, 2005).

There is a growing literature on the development of result-based schemes and on farmers' preferences for result-based payments. Elmiger et al. (2023) present a review of articles that investigate result-based schemes and show that most studies have considered plant conservation. More limited evidence exists for case studies on bird conservation. A recent article by Tanaka et al. (2022), for instance, assesses Japanese farmers' preferences for result-based schemes in bird conservation. Older articles by Verhulst et al. (2007) and Musters et al. (2001) have analyzed the potential of result-based schemes for the Netherlands.

Meadow bird conservation presents specific challenges that were not considered in these studies. For instance, bird mobility makes it necessary to also consider the spatial aspects of conservation (Allen et al., 2014; Bertke et al., 2008). To better account for these spatial aspects, the Netherlands has organized nature conservation through AES collectives since 2016. The collectives ensure that the appropriate measures and spatially connected locations are chosen (Terwan, 2016). In this context, it makes sense to reconsider the introduction of result-based schemes in meadow bird protection and to offer payments based on the success of the collective AES.

This article uses a Discrete Choice Experiment (DCE) to explore farmers' acceptance of a hypothetical scheme with both action-based and result-based elements that could replace the current action-based scheme for meadow bird protection in the Netherlands. The farmer collective Noardlike Fryske Wâlden (NFW) was involved in the development of the experiment, since strong cooperation with stakeholders allows the design of a hypothetical contract that is feasible and does not contain adverse incentives (Zabel and Roe, 2009). The hypothetical scheme is as realistic as possible by building on the actual measures that farmers can choose from in the current collective approach. In addition, only farmers enrolled in the collective meadow bird scheme were invited to participate in the experiment to ensure that the hypothetical AES contract attributes are easy to understand and evaluate by farmers.

The article is structured as follows. Section 2 provides background information on how collective meadow bird conservation is organized in the Netherlands. Section 3 describes the methods used, the development of the hypothetical AES contract, the design of the choice experiment, and the estimated model. Section 4 holds information on the data, while the results are presented in Section 5. A discussion of the findings and a conclusion follow in Sections 6 and 7, respectively.

## 2. Collective meadow bird conservation in the Netherlands

For the Netherlands, meadow bird protection is of particular importance because Dutch agricultural grasslands are essential breeding habitats for bird species. For instance, large shares of the European black-tailed godwit (*Limosa limosa*) and the oystercatcher (*Haematopus Ostralegus L.*) population breed on Dutch territory (Kleijn et al., 2004). Recent reports from conservation collectives indicate that the decline in meadow bird populations is continuing in the Netherlands. For example, research shows that the population of the black-tailed godwit in the Netherlands is now only 6700 breeding pairs, compared to 30,000 breeding pairs in 1990. Causes for the decline in bird numbers are habitat loss, insufficient food supply, and high chick mortality (Province Friesland, 2023).

Since 2016, farmer collectives have been responsible for the implementation of AES in the Netherlands. Their meadow bird protection activities mainly target the black-tailed godwit (*Limosa limosa*), lapwing (*Vanellus vanellus*), oystercatcher (*Haematopus Ostralegus L*), redshank (*Tringa totanus*), shoveler (*Spatula clypeata*), skylark (*Alauda arvensis*) and meadow pipit yellow wagtail (*Motacilla flava*) (Province Friesland, 2023). In addition, they also coordinate nature protection activities aiming at, for instance, grassland biodiversity, field hamsters, and insects (Boerennatuur, 2023).

A collective approach for nature protection was chosen to improve the spatial coordination of measures and to motivate farmers' participation through closer cooperation (Barghusen et al., 2021). In addition, the collective approach is intended to simplify the application process for farmers and to reduce errors. The Dutch government believes that implementing nature conservation through collectives is more ecologically and economically effective. Furthermore, implementing a collective approach was considered especially suitable in the Netherlands because there is a long history of the use of collectives in rural areas (Terwan, 2016).

The farmer collectives develop a management strategy together with their members that fulfills the objectives of the local government and that requires, for instance, corridors of connected AES. Once the management strategy fulfills the requirements, the farmer collectives set-up a six-year contract with the local government on the one hand and private AES contracts with their farmer-members on the other (Barghusen et al., 2021).

The current contracts are action-based as the collective coordinates specific measures to counteract declines in meadow bird numbers by creating ideal bird habitats. The measures usually seek for an extensification of farmland management as intensive agricultural production is considered an important threat to meadow birds (Breeuwer et al., 2009; Kleijn et al., 2004). The current measures have different levels of intervention: **type i** and **ii** measures have a lower depth of intervention and allow for more intensive production, while **type iii** measures have a potentially high environmental impact but affect agricultural activities more drastically. **Type i** measures include clutch management, where farmers protect nests against destruction from agricultural practices, and moderate delays in mowing dates; **type ii** measures ensure that insects are attracted for the birds to feed on, for instance, by banning chemical fertilizers and pesticides to develop herb-rich grassland, and by further delaying mowing dates; **type iii** measures target a more diverse landscape by introducing ditch inundation and extensive grazing.

These measures are not placed arbitrarily in the landscape because spatially connected habitats have a higher value (Drechsler et al., 2010; Bell et al., 2016). The collectives coordinate the implementation of measures to create so-called mosaics (Province Friesland, 2023; NFW, 2023). The center of the mosaic for meadow birds is usually a wet area for foraging that can be obtained through field flooding (**type iii**). Herb-rich grassland with delayed mowing dates is located around this area to allow birds to safely rest and to find sufficient food (**type ii**). Areas with clutch management are found at the outer bounds to ensure that nests are not destroyed (**type i**). In addition, other important landscape elements such as ditch inundation and extensive grazing to create a diverse pattern in the grassland are introduced (**type iii**) (NFW, 2023). Conservation activities target areas that potentially deliver the best results, hence, areas with above-average bird numbers and that allow for diverse landscapes (Province Friesland, 2023).

Once the above-mentioned measures are implemented, controls are organized by the collective. Farmers are visited by volunteers, the so-called local bird protectors. These are citizens or other farmers interested in bird protection (personal communication NFW). In addition, controls are conducted by officials of public monitoring agencies. If violations are found, penalties are imposed on the collective, which are passed on to its contract partners – the farmers (Terwan, 2016; NFW, 2023). To optimally adapt the system to changing circumstances and to motivate farmers, farmers are invited to make suggestions for new strategies to the collective (NFW, 2023).

Even though the conservation approach appears to be well designed and the collectives and their farmers evaluate it positively, the creation of the mosaic can be challenging. A likely reason for this is that some farmers are reluctant to implement **type ii** or **type iii** measures that are more restrictive to their farming operations. For instance, according to a national survey, <10% of Dutch dairy farmers provided flooding of their fields in 2018 (**type iii**). The same applies for the creation of herb-rich grasslands, which is provided by only 20% of dairy farmers (**type ii**). In contrast, delays in mowing dates were applied by nearly 40% of the surveyed dairy farmers (**type i**) (Planbureau voor de Leefomgeving, 2019). In addition, only few farmers have provided ditch inundation or extensive grazing (**type iii**) (personal communication NFW).

The contracts between the farmer collectives and farmer-members allow for local fine-tuning (Terwan, 2016). For instance, the collective can set-up contracts that have a shorter run-time than the six-year CAP period. This would allow to redistribute measures across the collective's territory if birds have left and are not likely to come back. Furthermore, the regulatory framework provides room for the introduction of result-based payments (Terwan, 2016). However, result-based payments for meadow bird conservation have not yet been introduced, and an adjustment of measures within the contract period is rarely applied in practice. A possible reason for this is that the collectives need to fulfill their contract with the local government and implement the measures agreed upon (personal communication NFW).

## 3. Methods

### 3.1. Development of the hypothetical AES contract

Apart from a general understanding of the ecological context, researchers are advised to consider the interests of the farming community to ensure their acceptance of adjustments in AES (Herzon et al., 2018; Allen et al., 2014). We therefore collaborated closely with one of the farmer collectives in the Netherlands (Noardlike Fryske Walden, NFW) for the development of the DCE. NFW is situated in Friesland, a province in the north of the Netherlands. About 565 farmers are members of the collective and participate in AES, of which roughly 200 participate in AES aiming at meadow bird protection (NFW, 2023).

A draft hypothetical AES contract was developed based on a literature review and discussions with NFW. This hypothetical contract was discussed in a focus group in November 2021. The focus group consisted of six farmer members of NFW engaged in bird protection and an expert in meadow bird management. During this meeting, the desirability of purely result-based schemes and the initial ideas for the design of the contract were discussed. In the end, a hybrid scheme was chosen over a purely result-based scheme for two main reasons.

First, focus group participants were concerned that purely result-based schemes are too risky for farmers because the success of meadow bird management depends on factors that farmers cannot control, such as the weather or predation. This is also mentioned by other authors (Barghusen et al., 2021; Wätzold and Schwerdtner, 2005).

Second, the literature review showed that purely result-based schemes are particularly suitable for areas with a good conservation status (Herzon et al., 2018; Allen et al., 2014). Research shows that meadow bird numbers are still in decline in the Netherlands (Province Friesland, 2023; Breeuwer et al., 2009; Kleijn et al., 2004), and that considerable ecological knowledge might be necessary to counteract this development. This also suggests that the current approach in which the collective creates mosaics for an optimal habitat may be preferable to a purely result-based scheme (Allen et al., 2014).

A hybrid result-based scheme combines action- and result-based elements, for instance, by including compensation for fixed measures and bonus payments for results.[1] This allows to mitigate risks while still providing incentives for improvements in biodiversity (Derissen and Quaas, 2013). Hybrid schemes seem preferable in the analyzed context. They allow for the mosaics with their specific structure to remain and thus ensure that appropriate measures are implemented. In addition, they allow to set incentives and motivate farmers.

The focus group discussions led to the identification of the attributes (and levels) for the AES contracts in the choice experiment. A first attribute relates to the potential use of bonuses to make the contract more result-based. The initial idea was to include an individual bonus for a concrete indicator of success, for instance, the number of clutches on the farmer's fields.[2] However, farmers in the focus group highlighted that a landscape-level rather than field-level approach would be more suitable because successful meadow bird conservation depends on the efforts of multiple farmers, for instance, because meadow birds can feed on the fields of one farmer but breed on the fields of another farmer.

Based on this argument, the AES contract in the experiment includes a **collective bonus** that is based on increases in meadow bird numbers within the collective. It is paid in the case that the collective reaches a higher BTS (*Bruto Territoriaal Succes*) value than the average provincial BTS.[3] The BTS value was proposed by experts because it is a measure that is already well known, it allows cost-effective monitoring and provides a clear link to the goals of the AES. These features are described as important when developing result-based schemes (Elmiger et al., 2023; Allen et al., 2014; Bertke et al., 2008).

However, the focus group also mentioned that it would be desirable that farmers who implement type iii measures, which are more restrictive than type i and type ii measures for the farmer's operations but that also contribute more towards creating a mosaic habitat for meadow bird conservation, receive higher rewards. Therefore, the experiment features an additional **individual bonus** for farmers that implement type iii measures on top of the other management requirements of the hypothetical AES contract. These additional measures are the landscape elements ‘extensive grazing’ and ‘ditch inundation’. To ensure that the bonus is an incentive, farmers participating in the experiment are informed that they get the bonus payment on top of an annual, fixed payment (that covers the costs for the measures included in the contract) and on top of the payments to cover the costs of the additional two measures, i.e. € 1500/ha ditch inundation and € 580/ha extensive grazing.

The hypothetical AES contracts also include the more common type i and ii measures for meadow bird protection. The attributes that refer to these less complex conservation measures in the hypothetical contract are **delays in mowing dates** and **bans on chemical fertilizers and pesticides**.[4]

When payments are (partly) dependent on results, knowledge transfer and trust between stakeholders are important (Schaub et al., 2023; Tyllianakis and Martin-Ortega, 2021; Herzon et al., 2018). To elicit different levels of trust and knowledge transfer, the contracts feature different authorities that would be responsible for **monitoring** the measures and the BTS values. The levels consider actors that are expected to show different levels of engagement. Bird protectors and bird directors might be more enthusiastic and experienced than a public

[1] There is no general definition for result-based or hybrid result-based schemes. According to Herzon et al. (2018) hybrid schemes are a subgroup of result-based schemes. Our scheme is, according to their classifications, a hybrid result-based management scheme that is management-based and includes an optional result-based top-up.

[2] This approach was taken in the earlier trials by Verhulst et al. (2007) and Musters et al. (2001).

[3] The BTS value is the share of alarming parent pairs out of the total number of breeding pairs during the time when most chicks start fledging. It is considered an indication for the number of chicks and, therefore, an indicator for the quality of the area for breeding and raising chicks (Province Friesland, 2023).

[4] Note that ‘high water levels’ and ‘field flooding ‘were not considered in the experiment because the increase in water levels can affect the accessibility of a parcel with tractors to such an extent that applications of fertilizers and pesticides would not be possible. To avoid a correlation between the attributes, ‘high water levels' were therefore not considered. Farmers were asked to assume that contracts for ‘high water levels' are offered separately. The same applies for ‘field flooding’ which is a measure to raise water levels above the soil level.

monitoring agency.[5] In addition, local monitors can be preferred above national authorities because they are more aware of local conditions and better trusted.

The focus group participants were also asked whether they were interested in eliciting the influence of additional contract elements. Some of the participants highlighted that they would prefer longer contracts because they provide the necessary security when implementing type iii measures. Their demand for longer contracts is also in line with the findings of Tyllianakis and Martin-Ortega (2021). Currently, contracts for AES cover a maximum period of six years. In the DCE, **contract lengths** up to ten years were included.

In addition, the bird directors highlighted that current contracts with farmers do not allow adjustments during the season, for instance, to delay mowing dates. This would be especially relevant when rare birds breed on certain fields and have not yet left when the contract would allow mowing. Therefore, the attribute of **flexibility** was introduced for bird directors, and farmers were informed that this allows bird directors to delay mowing until the birds have left. However, Šumrada et al. (2021) describe that flexibility is also important for farmers. Hence, the attribute also includes flexibility on the farmer's side to renegotiate measures annually.

### 3.2. Experimental design

In the experiment, farmers were presented with different choice sets. Each set presented farmers with two hypothetical contracts and the opt-out option (no contract). The levels of the attributes varied across the choice sets and are presented in Table 1. *Dcreate* in Stata was used to determine the variation of the attribute levels and the minimum number of choice sets necessary. The design was created without priors. The determined design was controlled for dominant alternatives. The design had a D-Efficiency of 93%, and was assumed to be sufficiently good. Auspurg and Hinz (2015) recommend designs with D-efficiency values above 90%.

**Table 1**
Attributes and levels chosen for the hypothetical hybrid AES.

| Attributes | Levels[a] |
|---|---|
| Fixed payment per year | **€ 0 / ha**; € 600 / ha; € 800 / ha; € 1000 / ha; € 1200 / ha[b] |
| Collective bonus | € 500 / farmer; € 1000 / farmer; **no bonus** |
| Individual bonus | € 1000 / farmer; € 5000 / farmer; **no bonus**[c] |
| Monitoring | Bird director; Local bird protector; **Public agency** |
| Mowing dates | Mowing allowed from 01.06; 15.06 or 01.07; **no restriction**[d] |
| Use of chemical fertilizers and pesticides | Ban on chemical fertilizer; ban on pesticides; ban on both; **fertilizers and pesticides are permitted** |
| Contract lengths | **0**, 2, 6, 10 years[d] |
| Flexibility | granted to the farmer (renegotiation of measures); the bird director (delay of mowing); both of them; **no flexibility** |

[a] The level that is used in the status quo option is printed in bold. For the attributes collective bonus, individual bonus, flexibility and monitoring, all levels varied across the alternatives. For the attributes fixed payment, contract period and mowing dates the level printed in bold was only used for the opt-out option (no contract).

[b] The levels are based on the payments that are currently granted. The range is broad because lower payments for type i and ii measures and higher payments for type iii measures were considered.

[c] Bonus payments of € 1000 or € 5000 per farmer were offered for providing ditch inundation and extensive grazing on the farm. The bonus comes on top of the compensation of €1500/ha for ditch inundation and €580/ha for extensive grazing and the fixed payment.

[d] Mowing grassland for feed production usually starts mid-May. For the estimation, the mowing dates were recalculated as delays by 15 days, 30 days or 45 days. Mowing from the first of June, therefore, means a possible delay of 15 days.

The choice sets were included in an online survey. Fig. 1 shows one of the choice sets used for the survey. The online questionnaire had three versions, which participants were randomly assigned to. Two questionnaire versions had seven choice sets; the last questionnaire version only featured six choice sets. The respondents were asked to choose their most preferred option from the contracts that were presented in each choice set. In addition, they were asked whether they would provide ditch inundation and extensive grazing to qualify for the individual bonus.

The survey was conducted in December 2021 and January 2022. The online survey was distributed via email and newsletters among farmers managing meadow birds of the farmer collectives *NFW*, *It Lege Midden*, *Midden Groningen, Súdwestkust* and *Rijn Vecht en Venen*. Distributing the survey through the collectives allowed to approach farmers that are experienced in nature conservation and to investigate how a switch towards contracts with result-based elements affects the acceptance of farmers already involved in meadow bird conservation. Previous articles determine farmers' acceptance of AES because they seek to increase their adoption among farmers that are not yet engaged in AES (e.g., Groeneveld et al., 2019; Leonhardt et al., 2022; Massfeller et al., 2022). By focusing on engaged farmers, we are able to address the question of whether policy changes will affect the participation of farmers that are currently involved in AES contracts for meadow bird protection. This is of importance for the Netherlands because participation rates in AES are already low and losing engaged farmers is critical (Groeneveld et al., 2019; Zimmermann and Britz, 2016). Furthermore, the study focuses on already engaged farmers because the hypothetical scheme features specific information that might be easier to evaluate by experienced farmers. For instance, the collective bonus payment is determined based on the BTS value, and the monitoring attributes refer to local bird protectors and bird directors.

Apart from the choice experiment, respondents were presented with a set of questions about their socio-demographic characteristics, farm characteristics, and their perception of current meadow bird management contracts. The questions were included to account for factors that were influential on farmers' decisions in earlier studies and added as controls. Comprehensive reviews on the topic are provided by Schaub et al. (2023) and Dessart et al. (2019).

### 3.3. Empirical model

DCE are based on the random utility maximization theory which leads to the following assumptions that are briefly reiterated after Hensher et al. (2015) and Train (2003). It is assumed that a farmer ($n$) chooses the alternative ($i$) that provides the highest utility ($U_{in}$). The utility of each alternative is determined by an observable component ($V_{in}$) and an unobservable component ($\varepsilon_{in}$). The $k$ characteristics of the AES are included in the observable component of utility and denoted as $x_i$. Their influence is described by the estimators $\beta$ in eq. 1:

$$U_{in} = V_{in} + \varepsilon_{in} = x'_{ik}\beta_{kn} + \varepsilon_{in} \quad (1)$$

The commonly used conditional logit assumes homogenous preferences for all participants and determines the likelihood to choose a contract as follows:

$$L_{in}(\beta_{kn}) = \frac{exp\left(x'_{ik}\beta_{kn}\right)}{\sum_{j=1}^{J} exp\left(x'_{jk}\beta_{kn}\right)} \quad (2)$$

[5] Bird directors fulfill a key role as the coordinator of measures and are the first contact point for farmers. They are connected to local birdwatch organizations and instruct other volunteers (the so-called bird protectors) on the bird management practices in a defined area of the collective's territory.

| | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| **Fixed payment per year** | €600/ha | €1000/ha | |
| **Mowing date** | 01.06 | 01.07 | |
| **Fertilizer & pesticide use** | No bans | Bans on both | |
| **Monitoring**<br>Measures and ha | Local bird protector | Bird director | |
| **Flexibility for:**<br>Farmer: yearly adjustable contract<br>Bird director: delay mowing to birds' needs | Farmer and bird director | No Flexibility | Neither of the alternatives |
| **Years** | 6 | 2 | |
| **Individual bonus**<br>For providing ditch inundation and extensive grazing on farm. Comes on top of the compensation of €1,500/ha for ditch inundation and €580/ha for extensive grazing AND the fixed payment. [a] | €5,000/farmer | €1,000/farmer | |
| **Collective bonus**<br>For a higher BTS value in the collective than the average provincial BTS value | €500/farmer | No bonus | |
| I choose | ☐ | ☐ | ☐ |

**Fig. 1.** Example of a choice card used in the survey (*translated from Dutch into English*).
[a] The explanation that farmers implementing ditch inundation and extensive grazing receive a bonus on top of the normal compensation for ditch inundation (which is currently €1500/ha) and the compensation for extensive grazing (currently €580/ha) was included to ensure that farmers understand that it is a bonus and not a change in the existing fixed compensations for the measures.

However, the estimated mixed logit model assumes a continuous distribution of the estimators $\beta$ across all participants and is solved using simulation. By doing so, the mixed model accounts for heterogeneity between decision makers. The distribution of the coefficients is described as $f(\beta_{kn}|M)$ with $M$ describing the moments of the distribution (eq. 3):

$$P_{in}(M) = \int_{\beta kn} L_{in}(\beta_{kn}) f(\beta_{kn}|M) d\beta_{kn} \tag{3}$$

In addition, the characteristics of the farmer, his or her farm and their experience with nature conservation are included to determine potential target groups for the improved AES. They are included as interaction effects with the alternative-specific constant (ASC). The interaction effects provide information on how the characteristics affect the decision to choose a hypothetical AES. The ASC takes the value one for the hypothetical AES and the value zero for the opt-out option (no participation) (Auspurg and Liebe, 2011)

A latent class model is presented in addition to the mixed logit estimation. Latent class models not only capture preference heterogeneity but also uncover sources of heterogeneity (Train, 2003). These models assume discrete preferences instead of continuous distributions. Within each latent class, the preference structure is assumed to be homogeneous, and specific coefficients are estimated for each subgroup. The model calculates the probability ($H_{ns}$) that an observation ($n$) belongs to a particular class (s = 1…S), based on respondent-specific covariates ($h_n$) and their influence indicated by $\delta_s$:

$$H_{ns} = \frac{exp(\delta_s h_n)}{\sum_{s=1}^{S} exp(\delta_s h_n)} \tag{4}$$

In latent class models, the class-specific predicted probability ($P_{in}$) of choosing a scheme ($i$) depends on the class-specific estimates ($\beta_{ks}$) for the $k$ attributes of the schemes (x):

$$P_{in|s} = \frac{exp(x_{ik}\beta_{ks})}{\sum_{j=1}^{J} exp(x_{jk}\beta_{ks})} \tag{5}$$

The overall probability ($Prob_{in}$) of decision maker $n$ choosing a scheme is determined by the class-specific predicted probabilities of choosing a scheme ($P_{in|s}$) and by the predicted probabilities of belonging to a certain class ($H_{ns}$):

$$Prob_{in} = \sum_{s=1}^{S} H_{ns} P_{in|s} \tag{6}$$

In addition, willingness-to-accept (WTA) values are estimated along with the coefficients. In models with fixed coefficients per subgroup, WTA is calculated as the ratio of the coefficient of the attribute of interest ($k$) to the coefficient of the price attribute ($c$), representing the compensation offered (Hensher et al., 2015):

$$\text{WTA} = -\frac{\beta_k}{\beta_c} \tag{7}$$

## 4. Data

### 4.1. Descriptive statistics

Table 2 presents descriptive information about the sample. The largest share of respondents (62%) are farmer-members of *NFW*, followed by 18% from another collective in Friesland, *It lege midde*. Smaller shares come from six other collectives located in various parts of the Netherlands.

In total, 78 farmers completed the survey and are considered in the estimation. The average farmer is 52 years old and operates on 65 ha. Most of their farmland is grassland (95%). Accordingly, the share of dairy farmers in the sample is high; nearly all farms keep dairy cows (98%). The sample also contains farms that are less intensively managed; 26% of respondents operate their farms part-time. In addition, 14% of farms are managed organically. All respondents are already engaged in meadow bird conservation. On average, farmers enroll 23 ha of land in their current AES contracts. Most farmers have contracts with type i and ii measures, 77% apply rough manure, 72% delay mowing (resting periods), 64% provide clutch management, and 60% offer herb-rich grassland. Type iii measures, such as extensive grazing and increased water levels, are offered less often, by 19% and 29% of the farms, respectively. 50% of the farmers indicate that they are satisfied with how the areas are currently managed, and most of them state to

**Table 2**
Descriptive statistics of the sample ($n = 78$).

| Variable | Mean (Std. Dev.) | Description |
|---|---|---|
| Year of birth | 1970 (11.18) | Year the farmer was born |
| Farming experience | 27 (12.54) | Years of farming experience |
| Higher education | 0.32 | Share of farmers with a diploma from a HBO or university |
| Farmer's risk perception | 2.09 (1.14) | Likert scale rating on how strongly farmer agrees with the statement 'I am less willing to take risks than my colleagues'(5 point scale from I strongly disagree to I strongly agree) |
| Risk & success perception | 3.27 (1.16) | Likert scale rating on how strongly farmer agrees with the statement 'Who wants to succeed needs to take risks' (5 point scale from I strongly disagree to I strongly agree) |
| Fulltime | 0.74 | Share of farms operated fulltime |
| Organic | 0.14 | Share of farms that are organically managed |
| Hectares | 65.21 (50.97) | Hectares of the farm |
| Share of grassland | 0.95 | Share of grassland on the agricultural area |
| Main occupation dairy | 0.74 | Share of farmers with dairy as their main production branch |
| First mowing | 21 (1.84) | Calendar week the farmer starts to cut the grassland |
| Financial position | 0.64 | Share of farmers that evaluate their financial position to be very good or good (on a 5 point scale) |
| Goals – profit maximization | 29.09 (16.51) | Result of a self-evaluation. Farmers were asked to distribute 100% between three |
| Goals –financial stability | 49.71 (20.11) | goals 1) profit maximation 2) financial stability 3) a reduction of the |
| Goals – reduction of the environmental impact | 29.08 (16.51) | environmental impact of the farm (with 100% meaning one goal is the single most important one) |
| AES - Hectares enrolled | 23.07 (21.01) | Hectares currently enrolled in conservation contracts |
| AES – Many birds | 0.17 | Dummy variable for farmers with >50 nests per hectare (based on self-evaluation) |
| AES - Resting period | 0.72 | Share of current AES contracts with resting periods |
| AES - Clutch Management | 0.64 | Share of current AES contracts with clutch management |
| AES - Herb-rich grassland | 0.60 | Share of current AES contracts with herb-rich grassland |
| AES - Extensive grazing | 0.19 | Share of current AES contracts with extensive grazing |
| AES - Rough manure | 0.77 | Share of current AES contracts with rough manure application |
| AES - Increased water levels | 0.29 | Share of current AES contracts with increases of water levels |
| AES – Field flooding | 0.53 | Share of current AES contracts with field flooding |
| AES – Other | 0.05 | Share of current AES contract with other measures |
| AES – Payment by measures | 0.76 | Share of farmers preferring action-based payments |
| AES – Payment by results | 0.12 | Share of farmers preferring result-based payments |
| AES – Satisfied | 0.50 | Share of farmers indicating that they are very satisfied or satisfied with the current meadow bird management |
| Knowledge bird protection | 3.51 (01.05) | Self-estimation - 5 point scale with 1 being knowledge is limited to 5 considers knowledge to be good |

prefer the current payments based on measures (76%). Only 12% would prefer a result-based payment, the remaining share does not have a preference.

## 5. Results

### 5.1. *Contract elements relevant for farmers' decision to choose the hypothetical scheme*

A mixed logit model was estimated, and a likelihood ratio test was used to determine the farmer's and farm's characteristics with explanatory power.[6] The final mixed logit model is presented in Table 3.[7] The pseudo-$R^2$ of the model is 0.258, which according to Hensher et al. (2015) represents a sufficiently good model fit. To better account for heterogeneity, the data was also estimated with a latent class model.[8]

According to the BIC criterion two preference classes provide the best fit for the data. The BIC values are presented in appendix Table 3. The latent class model has a pseudo-$R^2$ of 0.333.

In the mixed logit model, the predicted probability of choosing one of the hypothetical contracts is 75%. Most of the estimated coefficients for the contract attributes show the expected signs and have a significant influence on the probability of choosing a contract. The main variables of interest are the bonus payments. For the collective bonuses, farmers only show a higher probability to choose a contract in the case that the collective bonus is high (€ 1000/farmer). Similarly, for the individual bonus significant effects are only found for high bonuses (€ 5000/ farmer). That the financial aspects are of high importance is also shown by the fixed annual payments per hectare. The farmers are more likely to choose a contract if the contract includes a higher fixed annual payment per hectare.

The mixed logit model further shows that farmers are more likely to choose a contract if the bird director or local bird protectors monitor the measures instead of the public agency. Furthermore, the significant, positive estimate for flexibility on the farmer's side and the insignificant coefficient for contract length indicate that farmers are in favor of more flexible contracts allowing them to renegotiate the contract on an annual basis ('Flexibility Farmer').

An interesting result is that farmers also evaluate 'Flexibility bird director' and 'Flexibility both' positively, even though the effect of 'Flexibility bird director' is not significant. This indicates that farmers are willing to accept further delays in mowing dates if this is necessary. Whether farmers are offered shorter or longer contracts is not influential. In addition, the model shows the expected results for stricter requirements. Farmers are less likely to choose a contract in case it includes later mowing dates, bans on chemical fertilizers, bans on pesticides, or both.

Next to the mixed logit model, the results of the latent class estimation are presented in Table 3. The model distinguishes between two preference classes. This suggests that some of the already described results do not hold uniformly across the participants. The first preference

[6] Fulltime farming, organic, the risk & success perception, and the grassland share do not have explanatory power and were excluded from the final model.

[7] The mixed logit model in Table 3 only includes farmers that completed the survey. Since the sample size of the survey is rather small an additional mixed logit model was estimated with farmers that finished at least two choice sets. It shows that the effects of the attributes hold for the larger sample of 104 farmers. The larger mixed logit model and its WTA values are shown in Tables 1 and 2 in the appendix. In general, the sample sizes used are comparable to those in other studies, for instance, Latacz-Lohmann and Breustedt (2019) surveyed 68 farmers, Chèze et al. (2020) surveyed 75 farmers and Massfeller et al. (2022) 59 farmers.

[8] Additional robustness checks were performed by estimating separate models for the farmers that are members of NFW, and farmers of the other collectives. The logit model provides results that are similar to our original findings. In addition, a latent class model was estimated where a Dummy variable for NFW was included. Results show that the Dummy is not significant, which indicates that no differences between farmers from the separate collectives exist. The results of the robustness checks are available from the authors upon request.

**Table 3**
Estimated models to explain farmers' decision to participate in a hypothetical, hybrid meadow bird conservation contract.[a]

| | Mixed logit | | Latent class model | | | |
|---|---|---|---|---|---|---|
| | | | Class 1 | | Class 2 | |
| *Contract attributes* | Coef. | *p*-value | Coef. | p-value | Coef. | p-value |
| Fixed Payment (Euro / ha) | 0.002*** | 0.003 | 0.002*** | 0.000 | 0.001* | 0.067 |
| Delay in mowing dates | −0.077*** | 0.000 | −0.058*** | 0.000 | −0.029* | 0.053 |
| Bans on chemical fertilizer | −1.529** | 0.015 | −0.212 | 0.590 | −1.647*** | 0.004 |
| Bans on pesticides | −0.971* | 0.057 | −0.249 | 0.480 | −0.653 | 0.190 |
| Bans on both (chem. Fertilizers and pesticides) | −1.525*** | 0.005 | −0.525 | 0.110 | −1.258*** | 0.005 |
| Monitoring by bird director | 1.043*** | 0.003 | 0.510** | 0.021 | 0.690* | 0.057 |
| Monitoring by local bird protector | 0.973*** | 0.007 | 0.593** | 0.014 | 0.737** | 0.047 |
| Contract length | −0.005 | 0.904 | 0.012 | 0.690 | 0.036 | 0.470 |
| Flexibility farmer | 1.139** | 0.012 | 0.444 | 0.140 | 1.144** | 0.012 |
| Flexibility bird director | 0.762 | 0.115 | 0.141 | 0.660 | 1.630*** | 0.001 |
| Flexibility both | 0.999*** | 0.010 | 0.667** | 0.020 | 0.666 | 0.130 |
| Collective bonus (€ 500) | 0.179 | 0.619 | −0.149 | 0.530 | 0.805* | 0.060 |
| Collective bonus (€ 1000) | 0.766** | 0.021 | 0.479* | 0.069 | 0.902** | 0.049 |
| Individual bonus (€ 1000) | −0.142 | 0.669 | −0.439* | 0.095 | 0.365 | 0.390 |
| Individual bonus (€ 5000) | 0.670* | 0.084 | 0.210 | 0.410 | 0.391 | 0.330 |
| ASC | −183.060 | 0.462 | 2.191*** | 0.000 | −2.904*** | 0.001 |
| *Farm- and individual characteristics* | | | | | | |
| Year of birth | 0.095*** | 0.006 | 0.423* | 0.078 | 0.000 | 0.000 |
| Farming experience | −0.003 | 0.360 | −0.010 | 0.120 | 0.000 | 0.000 |
| Higher education | −2.769*** | 0.002 | −18.559*** | 0.005 | 0.000 | 0.000 |
| Own risk perception | −0.124 | 0.631 | −0.632 | 0.570 | 0.000 | 0.000 |
| Risk & success perception | 0.203 | 0.468 | 0.651 | 0.730 | 0.000 | 0.000 |
| Hectares | 0.015* | 0.056 | 0.050 | 0.220 | 0.000 | 0.000 |
| Main occupation dairy | −3.697*** | 0.003 | −20.494** | 0.025 | 0.000 | 0.000 |
| Date first mowing | 0.283* | 0.070 | 1.662** | 0.026 | 0.000 | 0.000 |
| Financial position | 1.739** | 0.016 | 7.031** | 0.024 | 0.000 | 0.000 |
| AES - Hectares enrolled | −0.025 | 0.208 | −0.022 | 0.730 | 0.000 | 0.000 |
| AES – Clutch management | −0.964 | 0.162 | 1.237 | 0.710 | 0.000 | 0.000 |
| AES – Field flooding | −0.925 | 0.163 | −14.834*** | 0.005 | 0.000 | 0.000 |
| AES - Herb-rich grassland | 3.228*** | 0.000 | 13.198** | 0.035 | 0.000 | 0.000 |
| AES - Rough manure | −1.129 | 0.187 | −2.369 | 0.480 | 0.000 | 0.000 |
| AES- High water levels | −0.819 | 0.184 | −10.084** | 0.012 | 0.000 | 0.000 |
| AES Payment by measures | −2.477*** | 0.005 | −13.345*** | 0.005 | 0.000 | 0.000 |
| AES – Many bird nests | 1.138 | 0.274 | 6.251 | 0.110 | 0.000 | 0.000 |
| Goals –Profit maximization | −0.013 | 0.401 | 0.152* | 0.084 | 0.000 | 0.000 |
| Goals –Financial stability | 0.036** | 0.048 | 0.078 | 0.150 | 0.000 | 0.000 |
| Goals –Environmental impact | −0.036* | 0.069 | −0.225** | 0.040 | 0.000 | 0.000 |
| Satisfaction | 0.537 | 0.410 | 2.748 | 0.360 | 0.000 | 0.000 |
| Knowledge | 0.338 | 0.219 | 1.350 | 0.250 | 0.000 | 0.000 |
| Intercept | | | −824.867* | 0.075 | 0.000 | 0.000 |

[a] For contract length, delays in mowing dates and the fixed payment, the linearity assumption was tested. The mixed logit models are based on calculations with 1000 Halton draws in Stata 15. The latent class model was estimated with Latent Gold 6 (Level of significance: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$).

class seems to consist of farmers that are more likely to participate in the hypothetical conservation contracts. The class-specific predicted probability of choosing a contract is estimated to be 84%, while the class membership probability is 65%. Farmers in this class are especially interested in a higher fixed annual payment, while the bonus payments seem to be of lower importance. The collective bonus payment is only evaluated positively when a € 1000 per farmer is on offer. The individual bonus payment of the same amount was even evaluated slightly negatively. Furthermore, farmers in the first preference class seem to tolerate bans on chemical fertilizers and pesticides but evaluate delays in mowing dates negatively. Additionally, the attribute 'Flexibility both' indicates that they would like to be able to adjust measures annually while also allowing the bird directors to further postpone mowing.

Farmers in class two seem less interested in the hypothetical conservation contracts. Their class-specific predicted probability to choose a contract is 16%, and the class membership probability is 35%. In contrast to the first preference class, farmers in the second preference class seem more interested in the collective bonus payments. They evaluate both levels for the collective bonus positively, while paying less attention to the annually offered fixed payments. The individual bonus payments seem to be unimportant for them. Another difference is that farmers in class two evaluate bans on chemical fertilizers, pesticides or both negatively. Furthermore, flexibility for farmers and bird directors is evaluated positively when offered separately. The effect 'Flexibility both' is not significant. Both classes have in common that monitoring by bird directors or bird protectors is preferred above monitoring by public officials and that the contract length is unimportant to them.

Since the coefficients of the estimated models are not suitable for interpreting the effect sizes of the attributes, WTA values were calculated. The estimated WTA values are presented in Tables 4 and 5. Positive WTA values provide information on how much more money a farmer would expect to accept an attribute that is evaluated negatively. Similarly, negative WTA values show how much money a farmer is willing to give up for an attribute that is evaluated positively. For example, farmers in the mixed logit model are willing to give up roughly € 336 for the possibility to be paid a collective bonus of € 1000, and roughly € 300 for the chance to earn an individual bonus of € 5000. However, the 95% confidence intervals are large, and the WTA values need to be interpreted with caution. They show, for instance, that the true WTA value of the population mean falls in a range between roughly € 18 and € 50 for a delay of mowing by one day. For a ban on chemical pesticides the range is between € 134 to € 1210.

In the latent class model, high WTA values for bans on chemical

**Table 4**
Estimated Willingness-to-Accept values and confidence intervals (CI) for the mixed logit model with a fixed price coefficient ($n = 78$)[a].

| | WTA | Lower-CI | Upper-CI |
|---|---|---|---|
| Delay in mowing dates | 33.99 | 17.61 | 50.37 |
| Bans on chemical fertilizers | 672.09 | 133.89 | 1210.30 |
| Bans on pesticides | x | x | x |
| Bans on both (chem. Fertilizers and pesticides) | 670.07 | 200.40 | 1139.75 |
| Monitoring by bird director | −458.17 | −804.20 | −112.13 |
| Monitoring by local bird protector | −427.38 | −765.71 | −89.05 |
| Contract length | x | x | x |
| Flexibility farmer | −500.70 | −879.45 | −121.95 |
| Flexibility bird director | x | x | x |
| Flexibility both | −439.18 | −763.16 | −115.20 |
| Collective bonus (€ 500) | x | x | x |
| Collective bonus (€ 1000) | −336.80 | −658.52 | −15.07 |
| Individual bonus (€ 1000) | x | x | x |
| Individual bonus (€ 5000) | −294.59 | −642.26 | 53.07 |

[a] Values were not calculated for insignificant values. Calculations were carried out with Stata 15.

Looking at their current conservation activities, farmers in class one offer fewer flooded fields. This conservation choice might explain the slightly negative attitude towards the individual bonus, which will only be provided if type iii measures such as ditch inundation are implemented. Considering other management requirements, class one farmers are willing to accept bans on chemical fertilizers and pesticides. Their experience with herb-rich grasslands possibly explains this. That these farmers already have late mowing dates could also explain why they are sensitive towards further delays. Furthermore, class one farmers are less likely to have dairy farming as their main occupation, they have a good financial position, are older and have lower levels of education.[10]

Farmers in class two operate their dairy enterprise more intensively (indicated by 'Date first mowing' and 'Main occupation dairy'), which can explain their dislike for limits on fertilizers and pesticides, and their reluctance to produce herb-rich grassland. Class two farmers did not evaluate the individual bonus positively, which is somewhat surprising since they are already more likely to provide the required flooded areas. That farmers in the second class pay less attention to the annual fixed payment may be explained by the fact that their currently applied measures (field flooding and high-water levels) were not covered by the experiment (as explained in footnote 5). An alternative explanation is that contracts including bans on fertilizers and pesticides have such a deterrent effect that they would rather not participate regardless of the payment.

**Table 5**
Estimated Willingness-to-Accept values and confidence intervals (CI) for the latent class model ($n = 78$)[a].

| | Class 1 | | | Class 2 | | |
|---|---|---|---|---|---|---|
| | WTA | Lower-CI | Upper-CI | WTA | Lower-CI | Upper-CI |
| Delay in mowing dates | 40.33 | 17.76 | 62.91 | 19.436 | −3.47 | 42.34 |
| Bans on chemical fertilizers | x | x | x | 1230.66 | −93.00 | 2554.32 |
| Bans on pesticides | x | x | x | 525.76 | −211.54 | 1263.05 |
| Bans on both (chem. Fertilizers and pesticides) | x | x | x | 912.72 | −38.97 | 1864.41 |
| Monitoring by bird director | −305.90 | −657.95 | 46.16 | −493.78 | −1240.84 | 253.27 |
| Monitoring by local bird protector | −361.32 | −749.31 | 26.68 | −517.65 | −1129.15 | 93.86 |
| Contract length | x | x | x | x | x | x |
| Flexibility farmer | x | x | x | −805.96 | −1736.58 | 124.67 |
| Flexibility bird director | x | x | x | −1190.24 | −2467.70 | 87.23 |
| Flexibility both | −424.54 | −857.58 | 8.50 | x | x | x |
| Collective bonus (€ 500) | x | x | x | −552.35 | −1382.82 | 278.12 |
| Collective bonus (€ 1000) | −351.53 | −764.66 | 61.61 | −575.26 | −1344.93 | 194.40 |
| Individual bonus (€ 1000) | 333.75 | −53.65 | 721.15 | x | x | x |
| Individual bonus (€ 5000) | x | x | x | x | x | x |

[a] Values were not calculated for insignificant values. Calculations were carried out with Latent Gold 6.

fertilizers and pesticides are found for class two. They highlight farmers' strong dislike for these measures.[9] Considering this, the estimated values for 'monitoring' and 'flexibility' also appear high. They indicate how strongly farmers prefer monitoring by local agents above monitoring by officials.

### 5.2. Farmer and farm characteristics relevant for farmers' decision to choose the hypothetical scheme

Potential target groups for hybrid schemes were identified by considering farmer and farm characteristics in the estimation (Table 3). The individual- and farm-specific characteristics in the latent class model provide information about class-membership. The significant coefficients show in which aspects farmers between the two classes differ. Farmers in class one seem to pay much attention to the fixed annual payment, which could be explained by their goal to maximize profits instead of minimizing the environmental impact of their farm.

### 5.3. Factors relevant for farmers' decision to qualify for the individual bonus

Farmers that opted for a hypothetical hybrid scheme with an individual bonus on offer were also asked whether they would offer ditch inundation and extensive grazing (the type iii measures that were preconditions for receiving the individual bonus). In total, 1407 cases were observed and contracts offering individual bonus payments were chosen in 259 cases, or only 18% of the times.[11] 108 times a contract was chosen that included a bonus of € 1000, and 151 times a contract was chosen that included a bonus of € 5000. Farmers chose to offer type iii measures if the bonus was € 1000 in 69% of the cases and in 76% of the cases if the

[9] Their compensation requirements are twice as high as current compensation payments for these measures. Farmers receive € 350 additionally when pesticides and chemical fertilizers are restricted. When mowing is delayed without restricting the use of chemical fertilizers and pesticides current compensation payments range between € 500 (mowing from June 1st) to € 1250 (mowing from July 1st) (Water, Land & Dijken, 2020), thus leading to an additional payment of roughly € 25 for a delay by one day.

[10] The interaction effects of farmer and farm characteristics, and the ASC in the mixed logit model also display how the decision to participate is influenced by farmer and farm characteristics. They confirm the results described.

[11] Due to this low number of observations, the choice between offering extensive grazing and ditch inundation and between not offering these measures and not qualifying for a bonus was not analyzed further.

bonus was € 5000. This shows that granting a bonus five times as high only slightly increases the share of farmers willing to adopt type iii measures. However, since only 22% of the farmers who are willing to offer extensive grazing in contracts with an individual bonus are currently offering extensive grazing, the individual bonus might still increase the share of these measures in the collective.

## 6. Discussion

This article aimed to develop and analyze farmers' acceptance of a hypothetical AES for meadow bird protection that accounts for results. The results of the DCE show that roughly 75% of farmers opted for one of our hypothetical contracts in the mixed logit model, and the bonus payments showed significant effects. This may indicate that Dutch farmers are willing to switch to a hybrid scheme.

### *6.1. Relevance of the contract attributes*

However, the discussions with stakeholders and the analyses also showed that the annual fixed payment per hectare is important for farmers. That farmers are sensitive to the fixed payment is also found by Rodríguez-Entrena et al. (2019) and Latacz-Lohmann and Breustedt (2019) for action-based schemes, and by Kuhfuss et al. (2016) for hybrid, result-based schemes.

Both of the chosen bonus payments in the experiment significantly affect farmers' decisions to choose a hypothetical scheme in the mixed logit model. Introducing a collective bonus in practice could thus help to shift farmers' focus towards results. However, the results of the mixed logit model also indicate that this bonus needs to be sufficiently high to be effective. A bonus of € 1000 per farmer had a significant influence in both estimations (the mixed logit and the latent class model), while a bonus of € 500 per farmer did not have an effect in the mixed logit model. It should be noted also that the collective bonus that was introduced in the experiment would be paid out only if bird numbers in the collective have increased more than on average in the province (where the collective is located). This means that if the increase in bird numbers in the collective is the same as (or lower than) the increase in bird numbers in the whole province, farmers in the collective do not receive the collective bonus. Essentially, this introduces an element of competition, not with other farmers in the collective but with farmers in other collectives in the province. This also results in uncertainty for farmers about whether or not their efforts (/success) will be rewarded with a bonus. The implications of this uncertainty for the willingness of farmers to participate in the hypothetical scheme were not further investigated. Future research could look at both the implications and alternatives for the measurement of results in bird conservation schemes.

The latent class analysis shows that this does not hold uniformly across farmers. For farmers in class two, a lower bonus payment already incentivizes them to choose a contract. This is an interesting finding because preference class two consists of the more intensive farmers that show low predicted probabilities to choose a contract. Farmers in class one had a class-specific predicted probability of 84% to choose a contract and are willing to participate regardless of a bonus.

The WTA values in the mixed logit model further indicate that farmers would be willing to accept a lower fixed payment of about € 300 per hectare for a € 1000 bonus per farmer. The farmers in the sample already offer more than three hectares on average for meadow bird protection. Therefore, contracts with an individual bonus of € 1000 per farmer and lower fixed payments could be cheaper than current contracts. In the latent class model, these WTA values are even higher. The result that farmers would be willing to give up more money than they could expect from a bonus is also found in Kuhfuss et al. (2016). They assume that farmers' positive attitude towards the bonus could be because farmers seek to ensure that their engagement for nature protection has an effect. However, these results need to be interpreted carefully. The respondents were asked to evaluate hypothetical contracts, and it is known that respondents tend to over- or underestimate their actual WTA in hypothetical situations (Lloyd-Smith and Adamowicz, 2018).

The individual bonus was offered to farmers willing to provide extensive grazing and ditch inundation on top of the other measures. In the mixed logit model, farmers were significantly more likely to choose a contract in case an additional individual bonus of € 5000 per farmer was offered. Therefore, a bonus payment could increase the number of farmers offering a combination of measures on their land. However, the effect of an individual bonus of € 5000 per farmer was only slightly significant and did not hold in the latent class estimation. Therefore, it should be further evaluated whether such a bonus is necessary. On the one hand, an individual bonus might support the supply of type iii measures, even though only a few farmers (18%) opted for such a contract. On the other hand, the low levels of significance also indicate that a bonus might not be necessary from the farmers' perspective and not paying the individual bonus would allow to save on costs for implementing the AES.

Considering the other attributes, significant, positive effects are found for ‘Flexibility’ and ‘Monitoring’. The high WTA values indicate that farmers strongly prefer them, and they could thus be used to set incentives for farmers to participate in meadow bird protection. Whether the collectives will be allowed to fully take on the monitoring task will depend on the trust between collectives and the government. That trust between governmental bodies and farmers is decisive is well described in the literature (Schaub et al., 2023). Allowing ‘Flexibility’ for farmers might not be in line with collectives' management practices, as it makes it more difficult to continue a mosaic for six years. However, the results also show that farmers are willing to accept ‘Flexibility for bird directors’. Including the possibility for bird directors to delay mowing dates in cases where rare species have not left the field in future contracts seems to be an easy way to better ensure successful conservation. Exploring such probabilities further is interesting given the flexibility that is provided in the current regulation (Terwan, 2016).

### *6.2. Influence of farm production intensities on participation*

The experiment also included attributes of different conservation measures. They were included because the conservation status of meadow birds in the Netherlands might not be sufficiently good to apply a purely result-based scheme. Allen et al. (2014) and Herzon et al. (2018) point out that result-based payments are particularly suitable in areas with good conservation status. The coefficients for the conservation measures and the characteristics of the farm and the farmers that are willing to participate, indicate that switches towards more result-based or even purely result-based schemes may not lead to the desired improvements in ecological effectiveness. This is often attributed to the fact that farmers are reluctant to adopt measures that lead to a lower production intensity and may not choose them in purely result-based schemes. However, implementing these measures is important for achieving sufficient protection and better ecological effectiveness for meadow birds (Kleijn et al., 2004) and other species (Tanis et al., 2020).[12] This could especially apply for intensively managed farms that create more negative externalities (Cullen et al., 2021).

Considering that more intensive farmers (class 2 in the latent class model) are less likely to state to prefer result-based payments, it is likely that switches towards result-based payments would reduce their participation in AES. Niskanen et al. (2021), who analyzed farmers'

[12] Tanis et al. (2020), for example, show that bird conservation only results in positive interactions with other species (in their case, pollinators) if farm management practices are extensified. They find that positive effects are not achieved if mowing dates are delayed. According to these authors, a positive interaction requires a switch from intensively managed grassland towards herb-rich grassland or even hay meadows.

preferences towards result-based schemes in Finland, also find that more intensive farmers strongly support the status quo, i.e. purely action-based AES. That intensive farming types are less interested in AES is also described in Cullen et al. (2021) and Zimmermann and Britz (2016),[13] and seems to be especially associated with higher farming intensities in livestock (Lakner et al., 2020; Latacz-Lohmann and Breustedt, 2019; Leonhardt et al., 2022; Schulz et al., 2014). This may be problematic as sufficient participation rates are particularly important for the Netherlands, where AES participation is already among the lowest in the EU (Groeneveld et al., 2019; Zimmermann and Britz, 2016). The fact that intensive producers are less likely to opt for a contract is often explained by their higher opportunity costs (Schaub et al., 2023), and could also explain the relatively high compensation requests (WTA) for bans on chemical fertilizers and pesticides for farmers in class two.

Considering these findings, it seems surprising that farmers in class one were more likely to state that they mostly seek to maximize profits rather than reduce their environmental impact. One explanation might be that class one farmers believe that they have already put in sufficient effort to adapt their management practices. Another explanation could be that the negative environmental effects of intensive livestock production are highly criticized in the Netherlands (Government of the Netherlands, 2020). It could therefore be that the farmers in class two, who produce more intensively, gave a socially desirable answer, or in the future indeed seek to reduce their negative impact on the environment. In the latter case, a bonus payment could have a motivating effect because it provides a clear link to management practices (Allen et al., 2014). Our results show that this motivational effect might even be present if the payment is paid for collective success.

## 7. Conclusion

This article contributes to existing literature by assessing farmers' willingness to participate in a hybrid scheme with both action-based and result-based payments in collective AES for meadow bird conservation. The findings indicate a positive impact of collective bonus payments on farmers' willingness to participate in the hybrid scheme.

However, the research also shows the opposition of intensive farmers towards result-based AES. This indicates the need for policies that effectively target and incentivize specific groups of farmers. Therefore, future research should focus on strategies to motivate intensive farmers, and specifically to better understand under which circumstances farmers are willing to implement complex measures (type iii). In addition, since this research surveyed farmers that are already enrolled in AES, future research should also consider farmers who have not yet participated in meadow bird conservation, especially in countries like the Netherlands where AES participation rates remain low.

## Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Dries, Liesbeth reports financial support was provided by European Union. Splinter, Melody reports financial support was provided by European Union.

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## Data availability

Data will be made available on request.

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## Appendix A

**Appendix Table 1**

Estimated mixed logit models to explain farmers' decision for a hypothetical, hybrid meadow bird conservation contract ($n = 104$).

| | Coef. | p-value | Std. Dev. | p-value |
|---|---|---|---|---|
| Fixed payment (€/ ha) | 0.002*** | 0.000 | −0.001 | 0.300 |
| Delay in mowing dates | −0.059*** | 0.000 | 0.037*** | 0.001 |
| Bans on chemical fertilizer | −0.726* | 0.081 | −0.657 | 0.292 |
| Bans on pesticides | −0.600* | 0.093 | −0.246 | 0.657 |
| Bans on both (chem. Fertilizers and pesticides) | −1.170*** | 0.003 | −0.560 | 0.298 |
| Monitoring by bird director | 0.722*** | 0.002 | 0.841** | 0.030 |
| Monitoring by local bird protector | 0.804*** | 0.001 | −0.958** | 0.043 |
| Contract length | −0.013 | 0.646 | 0.073 | 0.188 |
| Flexibility farmer | 0.764*** | 0.009 | −0.790 | 0.100 |
| Flexibility bird director | 0.546** | 0.078 | −0.593 | 0.491 |
| Flexibility both | 0.609** | 0.021 | −0.695 | 0.196 |
| Collective bonus (€ 500) | 0.162 | 0.505 | −0.054 | 0.915 |
| Collective bonus (€ 1000) | 0.684*** | 0.009 | 0.068 | 0.883 |
| Individual bonus (€ 1000) | −0.076 | 0.752 | 0.034 | 0.930 |
| Individual bonus (€ 5000) | 0.542* | 0.061 | −0.083 | 0.840 |
| ASC | 0.539 | 0.344 | 2.306 | 0.000 |

[13] Schaub et al. (2023) show in their literature review that 46% of the articles find negative effects between AES participation and farm management intensities, while 42% do not find any effects. In 12% of the cases a positive effect is found.

**Appendix Table 2**
Estimated Willingness-to-accept values (n = 104).

| | WTA | Lower - CI | Upper - CI |
|---|---|---|---|
| Fixed payment (€/ ha) | | | |
| Delay in mowing dates | 30.69 | 16.80 | 44.58 |
| Bans on chemical fertilizer | 377.35 | −30.59 | 785.28 |
| Bans on pesticides | 311.54 | −43.66 | 666.73 |
| Bans on both (chem. Fertilizers and pesticides) | 607.75 | 221.99 | 993.50 |
| Monitoring by bird director | −375.38 | −650.28 | −100.48 |
| Monitoring by local bird protector | −417.52 | −695.61 | −139.44 |
| Contract length | x | x | x |
| Flexibility farmer | −397.06 | −698.82 | −95.31 |
| Flexibility bird director | −283.63 | −599.35 | 32.10 |
| Flexibility both | −316.20 | −599.27 | −33.14 |
| Collective bonus (€ 500) | −84.20 | −340.44 | 172.03 |
| Collective bonus (€ 1000) | −355.35 | −641.83 | −68.87 |
| Individual bonus (€ 1000) | x | x | x |
| Individual bonus (€ 5000) | −281.70 | −576.65 | 13.25 |

**Appendix Table 3**
Estimated BIC values for the latent class estimation (Source: own calculation with Latent Gold 6).

| | Log-likelihood | BIC |
|---|---|---|
| 1 class model | −447.5983 | 964.9040 |
| 2 class model | −353.6016 | 946.8222 |
| 3 class model | −328.4522 | 1066.4351 |

## Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecolecon.2023.107999.

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