WHAT WE CAN LEARN FROM THE GERMAN IMPLEMENTATION OF GREENING - EFFECTIVENESS, PARTICIPATION AND POLICY INTEGRATION WITH THE AGRI-ENVIRONMENTAL PROGRAMS

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POLICY INTEGRATION OF GREENING AND THE AGRI-ENVIRONMENTAL PROGRAMS: LESSONS TO LEARN FROM THE GERMAN IMPLEMENTATION

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Abstract

We analyse the net impacts and the coherence of the ecological focus area (EFA) in Germany. The empirical results show that farmers prefer productive EFA options and refrain from those EFA options that focus on for biodiversity. Empirical results show that simplicity is an important argument for the selection of EFA options, and that larger farms tend to use fallow more frequently. In some German federal states, farmers can combine EFA with Agri Environmental and Climate measures (AECM). However, this option is not predominantly selected. Finally, we provide suggestions to raise the effectiveness of the EFA regulation through better policy integration and simplification.

Keywords

Common Agricultural Policy (CAP), Greening, Ecological Focus Area (EFA), Agri-Environmental Programs, Policy Integration

1 Introduction

The greening of direct payments has been the flagship of the 2013 reform of the EU's Common Agricultural Policy (CAP), introducing the idea of linking direct payments to public goods (ISERMEYER, 2012). In the EU, 30% of the national ceiling or around 12 bn. EUR has been dedicated to this environmental policy tool (HART, 2015). PE'ER et al. (2014) argued that crop diversification and the maintenance of sensitive grassland are largely ineffective. Many farmers already complied to crop diversification and the measures for the maintenance of sensitive grassland were already implemented in most of the federal states of Germany (LAKNER & HOLST, 2015). In contrast to this, the Ecological Focus Area (EFA) provides at least some additional potential to preserve biodiversity. Therefore, from an environmental perspective, it is important to analyse effectiveness and efficiency of the ecological focus area.

The Ecological Focus Area (EFA) is not the only policy instrument designed to support and preserve the biodiversity of agri-ecosystems. The second instrument, the Agri-Environment and Climate Measures (AECM), is situated in the second pillar of the CAP, the European Agricultural Fund for Rural Development (EAFRD). In the financial period of 2014-2020, this fund is spending 24% of the EU's agricultural budget (EU COMMISSION, 2016a). Various AECM pursue similar objectives as the EFA does. As a result, there exist some options to combine AECM with EFA (LAKNER et al., 2016). A survey among ecologists in Europe shows that just three EFA options are effective for biodiversity: fallow land, buffer strips and landscape elements (PE'ER et al., 2016). The registered EFA landscape elements existed before the introduction of greening in 2015. Regarding fallow land and buffer strips it is not clear to what extent these areas were installed due to the introduction of EFA or the new AECM, both introduced in 2015. We will investigate the impact of the introduction of EFA and the new AECM based on the two options *fallow land* and *buffer strips*.

When there are different policy areas addressing similar objectives we always have to ask whether these policies are 'integrated'. Policy integration is a process that leads to a situation where "*all significant consequences of policy decisions are recognized as decision premises, where policy options are evaluated on the basis of their effects on some aggregate measure of* *utility, and where the different policy elements are consistent with each other*" (UNDERDAL, 1980: 162). Incorporating "*environmental concerns into non-environmental policy sectors*" is defined as Environmental Policy Integration (EPI) (RUNHAAR et al., 2013). The EU commission has developed a policy analysis tool to evaluate the different EU policies, the so-called fitness check. Within this method, it is investigated whether a policy is a) effective, b) efficient, c) internally coherent d) externally coherent, e) relevant and f) of European value added (EU COMMISSION, 2015). The main research question of this paper is whether there is any internal coherence between EFA and AECMs. We also develop some hypotheses on the driving factors which influence the uptake of EFA on a farm level and on a regional basis.

In section 2, we will give a short overview and background (based on literature) whether the EFA is an effective and efficient policy tool. In our main analysis in section 3 and 4 which is based on German data about the combinations between EFA and AECM options, we will analyse to what extent there is internal coherence between those different EFA and AECM to support agricultural biodiversity on the farms. In section 5 we will draw conclusions and in section 6 we will describe possible policy implication.

2 Background: Implementation of EFA and AECM

Among the EU member states, Germany has chosen a flexible implementation of EFA: German farmers can select among 17 different options to fulfil their EFA obligation. This is together with Hungary (18) and France (17) one of the most flexible implementations on the European level (EU Commission 2016c, Appendix III). Figure 1 shows the farmers´ choices within the German federal states, documenting the degree of heterogeneity:

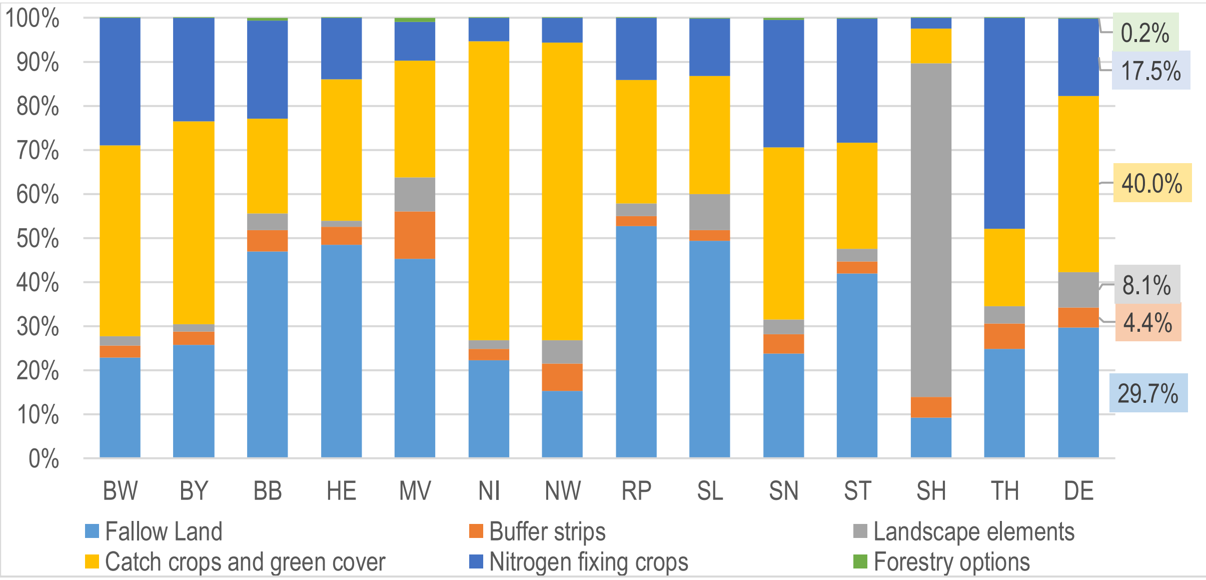

Figure 1: EFA options chosen in the federal state of Germany in 2016

Source: own calculation, data after applying weighting factors, data from BMEL 2016a;
BW = Baden Wurttemberg, BY = Bavaria; BB = Brandenburg; HE = Hesse; MV = Mecklenburg-Western Pomerania; NI = Lower Saxony; NW = North Rhine-Westphalia; RP = Rhineland-Palatinate; SL = Saarland; SN = Saxony; ST = Saxony-Anhalt; TH = Thuringia; DE = Germany.

In 2015, the ecological focus area was implemented for the first time, so in 2017 we can analyse the choice of farmers based on two years of experience. In 2016, after two years, it is obvious that the two productive options *catch crops* (with a weighting factor (WF) of 0.3) and *nitrogen fixing crops* (WF 0.7) are the most popular, accounting for about 57.5% of the total weighted, and 80.8% of the unweighted EFA in Germany (BMEL 2016a). The other three options *fallow land*, *EFA strips*[1] and *landscape elements* have a share of around 42.3% of the weighted and 18.9% of the unweighted area. The remaining area (0.3%) is accounted for by the two forestry options (short rotation coppice and afforestation area), which are almost irrelevant.

Besides EFA options, some of the German federal states allowed the combination of EFA and AECM. ZINNGREBE et al. (2017) show the potential options to combine EFA and AECM. In most federal states the combination of EFA and AECM is possible. The most common option is the combination of 'EFA strips' and AECM. On the other hand, the maintenance of existing landscape elements (e.g. trimming of hedges) is only supported in two federal states if the respective element is registered as EFA. Only three federal states (Hesse, Saarland and Saxony) opted against the option to combine EFA with AECM.

A combination of EFA and AECM can be regarded as an improvement or upgrade of the quality of EFA by the more ambitious AECM (e.g. flowering strips on fallows). The EU Commission does not allow for double funding of one measure (EU COMMISSION 2013: Article 28(6)) Therefore, the Rural Development Programs (EAFRD) fund only the additional costs associated with the more demanding realisation of the EFA within AECM. The national framework regulation for the EAFRD sets the support value due to EFA regulation at 250 EUR / ha EFA equivalent (BMEL, 2016b). This value is based on the costs of the establishment of cash crops, which is frequently the most cost-efficient option for the farmer to fulfil his EFA obligation. In order to avoid double funding, the support for an AECM on EFA must be lower by this amount compared to the support for the same AECM on non-EFA. However, for AECM established on fallow land, 380 EUR / ha and not 250 EUR / ha are deducted as one assumes for simplicity that the respective AECM will be implemented on EFA strips (380 EUR / ha divided by the weighting factor 1.5 = 253 EUR / ha). Table 1 illustrates the most relevant restrictions regarding the combination of EFA and AECM.

Table 1: Technical requirements for the combination of AECM* and EFA* in some selected federal states of Germany

	Requirement regarding			Own LPIS** parcel	utilization possible?
	Width (in m)	**Plot size (in ha)**	**Extent per farm**		
Requirements of Ecological Areas (EFA)					
Field Margin	[1-20 m]	n. a.	EFA should not exceed 7-8% of arable area	no	no
Buffer Strip	[1-10 m]	n. a.		no	some
Forest Margin	[1-10 m]	n. a.		no	some
Fallow Land	n. a.	> 0.1 - 0.5 ha		yes	no
Agri Environmental and Climate Measures (AECM) as flowering strip and flowering plot combined with Ecological Focus Area (EFA)					
North Rhine-Westphalia	$\begin{pmatrix} [6-12\ \text{m}] \\ \text{and} \\ < 20\%\ \text{of the plot} \end{pmatrix}$	or ≤ 0,25 ha	-	yes	no
Lower Saxony	([6-30 m] or	≤ 2 ha)	and ≤ 10 ha		
Thuringia	[5-36 m] or	≤ 4 ha	-		
Saxony-Anhalt	$\begin{pmatrix} \text{width} > 5\ \text{m} \\ \text{and} \\ \text{length to width} > 2:1 \end{pmatrix}$ or	$\begin{pmatrix} \leq 2{,}5\ \text{ha} \\ \text{and} \\ < 20\%\ \text{of the plot} \end{pmatrix}$	-		
Mecklenburg-West Pomerania	-	-	≤ 5 ha		
Bavaria	-	-	≤ 3 ha		
Baden-Wurttemberg	> 5 m	-	-		

Source: own presentation based on the regulation in the federal states;
* Combination of AECM types a.) flowering strips and b.) flowering areas combined with EFA types a.) buffer-strips and b.) fallow land; ** LPIS = Land parcel identification system.

[1] Buffer strips, field margins and strips of eligible hectares along forest edges.

The presented technical requirements of both EFA and AECM restrict the combination, which can be shown by a number of consequences coming from slight violation of the requirements:

- If an EFA 'buffer strip' (weighting factor (WF): 1.5) is wider than the maximum of 20 m, the respective plot of EFA is reclassified as 'fallow land' with a lower WF of 1.0.
- On the other hand, if the considered area is not an EFA strip and is smaller than the minimum plot size, the EFA area is not eligible for full direct payment, resulting in a reduction of the base payment plus the greening payment.
- In practice, the combination of EFA strips and AECM are challenging in particular for the case of buffer strips and forest margins: The strip has always to be wider than 5-6 m for a support by AECM and smaller than 10 m for the EFA registration. This is especially problematic if the plot is not a straight rectangle, since these width requirements apply for the full edge of a field margin.
- An own LPIS plot can result in lower measurement tolerance regarding size and location of a plot. If there are deviations of more than 2% of the size, payments might be reduced. Regarding the plot location, the acceptable location error is 20 cm.
- If an EFA plot is too large, authorities suspect that farmers intend to avoid that arable land changes its status to grassland, as an arable plot that is laid fallow for five consecutive years is declared grassland. This doesn't apply for fallow in combination with EFA, but also for AECM supported plots with fallow land.
- The specific combination of AECM for flowering strips with AECM for 'species rich crop rotation' is problematic: Flowering strips are not regarded as crop with respect to the second AECM (flowering strip). So if a farmer wants to be on the save side w.r.t. the flowering strip and his/her strips are consequently slightly larger than required, his area for species rich crop rotation will be too small.

On the other hand, calculations of LAKNER & BOSSE (2016) show for the case of the Magdeburger Börde that in some cases, combinations of EFA flower strips with AECM can be the least costly option of EFA (LAKNER & BOSSE 2016). So based on the weighting factor, the incentives should lead to a high uptake, but the level of complication of the technical requirements lead to high potential transaction costs and the risk of facing payment reduction and sanctions.

3 Material and Methods

The following analysis is based on data of the integrated accounting and control system (IACS) for five federal states (Schleswig-Holstein (SH), Lower Saxony (NI), North Rhine-Westphalia (NW), Rhineland-Palatinate (RP) and Brandenburg (BB)). 42 % of the utilized agricultural area (UAA) in Germany and 43% of the German arable land is located in these five states. The agricultural systems in these states are quite diverse, covering large arable farms on marginal soils in Brandenburg, intensive cash cropping and horticulture in loess areas, intensive granivore and dairy farming, the last mentioned being arable or grassland based, to small scale low input farming in low mountain ranges of Rhineland-Palatinate. The data set contains the georeferenced information of the agricultural plots, the area of cultivated crops, participation in AECM and farm size (for more details see NITSCH et al. (2017, *forthcoming*).

The geometries of the land parcel identification system (LPIS) are intersected with a 10 by 10 m point raster. This point raster is augmented with information on various data sources depicting e.g. floodplains, protected areas, distribution of organic soils, inclination and altitude. Based on these data we evaluate which factors influence the selection of a specific EFA measure and how EFA and AECM interact.

In the following section we analyse the implementation of the EFA options in dependence of the farm size and the location of the farm. We aggregate the farm and plot level information by soil-climate areas defined by ROßKOPF et al. (2007). Soil-climate areas are areas of homogenous climatic and soil characteristics designed to stratify the testing of new seed varieties. The results in the following section are mainly an excerpt of the results presented in NITSCH et al. (2017, *forthcoming*).

4 Analysis

4.1 The choice of EFA options on farms

Figure 2 shows that farm size influences the selection of EFA options. Especially the more effective options (i.e. fallow land, buffer strips and landscape elements) have a higher share among very large farms. In contrast, the small farms tend to select the 'productive options' like catch crops and green cover. The share of landscape elements is declining on farms beyond 245 ha. The share of nitrogen fixing crops is especially high in the larger size group. The size-dependent distribution of landscape elements and nitrogen fixing crops can be largely explained by regional effects. Only in Schleswig-Holstein landscape elements play a relevant role, and the aggregate picture reflects the share of farms in Schleswig-Holstein in the respective size class. On the other hand, the cultivation of nitrogen fixing crops is concentrated in Brandenburg, where large farms predominate. This confirms the finding of PE'ER et al. (2016) and ZINNGREBE et al. (2017) that nitrogen fixing crops require a specific harvesting technique which can be found more likely on large farms in East Germany.

The size effect remains for fallow land, even if we analyse the data for each federal state separately. Reasons for the positive correlation between farm size and the share of fallow are: (1) farms with less arable land are frequently specialized in intensive animal husbandry, so they need the arable land not only to produce forage but also to dispose slurry. (2) larger farms work more frequently with hired or contracted labour so they have to include the labour expenses into their calculation of the opportunity costs. (3) farms have frequently a quite dispersed plot structure (cf. LAGGNER and RÖDER, *submitted*) so the likelihood that especially the large farms have to manage some remote arable plots is rather high.

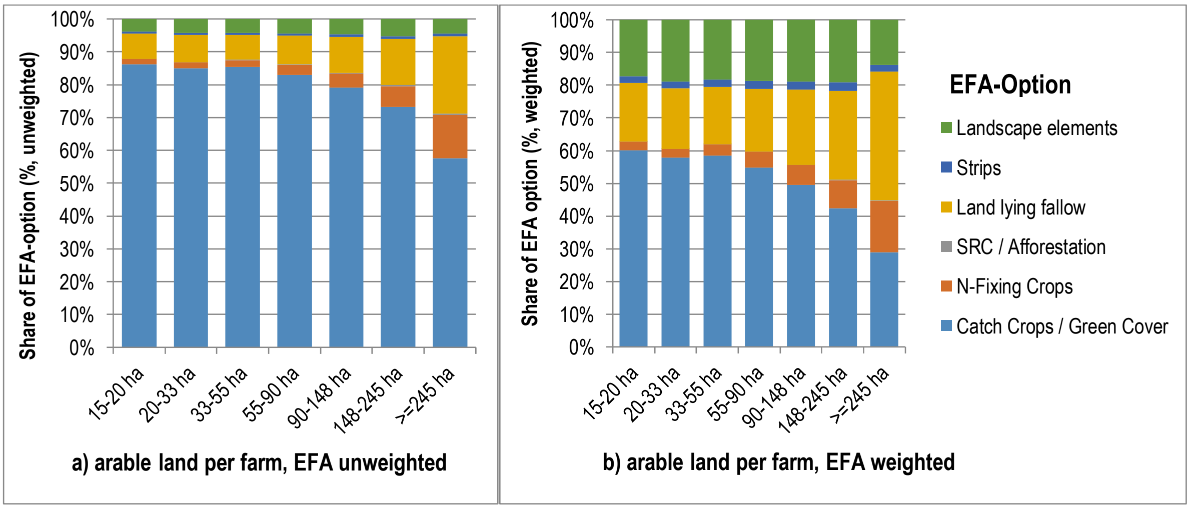

Figure 2: Shares of different EFA-option according different farm-size classes

Source: NITSCH et al. (2017). Data of 2015, Federal states BB; NI, NW, RP and SH
a) represents the share of unweighted EFA-area and b) represents the shares of weighted area.

The statistics of the implementation of EFA show that less than 75% of the farms register less than three EFA codes and use less than two EFA options (NITSCH et al., 2017, *forthcoming*).

Farmers tend to use only few of the diverse EFA options in order to keep the controls and the respective bureaucracy as simple as possible. Farmers quite frequently refrain from using the 'free' options as existing landscape elements that are protected by cross compliance anyway.

4.2 Spatial pattern of different EFA options

In the following, we will analyse the spatial distribution of different EFA options. Figure 3 displays the share of fallow land, buffer strips and arable land in different agro-ecological regions of Germany. High shares of fallow can be found in Rhineland-Palatinate and Brandenburg. The Rhineland, Western Lower Saxony and Schleswig-Holstein are characterized by very low shares of fallow land. In these regions horticulture, granivore production and intensive dairy farming are the typical farm types, leading to high value added per hectare of land. The differences in the share of fallow can therefore be explained by differences in the land rent (as in LAKNER et al., 2016). The low share in Schleswig-Holstein is also driven by the high share of existing landscape elements in this state. Consequently, the farmers in Schleswig-Holstein hardly need other EFA-elements to fulfil their obligation.

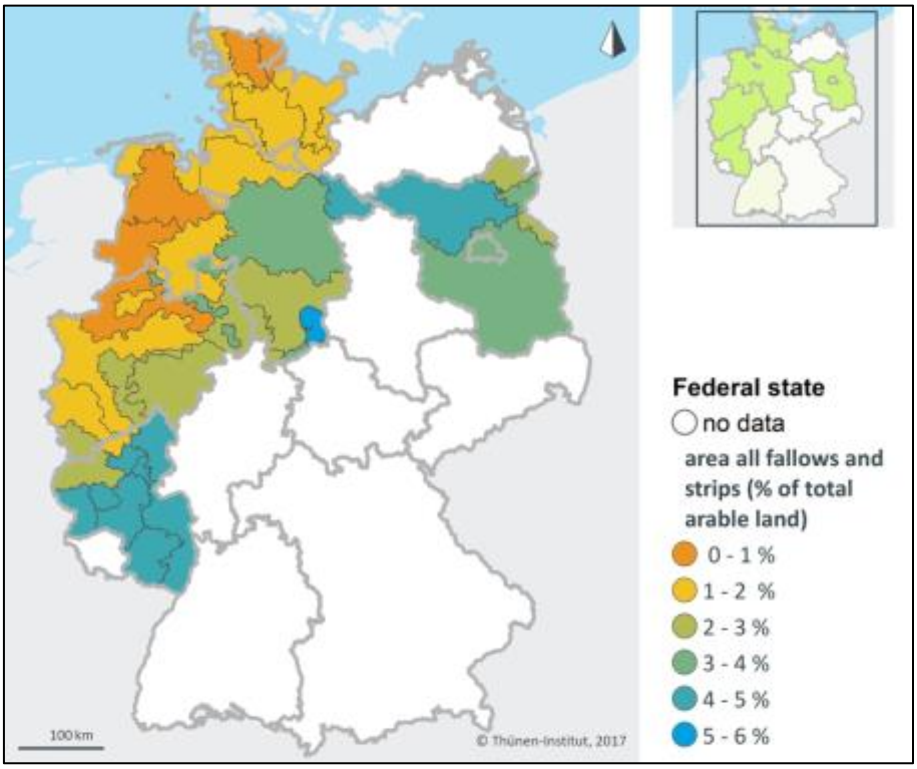

Figure 3: Share of the total fallow land and buffer strips to total arable land by soil-climate area in 2015

Source: Own presentation, based on NITSCH et al. (2017: *forthcoming*). The map refers to the total area of fallow land and buffer strips containing elements of EFA and AECM.

Not all existing fallows and buffer strips are registered as EFA and the respective share varies considerably across the country (figure 4). The share of EFA fallows and EFA strips on all fallows is relatively low in central Schleswig-Holstein, large parts of Lower Saxony and south-eastern North Rhine-Westphalia. While the result is the same, the low share is caused by different effects. Typical for the agriculture in south-eastern North Rhine-Westphalia are small to medium sized dairy and cattle farms managed at low to medium intensity and a fairly high share of grassland. As a result, many farms are exempted from the EFA obligation. On the other hand, a reasonable share of land is so marginal that normal agriculture is abandoned. In Schleswig-Holstein farmers frequently do not need other options than the existing landscape elements. Consequently, the fallows exist for other reasons, e.g. marginal soils or support by AECM. In Lower Saxony, catch crops are the predominant option to fulfil the EFA obligation. As 41% of the arable land in Lower Saxony (DESTATIS, 2015) is cultivated with maize, potatoes and sugar beet, in large parts of Lower Saxony farmers are practically legally obliged to grow catch crops in order to comply with the regulations on erosion and ground water protection. Compared to the other considered federal states, the regulations in Lower Saxony are quite attractive for the implementation of AECM supported buffer and flower strips. In contrast, Brandenburg offers no AECM to upgrade fallows and in North Rhine-Westphalia and Rhineland-Palatinate such an upgrade is restricted to buffer and flowering strips.

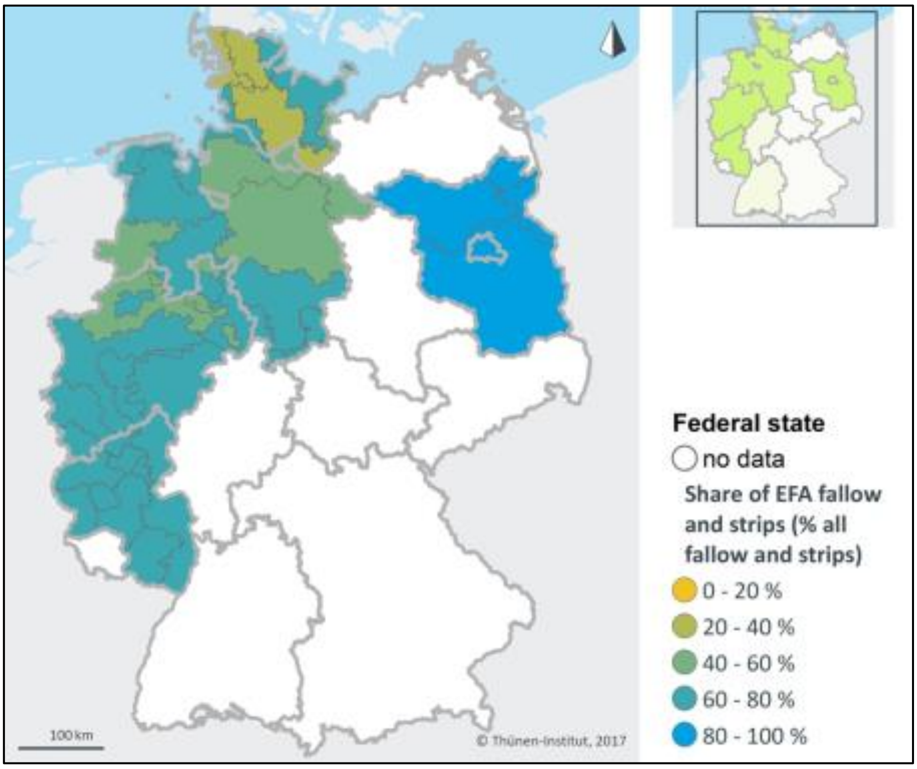

Figure 4: Share of EFA fallow land and EFA strips and all fallows and buffer strips by soil-climate area in 2015

Source: Own presentation, based on NITSCH et al. (2017, forthcoming). Data refer to the EFA-options fallow land and buffer strips.

In most soil-climate areas, we can see an increase of fallow land and buffer strips from 2014 (i.e. before greening) to 2015 (figure 5). The only exception is the central part of Schleswig-Holstein. A relatively strong increase can be observed along the river Rhine and in the Börde regions of North Rhine-Westphalia and Lower Saxony, where the share of fallow land and buffer strips almost doubled, however from a very low starting point. Intensive cash crops and horticulture predominate the agricultural land use in these regions. In the five federal states their share on arable land increased between 2014 and 2015 by +0.8 %-points or from 89,100 ha to 128,700 ha in total.

Additional results show that the EFA regulations lead to a more equal distribution of fallows and strips across the country side (NITSCH et al., 2017, *forthcoming*). Before 2015, fallows and strips were strongly concentrated in protected and marginal areas. Furthermore, EFA fallows are quite small. Even if EFA strips are not accounted for over 50% of the area of EFA, fallow is located in plots that are smaller than 3.2 ha, whereas the respective values for silage maize, EFA catch crops, winter wheat and sugar beet are more than twice as high and lie in the magnitude of 5.6 to 7.2 ha.

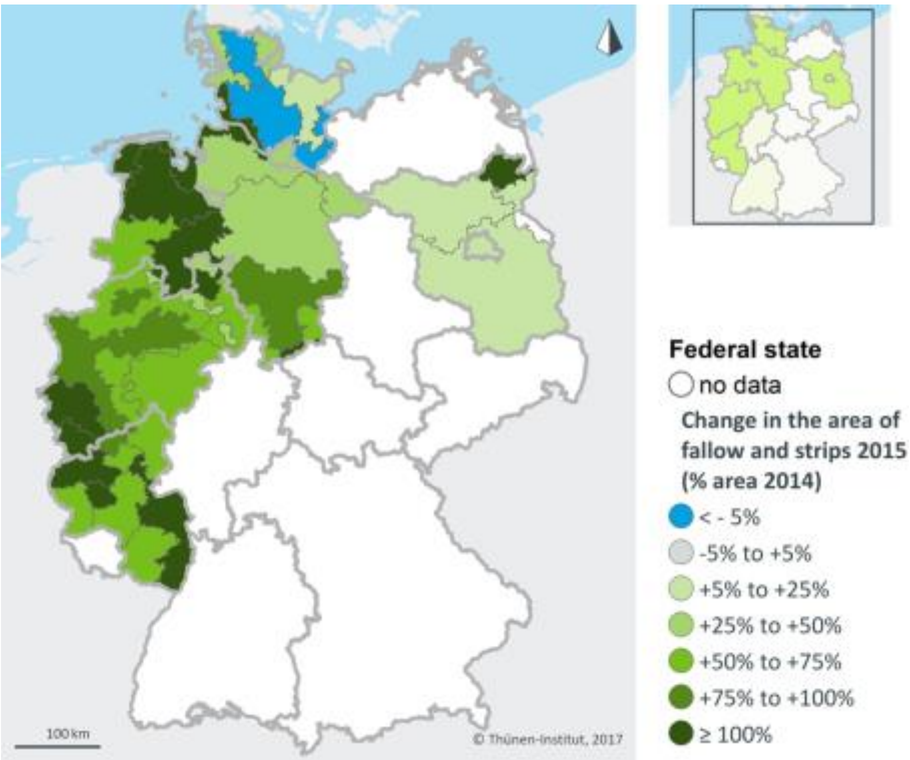

Figure 5: Change in the share of fallow land and buffer strips to the total arable land between 2014 and 2015 by soil-climate area.

Source: Own presentation, based on NITSCH et al.(2017, forthcoming).

4.3 Combinations of EFA and AECM on fallow land

In the following section we focus on the question whether there was reasonable uptake of AECM on fallows. Therefore we focus on data from Lower Saxony (Table 2). The table documents some changes from the period 2007-2013 to the new period 2014-2020.

Table 2: Development of the area of fallow land with[2] and without AECM in Lower Saxony between 2010 and 2015

	2010	2011	2012	2013	2014	2015	Change 2014 to 2015
Fallow with AECM							**+ 6,757**
with EFA	n.a.	n.a.	n.a.	n.a.	n.a.	3,794	+ 3,794
without EFA	8,112	10,615	9,578	10,066	10,139	13,102	+ 2,963
Fallows without AECM							**+ 7,989**
with EFA	n.a.	n.a.	n.a.	n.a.	n.a.	19,568	+ 19,568
without EFA	21,428	19,380	18,573	16,600	15,670	4,091	- 11,579
Total	***29,450***	***29,995***	***28,181***	***26,666***	***25,809***	***40,555***	***+ 14,746***

Source: Own evaluation of IACS data from Lower Saxony.

In total, the area of fallow land increased by 14,746 ha (+57%), which is substantial. However, there are 4,091 ha (ca. 10%) of the fallow land which are not used by farmers as EFA or upgraded by AECM. With the introduction of the EFA obligation, the area of fallow land increased in the year 2015 by 19,568 ha. From the AECM area, about 3,794 ha are also

[2] E.g. Flowering strips and flowering plots, strips for erosion management.

registered as EFA. So for about 16% of the EFA area in fallows and strips, the farmers also apply for AECM support and thereby 'upgrade' the EFA area.

At the same time, the area of fallow land within AECM increased by 6,757 ha (+67%). This higher uptake has several reasons. First, the payments were raised from 330-740 EUR / ha in the period 2006-2013 to 540-1,100 EUR / ha in the current period. The financial volume for this measure was increased by the transfer of funds from pillar I to pillar II, which was used for agri-environmental and climate measures (AECM). Second, the technical requirements within AECM are more flexible after 2015 and the target area has been increased (see Table A1 in the appendix), which might also explain the higher uptake.

5 Discussion

From the first years of EFA implementation in Germany, we can conclude that farmers tend to choose rather inefficient options for the preservation of biodiversity in agricultural landscapes (PE'ER et al., 2016). Catch crops and nitrogen fixing crops have a share of about 80% of the unweighted EFA area (BMEL, 2016a). It has been pointed out that this instrument is expensive and has just a limited impact on biodiversity (PE'ER et al., 2016).

However, if we focus on the 'effective' options *fallow land* and *buffer strips*, we can still see some positive effects from EFA: the net changes of fallow land and buffer strips took place in arable regions with high soil quality, such as the region of Cologne, Westphalia and the Börde regions (Figure 5). Those are regions where we can also find some deficits in the structural elements like buffer strips and landscape elements (see LAKNER and HOLST, 2015). The higher uptakes of EFA in very productive arable regions show one potential of EFA in contrast to AECM: in voluntary schemes, we often find lower participation rates in productive regions. EFA has therefore a complementary impact for those regions.

As stated above, a combination of EFA with an additional agri-environmental measure can result in a higher quality of biodiversity support and can be regarded as 'upgrade'. An integrated policy would enhance this type of combination. Our data for Lower Saxony show that only a share of 19.4% of the EFA area is combined with an AECM (see table 2). Policy integration is therefore weak, and this is despite the fact that in some cases such combinations of EFA and AECM can be less costly than other EFA options (LAKNER and BOSSE, 2016).

Farmers tend to choose fallow land within EFA, but hardly use the option to combine EFA with AECM. Bureaucratic burdens and constraints are the main arguments against such combinations. Table 1 documents the deviating technical requirements of EFA and AECM, which are also reported as one main obstacle in surveys from experts (LAKNER et al., 2016; ZINNGREBE et al., 2017) and among farmers (e.g. SCHULZ et al., 2014, MICHAELIS, 2016; NITSCH et al., 2017: *forthcoming*). Therefore, one strategy to enhance combinations is a reduction of bureaucracy and the use of smart regulations (examples given below).

There are a number of technical requirements that keep farmers from choosing buffer strips. One main issue is the limited precision in measuring the width of a buffer strip in real world settings, which can be at maximum 20 m or in strips at forest edges just 10 m wide. This example has been named in different studies on the drivers of EFA decisions (ZINNGREBE et al., 2017; MICHAELIS 2016). If farmers want to combine EFA strips with AECM support, the technical requirements are even stricter because of the minimum width of 6 m: A strip at a forest edge has to be between 6 m and 10 m, which leaves little flexibility. The low use of combined support of EFA and AECM is therefore not surprising.

Some of the EFA requirements do not fit into the typical management practice in Germany. We will illustrate the effect based on data from North Rhine-Westphalia. Here, the average size of an arable plot is below 2 ha (NITSCH et al., 2017: *forthcoming*). However, AECM support is restricted to 0.25 ha per plot if the whole plot is laid fallow. Due to basic farm economics it is unreasonable to lay fallow only parts of small plots. Therefore, a restriction of the additional AECM support excludes a large part of the arable land from a combined support of EFA and AECM. Smart regulation and simplification can therefore easily enhance such combinations.

Besides administrative burdens, rental contracts also restrict the choice of EFA. In Germany, a reasonable share of the rental contracts for arable land has a rather short duration of one or two years (SALHOFER et al., 2009: 40). Given the five year implementation of AECM, this might be an additional reason why farmers are more reluctant to choose buffer strips or fallow as AECM compared to EFA.

6 Policy Implications

One first conclusion refers to extension services specific to EFA: farmers deciding on their strategy to comply with the EFA obligation frequently favour a low administrative burden and a low risk of sanctions over the expense of gross margin maximization. We find more use of effective EFA measures on larger farms and on specialized arable farms. This highlights the importance of simplification and streamlining of EFA and AECM irrespective of farm size and also the necessity of EFA specific extension services.

The second conclusion refers to the change in weighting factors: if the efficiency of the greening to deliver environmental services should be increased, the weighting factors have to be adapted especially for nitrogen-fixing plants and catch crops (PE'ER et al., 2016). In particular, it is not plausible that the cultivation of nitrogen-fixing plants (0.7 in year n) with preceding catch crops (0.3 in year n-1) results in the same EFA weighting per ha aggregated over one cropping year (spanning from August till August) than a fallow land (WF =1.0 p.a.).

Third: other options to simplify the EFA should be used. More flexibility of the technical requirements can increase the uptake of effective options like buffer strips. As described above, the regulations do not only involve the risk of being sanctioned w.r.t. the greening payment, but also include the risk of losing the basic payment. However, any simplification won't improve the effectiveness, as long as easy and less effective options as catch crops are available.

Fourth, as public funds and land are limited, the question remains how a strategy to increase the efficiency of the public intervention could look like. Increasing the biodiversity output per ha of land one takes out of production. (Species richness is a function of the age of fallow. The area and width of the fallow is inversely correlated to the biomass production and the number of plant species) (WAGNER et al., 2014). If farmers do not receive additional incentives, the frequent use of species-poor mixtures or self-establishment of fallow land on more fertile soils often leads to species-poor implementation of EFA measures.

'Smart regulation' can help to set proportional incentives for biodiversity. Farmers can use the additional incentives given by AECM, however AECM funds are limited. The costs of fallow land depend on the opportunity costs of the land use and vary substantially even within federal states. To limit windfall gains, in Bavaria the payment per ha of flowering area is conditional to soil fertility: the AECM payment is based on the classification of the yield index unit - a system used for the taxation of agricultural land throughout Germany. The yield index unit reflects differences in the productivity of agricultural land and limits the problem of overcompensating in marginal areas while not achieving a relevant area in more productive regions. In Baden-Wuerttemberg, flowering strips and flowering areas are treated differently in dependence whether they are also declared as EFA. In the case of a combination, no size limit applies on the farm level, whereas at most 5 ha per farm are supported if the area is not declared as EFA.

Integrating the needs of biodiversity protection in very productive arable regions remains a challenging and expensive task. In contrast to other environmental goals, the potential of new technologies to alleviate the conflict between environmental impact and productive agriculture is limited. At least for Central Europe this conflict is in our view unsolvable. This antagonism is due to the fact that biodiversity protection essentially requires areas with a low biomass production or areas that are not used.

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Appendix

Table A1: Payments for Lower Saxony and Bremen in AECM before and after 2015

Agri-environmental and climate measure (AECM)	Profil 2007-2013		Pfeil 2014-2020	
	Payment (EUR/ha)	**Technical Requirements**	**Payment* (EUR/ha)**	**Technical Requirements**
Catch Crops & Green Cover (A7 / AL 21)	70	15.09. – 15.02. min. area 5% of arable land	75/–	01.10. – 15.02. min. area 5% of arable land
Yearly flower strips (A5 / BS 1)	540	• 3 – 24 m width • max. plot size: 1 ha • max. eligible area per farm: 15% of arable land	700/320	• 6 – 30 m width • max. plot size 2 ha • max. eligible area per farm: 10 ha
Multiannual flower strips (A6 / BS 2)	330-480		875/495	

Source: own presentation, based on information of the Ministry for Agriculture Lower Saxony.
* The payment in the period 2014-2020 includes the rate without and with registration as Ecological Focus area.