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Farmers' preferences for result-based schemes for grassland conservation in Slovenia

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ABSTRACT

Government-funded payments for ecosystem services (PES) have increasingly been used to facilitate transactions between users of environmental services and their providers. In order to improve the link between payments and the service provided, some countries in the EU have promoted result-based schemes (RBS), which remunerate farmers for ecological results, as part of their agricultural policy. Since PES programs are voluntary, it is important to understand farmers' responses before more large-scale implementations of RBS are initiated. Using a choice experiment and a mixed logit model, we elicited the preferences of farmers in two Natura 2000 sites in Slovenia for different design elements of a hypothetical scheme for dry grassland conservation. We found that the majority of farmers preferred the result-based approach over the management-based scheme both in terms of payment conditions and monitoring; one group of farmers preferred the RBS very strongly (average WTA of more than 500 EUR/ha/yr) and another group less strongly (average WTA about 200 EUR/ha/yr). Farmers also showed a higher preference for on-farm advise and training in small groups than for lectures, which would be offered to a larger audience. A collective bonus, which would incentivise coordination and could potentially increase participation rates in the scheme, significantly influenced the farmers' willingness to adopt the scheme. However, the estimated average WTA was comparable or lower than the 40 EUR/ha annual bonus payment. Older farmers and those who managed small and semi-subsistent farms were significantly more likely to be highly resistant to scheme adoption no matter its design.

1. Introduction

In the last decades, biodiversity in agricultural ecosystems worldwide has undergone widespread and rapid decline, which has been mostly attributed to the intensification and structural changes of agriculture and land use change (IPBES secretariat, 2019; Pereira, Navarro, & Martins, 2012; Stoate et al., 2009). One of the particularly vulnerable habitats are semi-natural grasslands, which are highly dependent on anthropogenic disturbance (Dengler, Janišová, Török, & Wellstein, 2014; EEA, 2020). They provide a range of ecosystem services, including the provision of fodder for livestock, regulation of water flows and several cultural services (Lamarque et al., 2011; Nowak-Olejnik et al., 2020; Villoslada Peciña et al., 2019). However, since most of these services can be categorised as public goods, they are usually not adequately valorised by the market. The opportunity costs associated with maintaining extensive use of grasslands are thus largely borne by farmers (Hanley et al., 2012).

Payments for ecosystem services (PES) have increasingly been used to stimulate voluntary transactions between users of an environmental service (or agencies acting on their behalf) and its providers (Engel et al., 2008). Government-funded PES now include some key large-scale policy instruments, including the agri-environmental measure (AEM) in the European Union (EU) (Matzdorf et al., 2013), which was implemented as part of the Common Agricultural Policy (CAP) on more than 26 million hectares or 15 % of utilised agricultural area in the EU in 2017 (Alliance, 2019).

To increase their effectiveness, PES should be as directly linked to ecosystem services provided as possible (Gerowitt et al., 2003). However, suitable indicators are often hard to define at the level of individual farms, because they might be difficult to measure and because environmental results may depend on efforts made by a large group of farmers. Most PES programmes are thus designed as management-based

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schemes, which provide payments for farming practices that are believed to secure certain services, rather than being tied to their actual provision (Burton & Schwarz, 2013).

By contrast, some countries in Europe have developed result-based (or outcome-based) schemes (RBS), which remunerate farmers for ecological results, demonstrated by indicators such as the presence of plant species and the breeding success of farmland birds (Herzon et al., 2018). This kind of payment conditionality is particularly important in government-funded PES, where monitoring of performance is often narrowed down to monitoring the compliance of beneficiaries with prescribed management practices, whereas actual environmental impacts might be less emphasised (Engel et al., 2008). However, since RBS largely shift the risk of achieving results from a government to a ecosystem service provider, they might be less appealing to more risk-averse farmers (Uthes & Matzdorf, 2013). In addition, farmers need to know the indicators well and have a good sense of farming practices, which are needed to achieve the results (Herzon et al., 2018). Therefore, they should have access to sufficient information and training (Moran et al., 2021).

Because farmers' decision to participate in PES is voluntary, a good understanding of their preferences and motives is crucial for planning and implementing biodiversity policy in agricultural ecosystems (de Snoo et al., 2013; Lastra-Bravo et al., 2015). Previous studies in Europe indicate that farmers often positively respond to RBS, because they seem to consider this approach to be fairer, more flexible and easier to implement (Birge et al., 2017; Matzdorf & Lorenz, 2010; Wezel et al., 2018). However, farmers do not always recognise the result-oriented approach as more legitimate (Vainio et al., 2019). It is thus important to test farmers' responses in various contexts before more large-scale implementation of RBS is initiated, since this would represent a significant shift from the current way in which AEM and other PES are implemented, as they are, at present, mostly management-based both in Europe and on other continents (Burton & Schwarz, 2013).

To address this research gap, we conducted a discrete choice experiment (DCE) to elicit farmers' preferences for different PES scheme designs for dry grassland conservation in Slovenia, an EU Member State in Central Europe (Perko, Ciglič, & Zorn, 2020). To tackle the loss of biodiversity and grassland habitats, the Slovenian government introduced a management-based agri-environmental scheme in 2008 to incentivise the extensive management of grasslands (Government of the RS, 2015). However, the participation rates have been relatively low, as only 27 % of the target extent of grassland conservation was reached in the scheme in 2018 (MOP, 2019). Previous studies in Slovenia indicate that the key reasons for the low participation rates in AEM are probably connected to the schemes' requirements and farmers' difficulty to understand them, unstimulative payment levels, administrative burden and lack of information (Pust Vučajnk & Udovč, 2008; Špur, Šorgo, & Škornik, 2018; Žgavec, Eler, Udovč, & Batič, 2013). We thus wanted to test whether the adoption rate of the scheme could be improved by changing its design to better fit the preferences of local farmers. In particular, we were interested in farmers' willingness to accept RBS and their associated monitoring approach as well as their preferences regarding the training method.

DCE is a choice modelling method that enables elicitation of people's stated preferences in hypothetical situations, making them useful for pre-testing new policy instruments (Colen, 2016). The DCE method has often been used to elicit farmers' preferences regarding AEM contract characteristics (Mamine et al., 2020), such as length of commitment and administrative burden (Ruto & Garrod, 2009), as well as regarding a range of agri-environmental farming practices (e.g. Beharry-Borg et al., 2013; Christensen et al., 2011; Villanueva et al., 2015). The latter include grassland management schemes, where it has been shown that farmers tend to prefer more flexibility in contract implementation (Espinosa-Goded et al., 2010) and as little change to their current management practice as possible (Santos et al., 2015; Vaissière et al., 2018).

By contrast, farmers' preferences regarding a result-oriented policy have been less explored. To the best of our knowledge, farmers' choices between result- and management-based schemes have not yet been quantified with the choice experiment approach, except indirectly in a study by Niskanen et al. (2021). Similarly, while it has often been demonstrated that farmers are willing to accept lower compensation levels if they have access to free-of-charge training and advisory support (Christensen et al., 2011; Espinosa-Goded et al., 2010; Hannus et al., 2020; Kuhfuss et al., 2016), DCEs have rarely been used to test for preferences regarding different methods that could be used to provide extension services.

In the DCE, we also inquired whether participation rates in the schemes could be increased by incentivising coordination efforts of farmers (Kuhfuss et al., 2016). This question is particularly important because many grassland species depend on maintaining sufficient amount of unfragmented or spatially well connected areas with suitable habitat. However, PES are often implemented in regions with fragmented land ownership, so successful grassland conservation depends on incentivising a large number of farmers to participate in the programme (Franks & Emery, 2013). Several previous studies have shown that farmers generally prefer individual contracts over different approaches to coordination and collective enrolment of farmers into the AEM (Le Coent et al., 2017; Villanueva et al., 2015; Wainwright et al., 2019). However, if coordination efforts are compensated with an additional payment (i.e. collective bonus) or other financial benefits, the response was generally found to be positive (Barghusen et al., 2021; Sheremet et al., 2018) and such a payment can even function as a nudge for farmers to enrol more land in the scheme (Kuhfuss et al., 2016).

This paper is structured as follows. In the next section, we introduce the study area and describe our methodological approach. The Results section presents the outcomes of the choice analysis conducted with mixed logit models and further explores preference heterogeneity. Finally, we interpret our findings in the context of future PES design and the potential for scaling up the implementation of RBS in the EU and wider.

2. Methods

2.1. Study area

Our study was conducted in two research areas in Slovenia. Haloze (172 km^2) is a hilly sub-Pannonian region in the Eastern part of the country, whereas Karst (618 km^2) is a sub-Mediterranean limestone plateau near the Adriatic coast (Perko, Ciglič, & Zorn, 2020). Both areas were designated as part of the Natura 2000 network of protected areas due to their highly diverse dry grasslands, which require extensive management and are protected under the EU Habitats Directive (Council Directive 92/43/EEC) (Government of the RS, 2015).

Similarly to many remote rural areas in Europe in recent decades (van Vliet et al., 2015), structural changes in agriculture and an ageing rural population in Haloze and Kras have led to widespread abandonment of farming and consequent overgrowth of grasslands with forests. On the other hand, the remaining farms have often intensified the use of grasslands by increasing fertilisation and early mowing of meadows and introducing more intensive grazing regimes due to growing demand for livestock feed. As a result, the extent of extensively managed dry grasslands in both study areas has diminished despite the available funding through AEM (Kaligarič & Ivajnšič, 2014; Škornik et al., 2010; Žiberna, 2012).

2.2. Experimental design

Based on a literature review, we identified various possible approaches to further incentivise the extensive management of dry grasslands (Franks & Emery, 2013; Herzon et al., 2018). These approaches were discussed in two focus groups with experts in botany, nature conservation, agriculture and agricultural economics, three focus groups with local agricultural advisors and two meetings with representatives of agricultural and nature conservation authorities. In the initial focus groups, farmers were not specifically included, because the discussion required good knowledge of the agri-environmental policy instruments and scheme design. In this way, we identified the key issues and possible designs of the hypothetical new scheme. These were then used to design a choice experiment with five attributes, conducted with farmers (Table 1). The experiment and the questionnaire (see section 2.3) were pretested by surveying 22 farmers in both research areas.

We identified two possible payment conditions, which can be equally used to ensure the provision of biodiversity-rich dry grasslands with a favourable conservation status in the research area. The management-based scheme was described as a system with several prescribed practices, including a fixed date, before which mowing or grazing is not allowed, and a limited amount of livestock per hectare and input of organic fertilisers. By contrast, the result-based scheme was defined as a system where no practices are prescribed by the contract. However, farmer is required to develop or maintain suitable grassland management that enables the presence of at least 4 indicator plant species, whose total coverage must reach at least 10–30 % of the meadow or pasture area. Both the indicator species and total coverage were graphically presented to farmers before the experiment in order to ensure that the payment conditions were well understood by the respondents.

Monitoring of the measure would be conducted by the monitoring agency on a random sample of 5 % of enrolled farm holdings each year. However, the monitoring itself could be implemented in three possible ways. Prescribed practices would be monitored by reviewing mandatory records of prescribed practices and on-field verification of compliance. In the result-based scheme, the monitoring agency would screen the enrolled grasslands for indicator plant species. The third option would be a hybrid system with control primarily based on monitoring indicator species. However, if he or she so wishes, the farmer could also demonstrate suitable farming practices by keeping the records of management practices. This option was included to test whether such hybrid system would be more appealing to more risk-averse farmers, because research showed that the verification process and potential inability to demonstrate the results due to external factors (e.g. weather) was often among the key concerns to farmers (Birge et al., 2017; Wezel et al., 2018).

In this hypothetical scheme, free-of-charge training would be compulsory for all participating farmers. The attribute training mode had three possible levels, i.e. methods that the extension service could use. The first method was four hours of lectures per year, which would be organised for a large audience of farmers. The second was four hours of training per year, where a farmer can choose training from a list of options such as field trips, lectures or group learning in smaller groups. A third option was individual advisory service carried out on-farm three times during a five-year contract, which would last about half a day (i.e. 5–6 h).

Table 1
Attributes and levels used in the choice experiment.

Attribute	Acronym	Levels
Payment conditions	MBS	Prescribed practices (management-based scheme)
	RBS	No prescribed practices (result-based scheme)
Monitoring	RECORDS	Control of records of prescribed practices
	PLANTS	Control of presence of plant species
	HYBRID	Control of presence of plant species and voluntary record- keeping
Training mode	LECTURES	4 h of lectures annually
	SELECT	4 h of training annually, where farmer can select a training method from a list of options
	VISITS	3 advisory visits on farm in 5 years
Annual payment	PAYMENT	180, 230, 290, 340, 390 and 450 EUR/ha
Collective annual bonus	BONUS	40 EUR/ha and 0 EUR/ha

The collective bonus was defined as an additional annual payment of 40 EUR per hectare that would activate when a target enrolment of grasslands was reached, i.e. 26 % of grasslands in Haloze and 19 % in the Karst. Lastly, the basis for determining the six annual payment levels (180–450 EUR/ha) was the average payment of the existing scheme in the research area (223 EUR/ha). Suitable payment levels for the research context were than discussed and determined within the focus groups.

All possible combinations of attributes and their levels would result in (2*3*3*6*2) = 216 combinations, so a full factorial design was not feasible. We used the software Ngene (ChoiceMetrics, version 1.2) to generate an orthogonal fractional factorial design, which consisted of 18 choice cards. Those were then randomly divided into three blocks with six choice cards (Fig. 1) and each respondent was randomly assigned to one block. We did not use a more advanced efficient design as we had no reliable prior knowledge on utility function parameter values.

2.3. Survey and data collection

We collected data by using a survey questionnaire consisting of three parts. In the first part, we checked whether the respondents belonged to the target population and asked questions about their experience with agricultural policy measures and attitudes towards grassland conservation. With the help of photographs, we also checked how well the respondents knew the plant species that could be used as indicators in the result-based scheme. In the second part, we first presented and tested the understanding of individual attributes. We then presented the respondents with six choice cards and follow-up debriefing questions to identify protest responses and understand how the respondents made their decisions. The last part of the questionnaire consisted of socio-demographic questions and questions on farm characteristics.

The sampling population consisted of all registered farm holdings that managed at least 0.3 ha of permanent grassland in the research areas. Furthermore, they had to file their annual application for agricultural subsidies at the selected regional units of the Public Agricultural Advisory Service. There were approximately 680 such farm holdings in Haloze and 650 in Karst. All farmers who met the above criteria were invited to participate in the survey, which was conducted through face-to-face interviews by six trained surveyors in March and April 2019. A total of 258 interviews were conducted in Haloze (37.9 %) and 263 in the Karst (40.5 %).

Before econometric analysis, we excluded from the sample all respondents who chose the opt-out option in all 6 choice cards and stated that they would not enrol in this scheme regardless of the contract conditions (n = 54) or indicated that the choice task was too challenging (n = 7). However, due to their potentially interesting characteristics, we regarded the former group of farmers as "non-adopters" and included them in a separate analysis (see section 3.4). We also excluded respondents who said that they did not take the envisaged options seriously (n = 20) or that they do not make such decisions on their farms (n = 3). The final sample thus included 437 respondents (83.9 % of respondents).

2.4. Model specification and econometric analysis

The theoretical framework of the DCE is derived from Lancaster (1966) theory of consumer behaviour and random utility models (Train, 2009). The latter is based on the assumption that individual i ($i = 1, \ldots, n$) will choose alternative j that maximises his or her utility U_{ij}. The overall utility then consists of a deterministic component V_{ij} and a stochastic component ε_{ij}. The deterministic component is a function of m attributes $(x_1, \ldots, x_m)$, which describe each alternative, while the parameters β_m represent individual preferences for each attribute (Train, 2009):

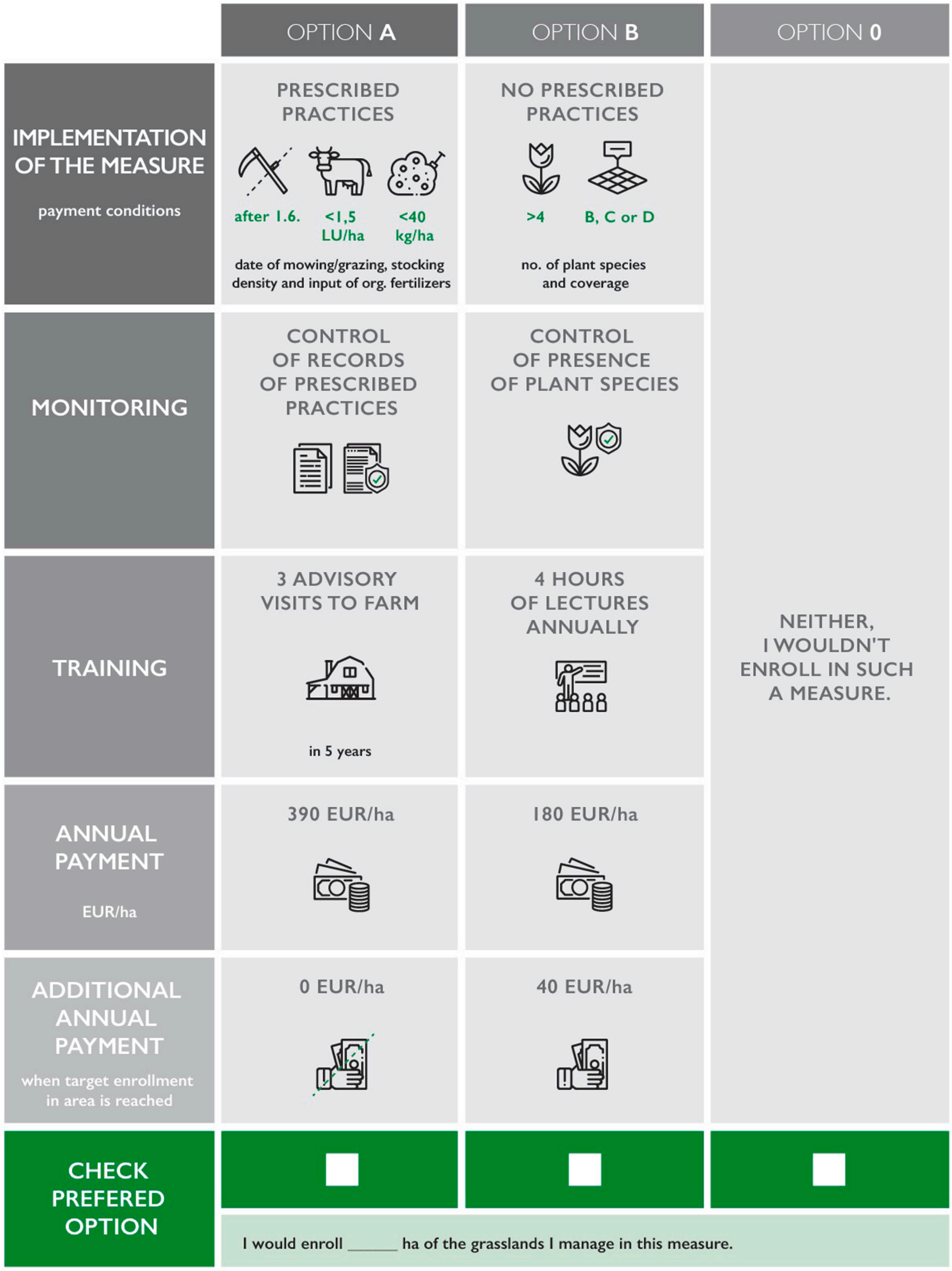

Fig. 1. An example choice card.

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

$$V_{ij} = \beta_0 + \beta_{1x1} + \beta_{2x2} + \cdots + \beta_{mxm}$$

where β_0 represents an alternative-specific constant (ASC).

Because the random error component ε_{ij} cannot be measured, some assumptions must be applied regarding its distribution. The conditional logit (CL) model assumes that ε_{ij} is independently and identically distributed (IID) according to a Gumbel extreme value type-I distribution. In addition, we assume that the irrelevant alternatives are independent (IIA) (Train, 2009). The probability that an individual *i* chooses alternative *j* ($j = 1, \ldots, m$) on a choice card C_t is thus equal to:

$$P(A_{ijt} = 1|\beta) = \frac{\exp(X'_{ijt}\beta)}{\sum_{m \in C_t} \exp(X'_{imt}\beta)}$$

where A_{ijt} is a dummy variable that takes the value of 1 if this happens.

However, the IIA assumption and the premise that individual preferences are homogenous are in many cases too stringent. The mixed logit (MXL) model (also known as the random parameter logit model) is one of the most widely used models for choice experiment analysis which overcome these limitations by allowing the parameters β_m to vary and to follow a normal, log-normal or other distributions. Therefore, it can be used to capture preference heterogeneity (Train, 2009).

Estimates of parameters β can also be used to assess farmers' willingness-to-accept (WTA) for individual attributes. WTA is calculated by dividing the value of the attribute parameter β_k by the parameter for the payment attribute β_{pay}:

$$WTA_k = -\frac{\beta_k}{\beta_{pay}}$$

Data analysis was performed in Stata (StataCorp, version 16.1). The conditional logit model was estimated using the `clogit` command, and the `mixlogit` command was used for the mixed logit model (Hole, 2007a). Epanechnikov kernel density graphs (Silverman, 1998) were plotted with the `kdensity` command to illustrate the distribution of the individual parameter estimates (2019). WTA was estimated using the `wtp` command and the confidence intervals were calculated using the delta method (Hole, 2007b).

3. Results

3.1. Farmer and farm holding characteristics

We compared our sample with the characteristics of all farm holdings in the research area (Table 2). The latter data were retrieved from the Integrated administration and control system (IACS) database of Slovenia, which is managed by the Ministry of Agriculture to facilitate the implementation of the Common Agricultural Policy (CAP). In terms of the gender and age of farmers and the production orientation of their farms, our sample represents the local farm holdings well. However, the age group of above 71 years is under-represented, which is likely because these farmers often refused to participate or it was their representatives who took part in the survey. Average size of farms and the extent of grasslands in our sample is higher than in the sampling population, which can be attributed to a slight under-representation of the group with the smallest farms (<5 ha).

Table 2
Socio-demographic characteristics of farmers and properties of farm holdings (AEM – agri-environmental measure; HAB – current scheme for extensive use of grasslands) in 2019.

Characteristic	Population (n = 2,022)	Sample (n = 437)	*t*-test p	Proportion test p
Gender – male	1,363 (67.4 %)	300 (68.7 %)		0,615
Age				
Average age [years]	59.5● (SD = 16.29)	55.1 (SD = 12.31)	0.615	
<30 years	47 (2.3 %)	14 (3.2 %)		
31–50 years	475 (23.7 %)	126 (28.8 %)		
51–70 years	1,029 (51.2 %)	263 (60.2 %)		
greater than71 years	457 (22.8 %)	34 (7.8 %)		
Farm size				
Average size [ha]	8.8 (SD = 16.28)	12.7 (SD = 28.68)	***	
<5 ha	1,125 (55.6 %)	191 (43.7 %)		
5–10 ha	518 (25.6 %)	145 (33.2 %)		
11–20 ha	207 (10.2 %)	50 (11.4 %)		
21–50 ha	120 (5.9 %)	35 (8.0 %)		
greater than51 ha	52 (2.6 %)	16 (3.7 %)		
Average size of grasslands [ha]◆	6.8 (SD = 15.03)	10.6 (SD = 24.40)	***	
Average share [%] of grasslands in farm area	77.6	83.5		
Livestock or mixed farms	1,277 (63.2 %)	283 (64.8 %)		0.528
Enrolment in AEM	334 (16.5 %)	142 (32.5 %)		***
Enrolment in HAB	162 (8.0 %)	77 (17.6 %)		***

Note: Significance levels are *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.
● Age of 14 farmers is unknown.
◆ 61 farms in the population had no grasslands, whereas all farms in the sample had at least 0.3 ha of grasslands.

Most farmers in our sample had been engaged in agriculture since childhood (85.6 %). They had finished either elementary (19.4 %) or high school (59.7 %) and had never taken part in any formal or vocational training in agriculture (74.8 %). For most households (66.5 %), farming represented less than a quarter of their yearly income, whereas only 12.9 % of respondents indicated that they received more than half of their income from their farm. Farmers mostly engaged in mixed production (56.3 %) or were specialised cattle (16.5 %) or other livestock (15.3 %) breeders. Specialised plant producers (11.9 %) were mainly engaged in wine growing, but have also maintained grasslands.

The vast majority of respondents (92.8 %) supported the public funding of schemes for maintaining local biodiversity-rich meadows and pastures. In comparison to the population, our sample included a higher share of farmers currently enrolled in the agri-environmental measure and the scheme for extensive use of grasslands (Table 2). Farmers felt that they were, on average, well acquainted with available instruments of the CAP (3.2, SD = 0.80, measured on a 5-point Likert scale). Furthermore, the agri-environmental measure was well known among respondents because they had already entered the measure at some point in the past (54.9 %) or were at least informed about it (34.8 %). When deciding whether to enrol in the measure, the payment amount and its impact on farm economics (66.1 %), advice from their agricultural extension officer (41.9 %) and the administrative burden (41.2 %) were singled out as the most important decision factors. This was followed by the perceived impacts of schemes on fodder production (38.2 %) and the environment (37.3 %), whereas opinions of other farmers (30.0 %) and the duration of the contract (28.2 %) were deemed less important.

3.2. Choice analysis

To estimate farmers' preferences regarding different elements of the scheme's design, we first ran a conditional logit (CL) model. Since there was a complete correlation between the levels of the attributes that describe the payment conditions and monitoring, we decided to analyse the data with two models. In Model 1, we omitted the attribute Monitoring, and in Model 2, we omitted Payment conditions. The Hausman test showed that the CL estimations were not valid, because the IIA hypothesis was rejected for both Model 1 and Model 2.

We thus continued the analysis with the mixed logit (MXL) model. In both Model 1 and Model 2, all variables except the payment were defined as random parameters with normal distribution (Table 3). We also estimated other MXL models, where some other variables were defined as fixed. However, after comparing the models with AIC and BIC indicators, these models did not show a noticeably better fit so we do not report them in this paper. All estimated models were statistically significant.

In both MXL Model 1 and Model 2 (Table 3), the payment parameter and the availability of collective bonus were statistically significant and had a positive sign. Both results are intuitive because this means that respondents derived a higher utility from a higher financial compensation. On the other hand, the opt-out option (ASC), in which farmers would not enrol in neither of the scheme alternatives, was not statistically significant. The respondents thus did not seem to have clearly preferred to enter the offered scheme alternatives or to maintain the status quo.

The result-based scheme, where the farming practices are not prescribed, was statistically significantly preferred among the surveyed farmers. Similar preferences are reflected in MXL Model 2, because the respondents tended to favour the type of monitoring that is at least

Table 3
Mixed logit model estimates for attributes.

	Mixed logit model 1			Mixed logit model 2		
	coeff.	p	S.E.	coeff.	p	S.E.
Parameters						
Payment	0.007	***	0.0005	0.008	***	0.0006
ASC●	−0.071	0.836	0.3435	0.551	0.135	0.3686
Result-based scheme (RBS)	1.599	***	0.1685			
Monitoring *(base: RECORDS)*						
HYBRID				0.905	***	0.1184
PLANTS				2.359	***	0.2091
Training *(base: LECTURE)*						
SELECT	0.481	***	0.1276	0.160	0.256	0.1408
VISITS	0.384	***	0.0876	0.261	***	0.0981
Bonus	0.301	***	0.0864	0.176	*	0.0983
Standard deviation						
SD (ASC)	3.712	***	0.3125	3.750	***	0.3178
SD (RBS)	2.468	***	0.2028			
SD (HYBRID)				1.107	***	0.1906
SD (PLANTS)				2.646	***	0.2277
SD (SELECT)	0.333	0.411	0.4049	−0.140	0.751	0.4419
SD (VISITS)	−0.731	***	0.1472	0.964	***	0.1466
SD (BONUS)	−0.119	0.674	0.2828	−0.343	0.133	0.2282
Model summary statistics						
No. of respondents	437			437		
No. of observations	7866			7866		
χ^2	680.92	***		714.60	***	
McFadden pseudo R^2	0.1381			0.1470		
Log likelihood	−2124.5			−2073.8		
AIC	4271.1			4173.6		
BIC	4347.8			4264.2		

Note: Significance levels are *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.
● ASC was coded as the opt-out option “I would not enrol in such a scheme.”

partly based on controlling for the presence of indicator plant species as opposed to only keeping records on the implementation of prescribed practices.

An individual approach to training, where an extension officer provides advice on-farm, was preferred over annual lectures to large groups of farmers. In comparison to attending lectures, farmers also preferred to choose from a list of training options that includes field excursions, lectures and consultation in small groups. However, the latter variable was not statistically significant in MXL Model 2.

3.3. WTA and heterogeneity of preferences

We used the parameter estimates from the MXL models to calculate the farmers’ willingness to accept (WTA) financial compensation for different elements of the scheme design (Table 4). The estimates from the MXL Model 1 show that the farmers are willing to forgo 229 EUR/ha annually if the result-based scheme is offered instead of the management-based scheme. Similarly, if the monitoring is based entirely on controlling for the presence of indicators, the farmers are prepared to accept 305 EUR/ha lower payments annually than if they need to prove the implementation of prescribed practices. On the other hand, the WTA for the hybrid type of monitoring, which includes both result-based monitoring and voluntary record-keeping on the prescribed practices, was estimated at 117 EUR/ha annually.

estimates for different types of mandatory training slightly differ between the two MXL models. However, we can conclude that when compared to the system of annual lectures, farmers are willing to accept somewhat lower payments if they can choose the training method themselves or if the training takes place in the form of individual advisory visits to farms. WTA estimates of the collective bonus also somewhat differ between the models. Based on MXL Model 1, the WTA slightly exceeds 40 EUR/ha, which was the bonus payment offered to farmers in the experiment. This would mean that introducing a collective bonus could lower the overall costs of financing such a scheme. However, this conclusion is not supported by MXL Model 2, where the estimated WTA for the bonus is only 23 EUR/ha.

The estimated standard deviation (SD) coefficients indicate a considerable heterogeneity in farmers’ preferences for all variables except for the collective bonus and the option to freely choose among the mandatory training approaches (Table 3). We analysed this

Table 4
Estimated willingness to accept (WTA) financial compensation for different grassland scheme characteristics in EUR/ha per year.

	Mixed logit model 1			Mixed logit model 2		
	WTA	LL	LU	WTA	LL	LU
Result-based scheme (RBS)	−228.83	−277.69	−179.97			
Monitoring *(base: RECORDS)*						
HYBRID				−116.85	−148.53	−85.18
PLANTS				−304.68	−359.35	−250.00
Training *(base: LECTURE)*						
SELECT	−68.82	−105.79	−31.85	−20.65[ns]	−56.58	15.28
VISITS	−54.90	−79.79	−30.01	−33.74	−58.73	−8.75
Bonus	−43.12	−66.09	−20.16	−22.73	−46.92	1.46

Note: LL and UL indicate confidence intervals at 95% level.
[ns] Not significant.

heterogeneity by plotting Epanechnikov kernel density plots, which show the distribution of individual WTA estimates for each variable.

The distribution of estimates indicates that farmers' preferences for both training approaches and collective bonus tend to concentrate around a single value (Figs. 2 and 3). On the other hand, preferences for result-based schemes in MXL Model 1 and result-based monitoring in MXL Model 2 indicate a bimodal distribution. The first group of farmers preferred the result-based approach to scheme design very strongly, as they would be willing to accept 500 or more EUR/ha lower annual payment if such a scheme design would be offered. The second group favours the result-based approach less strongly, but their WTA is still about 200 EUR/ha annually. Finally, the smallest group of farmers seems to prefer the alternative management-based system of prescribed practices, as their WTA has a positive sign.

3.4. Non-adopters

We used a binomial logit model to analyse the characteristics of the respondents, who said that they would never participate in a scheme regardless of its conditions (i.e. "non-adopters") (n = 54) and were thus excluded from the sample we used for choice analyses described in sections 3.2 and 3.3.

The model estimates indicate that non-adopters were significantly more likely to be older, have a smaller farm and were more likely to abandon farming in the next 10 years (Table 5). They were also significantly more likely to be women and have less knowledge of the indicator plant species. In terms of the CAP, these farmers were more likely to consider themselves less familiar with CAP instruments and farm subsidies in general. Finally, they were less likely to consider the amount of payments among the key factors when deciding whether to enrol in the AEM or not.

4. Discussion and conclusions

4.1. Result-based schemes (RBS) preferred over management-based approach

Over the last three decades, various new designs of PES, and AEM in particular, have been tested to improve their cost-effectiveness in achieving environmental goals (Herzon et al., 2018; OECD, 2010, 2013). RBS have been promoted because they more directly bind agri-environmental payments to ecological impacts. Furthermore, they are intended to improve targeting, as farmers are incentivised to enrol land that will be best able to provide biodiversity results (Burton & Schwarz, 2013). Many institutions, including the European Court of Auditors (2020), have therefore recommended a wider use of these schemes. Where both result-based and management-based schemes are possible, however, one of the criteria to select the scheme design should be the farmers' preferences, as their positive response can improve participation rates and reduce implementation costs (Lastra-Bravo et al., 2015).

Our study contributes to addressing this gap by eliciting farmers' preferences in two study areas where respondents have had little previous experience with RBS. Both MXL models indicate that most farmers preferred the result-based approach to the management-based one, both in terms of payment conditions and monitoring. These results are in line with previous studies, where farmers were often found to support a

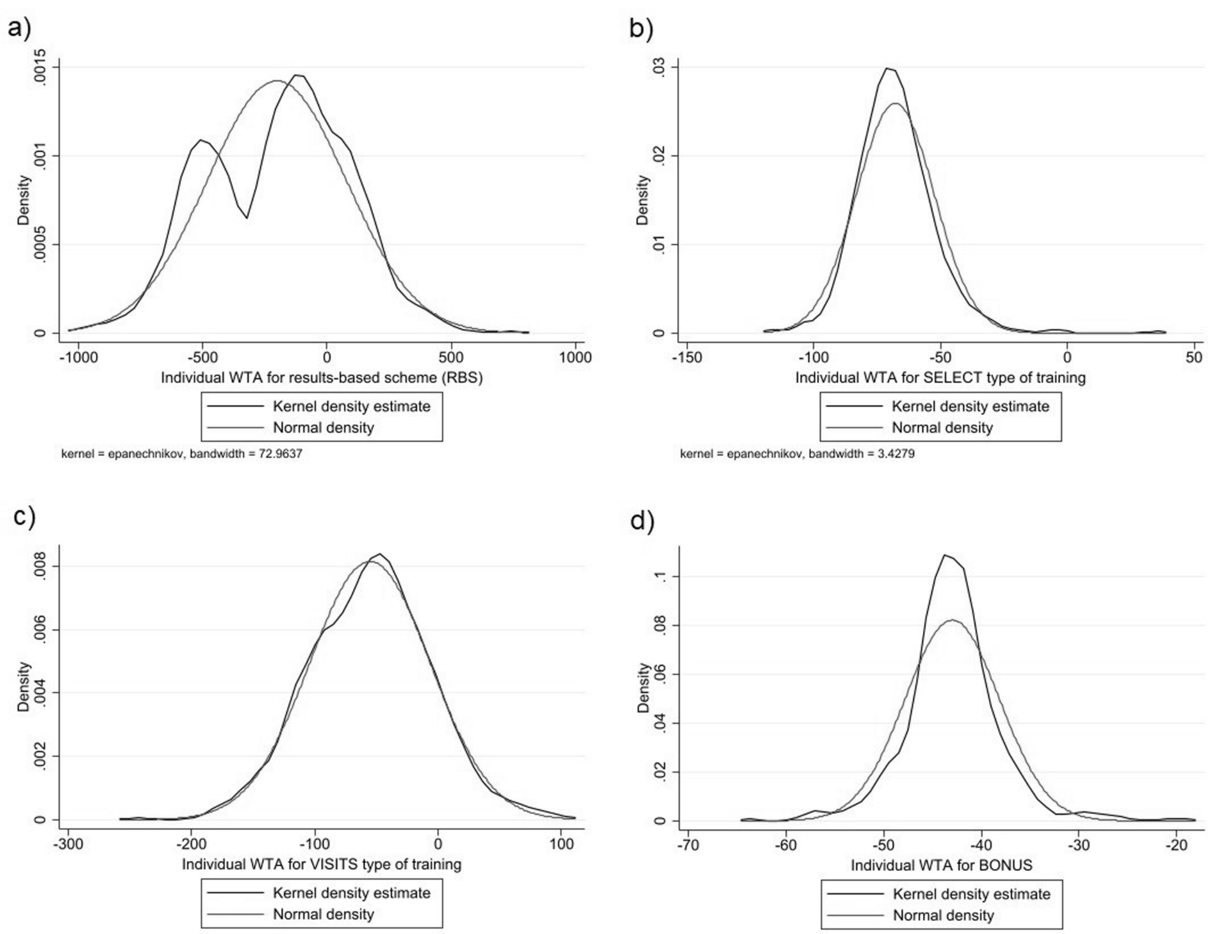

Fig. 2. Distribution of the estimated individual WTA for (a) results-based scheme, (b) free choice among the list of mandatory training approaches, (c) individual on-farm advisory service and (d) collective bonus in EUR/ha annually based on Mixed logit model 1.

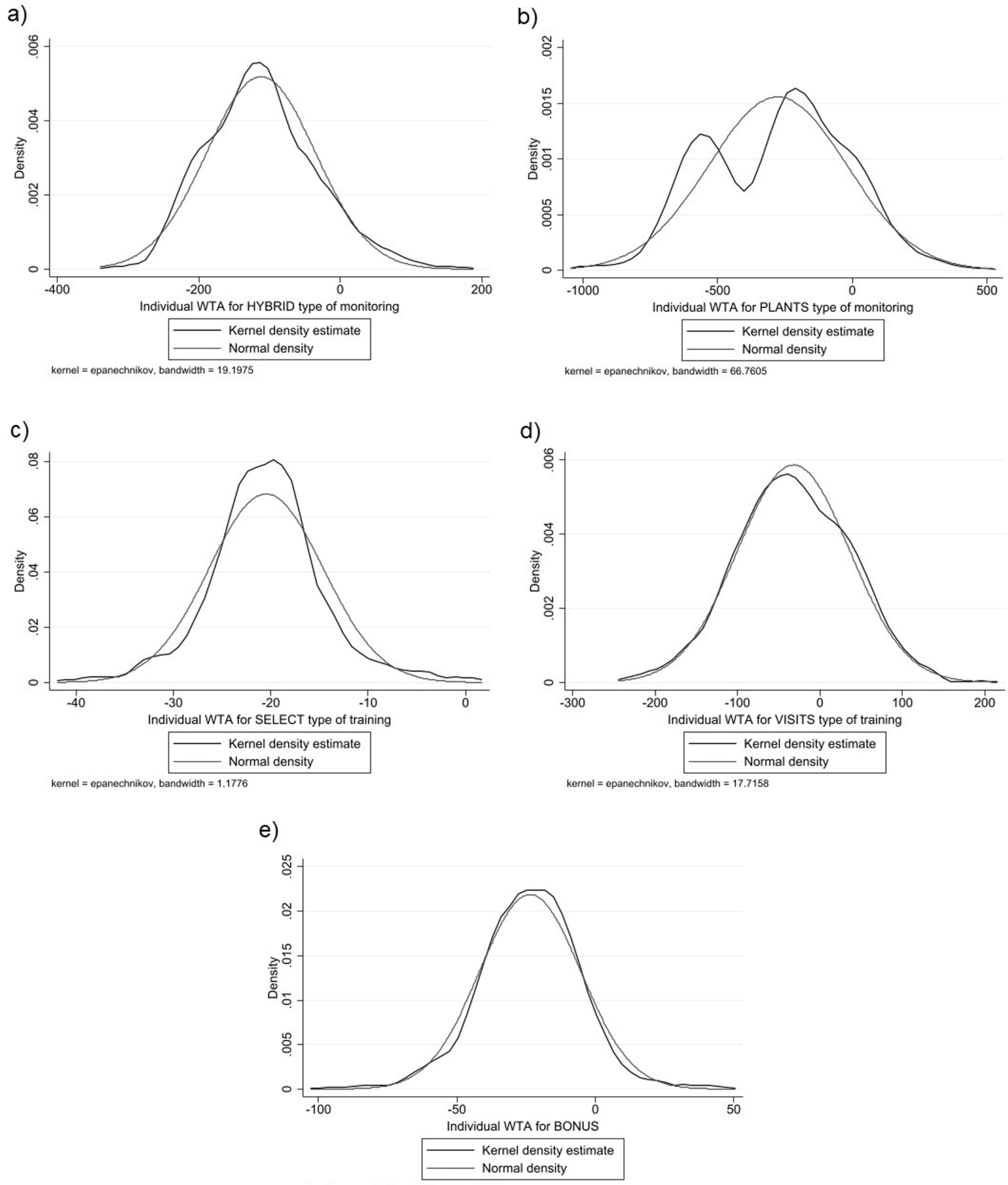

Fig. 3. Distribution of the estimated individual WTA for (a) hybrid monitoring, (b) result-based monitoring, (c) free choice among the list of mandatory training approaches, (d) individual on-farm advisory service and (e) collective bonus in EUR/ha annually based on Mixed logit model 2.

result-based approach (Birge & Herzon, 2019; Birge et al., 2017; Fleury et al., 2015; Russi et al., 2016; Wezel et al., 2018). However, most of these studies used a qualitative methodology and were often conducted in areas where RBS have already been introduced. By contrast, a DCE study featuring result-based attributes for a wide range of agri-environmental objectives in Finland showed that, although there was high support for the AEM reform, only a quarter of farmers would be willing to accept RBS with moderate compensation levels. Most farmers thus seemed to prefer the current management-based approach, which they generally perceived as more legitimate, perhaps due to the difficulty of authors to define clear result-based indicators for some objectives (Niskanen et al., 2021).

This discrepancy with the Finnish study might also be explained by the differences in the structural and socio-economic characteristics of both case studies. In Finland, the sample was believed to represent the farm population at the national level (Niskanen et al., 2021), whereas the share of production-oriented and intensive farms in our study is relatively low. Both research areas in our study have several natural constraints, including steep slopes or stony landscape, shallow soils and relatively dry climate, which significantly limit the potential for

Table 5
Binomial logit model estimates of serial opt-out choices (“non-adopters”) (AEM – agri-environmental measure).

	coeff.	p	S.E.
Parameters			
Research area *(1 = Karst)*	0.495	0.314	0.4915
Gender *(1 = female)*	0.995	**	0.3926
Age	0.088	***	0.0203
Education	−0.352	0.210	0.2811
Share of household income from agriculture	−0.410	0.267	0.3697
Farm size	−0.536	*	0.3057
Share of land rented	0.200	0.415	0.2451
Production orientation *(base: specialised plant producer)*			
Special. cattle breeder	0.734	0.401	0.8741
Special. animal breeder	−1.452	0.161	1.0360
Mixed farming	−0.483	0.521	0.7530
Purpose of production *(base: only for own consumption)*			
Mainly for own consumpt.	−0.107	0.815	0.4556
Mainly for sale	−1.461	**	0.7333
Future of the farm *(1 = abandonment)*	1.070	***	0.4022
Knowledge of CAP instruments	−0.723	***	0.2689
Previous experience with AEM *(base: I do not know it.)*			
I have already been enrolled.	0.005	0.993	0.5517
I know AEM, but have never been enrolled.	−0.273	0.591	0.5076
Important factors influencing decision to enrol *(1 = yes)*:			
Amount of administration	0.143	0.733	0.4187
Impact on fodder produced	0.251	0.546	0.4149
Impact on the environment	−0.350	0.406	0.4219
Payment	−1.228	***	0.3937
Contract length	−0.470	0.285	0.4393
Advice of extension officer	−0.092	0.825	0.4148
Importance of grassland conservation	0.260	0.224	0.2143
Share of plant indicators that respondent recognised	−2.550	**	1.1582
Model summary statistics			
No. of respondents	491		
χ^2	117.22	***	
McFadden pseudo R^2	0.3445		
Log likelihood	−111.5		
AIC	273.0		
BIC	377.9		

Note: Significance levels are *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$.

agricultural intensification (Perko, Ciglič, & Zorn, 2020). Furthermore, the farm structure is dominated by small and semi-subsistence farms. The importance of this factor may be corroborated by studies conducted in the established RBS in Northern and Western Europe, where the participating farmers most often managed farms and agricultural land where intensification of farming was not possible due to natural and structural characteristics. On the other hand, production-oriented and intensive livestock farms were found to rarely participate in such schemes (Fleury et al., 2015; Russi et al., 2016). In contrast to more productive regions, RBS might thus be a particularly preferable scheme design for farmers in areas with natural constraints, because they can often provide the desired biodiversity outcomes without considerable changes to management practices. Since the structural and technological changes have been slower than in more productive regions, farmers might also still have traditional and local knowledge on how to maintain the extensive use of habitats (cf. Babai & Molnár, 2014).

The strong preference for result-based monitoring in our study might also be explained by the lower perceived administrative costs compared to the management-based alternative, where farmers would be required to keep records on the implemented farming practices. Several previous studies confirmed that farmers prefer agri-environmental contracts where little time is spent on administration (e.g. Ruto & Garrod, 2009). Regardless of scheme design, care should thus be taken to reduce the (perceived) administrative burden for farmers. However, the benefits of result-based monitoring in our experiment seem to outweigh even the potential double administrative burden in the hybrid monitoring option, where farmers need to keep the records on farming practices only if they wish to avoid the risk of not being able to demonstrate the presence of indicators due to some external factors (e.g. weather).

4.2. Farmers preferred a more individualised training

In RBS, adequate training plays an important role as farmers are relatively free to choose management practices that will achieve biodiversity goals (Herzon et al., 2018). The local advisory service is often among the primary sources of information for farmers and can also help shape their attitudes (Barreiro-Hurlé et al., 2010). Research shows that advisory support, especially if offered free of charge, positively affects farmers’ decision to enter the schemes (Lastra-Bravo et al., 2015) and can also improve their knowledge (Lobley et al., 2013). However, less is known about the acceptability of different training approaches.

Farmers in our study showed a higher preference for training offered individually or to small groups of farmers compared to lectures offered to a larger audience. They also seemed to prefer more freedom of choice when selecting the training approach. Experience in the existing RBS in Europe shows that specialised farm advice is one of the key factors of success for RBS (Moran et al., 2021). Furthermore, farmers were found to have positive preference for site-specific advice over more generalized recommendations (Oyinbo et al., 2019). However, more research is needed on what knowledge farmers seek and which methods could be most effectively used to facilitate knowledge transfer. A more individualised approach to knowledge transfer would probably also require more investment in these instruments (OECD, 2017). Different types of training should thus be assessed in terms of their cost-effectiveness as well.

4.3. Collective bonus not considered an important incentive

PES programmes often require coordination of action at the landscape level because it is necessary to ensure the enrolment of sufficient amount of land (Dupraz et al., 2009). The collective bonus, which was included in our study as a relatively simple way to incentivise coordination, was found to have a significantly positive influence on the farmers’ willingness to participate in the scheme. However, the estimated average WTA was comparable or lower than the 40 EUR/ha annual bonus, which contrasts with the results obtained by Kuhfuss et al. (2016), where the estimated WTA in a similar design setting was much higher than the potential bonus payment. This is particularly interesting since most farmers in our study believed that it was likely (47.2 %) or very likely (20.7 %) that the pre-condition for the bonus payment, i.e. enrolment of sufficient grassland area in the scheme, would be met in their region.

Based on the farmers’ comments during the interviews, we conjecture that cooperation between farmers is limited by the relatively high rate of farm abandonment in recent decades. In many villages, only one or a few farms are still actively engaged in agriculture, so the respondents often felt that there were few neighbours that they could talk to. Another problem could be mistrust among farmers, especially if they depended on each other to receive the payment, since farming is increasingly considered an individual rather than a collective endeavour (cf. Riley et al., 2018).

We thus conclude that the introduction of a collective bonus or other, more demanding coordination or collaboration approaches, would probably not be successful in the research areas. However, more straightforward approaches, which are not necessarily related to AEM schemes themselves, might still be developed to increase participation rates. These include supporting promotional activities of extension officers and various locally led projects, which could facilitate the building of the culture of trust among farmers and with other actors (Moran et al., 2021; Rac et al., 2020).

4.4. Some farmers unwilling to enrol due to high age

Some farmers in our study indicated a high level of opposition to participation in the hypothetical scheme for grassland conservation, although it would often not require much change to their current management practices. Further analysis with the binomial logit model showed that respondents who always chose an opt-out option were significantly more likely to be older and manage smaller and semi-subsistent farms. They also judged themselves to have little knowledge about the CAP system and more often believed that their farm would be abandoned within the next decade. At least 10 % of farmers in our sample were thus unwilling to enrol in the AEM. However, old farmers and the smallest farm holdings are under-represented in our sample compared to the farmer population in the research area. The sample also has a higher share of farmers who are currently enrolled in the AEM. Therefore, it is plausible that the share of "non-adopters" among farmers in the research area is even higher than our study suggests.

Although it might be reasonable to focus agri-environmental schemes on farms with higher development potential, it is worth noting that elderly and small farmers may still importantly contribute to maintaining grasslands, because they prevent overgrowth and provide local knowledge on traditional farming practices (Babai & Molnár, 2014). Targeted instruments are thus needed to enable a viable production model for small and semi-subsistent farms, which would be interesting for younger farmers. At the same time, it is necessary to ensure that the conservation value of the habitats is maintained and that the local knowledge is passed on to the next generation of farmers (Sutcliffe et al., 2015).

4.5. Future research, study limitations and policy implications

Many PES programmes today, especially publicly funded ones like the agri-environmental measures in the European Union, have evolved in a large-scale and resource-intensive schemes, which are expected to deliver long-term provision of ecosystem services. However, setting up an effective scheme design, which would ensure that payments are spatially targeted and conditioned on demonstrable effects of land management on ecosystem services, remains a challenging task for both researchers and decision-makers (Reed et al., 2014).

In our study, we elicited farmers' preferences for different designs of a hypothetical scheme, which would facilitate payments for ecosystem services provided by the biodiversity-rich dry grasslands. Results of the models indicate that, for most farmers, RBS are a preferred choice for a scheme design when compared to management-based approach. However, our research also points to the importance of understanding preferences in specific socio-economic systems. In particular, care should be taken when introducing RBS to more productive regions in Europe (Niskanen et al., 2021). Where suitable indicators can be identified, further research is also needed to elicit preferences for the result-based approach in the PES programs in other continents and biomes, where providers might respond differently due to cultural, socio-economic and contextual differences.

It should be noted, however, that the experimental design in this study is somewhat particular, because the attribute describing the monitoring system is connected to the payment conditions (i.e. the type of scheme). For this reason, the data was analysed with two separate models, which was possible due to perfect collinearity between the levels of both attributes. Although we believe that the main conclusions would probably not change, upon reflection, a labelled design of the experiment might have been more appropriate.

Finally, although farmers' preferences should constitute an important factor for decision-making (Lastra-Bravo et al., 2015), designing of successful PES programmes also requires sufficient research and institutional support, for example for identifying suitable indicators and offering specialised and site-specific advice to farmers (Moran et al., 2021). Experience with RBS in Europe shows that these factors might help to explain the relatively slow adoption of this approach in certain regions, particularly in Central and Eastern Europe (Herzon et al., 2018; Šumrada et al., 2021). Future policy support should thus also be directed towards gathering necessary ecological data and securing trained staff in the managing authorities, monitoring agencies and extension services.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES secretariat. (2019). https://ipbes.net/global-assessment.

Biodiversity on farmland: CAP contribution has not halted the decline. Special report no. 13/2020 (p. 58). European Court of Auditors. (2020). https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=53892.

Babai, D., & Molnár, Z. (2014). Small-scale traditional management of highly species-rich grasslands in the Carpathians. *Agriculture, Ecosystems & Environment, 182*, 123–130. https://doi.org/10.1016/j.agee.2013.08.018

Barghusen, R., Sattler, C., Deijl, L., Weebers, C., & Matzdorf, B. (2021). Motivations of farmers to participate in collective agri-environmental schemes: The case of Dutch agricultural collectives. *Ecosystems and People, 17*(1), 539–555. https://doi.org/10.1080/26395916.2021.1979098

Barreiro-Hurlé, J., Espinosa-Goded, M., & Dupraz, P. (2010). Does intensity of change matter? Factors affecting adoption of agri-environmental schemes in Spain. *Journal of Environmental Planning and Management, 53*(7), 891–905. https://doi.org/10.1080/09640568.2010.490058

Beharry-Borg, N., Smart, J. C. R., Termansen, M., & Hubacek, K. (2013). Evaluating farmers' likely participation in a payment programme for water quality protection in the UK uplands. *Regional Environmental Change, 13*(3), 633–647. https://doi.org/10.1007/s10113-012-0282-9

Birge, T., & Herzon, I. (2019). Exploring cultural acceptability of a hypothetical results-based agri-environment payment for grassland biodiversity. *Journal of Rural Studies, 67*, 1–11. https://doi.org/10.1016/j.jrurstud.2019.02.006

Birge, T., Toivonen, M., Kaljonen, M., & Herzon, I. (2017). Probing the grounds: Developing a payment-by-results agri-environment scheme in Finland. *Land Use Policy, 61*, 302–315. https://doi.org/10.1016/j.landusepol.2016.11.028

Burton, R. J. F., & Schwarz, G. (2013). Result-oriented agri-environmental schemes in Europe and their potential for promoting behavioural change. *Land Use Policy, 30*(1), 628–641. https://doi.org/10.1016/j.landusepol.2012.05.002

Christensen, T., Pedersen, A. B., Nielsen, H. O., Mørkbak, M. R., Hasler, B., & Denver, S. (2011). Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones—A choice experiment study. *Ecological Economics, 70*(8), 1558–1564. https://doi.org/10.1016/j.ecolecon.2011.03.021

Alliance Environnement. (2019). *Evaluation of the impact of the CAP on habitats, landscapes, biodiversity. Final Report*. European Commission, Directorate-General for Agriculture and Rural Development. https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/common-monitoring-and-evaluation-framework/sustainability/impact-cap-habitats-landscapes-biodiversity_en.

Colen, L., Gomez y Paloma, S., Latacz-Lohmann, U., Lefebvre, M., Préget, R., & Thoyer, S. (2016). Economic Experiments as a Tool for Agricultural Policy Evaluation: Insights from the European CAP. *Canadian Journal of Agricultural Economics/Revue Canadienne d'agroeconomie, 64*(4), 667–694. https://doi.org/10.1111/cjag.12107.

de Snoo, G. R., Herzon, I., Staats, H., Burton, R. J. F., Schindler, S., van Dijk, J., Lokhorst, A. M., Bullock, J. M., Lobley, M., Wrbka, T., Schwarz, G., & Musters, C. J. M. (2013). Toward effective nature conservation on farmland: Making farmers matter. *Conservation Letters, 6*(1), 66–72. https://doi.org/10.1111/j.1755-263X.2012.00296.x

Dengler, J., Janišová, M., Török, P., & Wellstein, C. (2014). Biodiversity of Palaearctic grasslands: A synthesis. *Biodiversity of Palaearctic Grasslands: Processes, Patterns and Conservation, 182*, 1–14. https://doi.org/10.1016/j.agee.2013.12.015

Dupraz, P., Latouche, K., & Turpin, N. (2009). Threshold effect and co-ordination of agri-environmental efforts. *Journal of Environmental Planning and Management, 52*(5), 613–630. https://doi.org/10.1080/09640560902958164

Engel, S., Pagiola, S., & Wunder, S. (2008). Designing payments for environmental services in theory and practice: An overview of the issues. *Ecological Economics, 65* (4), 663–674. https://doi.org/10.1016/j.ecolecon.2008.03.011

Espinosa-Goded, M., Barreiro-Hurlé, J., & Ruto, E. (2010). What Do Farmers Want From Agri-Environmental Scheme Design? A Choice Experiment Approach: A Choice Experiment Approach on Agri-Environmental Scheme Design. *Journal of Agricultural Economics, 61*(2), 259–273. https://doi.org/10.1111/j.1477-9552.2010.00244.x

Fleury, P., Seres, C., Dobremez, L., Nettier, B., & Pauthenet, Y. (2015). "Flowering Meadows", a result-oriented agri-environmental measure: Technical and value changes in favour of biodiversity. *Land Use Policy, 46*, 103–114. https://doi.org/10.1016/j.landusepol.2015.02.007

Franks, J. R., & Emery, S. B. (2013). Incentivising collaborative conservation: Lessons from existing environmental Stewardship Scheme options. *Land Use Policy, 30*(1), 847–862. https://doi.org/10.1016/j.landusepol.2012.06.005

Gerowitt, B., Isselstein, J., & Marggraf, R. (2003). Rewards for ecological goods—Requirements and perspectives for agricultural land use. *Agriculture, Ecosystems & Environment, 98*(1), 541–547. https://doi.org/10.1016/S0167-8809(03)00112-9

Hanley, N., Banerjee, S., Lennox, G. D., & Armsworth, P. R. (2012). How should we incentivize private landowners to "produce" more biodiversity? *Oxford Review of Economic Policy, 28*(1), 93–113. https://doi.org/10.1093/oxrep/grs002

Hannus, V., Venus, T. J., & Sauer, J. (2020). Acceptance of sustainability standards by farmers—Empirical evidence from Germany. *Journal of Environmental Management, 267*, Article 110617. https://doi.org/10.1016/j.jenvman.2020.110617

Herzon, I., Birge, T., Allen, B., Povellato, A., Vanni, F., Hart, K., Radley, G., Tucker, G., Keenleyside, C., Oppermann, R., Underwood, E., Poux, X., Beaufoy, G., & Pražan, J. (2018). Time to look for evidence: Results-based approach to biodiversity conservation on farmland in Europe. *Land Use Policy, 71*, 347–354. https://doi.org/10.1016/j.landusepol.2017.12.011

Hole, A. R. (2007a). Fitting mixed logit models by using maximum simulated likelihood. *Stata Journal, 7*(3), 388–401.

Hole, A. R. (2007b). *WTP: Stata module to estimate confidence intervals for willingness to pay measures*. Boston College Department of Economics. https://ideas.repec.org/c/boc/bocode/s456808.html.

Kaligarič, M., & Ivajnšič, D. (2014). Vanishing landscape of the "classic" Karst: Changed landscape identity and projections for the future. *Landscape and Urban Planning, 132*, 148–158. https://doi.org/10.1016/j.landurbplan.2014.09.004

Kuhfuss, L., Préget, R., Thoyer, S., & Hanley, N. (2016). Nudging farmers to enrol land into agri-environmental schemes: The role of a collective bonus. *European Review of Agricultural Economics, 43*(4), 609–636. https://doi.org/10.1093/erae/jbv031

Lamarque, P., Tappeiner, U., Turner, C., Steinbacher, M., Bardgett, R. D., Szukics, U., Schermer, M., & Lavorel, S. (2011). Stakeholder perceptions of grassland ecosystem services in relation to knowledge on soil fertility and biodiversity. *Regional Environmental Change, 11*(4), 791–804. https://doi.org/10.1007/s10113-011-0214-0

Lancaster, K. J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy, 74*(2), 132–157. http://www.jstor.org/stable/1828835.

Lastra-Bravo, X. B., Hubbard, C., Garrod, G., & Tolón-Becerra, A. (2015). What drives farmers' participation in EU agri-environmental schemes?: Results from a qualitative meta-analysis. *Environmental Science & Policy, 54*, 1–9. https://doi.org/10.1016/j.envsci.2015.06.002

Le Coent, P., Préget, R., & Thoyer, S. (2017). Compensating Environmental Losses Versus Creating Environmental Gains: Implications for Biodiversity Offsets. *Ecological Economics, 142*, 120–129. https://doi.org/10.1016/j.ecolecon.2017.06.008

Lobley, M., Saratsi, E., Winter, M., & Bullock, J. (2013). Training farmers in agri-environmental management: The case of Environmental Stewardship in lowland England. *International Journal of Agricultural Management, 3*(1), 12–20. https://ageconsearch.umn.edu/record/199356.

Mamine, F., Fares, M., & Minviel, J. J. (2020). Contract Design for Adoption of Agrienvironmental Practices: A Meta-analysis of Discrete Choice Experiments. *Ecological Economics, 176*, Article 106721. https://doi.org/10.1016/j.ecolecon.2020.106721

Matzdorf, B., & Lorenz, J. (2010). How cost-effective are result-oriented agri-environmental measures?—An empirical analysis in Germany. *Land Use Policy, 27* (2), 535–544. https://doi.org/10.1016/j.landusepol.2009.07.011

Matzdorf, B., Sattler, C., & Engel, S. (2013). Institutional frameworks and governance structures of PES schemes. *Forest Policy and Economics, 37*, 57–64. https://doi.org/10.1016/j.forpol.2013.10.002

MOP. (2019). *Poročilo o izvajanju Programa upravljanja območij Natura 2000 (2015 do 2020) za leto 2018 [Report on the implementation of the Natura 2000 Site Management Program (2015 to 2020) for 2018]* (p. 50). Ministrstvo za okolje in prostor. http://www.natura2000.si/fileadmin/user_upload/Novice/Life_IP_Natura_SI/porocilo_PUN_2018.pdf.

Government of the RS. (2015). *Natura 2000 Management Programme (2015-2020) (no. 00719-6/2015/13)*. Government of the Republic of Slovenia. http://www.natura2000.si/en/natura-2000/life-management/programme-management/.

EEA. (2020). *State of nature in the EU. Results from reporting under the nature directives 2013-2020. EEA Report 10/2020* (EEA Report No. 10/2020; p. 146). European Environment Agency. https://www.eea.europa.eu/publications/state-of-nature-in-the-eu-2020.

Moran, J., Byrne, D., Carlier, J., Dunford, B., Finn, J. A., O hUallacháin, D., & Sullivan, C. A. (2021). Management of high nature value farmland in the Republic of Ireland: 25 years evolving toward locally adapted results-orientated solutions and payments. *Ecology and Society*, *26*(1). https://doi.org/10.5751/ES-12180-260120.

Niskanen, O., Tienhaara, A., Haltia, E., & Pouta, E. (2021). Farmers' heterogeneous preferences towards results-based environmental policies. *Land Use Policy, 102*, Article 105227. https://doi.org/10.1016/j.landusepol.2020.105227

Nowak-Olejnik, A., Mocior, E., Hibner, J., & Tokarczyk, N. (2020). Human perceptions of cultural ecosystem services of semi-natural grasslands: The influence of plant communities. *Ecosystem Services, 46*, Article 101208. https://doi.org/10.1016/j.ecoser.2020.101208

OECD. (2010). Guidelines for Cost-effective Agri-environmental Policy Measures. *OECD Publishing*. https://doi.org/10.1787/9789264086845-en

OECD. (2013). Providing Agri-environmental Public Goods through Collective Action. *OECD Publishing*. https://doi.org/10.1787/9789264197213-en

OECD. (2017). *Evaluation of Agricultural Policy Reforms in the European Union: The Common Agricultural Policy 2014-20*. Paris: OECD Publishing. https://doi.org/10.1787/9789264278783-en.

Oyinbo, O., Chamberlin, J., Vanlauwe, B., Vranken, L., Kamara, Y. A., Craufurd, P., & Maertens, M. (2019). Farmers' preferences for high-input agriculture supported by site-specific extension services: Evidence from a choice experiment in Nigeria. *Agricultural Systems, 173*, 12–26. https://doi.org/10.1016/j.agsy.2019.02.003

Pereira, H. M., Navarro, L. M., & Martins, I. S. (2012). Global Biodiversity Change: The Bad, the Good, and the Unknown. *Annual Review of Environment and Resources, 37*(1), 25–50. https://doi.org/10.1146/annurev-environ-042911-093511

Perko, D., Ciglič, R., & Zorn, M. (Eds.). (2020). *The Geography of Slovenia: Small But Diverse*. Springer International Publishing. https://doi.org/10.1007/978-3-030-14066-3.

Pust Vučajnk, M., & Udovč, A. (2008). Stališča kmetov ter kmetijskih svetovalcev do Slovenskega kmetijskega okoljskega programa [Position of farmers and agricultural advisors towards the Slovenian Agri-Environmental programme]. Novi izzivi v poljedelstvu 2008. *Slovensko agronomsko društvo*, 202–207. https://repozitorij.uni-lj.si/IzpisGradiva.php?id=36417.

Rac, I., Juvančič, L., & Erjavec, E. (2020). Stimulating collective action to preserve High Nature Value farming in post-transitional settings. A comparative analysis of three Slovenian social-ecological systems. *Nature Conservation, 39*, 87–111. https://doi.org/10.3897/natureconservation.39.51216

Reed, M. S., Moxey, A., Prager, K., Hanley, N., Skates, J., Bonn, A., Evans, C. D., Glenk, K., & Thomson, K. (2014). Improving the link between payments and the provision of ecosystem services in agri-environment schemes. *Ecosystem Services, 9*, 44–53. https://doi.org/10.1016/j.ecoser.2014.06.008

Riley, M., Sangster, H., Smith, H., Chiverrell, R., & Boyle, J. (2018). Will farmers work together for conservation? The potential limits of farmers' cooperation in agri-environment measures. *Land Use Policy, 70*, 635–646. https://doi.org/10.1016/j.landusepol.2017.10.049

Russi, D., Margue, H., Oppermann, R., & Keenleyside, C. (2016). Result-based agri-environment measures: Market-based instruments, incentives or rewards? The case of Baden-Württemberg. *Land Use Policy, 54*, 69–77. https://doi.org/10.1016/j.landusepol.2016.01.012

Ruto, E., & Garrod, G. (2009). Investigating farmers' preferences for the design of agri-environment schemes: A choice experiment approach. *Journal of Environmental Planning and Management, 52*(5), 631–647. https://doi.org/10.1080/09640560902958172

Santos, R., Clemente, P., Brouwer, R., Antunes, P., & Pinto, R. (2015). Landowner preferences for agri-environmental agreements to conserve the montado ecosystem in Portugal. *Ecological Economics, 118*, 159–167. https://doi.org/10.1016/j.ecolecon.2015.07.028

Sheremet, O., Ruokamo, E., Juutinen, A., Svento, R., & Hanley, N. (2018). Incentivising Participation and Spatial Coordination in Payment for Ecosystem Service Schemes: Forest Disease Control Programs in Finland. *Ecological Economics, 152*, 260–272. https://doi.org/10.1016/j.ecolecon.2018.06.004

Silverman, B. W. (1998). *Density Estimation for Statistics and Data Analysis*. Chapman and Hall/CRC.

Škornik, S., Vidrih, M., & Kaligarič, M. (2010). The effect of grazing pressure on species richness, composition and productivity in North Adriatic Karst pastures. *Plant Biosystems - An International Journal Dealing with All Aspects of Plant Biology, 144*(2), 355–364. https://doi.org/10.1080/11263501003750250

Špur, N., Šorgo, A., & Škornik, S. (2018). Predictive model for meadow owners' participation in agri-environmental climate schemes in Natura 2000 areas. *Land Use Policy, 73*, 115–124. https://doi.org/10.1016/j.landusepol.2018.01.014

StataCorp. (2019). *Stata Reference Manual. Stata: Release 16*. Stata.

Stoate, C., Báldi, A., Beja, P., Boatman, N. D., Herzon, I., van Doorn, A., de Snoo, G. R., Rakosy, L., & Ramwell, C. (2009). Ecological impacts of early 21st century agricultural change in Europe – A review. *Journal of Environmental Management, 91* (1), 22–46. https://doi.org/10.1016/j.jenvman.2009.07.005

Šumrada, T., Vreš, B., Čelik, T., Šilc, U., Rac, I., Udovč, A., & Erjavec, E. (2021). Are result-based schemes a superior approach to the conservation of High Nature Value grasslands? *Evidence from Slovenia. Land Use Policy, 111*, Article 105749. https://doi.org/10.1016/j.landusepol.2021.105749

Sutcliffe, L. M. E., Batáry, P., Kormann, U., Báldi, A., Dicks, L. V., Herzon, I., … Tscharntke, T. (2015). Harnessing the biodiversity value of Central and Eastern European farmland. *Diversity and Distributions, 21*(6), 722–730. https://doi.org/10.1111/ddi.12288

Train, K. (2009). *Discrete Choice Methods with Simulation* (2nd ed.). Cambridge University Press.

Uthes, S., & Matzdorf, B. (2013). Studies on Agri-environmental Measures: A Survey of the Literature. *Environmental Management, 51*(1), 251–266. https://doi.org/10.1007/s00267-012-9959-6

Vainio, A., Tienhaara, A., Haltia, E., Hyvönen, T., Pyysiäinen, J., & Pouta, E. (2019). The legitimacy of result-oriented and action-oriented agri-environmental schemes: A comparison of farmers' and citizens' perceptions. *Land Use Policy, 104358*. https://doi.org/10.1016/j.landusepol.2019.104358

Vaissière, A.-C., Tardieu, L., Quétier, F., & Roussel, S. (2018). Preferences for biodiversity offset contracts on arable land: A choice experiment study with farmers. *European Review of Agricultural Economics, 45*(4), 553–582. https://doi.org/10.1093/erae/jby006

van Vliet, J., de Groot, H. L. F., Rietveld, P., & Verburg, P. H. (2015). Manifestations and underlying drivers of agricultural land use change in Europe. *Landscape and Urban Planning, 133*, 24–36. https://doi.org/10.1016/j.landurbplan.2014.09.001

Villanueva, A. J., Gómez-Limón, J. A., Arriaza, M., & Rodríguez-Entrena, M. (2015). The design of agri-environmental schemes: Farmers' preferences in southern Spain. *Land Use Policy, 46*, 142–154. https://doi.org/10.1016/j.landusepol.2015.02.009

Villoslada Peciña, M., Ward, R. D., Bunce, R. G. H., Sepp, K., Kuusemets, V., & Luuk, O. (2019). Country-scale mapping of ecosystem services provided by semi-natural grasslands. *Science of The Total Environment, 661*, 212–225. https://doi.org/10.1016/j.scitotenv.2019.01.174

Wainwright, W., Glenk, K., Akaichi, F., & Moran, D. (2019). Conservation contracts for supplying Farm Animal Genetic Resources (FAnGR) conservation services in Romania. *Livestock Science, 224*, 1–9. https://doi.org/10.1016/j.livsci.2019.03.016

Wezel, A., Vincent, A., Nitsch, H., Schmid, O., Dubbert, M., Tasser, E., Fleury, P., Stöckli, S., Stolze, M., & Bogner, D. (2018). Farmers' perceptions, preferences, and propositions for result-oriented measures in mountain farming. *Land Use Policy, 70*, 117–127. https://doi.org/10.1016/j.landusepol.2017.10.020

Žgavec, D., Eler, K., Udovč, A., & Batič, F. (2013). Contribution of agricultural policy measures to maintain grassland areas (the case of Radensko Polje Landscape Park). *Acta Agriculturae Slovenica, 101*(1). https://doi.org/10.2478/acas-2013-0009

Žiberna, I. (2012). Spreminjanje rabe zemljišč v Halozah v obdobju med letoma 2000 in 2011. *Geografski Obzornik*, *59*(1/2), 12–19.