Farmers' Preferences for an Agri-Environemental Measure designed for Climate Friendly Peatland Managment

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Abstract:

*Well-managed, agriculturally used peatlands play an important role for the storage of greenhouse gases. A new agri-environmental measure (AEM) was established in the European Common Agricultural Policy to incentivise a land management, which conserves climate functionality of peatlands through high water levels. To investigate which factors influence the willingness of farmers to participate in this measure, we carried out an empirical study applying a discrete choice experiment (DCE). The aim was to identify optimal contract designs that can also reduce transaction costs for farmers. Besides monetary compensation, measure characteristics such as contract length, assured purchase of the cut grass, support in the cooperation with neighbouring farmers, and administrative efforts are considered as decisive attributes. Results show that the average willingness to adopt the measure is set at 522 €/ha*a. Moreover, we find that factors such as supporting cooperation among farmers and regional value chain approaches have a statistically significant and large positive influence on the adoption decision. Based on our results, the uptake and success of the new measure could therefore be increased by a more appropriate tailoring towards different farm types and their needs. Adjustments would increase the climate protection potential of the proposed measure.*

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Abstract

Well-managed, agriculturally used peatlands play an important role for the storage of greenhouse gases. A new agri-environmental measure (AEM) was established in the European Common Agricultural Policy to incentivise a land management, which conserves climate functionality of peatlands through high water levels. To investigate which factors influence the willingness of farmers to participate in this measure, we carried out an empirical study applying a discrete choice experiment (DCE). The aim was to identify optimal contract designs that can also reduce transaction costs for farmers. Besides monetary compensation, measure characteristics such as contract length, assured purchase of the cut grass, support in the cooperation with neighbouring farmers, and administrative efforts are considered as decisive attributes. Results show that the average willingness to adopt the measure is set at 522 €/ha*a. Moreover, we find that factors such as supporting cooperation among farmers and regional value chain approaches have a statistically significant and large positive influence on the adoption decision. Based on our results, the uptake and success of the new measure could therefore be increased by a more appropriate tailoring towards different farm types and their needs. Adjustments would increase the climate protection potential of the proposed measure.

Keywords

Agri-Environmental Measure, Climate Change, Farmers' Preference, Discrete Choice Experiment, Transaction Costs.

1 Introduction

The Paris Agreement calls for zero net anthropogenic greenhouse gas (GHG) emissions until 2050. To reach this goal increased efforts are required in all sectors of the economy, including farming. Drained and agriculturally used peatland areas are one major GHG source in many countries and make up 5 % of overall German GHG emissions (Tiemeyer et al., 2016). These emissions are mainly driven by the water level and its respective land management. Currently, most peatlands are managed as grassland (51 %) and about 20 % as cropland (UBA, 2017). A reduction of GHG emissions from peatlands can be reached through a) improved water table management and water logging, as the emissions are lowest with a water table just below the surface, and b) extensive land management (Jurasinski, Günther, Huth, Couwenberg, & Glatzel, 2016). Therefore, peatlands that are currently in agricultural use possess a huge emission reduction potential.

To compensate farmers for increased cost and forgone income a new agri-environmental measure (AEM) for peatland protection through water logging ("Moorschonende Stauhaltung") on grasslands was established in the Federal State of Brandenburg, Germany. The measure pursues two main objectives – protecting and re-establish peatlands and keeping water in the landscape system and allowing farmers to manage their land, and to maintain their business activities. Currently an annual compensation of 387 €/ha is paid for higher water tables with extensive grassland management. This 387 €/ha*a is calculated, according to EU legislation, as the average additional costs and foregone revenues of the implementation of the measure. The EU legislation allows also taking into account the private

transactions costs in participation to the measure. However, as these are very difficult to quantify (Mettepenningen, Verspecht, & Van Huylenbroeck, 2009), they are not taken into account. Until now, only limited knowledge and experiences are available about the measure uptake, its effectiveness and optimal contract design of the AEM and the perceived private transaction costs.

With our study, we aim to identify the factors that influence the willingness of farmers to participate in an AEM designed for climate friendly peatland management targeted at reducing GHG emissions. We apply a discrete choice experiment (DCE) in order to identify optimal contract designs. Along with a monetary element, we especially focus on the role of non-monetary attributes that are relevant for farmers' willingness to participate, such as support for cooperation with neighbouring land managers, and regional value chain approaches.

The comparison of the current annual compensation and the average willingness to accept will also give additional information on the order of magnitude of the transaction costs of participating in agri-environmental schemes.

2 Research Design and Methodology

We apply a DCE to access which factors influence the willingness of farmers to participate in the AEM for climate-friendly peatland management. This method is rooted in traditional microeconomics theories of consumer behaviour, marketing and preference theory and is used to estimate attribute utilities based on an individual's response to combinations of multiple decision attributes (Louviere, Hensher, & Swait, 2000). The DCE allows simultaneously testing the influence of multiple attributes of possible contracts for the AEM, through pairwise comparisons of different hypothetical contract schemes with varying attribute levels. Alternatives are defined as combinations of attributes (Louviere et al., 2000). The advantage is that each alternative is evaluated as a whole, and the choices can be modelled as a function of the attributes of the alternatives (McFadden, 1974). The decision-maker faces a set of alternatives from which the preferred alternative is chosen. It is assumed that individuals will choose the alternative that yields the highest utility for them.

In order to develop a theoretical model and choice design, we pursued a three step process. In a first step relevant attributes and their respective levels are selected through literature research. These were accompanied by a series of stakeholder and expert workshops as well as initial interviews with peatland farmers. In a preliminary list, 14 possible attributes were identified, including aspects related to the land management, financial and administrative questions and wider support and market mechanisms.

In a second step, an online pre-test was conducted among farmers, experts and stakeholders involved in peatland management from the fields of science, administration and environmental protection (N=22). Participants were asked to rank the list of attributes regarding their importance for the measure uptake. As a result a final list of five attributes was compiled.

In order to define the respective attribute levels, we conducted cognitive interviews with peatland farmers to discuss suitable levels from a practitioner's perspective. In the final design of the DCE the following five attributes and the respective levels were considered (Table 1).

Table 1. List of attributes and the respective levels considered in the discrete choice experiment (DCE).

Attributes	**Levels**
Contract length (years)	2 / 5 / 10
Support in the cooperation with neighbours	No / Yes, by the office for agriculture / Yes, by the water and soil association
Effort to register for the measure	Low / middle / high
Purchase of cut grass is assured	No / Yes, for a fixed price of 50 €/t DM / Yes, at market prices
Financial compensation (€/ha*a)	140 / 220 / 300 / 380 / 460 / 540

As an attribute which represents regional value chain approach, we included the guaranteed purchase of cut grass, e.g. through a local bio-energy power plant. A higher water table leads to a different species composition including more sedge and thus reducing the quality of cut grass for fodder use. In some cases, even grass species that are poisoning (such as *Equisetum palustre*, the marsh horsetail) for many livestock occur. The cut grass cannot be used on the farm anymore. The necessity to find new possibilities for usage and markets for the cut grass arises. In current practice, the cut grass remains on the ground and is often not used when the climate-friendly peatland management is applied. As a result from the initial interviews, it appeared that the attitude of farmers towards water logging would be positively influenced if they could find a usage for the cut grass. Farmers have a preference to rather produce material or physical value than an exclusive immaterial output such as climate mitigation. For the DCE, we therefore generate a hypothetical scenario of the local use of the cut grass for combustion in a peatland power plant that is run by the local municipality (see e.g. Wichmann, 2017). In the hypothetical scenario, the purchase of the cut grass from peatlands is provided in three levels of a fixed price of 50€/t dry matter or at market prices or not at all.

As the peatland management and rewetting actions are effective at landscape or watershed-scale and not limited to plot or farm level, the setting of water tables and the land management require high degrees of communication, coordination and agreement between neighbouring land managers and local authorities. Farmers indicated in the initial interviews that an overarching institution, which has reliable information and has neutral position, is currently missing but needed for coordinated action. We therefore also included the attribute support in the cooperation with neighbours. The levels of this attribute allow varying the institutional body that provides this support, which is determined as either the office for agriculture or the water and soil association. The non-support option is included as a third level.

The selected attributes allow designing a large variety of different contract schemes by varying their levels. To reduce the number of possible combinations, we combined attribute levels in an orthogonal design. Four versions of the questionnaire with 9 choice situations each are created. In each of the nine choice situations, respondents could choose between two different contract designs and an opt-out (status quo) option. The nine choice options were all presented in the format of the example in Table 2. Subsequent to the actual choice experiment questions regarding the farm holding and personal information are asked.

To carry out the DCE, we have conducted a survey among farmers in Northern Germany between February and May 2017. Therefore, we applied both postal and online questionnaires to maximise the response rate. 3000 letters were sent to farmers to postal areas that have a high share of peatlands. Postal codes were selected according to the following criteria: at least 20 % share of peatland within the postal code AND peatland area > 1000ha; OR 5000ha. We additionally distributed the online link via farmers associations in Northern Germany. In total

we received 465 responses, of which 180 farmers were managing peatland and 155 farmers completed the DCE. The data were analysed by estimating a conditional logit model.

For which of the following options would you choose to sign a contract (set the barrage 10 cm below surface; 30 cm below surface during land management period allowed 01.06. - 15.10)?

	Option A	**Option B**	**Option C**
Length of contract	10 years	2 years	None of both
Support in the cooperation with neighbours	Yes, through Water and Soil Association	No	
Effort	Low	High	
Acceptance of cut grass	Yes, is assured at market prices	No	
Financial compensation	220 €	380 €	
I choose:	❑	❑	❑

Table 2. Example of a choice task with 2 alternatives and an opt-out option.

3 Results and Discussion

We find that all considered attributes are relevant for the willingness to participate in the measure, but very differently important (Table 3). Farmers have a statistically significant higher preference for a medium contract length of five years compared to two years. Furthermore, they prefer the water and soil association to support the cooperation with neighbouring land managers and appreciate, if the purchase of cut grass would be assured. Only a high effort to register for the measure has a statistically significant negative influence on the farmers' willingness to participate. However, while 75 % of respondents consider participating in the measure, one out of four always chose the opt-out option. One reason is that the monetary incentive cannot compete with the prices in very intensively-managed agricultural systems (especially in intense agricultural regions such as Niedersachsen).

Table 3. Results of the conditional logit model.

Attribute	**Level**	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
ASC		2.613 ***	0.203	12.900	0.000	2.216	3.010
Contract Length *(2 years is reference)*							
	5 Years	0.411 ***	0.122	3.370	0.001	0.171	0.650
	10 Years	0.188	0.115	1.630	0.102	-0.037	0.413
Support for Cooperation *(none is reference)*							
	by Office for Agriculture	-0.090	0.124	-0.720	0.470	-0.334	0.154
	by Water and Soil Association	0.228 ***	0.112	2.040	0.042	0.009	0.447
Effort *(low is reference)*							
	middle	-0.025	0.105	-0.240	0.813	-0.231	0.181
	high	-0.538 ***	0.117	-4.600	0.000	-0.768	-0.309
Acceptance of Cut Grass *(no is reference)*							
	yes, fixed price	0.288 ***	0.119	2.420	0.016	0.055	0.521
	yes, market price	0.330 ***	0.116	2.850	0.004	0.103	0.556
Financial Compensation		0.004 ***	0.000	11.520	0.000	0.004	0.005

The overall average willingness to accept under the current contract conditions (five years; no support for cooperation; medium effort; no acceptance of cut grass assured) is calculated as 522 €/ha*a, which is above the current payment of the scheme of 387 €/ha*a. This difference of 135 €/ha*a could arise due to the farmers' perceived transaction costs, such as search, decision making, negotiation, and coordination costs (Mettepenningen et al., 2009) and equal about 25 % of the calculated payment.

Based on the model results the compensation payment could be significantly reduced by two means. First, offering support for cooperation by the water and soil associations would reduce the minimum financial compensation level by 53 €/ha*a. Second, the guaranteed purchase of the cut grass would reduce monetary compensations even more by 67 €/ha*a for a fixed price; or 77 €/ha*a for market prices. As a result, under an adjusted design farmers would be willing to participate in the scheme for a compensation of 385 €/ha*a.

However, it needs to be considered, that this choice modelling result only represents an average estimate. In practice, farming conditions, required management efforts and yield potentials vary tremendously between different locations, which would influence farmer's decision making. Whereas in regions with less favoured conditions and lower yield expectations, such as in Brandenburg (for which the original measure was designed), lower monetary compensation levels might be sufficient, highly intensively managed and high-yield grasslands, such as in Northwest Germany, even the 522 €/ha*a would be insufficient to encourage farmers to participate in the AEM. Farm type and regional differences thus have to be considered more closely in further modelling.

Considering the costs of the climate friendly peatland management AEM and the avoided GHG emissions, we can estimate the price of metric tonnes CO_2 equivalent. Through the change from drained medium-intensive grassland management to extensive wet grassland management about 15 t CO_2-Eq/ha*a emissions could be avoided (see Figure 1 based on e.g. Couwenberg et al., 2011; Drösler et al., 2013; Tiemeyer et al., 2016). Hence, combining the costs of 522 €/ha*a and the 15 t CO2-Eq/ha*a avoided GHG emissions, the price for saved carbon is calculated as 35 €/t CO2-Eq.

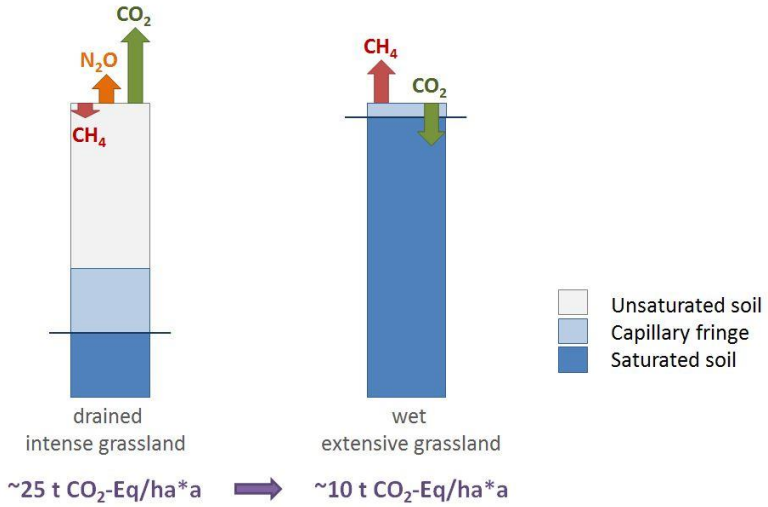

Figure 1. Possible GHG reduction through agri-environmental measure (AEM) according to Couwenberg et al., 2011; Drösler et al., 2013; Tiemeyer et al., 2016) .

By offering a measure design which is more adjusted to the preferences of the farmers and reduces the necessary payment to 385 €/ha*a would result in 26 €/t CO_2-Eq. Also the particular biophysical characteristics of locations are not reflected. Other authors have named

more optimistic estimations of the tons of CO_2-Eq of emissions that could be avoided through optimized peatland management. Schaller (2014) estimates a higher possible reduction of GHG emissions through climate friendly peatland management (Havelluch region in Brandenburg, Germany, one of the biggest peatland areas; avoided emission through water logging = 28 t CO_2-Eq/ha*a), which hence would also reduce the price per t CO_2-Eq.

Compared to other market mechanisms to reduce GHG emission, the AEM is rather expensive. GHG emission trading schemes (ETSs) for instance are operational in several countries and range between 0 and 24 $A (Talberg & Swoboda, 2013), of which the EU ETS is the biggest with currently almost 8 € per metric tonne CO_2 (14.01.2018). But if we compare our results to private payments for ecosystem services (PES), such as atmosfair (www.atmosfair.de/en) that compensates GHG emissions from traveling, or the world's first carbon credit scheme from peatland rewetting, MoorFutures® (www.moorfutures.de), we see that there is a high willingness to pay of private persons for carbon saving. The certificates are sold for 23€ (www.atmosfair.de/en) and 35 – 67 € per unit (Günther, Böther, Couwenberg, Hüttel, & Jurasinski, 2017), respectively.

4 Conclusions

To investigate which factors influence the willingness of farmers to participate in the agri-environmental measure (AEM) climate-friendly peatland management, we carried out an empirical study among famers applying a discrete choice experiment (DCE). The average willingness of farmers to participate in the measure is 522 €/ha*a. This price could be significantly reduced by taking into account the perceived private transaction costs and tailoring the contract design through 1) offering support for cooperation by the water and soil associations and 2) by securing the purchase of cut grass. Hence, to maximize the climate protection potential of the proposed measure and reach climate mitigation goals, incentives are needed, as well as support for cooperation and involvement in regional value chains.

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