Farmers adoption of the Habitats Directive in Eastern Germany – what drives the optimization of grassland conservation?

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Abstract:

The following paper provides insights in the adoption-behavior of farmers in Saxony due to the Fauna-Flora-Habitat directive (habitat-directive) of the European Union (EU). For the implementation of the habitat directive, the federal state of Saxony has introduced the instrument of managementplans in combination with agri-environmental programs. The paper shows that the combination of managementplans and agri-environmental programs can be successful for the implementation of nature-conservation measures under specific circumstances. The paper investigates the determinants of the farmers decision to optimize their farming practices towards the objective of nature conservation. The data set consists of interviews with 139 farmers between 2004 and 2011 and additionally information of 333 grassland-sites. A multinomial logit model was applied. The results show that location factors and the design of AEPs exhibit an influence on the implementation of measures of the Habitat Directive. At the plot level, we can (among other factors) observe an impact of specific (dark green) agri-environmental programs on the willingness of farmers to adopt nature conservation measures within the framework of the EU habitat directive. We also investigate the determinants of participation in light green and dark green AEPs. The findings highlight the potential of integrated policy packages to incentivize specific measures of nature conservation within the Natura 2000 framework.

Acknowledegment:

JEL Codes: Q58, Q12

#1925

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Keywords: EU Habitat Directive, Managementplans, Decision, Adoption, Saxony

JEL-Codes: Q18, Q58, Q15

1 Introduction

The conservation and support of grassland biodiversity within the Natura 2000-framework strongly depends on farming practices and farmers' attitudes towards nature conservation. Supporting policy instruments in the fields of agricultural and environmental policy are necessary to provide incentives for biodiversity supporting practices. Within the EU's Common Agricultural Policy (CAP), **agri-environmental programs (AEP)** with its specific measures support farmers to integrate conservation practices on grassland. In Germany, the CAP's Agri-Environmental Measures (AEMs) account for 610 Mio. EUR per year (BMEL 2015), however with some differences among the German federal states. The EU's **biodiversity strategy 2020** (EU Commission 2011a, 2015) identifies the "Habitats Directive" as a central instrument to govern the Natura 2000-framework.

Trends of increasing numbers of habitats and species with "unfavourable conditions" for the period from 2007 to 2013 documented by in the Natura 2000-report of the German government (BMUB 2013) however suggest that the Habitats Directive as insufficient to meet the EU's biodiversity objectives. Thus, further complementary policies are needed to improve biodiversity conservation in Natura 2000 sites.

Biodiversity friendly farming requires farmers as the central "stewards" of agricultural landscapes to adopt extensive, more biodiversity sound farming practices. Appropriate and attractive policies can compensate farmers for the costs of conservation activities and provide incentives for adjusting farming practices. Therefore, the main challenge to achieve a better conservation status is the design of political incentives. The Habitats Directive and the CAP's AEMs are funded and administered by different EU sectors (agriculture and environment) which adds to the difficulty of designing coherent incentive schemes. The question arises to what extent AEMs are complementary to the implementation of the Habitats Directive. In many German federal states, Special Areas of Conservation (SACs) including farmland are designated and implemented in top-down approaches by the federal state governments . The active participation of stakeholders like farmers, conservationists or other land user is however not sufficiently enforced (as reported by Geitzenauer et al. 2015 for Austria). Saxony is an exception, as here the implementation of the Habitats Directive is voluntary and mainly based on AEMs. In Saxony, management plans are used to integrate the objectives of the Habitats Directive into AEMs.

Management plans are based on larger regional areas (in most cases following one of the rivers in Saxony). Within that region, the management plan identifies the plots with high biodiversity, which are subject to the protection by the habitat regulation, the so called 'sites of community importance (SCI)'. For the SCI, the management plans identify the conservation status, develops specific conservation measures and communicates with farmers on the implementation within the agri-environmental measures of the state of Saxony. The following figure shows the role of the management plans in a time line:

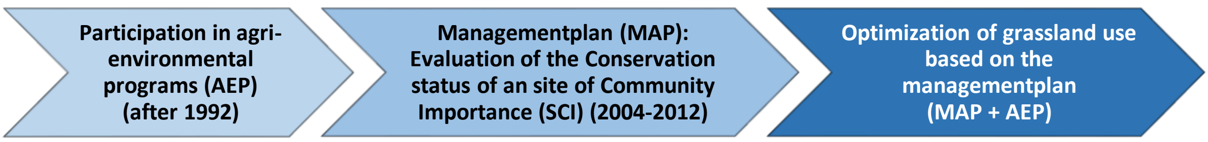

Figure 1: The development of sites of community importance (SCI) in Saxony since 1992

After the MacSharry-Reform of 1992, the new agri-environmental programs (AEP) were introduced and set some first incentives for biodiversity friendly farming (1). After 2004, the management plans also coordinate the objectives of the Habitats Directive with the existing AEP. Appropriate measures to maintain the conservation status of a specific SCI are developed (2). Within the process of planning, farmers were contacted and asked, if they were willing to further optimize their grassland use with respect to the measures foreseen in the management plans on a voluntary basis (3).

The Common Agricultural Policy (CAP) with it's AEP and the Natura 2000 policy, with the habitats directive and it's management plans are integrated policies, where instruments of both policies are combined in order to implement the habitats directive. In this article, we will investigate, whether AEPs in Saxony effectively support the implementation of the Habitat Directive. Despite the large body of literature on the effectiveness of AEPs (Uthes & Matzdorf

2013; Breustedt et al. 2013; Batary et al. 2015) and on farmers AEP uptake (Lastra-Bravo et al. 2015), little has been reported on the behaviour and preferences of farmers within a framework, where different policies are combined and parts of the measures go beyond AEPs. In order to fill this gap, we assess the impact of fourteen management plans. We base our analysis on a quantitative survey, which is based on 14 management plans in Saxony between 2004 and 2012. With the target of identifying the strengths and limitations of the Saxonian' model, we identify drivers, which allow successful implementation of the Natura 2000. This is done within the management plans (and farms) that motivate farmers to engage in conservation practices.

2 Background and theory

2.1 Background of the management plans

The objective of the Habitats Directive is the protection and conservation of certain species and habitats, which are of interest at the European level via the designation of 'Special Areas of Conservation' (SACs). SACs are selected in three stages (EU Commission, 2011b):

1. The EU member-states propose habitats and areas to the EU Commission that might potentially fulfill the criteria of the habitat directive. The selection procedure has to be based on scientific documents (such as species lists).
2. The European Commission has to agree to the proposed areas as '*Sites of community importance (SCI)*', which is done in a consultation process including representatives of the member states, different stakeholders, experts and representatives of non-governmental organizations (NGO). The objective of this consultation process is ensure the '*favorable conservation status'* of the habitats or species in the respective area.
3. In the final step, the member-states have to designate these SACs to ensure that the favorable conservation status of habitats or species is maintained. According to Article 6 (2) of the Habitats Directive, the member states have to identify the necessary nature conservation or land use measures to keep or reach this status within 6 years after the adoption of the area by the European Union. As a result of this, member states are legally obliged to avoid deterioration of species/habitats (EU Commission, 2000: 24/25).

In Germany, the task of identifying these measures is conducted by the federal states. The state of Saxony has merged the documentation process of species and habitats and the identification of measures to maintain the favorable condition into one step, so in practice, both steps are done by means of the management plans, that document the special area of community interest (SCI) and at the same time identify the necessary measures to maintain the documented species and habitats.

The typical management plan follows a structured process described in Figure 2:

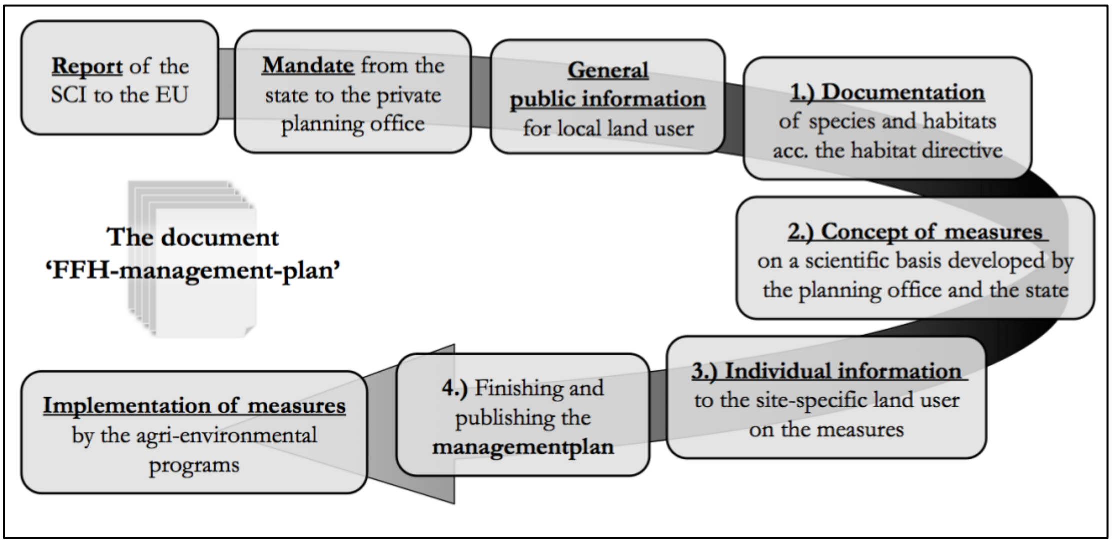

Figure 2: Procedure of the management plan development in Saxony

Source: **Franke 2008**

According to the Habitats Directive (Art. 6, § 4), '*other plans*'[1] which might interact with the objectives of Habitats Directive, have to be assessed for potential impacts on this plan. Therefore, agricultural practices which are related to SACs, are documented in the management plans. In Saxony the management plans are developed by private planning offices and paid for by the state. After the final report of the areas of special interest, the federal government of Saxony gives the mandate to the private planning office and the planning office provides information for the population in the surrounding region.

In the first stage, the planning offices document the species and habitats of interest based on the Annexes of the Habitats Directive. In a second stage, a concept of conservation measures is developed. The third stage is a communication with the respective farm enterprises. This communication consists of (a) information on the project, (b) an interview, on the land use system on the specific grassland, (c) the question, if a farmer wants to implement the measures and (d) if there are any other problems, which might have an influence on the nature conservation objective on the specific site. The fourth stage consists of the documentation the agricultural plans and the result of the communication procedure with the farmers, which has to be part of the so called 'FFH-Managementplan'.

The suggested conservation measures are designed for the respective sites, however we can identify some typical measures in Saxony: For example, there exists a uniform recommendation with respect for the level of fertilization on grassland within the state of Saxony (Franke and Riehl, 2005)[2]. We can distinguish roughly six simplified types of typical measures (table 1):

[1] Other plans can be infrastructure measures such as transport infrastructure plans or water management plans, but also the typical agricultural practices (EU Commission, 2000), which can be considered as '*farm-plans*'.

[2] If planning offices develop e.g. other fertilization regimes for a specific grassland-site, they have to give a justification based on a good documentation and on a scientific reason for this measure.

Table 1: Examples for typical measures in SACs in Saxony (simplified)

Type of measure	Description
1. Fertilization	Restriction of the fertilization to 60-75 [kg N/ha and year] on grassland with high yield potential and to 60-75 [kg N/ha every second or third year] on grassland with medium yield-potential, no fertilization on grassland with low yields potential.
2. Time of mowing on grassland	Harvesting of the grassland after 15.June or at the time of flourishing of the main yield giving grassland-species, 40 days rest-period before the second cut
3. 'Glaucopsyche-regime'	*Glaucopsyche nausithous* (Dusky Large Blue) is a red-list species, which needs the flower *Sanguisorba officinalis* (Great Burnet) for reproduction. *Sanguisorba* is flourishing in August. Therefore, the measure includes mowing of grassland before June 30, the second cut cannot be done before Sept. 15.
4. Introduction a mowing-regime	Introduction of a mowing-regime on grasslands, which were not in regular agricultural use. This is especially the case on grasslands, where the use has been given up and the conversion into a forest-habitat is in process. This measure also applies for very wet grasslands such as tall forb communities.
5. Cutting young wood	Cutting young trees and hedges in order to re-establish a grassland-regime. Often we can detect unused grassland by young trees, which finally after some years replace blooming-species from grassland.

Source: own elaboration, information based on different management plans

Management prescriptions are based on the phenotype of the important grassland-species, not on fixed dates. For example, the time of mowing should be at the time the flourishing of the most important yield giving grassland-species (Measure 2 in Table 1). There are substantial differences between this rough time-description and the time descriptions in the agri-environmental programs, which are important for supporting the introduced measures. The same holds for the measure 1), which bases fertilizer levels on the yield potential of the grassland. Both measures in theory are based on plot specific necessities rather than on general guidelines. Nevertheless, farmers often regard these measures as being too restrictive. Measures 4) and 5) are designed to re-establish or secure the grassland use of certain plots, since grassland with young trees is often not used anymore. These two measures are in some cases not applicable, since they also involve investment costs and the agri-environmental programs in the financial periods 2000-2006 and 2007-2013 in Saxony do not always cover these investment costs.

The planning method of management plans also allows for '*site-specific compromises*', where the farmer and the planning office agree on an appropriate measure that provides a lower habitat quality compared to an optimal measure. This might apply e.g. on the grazing regimes with suckler-cows: This grassland-regime is not optimal for the habitat '*Lowland hay meadow*' (No. 6510, similar to *Arrhenaterion*), since this phenotype (theoretically) has to be mowed. Nevertheless, we can find some of the important species of this phenotype on grassland, even when suckler-cows used to graze on the plot for many years. In such a case just a second cut mowing regime or even no mowing at all is possible.

In about 57% of the SAC farmers already used agri-environmental measures, therefore there is a strong interlinkage with agri-environmental programs. Typical agri-environmental programs and measures relevant for the management plans are described in table 2:

Table 2: Agri-environmental schemes to implement habitat directive in Saxony

Program-name	Description	Premium
KULAP (2000-2006)	Part of the program environmental friendly agriculture ('Umweltgerechte Landwirtschaft (UL)'). A basic extensification program on the grassland, no chemical fertilizer and plant-protection, in some cases cutting only after the 15.June allowed.	102-204 €/ha
NAK (2000-2006)	A program for nature-protection and sustaining cultural landscape ('Naturschutz und Erhalt der Kulturlandschaft (NAK)')*:* A site-specific program similar to KULAP but with mowing regimes after 15.June and 15.July.	360-450 €/ha
Organic Farming (2000-2013)	A Program to promote the organic farming scheme according to the Regulation EU-VO 2092/91.	244 €/ha (2000-2006) 237 €/ha (2007-2013)
AUW (2006-2013)	A basic program for grassland-extensification, no chemical fertilizer and plant-protection. It is possible to mow the grassland or keep animals grazing	102 €/ha
AUW 35 (2006-2013)	An advanced program for grassland-extensification addressed to *glaucopsyche nausithous* (Dusky Large Blue). The life cycle of this species is strongly connected to the flower *sanguisorba officinalis* (Great Burnet), which flourishes in August. No chemical fertilizer and plant-protection, mowing after the 15.June, or not mowing in August until 15.Sept, keeping of sheep and goats is possible.	350-373 €/ha

Source: own description, simplified, based on Ministry for Environment and Agriculture Saxony (2007, 2015)

One important objective of the management plans is to document the willingness of farmers to optimize their grassland use and to implement the measures of the plan. Therefore, at the end of the interview, the farmers were asked to make a statement, if they would be willing to apply the suggested measures for grassland optimization. This optimized grassland-use is often similar to agri-environmental program measures of the state of Saxony, but the details of the measures can deviate from the programs outlined in Table 2. The '*willingness to optimize*' is therefore to some extent linked to the participation in agri-environmental programs, however, there are also cases, where optimization is independent from the financial support of those programs. Based on the interviews with farmers, we can in general distinguish two situations:

- For farmers without any program-participation it is most important, whether they are in general willing to practice less intensive grassland farming and use the agri-environmental support. In some cases, an optimization of the grassland-use is possible even without any financial support (which was sometimes even economically rational taking into account administration costs for a farm to participate).
- For farmers, who already used agri-environmental programs the focus lies on the details of the optimization, which was in some cases not trivial despite the financial support of the program. For some farmers, a change in a more complex AEM with higher payments was attractive.

Some of the main arguments against an optimized grassland use are the details of the agri-environmental schemes, which did not always fit to the very detailed measures. For instance, mowing times according to an AEM (e.g. on 15.06.) are often stricter than required by the management plan. This indicates some conflict of objectives between AEP and the implementation of the Habitat Directive. Therefore, in our model we mainly investigate the willingness of farmers to optimize the use of grassland in contrast to other studies, which focus mainly on farmers participation at AEPs (Vanslembrouck et al., 2002, Mann, 2005, Ma et al., 2012, Breustedt et al. 2013, Lastra-Bravo et al. 2015). Figure 2 gives an overview on the potential impacts of FFH-management in Saxony:

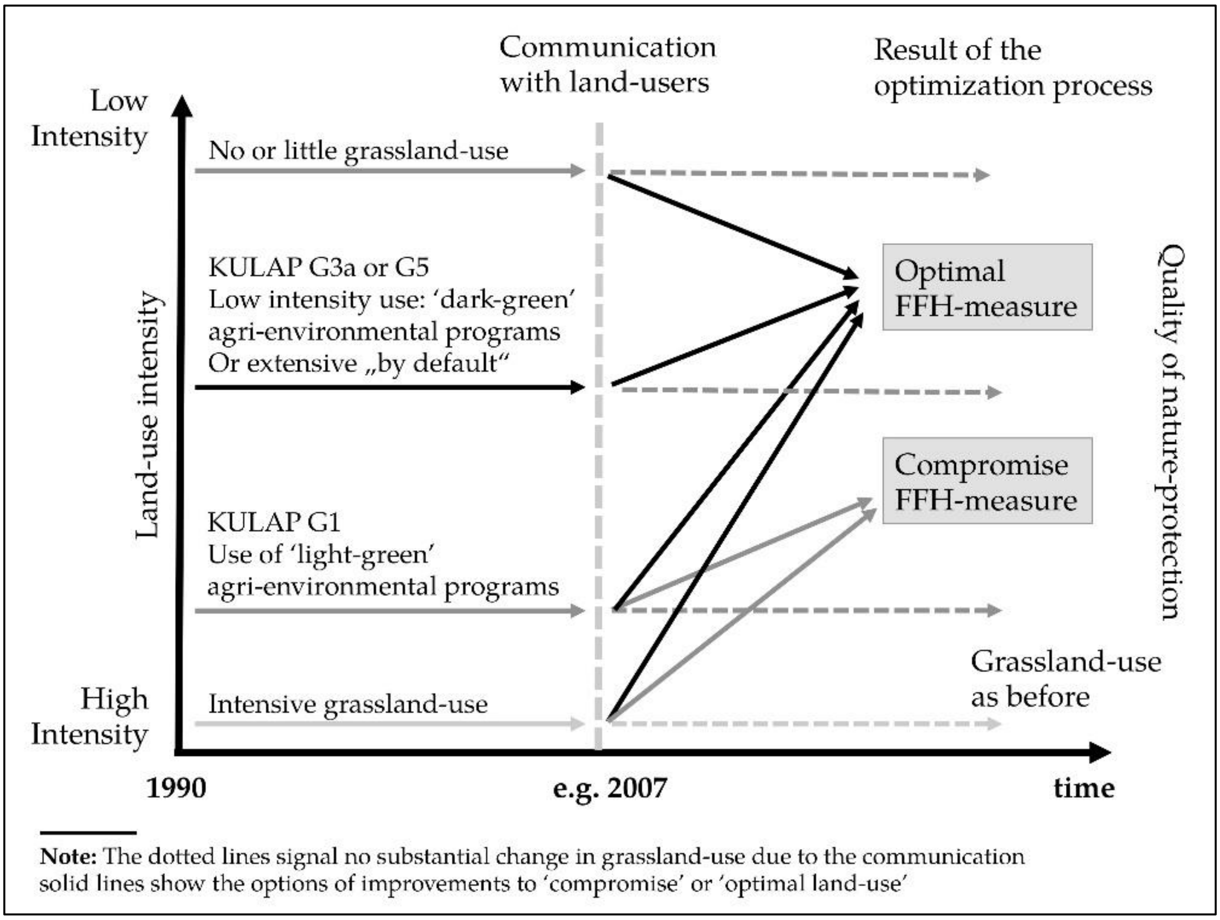

Figure 2: Potential impacts of management plans in Saxony
Source: own presentation

2.2 A short literature review on participation studies

Farmers can substantially contribute to nature-conservation and to species maintenance and advocates of nature-conservation can find capable partners in agriculture. For such a partnership an appropriate planning method has to be implemented and managementplans can be such an instrument for balancing interests in the area of special interest. There are some case studies and general elaboration on the topic of the habitat directive (Hochkirch et al. 2012, Young et al. 2013, Santana et al. 2013; Greitzenauer et al. 2016).

The planning and implementation of conservation measures in rural area in Germany have been a controversial issue ever since. Despite elaborated programs and financial incentives for farmers, Stoll (1999) stated, that the participation of farmers implementing nature-conservation has been disappointing (Stoll 1999: p.19). Farmers see the agricultural land primarily as a production resource, whereas advocates of nature often claim the agricultural land (here the grassland) for their interests without any compromises. There is a huge literature on the acceptance of nature conservation area, which document the conflicts with respect to optimal nature-friendly production systems. The work of Stoll (1999) gives a literature-overview on different studies on acceptance of nature conservation projects by farmers. A joint result of the different studies is the fact, that besides the details of the concrete project, the acceptance and perception of nature conservation measures is influenced by attitudes of the farmers and past experiences with other projects (Stoll 1999: 24/25). There is a broad literature on the participation of farmers in AEPs (e.g. Vanslembrouck et al., 2002; Mann 2005; Ma et al. 2012; Breustedt et al. 2013; Lastra-Bravo et al. 2015). However, most of the literature does not address specific question of the implementation if conservation policies such as the implementation of the habitat directive. Lastra-Bravo et al. (2015) summarize factors influencing farmers' willingness to participate in AEP as financial incentives, the fit between scheme prescriptions and farming systems, farmers' characteristics, attitudes, and preferences, the underlying geographical and regulatory context, and farm characteristics. Breustedt et al. (2013) find a level of subsidies between 100-200 EUR/ha as necessary incentives to convince farmers to participate in conservation activities. Geitzenauer et al. (2015) investigated the special case of the Natura 2000 implementation in Austria. They find that the implementation of Natura 2000 is influenced by the governance within the federal states of Austria.

3 Data and Methods

3.1 Optimization of grassland use: Theoretical model

We assume that a farmer's utility is a function of agri-environmental program participation (*AEP*) and grassland optimization (*Opt*), and other explanatory variables *Z*. We use the variable *Subs* to describe the difference between subsidies and additional costs related to the policy.

$$U = U(AEP, Opt, Z)$$

Where $AEP = AEP(Subs)$ and $Opt = Opt(AEP, Subs)$. A change in the total subsidy therefore acts through several channels:

$$\frac{dU}{dSubs} = \frac{\partial U}{\partial AEP}\frac{\partial AEP}{\partial Subs} + \frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial Subs} + \frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial AEP}\frac{\partial AEP}{\partial Subs} \qquad (1)$$

Where

$\frac{dU}{dSubs}$ is the total effect of changing subsidies on a farmer's utility.

$\frac{\partial U}{\partial AEP}\frac{\partial AEP}{\partial Subs}$ is the change in utility due to subsidies channelled through the agri-environmental scheme. Theoretically, $\frac{\partial AEP}{\partial Subs} > 0$, i.e. an increase in subsidy should ceteris paribus lead to an increase in AEP participation, while the sign of $\frac{\partial U}{\partial AEP}$ is unknown.

$\frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial Subs}$ is the effect of subsidies on utility via the optimized grassland use, where $\frac{\partial Opt}{\partial Subs} > 0$ and the sign of $\frac{\partial U}{\partial Opt}$ is unknown.

$\frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial AEP}\frac{\partial AEP}{\partial Subs}$ describes the effect that subsidies have on utility through the interaction of agri-environmental schemes and optimized grassland use. It is plausible that farmers who already receive subsidies through the agri-environmental scheme are already familiar with the bureaucracy involved and are more likely to participate in grassland optimization, i.e. $\frac{\partial Opt}{\partial AEP} > 0$.

Given the subsidy is greater than the additional costs (i.e. *Subs > 0*), and the farmer's marginal utility of income is a positive and concave function of income, a farmer will be more likely to participate compared to a status quo of non-participation if either $\frac{\partial U}{\partial AEP} > 0$ and $\frac{\partial U}{\partial Opt} > 0$, i.e. if the change in utility from participation is positive. Further, by rearranging equation (1) to

$$\frac{dU}{dSubs} = \left(\frac{\partial U}{\partial AEP} + \frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial AEP}\right)\frac{\partial AEP}{\partial Subs} + \frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial Subs}$$

we can conjecture that $\frac{dU}{dSubs} > 0$ if $\frac{\partial U}{\partial Opt} > 0$ and $-\frac{\partial U}{\partial AEP} < \frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial AEP}$, i.e. if the marginal benefit from optimizing grassland outweighs a possible loss from the agri-environmental scheme participation. Finally, if $\frac{\partial U}{\partial Opt} < 0$, then $\frac{\partial U}{\partial AEP} > \frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial Subs} + \left(\frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial AEP}\right) / \frac{\partial AEP}{\partial Subs}$, so the marginal benefit from the AEP must outweigh both the loss from the optimization measure plus the loss from the interaction effect.

Obviously, all the arguments outlined above are reversed if *Subs < 0*.

3.2 Applied model for grassland optimization

To estimate farmers' choices, we apply the framework of random utility theory. Farmers face a choice among several alternatives. The utility (U) maximization principle assumes that a farmer will agree to a proposed policy management alternative i over alternative j if $U_i > U_j$. Because utility is an ordinal concept, the standard approach in the literature has been to model choices probabilistically, i.e. $\Pr(U_i > U_j)$ is the probability of choosing option i over option j (Train 2009). In random utility theory, it is assumed that utility is the sum of a deterministic, observable term V and a random, unobservable term ε. The probability of choosing option *i over j* can therefore be expressed as $\Pr(V_i + \varepsilon_i > V_j + \varepsilon_j)$. This expression requires assumptions about (1) the functional form and the components of the deterministic utility function and (2) the distribution of the error term. A convenient expression of the deterministic part V is the linear additive form that sums up characteristics of the choice in addition to characteristics of the farmer, each weighted by their respective part-worth utilities β_i (Lancaster 1966).

$$U_{ij} = \beta_i X_{ji} + \varepsilon_{ij}$$

Given the categorical choice, assuming an extreme value type 1 distribution of the error term leads to a simple multinomial logit (MNL) model to describe the probability of choosing a given alternative (Train 2009).

In this paper, we estimate to separate but related choices. First, we use a multinomial logit model to model the decision of participation in an agri-environmental scheme, which we name the *AEP model*. The decision here is between (1) no AEP participation, (1) a light green program, and (3) a dark-green program.

$$V_{darkgreen} = \alpha_0 + \alpha_1 farmsize + \alpha_2 gl\_share + \alpha_3 gv\_ha + \alpha_4 parttime \ + \alpha_5 subsidy$$

$$V_{lightgreen} = \beta_0 + \beta_1 farmsize + \beta_2 gl\_share + \beta_3 gvha + \beta_4 parttime + \beta_5 subsidy$$

In this formulation, α_5 and β_5 correspond to $\frac{\partial U}{\partial AEP}\frac{\partial AEP}{\partial Subs}$ in equation 1. Second, we model the decision of participating in optimized grassland use on SAC sites, which we name the *OPT model*.

The deterministic utility associated with the compromise alternative is determined by the three alternatives, to either (1) not participate in optimized grassland use, (2) to participate in a compromise measure or to (3) fully participate.

$$V_{compromise} = \gamma_0 + \gamma_1 Subsidy + \gamma_2 Darkgreen + \gamma_3 Lightgreen + \gamma_4 organic + \gamma_5 sitequality + \gamma_6 DrivingDistance$$

while the utility associated with the full commitment is

$$V_{full} = \delta_0 + \delta_1 Subsidy + \delta_2 Darkgreen + \delta_3 Lightgreen + \delta_4 organic + \delta_5 sitequality + \gamma_6 DrivingDistance$$

Here, γ_1 and δ_1 correspond to the term $\frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial Subs}$ in equation 1, while $\gamma_2, \gamma_3, \delta_2$ and δ_3 correspond to $\frac{\partial U}{\partial Opt}\frac{\partial Opt}{\partial AEP}$.

The probability of choosing a compromise alternative is $\Pr(C) = \frac{e^{V_C}}{1+e^{V_C}+e^{V_F}}$, and the probability that of a full commitment is $\Pr(F) = \frac{e^{V_F}}{1+e^{V_C}+e^{V_F}}$. The probability of not participating therefore is $\Pr(N) = \frac{1}{1+e^{V_C}+e^{V_F}}$, and analogously for the AEP model. Parameters α, β, γ and δ are estimated by maximum likelihood (e.g. Wooldrige 2006) in STATA version 13.

The utility of not participating is normalized to zero in both models, so all estimated parameters are interpreted as marginal utilities relative to choosing not to participate. α_1 and β_1 describe the marginal utility of money of respectively choosing the compromise measure or the full participation.

3.3 Dataset

The data were collected between 2004 and 2011 in 17 management plans in Saxony. The interviews were part of the management plan and within every plan, the choice of farmers was dependent from the existing knowledge of the authorities provided to the planning offices. Within every plan, we have interviewed as many farmers as possible.

In the structured interview, the farmers were asked about their actual land-use practices on the grassland. By means of these interviews, information of 131 farms and 333 FFH-sites in West and Central Saxony were collected. The following table 3 shows the characteristics of different farm-groups according to legal form.

Table 3: Structural elements of the interviewed farms

Legal form	unit	Farm size [ha]	Grassland-share [%]	Impact of FFH-area	
				Size FFH-area hectares	Grassland-share [%]
Single farms Part-time (n=42)	mean	23.9	76.8	3.66	25.6
	min-max	0.8 – 68.5	8.6 – 100	0.08 – 39.1	0.4 – 93.2
Single farms Full-time (n=46)	mean	176.0	36.3	7.23	11.3
	min-max	8.0 – 600	5.0 – 100	0.04 – 59.9	0.2 – 100.0
Civil law associations (n=8)	mean	438.7	35.7	4.61	8.1
	min–max	24 – 852	7.2 – 100	0.1 – 11.7	0.2 – 23.8
Lim. liability and priv. Company (n=21)	mean	1,159.7	36.8	6,80	5.4
	min–max	55 – 3,050	4.0 – 100	0,15 – 46.9	0.06 – 29.0
Cooperatives (n=21)	mean	1,734.1	26.7	5.57	3.2
	min–max	296 – 4,500	0.7 – 100	0.2 – 21.9	0.03 –19.4

Source: own calculation based on 131 farms, **notes**: FT= Fulltime, PT= Part-time,

Single farms are more affected by FFH-measures, since FFH-measures account (on average) for about 7 ha and 11.3 % of their grassland area. Within the group of part-time farms, the share of FFH-area is even at 25.6 %, which highlights the importance of part-time farms for nature-protection. The dual structure of East-German agriculture can be found in this data set, too. The large farms (Cooperatives, civil-law associations and large private companies) have a lower share of their area touched by FFH-area (3.2 %; 5.4 % and 8.1 %). Nevertheless, the FFH-area in for this type of farms is large absolute terms.

Overall, about 63 % of farms were willing to optimize their grassland use for the purposes of the habitat directive. Another 20 % of farms were willing to accept measures, which contained compromises. This seems to be very high, especially taking into account, that about 43 % of the farms are not using any agri-environmental schemes. However, there is some kind of 'pre-selection effect' within the method of management plans and also in the data-set: The FFH-sites within a larger project area are selected by documenting the biodiversity of all grassland within the project area. A grassland-plot is only selected as SAC site, if a farmer is already using the grassland in a way that allows for a high biodiversity.

Besides this, the data selection is typical for an investigation of managementplans in Saxony, since the distribution of interviewed farmers covers the typical regions within Central and Western Saxony (see figure 3):

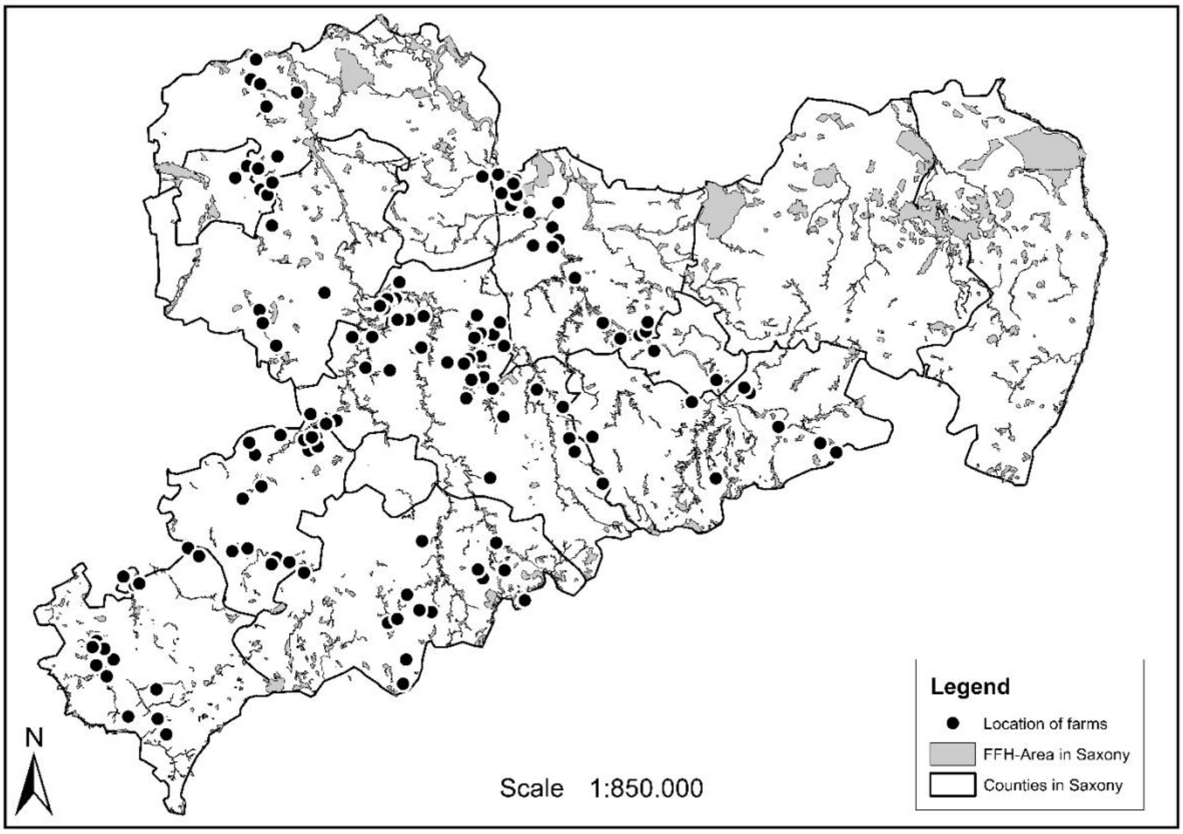

Figure 3: The location of the interviewed farms in Saxony 2003-2011
Source: own elaboration

The farms are distributed throughout all geographical regions in Saxony, in the productive flatlands around Leipzig, the hilly regions and river-valleys of central Saxony and finally the hilly region of the 'Erzgebirge'. The FHH-areas are more or less along rivers and the interviewed farmers were identified during the documentation process, therefore just farmers with grassland with a minimum diversity of species on their grassland were interviewed. The summary of statistics of the used variables are presented in the appendix.

The data set also contains some site-specific information about the habitat type. These data contain information, which habitat is recorded in the plan (e.g. highland hay meadow), the quality of biodiversity on the site (quality A, B, C), the location and size of the plot and the implemented agri-environmental scheme.

The decision pattern is documented in the following table:

Table 4: Implementation regimes of the ffh-managementplans and used AEP in Saxony

	No optimization	Compromise	Full optimization
No AEP	44	29	70
Light green	13	25	44
Dark green	6	13	68
Organic	2	3	16

Source: own calculations; number of plots = 333, number of farms 131

4 Results

The model analyses the correlation of Nature 2000 decisions with a range of explanatory parameters (see Table 5). The following table presents estimation results of a multinomial logit model, explaining farmers' decision within the Natura 2000-management plans.

Table 5: Estimated Coefficients of the multinomial Logit-Model

Variable	Coefficient	z	P>|z|	Coefficient	z	P>|z|
	Compromise regime			Optimal regime		
Constant	*3.8707*	*1.65*	*0.10*	*-3.4227*	-1.56	*0.118*
Quality A (=high) (1/0)	*0.4374*	*0.00*	*1.00*	*0.1372*	0.22	*0.827*
Quality C (=low) (1/0)	*0.3573*	*0.72*	*0.47*	*0.1677*	0.38	*0.706*
Development site (1/0)	- 0.9133*	- 1.87	0.06	- 0.6968*	- 1.80	0.072
Altitude of the FFH-plot (m)	0.0025**	2.48	0.01	*- 0.0006*	*- 0.75*	*0.453*
Distance plot to farm (km)	- 0.1422***	- 3.32	0.00	- 0.0928***	- 3.15	0.002
Subsidies (EUR/ha)	- 0.7488*	- 1.72	0.09	0.8324**	2.07	0.039
Dark-green programs (1/0)	1.4472**	2.15	0.03	2.2093***	4.05	0.000
Light-green programs (1/0)	1.0452**	2.34	0.02	0.7890**	2.05	0.040
Organic farming scheme (1/0)	*0.6803*	*0.70*	*0.48*	1.3434*	1.69	0.091
Number of observations	333					
LR $chi^2(18)$	83.08					
Probability > chi^2	0.00					
Log likelihood value	-276.77					
Pseudo R^2	0.1305					

The results show diverse effects: The **quality of a specific FFH-site** does not systematically influence the probability to optimize, however, if a plot has been evaluated as "development site", the probability is lower, that farmers agree to optimize the production. This finding can be explained by the fact that these plots are often more intensively used by farmers than regular FFH-plots. Therefore, the willingness of farm managers might be lower to change the management of these more intensive grassland plots.

The plots in **higher altitudes** are rather managed with a compromise regime. In contrast to this, altitude does not systematically impact the implementation in an optimal regime.

The **distance from plot to farm** exhibits a negative influence on an implementation in both compromise and optimal regime.

The **amount of subsidies (EUR/ha)** increase the probability, that farmers apply a compromise regime. Famers obviously react on the incentives of agri-environmental schemes. On the other hand, plots with very high costs have a lower probability to be managed within an optimal regime. Many of the plots with very high costs are in the high Erzgebirge. In the survey farmers often stated practical problems, why those plots could not be managed within an optimal regime.

Dark-green program exhibit a positive influence on farmers decisions for both the compromise and the optimal regime. Their effect is even higher for the optimal regime. The

Light-green programs also incentivize the implementation, however with a lower effect than dark green measures and being less probable for the optimal regime.

The **organic farming support** only shows a significant positive effect for an optimal implementation. Especially farmers with already running dark-green programs were very constructive in the talks about the implementation of FFH, therefore this results reflect the experience of the managementplans. This result documents that dark-green agri-environmental programs are better suited to support the implementation of Natura 2000.

The following Table 6 presents the determinants of program participation:

Table 6: Determinants of participation at light green and dark green programs ins Saxony

Variable	Coefficient	Z	P>|z|	Coefficient	Z	P>|z|
	Participation light green programs			Participation dark green programs		
Constant	- 4.8805***	- 4.36	0.000	- 2.4374**	- 2.38	0.018
Farm size (in ha)	0.5627***	3.73	0.000	*0.1927*	*1.36*	*0.175*
Part time farming (1/0)	1.3976**	2.74	0.006	*- 0.0408*	*- 0.08*	*0.937*
Animal density (AU/ha)	*- 0.2564*	*- 0.79*	*0.432*	- 1.0564***	- 2.86	0.004
Share grassland (in %)	1.7365***	3.41	0.001	2.1788***	4.32	0.000
Number of observations	316					
LR chi^2 (8)	43.09					
Probability > chi^2	0.00					
Log likelihood	298.62					
Pseudo R^2	0.067					

Source: own calculations

The table shows that **farm size**, **part time farming** and a **high share** of grassland increase the probability of a farm to participate at light green farms. Especially the first finding can be explained by the flexibility given c.p. to large farms: Light green farms are often whole farm measures with rather low requirements and low payment rates. It seems quite clear, that especially large farms can participate due to the higher land endowment. Since dark green programs are rather linked with high requirements, high payment rates and plot specific regulations, it is clear, that the land endowment is not the crucial factor here. Share of grassland is positively correlated with both, light green and dark green measures.

The **animal density** per hectare is only negatively correlated with the participation at dark green programs. A high animal density indicates a high land use intensity. Farms with a large herd size need to use grassland intensively to produce fodder. These farms are therefore less willingness to use grassland less extensively. High level conservation therefore requires enough land and a lower ex ante land use intensity. Alternatively, agri environmental programs need to sufficiently remunerate the costs of extensive grassland use. This result was found by Breustedt et al. (2013) in a discrete choice experiment for conservation contracts in Norther Germany as well, indicating a coherence of stated preferences and actual behavior.

5 Discussion and Conclusions

Our findings particularly identify some site and farm characteristics that favour the implementation of conservation measures that support the Habitats directive: The locaton of the grassland plots, the intensity of land use, type and payments within AEP and existing experiences with AEPs.

Farm location: The results of the implementation show that some characteristics of the grassland plots influence the probability of farms to implement the measures of the management farms. The quality of assessed species on the plot do not influence the probability, however, plots with poor quality (development sites) are less probable to get an optimize regimes. Those sites are more intensively used within the farms and therefore, farmers are reluctant to extensify. Plots in higher altitudes are especially interesting for the implementation of "compromise" regimes, but not for optimal regimes. The distance from plot to farms reduces the probability to implement. And in general, if a farm is highly specialized and has therefore a high animal density, the probability of a successful implementation via a dark green program is reduced.

Large farms seem to favour light green measures. If we apply a model with farm level indicators, larger farms increase the probability of an implementation of both, compromise and optimal regime (see Table 9 in the appendix). This finding is in contrast to Mann (2005), who found smaller farms to be rather willing to participate in AEPs in Switzerland. Obviously, within the framework of the specific conservation measures of the Natura 2000 regime, land scarcity is overweighing structural disadvantages. Larger farms have higher flexibility and are therefore more willing to implement conservation measures.

Policy influence: The results also highlight the role of agri environmental programs for the successful implementation of conservation according the habitats directive. Light green and also dark green measures and also the organic farming scheme contribute to the willingness of farmers, to implement the measures. Especially for the optimal regimes, dark green measures are necessary, since they provide higher payment rates, which might even outweigh the higher requirements.

The results of the level of subsidies is twofold: Higher levels of payment seem to rather reduce the probability for "compromise regimes". Breustedt et al. (2013) find in a discrete choice experiment, that farmers are willing to accept conservation measures for an incentives of 100-200 EUR/ha. This is beyond the actual level of light green payments, which are around 100 EUR/ha. The average payment for a compromise regime (see table 7 in the appendix) is about 144,33 EUR/ha[3], which might explain, why a payment of 102 EUR/ha is not sufficient to incentivize the implementation. The average payment for an optimal regime is 247,73 EUR/ha. The payments for organic farming is about 244 EUR/ha and the typical dark-green payments. Which are between 350 and 450 EUR/ha (See Table 2). This might also explain, why dark-green

[3] Parts of the compromise regimes are implemented with dark-green and parts with light-green measures, see table 4.

measures have a positive influence on the implementation in contrast to the negative influence of light-green AEPs.

The negative influence of light-green measures might also fit with some of the farmers, who stated within the interviews that they would rather implement small changes without any AEP, i.e. without payment. As a reason for this type of “zero-cost implementation”, they stated the administrative burdens would keep them away from a participation in AEP. On the other hand, a high level of payment has a positive influence of “optimal regimes”. So if the measures are somewhat complex, incentives have to be rather high to convince farmers to optimize their conservation efforts.

Overall, the interlinkages between AEP and the implementation of habitat directive is high, which suggests, that past experience have a high influence on the successful implementation of the habitat directive. The variable of **agri-environmental scheme** participation may partially capture a farmer’s attitude towards environment-friendly farming practices. This is in line with Breustedt et al. (2013) and Lastra-Bravo et al. (2015), who find that previous experiences with agri-environmental programs increase the likelihood of the adoption of new AEPs.

Financial gain may only be one of many objectives in the farmer’s utility function. One might expect that farmers with high appreciation of nature would participate in a “dark green” program, while farmers with a primary focus on profits would participate in a “light green” program. Nevertheless, farmers who participate in an agri-environmental program may already be familiar with the bureaucracy involved and therefore have a lower threshold towards accepting additional measures.

On the other hand, the variable “site quality” may capture both: current efforts to support habitat, but also marginalization of farmland due to unproductiveness. Surprisingly, there does not seem to be a systematic relation between the ecological quality on the site and the probability to implement the measures from the habitat regulation.

Overall, the results document that managementplans can be a useful complement for the agri-environmental schemes, since this planning-method includes communication with and consulting of farmers. In Saxony this method also had a motivating impact: On average, farmers agreed on 59 % of all sites to execute an optimal grassland-regime, ranging from 40 % to 86 % depending from the specific management-plan. Another 24 % of the sites were managed with a regime, which included a compromise with the farmer.

The following figure 4 shows the rates of consent on the plot-level within the investigated managementplans in Saxony. The data describe the share of plots, where farmers agreed to use grassland in the optimal way according the measures of the FFH-managementplan.

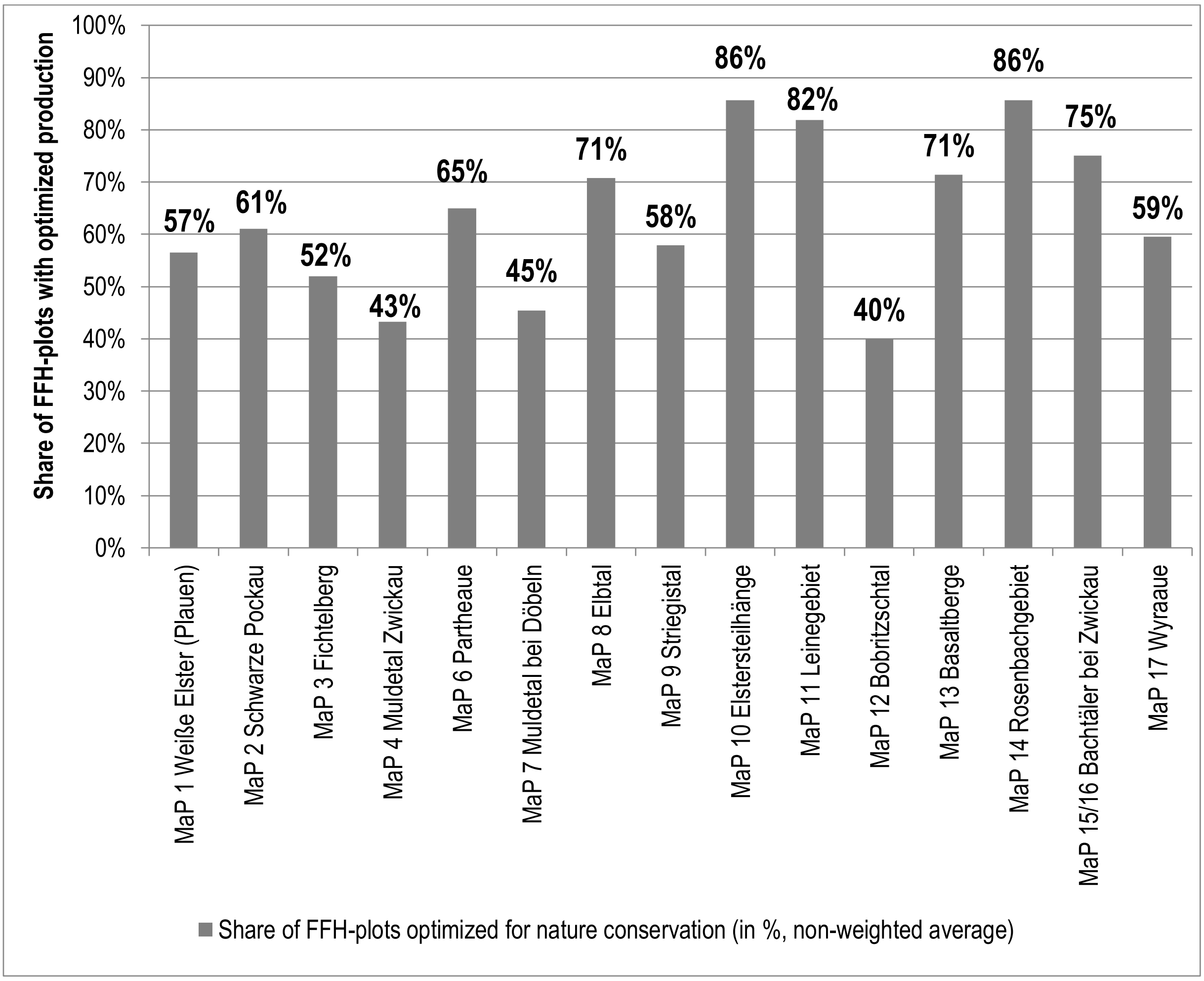

Figure 4: Share of FFH-plots with optimized production due to nature conservation according the managementplans (in %, non weighted average)
Source: own calculations

The managementplans are in first instance a tool for implementing the conservation of high nature value (HNV) grassland of European importance, which defined by the EU's habitat directive. The objective of the habitat directive is to create a '*coherent European ecological network*' for fauna, flora and habitats. The managementplans are not directly linked the classical agri-environmental programs, however, they can also be used to manage and improve the agri-environmental programs for the purposes biodiversity. However, agri-environmental schemes still need to be improved for the conservation of HNV-grassland, since e.g. the costs of measures of landscape conservation in the highlands and also slome investment measures are not always covered by the programs. Especially during the financial period 2007-2013, Saxony developed program lines for investments, and among the German federal states, Saxony (after Bavaria) has the second largest provision of program-money for investment into nature-conservation (Güthler and Orlich, 2009: 134). This might be another reason, why overall the managementplans are functioning as a method.

Managementplans can also be used to discover those types of deficits for the implementation, since farmers usually state, why they might not willing to implement or optimize their grassland regime. Finally, the modeling results also show, that an implementation of the habitat directive can lead to an impact on biodiversity without any amendment of the habitat-directive (cp. Hochkirch et al., 2013, Maes et al., 2013).

The instrument of managementplans seems also interesting on the background of the CAP-reform 2013-debate: The EU-Commission claimed to implement an environmental friendly farming-scheme through greening-measures in the first pillar (EU-Commission, 2011b). In contrast to the view of the EU-Commission, one of the main criticism from scientists on the concept of greening is the low effectiveness for protecting biodiversity (Pe'er et al., 2014, Hart & Little, 2012). The light-green agri-environmental schemes are criticized for the same reason (European Court of Auditors, 2011). The model results show that by identifying biodiversity-rich FFH-plots, by the designing the specific measures to maintain/conserve the protected species on the identified FFH-plots and by intensive communication with farmers (and other users of grassland), managementplans as policy tool can achieve high levels of agreement with farmers/land-users. Adjusted specific agri-environmental schemes with rather high payment-rates are another precondition for the successful implementation of the habitat directive, even if control and administration costs are higher with this type of 'dark-green programs' (Armsworth et al., 2012).

Within the CAP-reform 2013, there were a few better links to the EU's biodiversity policy and the Rural Development-Programs (EPRD). Target 1 of the EU's biodiversity strategy 2020 is to fully implement birds- and habitat-directives and target 3 asks for a stronger contribution e.g. of agriculture for the maintenance of biodiversity (EU-Commission, 2011c). So for the next reform of the Common Agricultural Policy (CAP) in 2020, a stronger link and a better implementation of the objective of the habitat-directive into the agri-environmental schemes (including FFH-managementplans) might lead on the one hand to better policy results for EU's biodiversity-strategy 2020 and at the same time increase the low effectiveness of EU's Common Agricultural Policy (CAP).

The study has a number of limitations: The data-set was taken mainly from 14 managementplans in Western and Central Saxony. Parts of Saxony are not included in the study. The specific results give some interesting insights in the implementation of the Habitat Directive in Saxony, however, the findings are not representative. Besides this, the long time period from 2004-2011 might slightly affect the famers behavior, since at the beginning, the system of managementplans was unknown, whereas at the end, many farmers were already aware of it. However, we could not find a systematic influence of time within the data set. The findings are specific for the willingness to optimize, so they go beyond the participation literature within AEPs. The focus of this study lies on the conservation of high value nature (HNV) grassland and cannot be generalized for all type of farms. Therefore, results have to be treated with caution with regards to other regions and other types of grasslands.

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Appendix

Table 7: Average payments for farmers implementing FFH-managementplans

Decision for FFH measure	Average Payment (EUR/ha)
No optimization	66,54
Compromise	144,33
Full optimization	247,73

Source: own calculation, n=333

Table 8: Description of the site specific variables for the logit-model

Variable	Unit	Mean	Std.Dev.	Min	Max
Compromise regime	1/0	0,84	0,37	-	1,00
Optimal regime	1/0	0,59	0,49	-	3,00
Farm size	[In ha]	5,01	1,75	-0,22	8,11
Part time farm	1/0	0,25	0,43	-	
Single farm	1/0	0,36	0,48	-	1,00
Partnership under civil law (GbR)	1/0	0,10	0,30	-	-
Cooperative (e.G.)	1/0	-	-	-	1,00
Limited liability company (GmbH)	1/0	0,12	0,33	-	
Animal density	[AU/ha]	0,68	0,49	0,00	1,12
Share grassland	In %	0,59	0,36	0,05	
Quality A (=high)	1/0	0,08	0,26	-	1,00
Quality C (=low)	1/0	0,19	0,39	-	1,00
Development-site	1/0	0,20	0,40	0	1
Altitude of the FFH-plot	meters	312	261,87	85	1134
Distance ffh-plot to farm	meters	5,86	6,39	0,08	30,2
Cost per ha	EUR/ha	190,63	305,43	0	2.930,0
Dark-green program	1/0	0,20	0,44	0	1
Light-green program	1/0	0,20	0,43	0	1
Organic farming	1/0	0,06	0,24	0	1

Source: own calculations, n = 333,
Note: Explanations of the agri-environmental schemes are provided in table 2 above

Table 9: Determinants of Natura 2000 implementation at the farm level in Saxony

Variable	Coefficient	z-value	P>|z|	Coefficient	z-value	P>|z|
	Compromise regime			Optimal regime		
Constant	- 5,8240***	-4,55	-	- 4,3297***	-3,59	-
Farm size area (in ha)	0,8229***	4,00	-	0,6689***	3,36	0,001
Share grassland (in %)	1,6479***	3,10	0,002	2,1228***	4,05	-
Part time farming	1,6339***	3,05	0,002	*0,4590*	*0,85*	*0,393*
Animal density (AU/ha)	*-0,1963*	*-0,59*	*0,557*	- 0,8607**	-2,24	0,025
Partnership under civil law (GbR)	- 2,4001***	-2,92	0,003	- 2,7665***	-3,40	0,001
Cooperative (e.G.)	- 1,4010**	-2,36	0,018	- 2,0740***	-3,36	0,001
Limited liability company (GmbH)	*0,2512*	*0,48*	*0,632*	- 1,0646*	-1,80	0,071
Number of observations	316					
LR chi^2(14)	79,45					
Probability > chi^2	0,00					
Log likelihood	-280,43					
Pseudo R^2	0,12					

Source: own calculations