Possible solutions to the failure of agri-environmental measures

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Possible solutions to the failure of agri-environmental measures

Could increasing collaboration and knowledge save biodiversity?

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Abstract

The common agricultural policy (CAP) has been stated as one of the most important policies within the European Union (EU), and is the fundament for agricultural development in the member states. However, the CAP has been stated to effect biodiversity in a negative way. To handle the decreasing biodiversity in agricultural landscapes within the EU, the CAP has been developed to include measures to maintain biodiversity in agricultural landscapes, two of them being the mandatory "Ecological Focus Areas" (EFA) and the voluntary Agri-Environmental Schemes (AES). In this study, I investigate the differences in farmers' preferences towards these different measures, and how collaboration between farmers could be increased. The results are obtained through a systematised literature review. One reason for farmers having a negative preference towards collaboration regarding environmental measures could be the risk of lost farmland productivity, which could have an even more negative effect if there is a high probability of farm-takeover. Collaboration between farmers regarding AES could be increased by actively offer information on why collaboration could increase farm productivity, as well as giving information on why this could lead to increased biodiversity. Even if economical determinants have a great impact on farmers' preferences towards, other determinants such as administrative restrictions and farmers' perceptions and knowledge play a crucial role when explaining farmers' preferences towards both AES and EFA. Generally, farmers are most willing to take on environmental measures that are easily implemented and cheap to maintain. This means that when developing agri-environmental policies, policy makers must take a holistic approach to design a policy that motivates farmers to choose measures with high environmental impact.

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Introduction

The common agricultural policy (CAP) has been stated as one of the most important policies within the European Union (EU), and is the fundament for agricultural development in the member states (Leventon et al. 2017). However, the CAP has been stated to effect biodiversity in a negative way (Wretenberg et al. 2007). There are studies showing that when the CAP is applied to agricultural landscapes, the diversity of bird species decrease, compared to when the agricultural land was less intensive, or compared to countries outside of the EU (Donald et al. 2002; Wretenberg et al. 2007). The reason behind this pattern has been explained by Donald et al. (2002) as the CAP being focused on productivity and thus increasing farming intensity also in less intensive farming areas.

To handle the decreasing biodiversity in agricultural landscapes within the EU, the CAP has been developed to include methods to maintain biodiversity in agricultural landscapes, starting with the reform of the policy in 2003 and increasing in the 2013 reform (Hauck et al., 2014). There are different agri-environmental measures in the CAP to promote biodiversity, two of them being farmers' participation in voluntary agri-environmental schemes (AES), regulated in the Rural Development Programmes under pillar 2 (Regulation [EU] No. 1305, 2013), and the mandatory greening measures that are part of the direct payments under pillar 1 (Regulation [EU] No 1307, 2013). The mandatory greening measures include that farmers must leave 5% of their land as Ecological Focus Areas (EFA). However, there is a suggestion from the Commission to increase the limit from 5 % to 7% (Regulation [EU] No 1307, 2013).

Although one of the purposes of environmental measures is to increase and maintain biodiversity in agricultural landscapes, the actual effects on biodiversity are still widely debated. The common conclusion is that there are some benefits on biodiversity, although the overall effectiveness of the measures could be improved (Batáry et al., 2015; Pe'er et al., 2014). Although this has been argued since the 2003 reform (Kleijn & Sutherland, 2003), the CAP reforms so far have not lead to an increased the effectiveness of the measures regarding biodiversity (Pe'er et al. 2014; Batáry et al. 2015). Due to failures in policy design and implementation, the biodiversity still decreases today, although for some taxa at a lower rate as one decay ago (Pe'er et al. 2014).

There are many reasons on why the CAP fails on increasing biodiversity, one of them being the low commitment from farmers regarding voluntary agri-

environmental measures (Hauck et al. 2014). Research investigating solutions for this failure often brings up possible improvements when revising the CAP and its agri-environmental measures, making it easier or more attractive for farmers to adopt the measures (Villanueva et al. 2015a; Villanueva et al. 2015b). An example of such an improvement is to increase the administrative support and ecological advice, as suggested by Pe'er et al. (2016). Another reason is that the measures fail to reach the ecological issues they are designed to improve due to unsuitable management or implementation of the measures from an ecological point of view (Pe'er et al. 2016). For example, among the EFAs that Member States can choose to implement are land lying fallow, landscape features, buffer strips, agroforestry, short rotation coppice and afforested areas (Regulation [EU] No 1307, 2013). For some of these measures, such as buffer strips, fallow land and landscape features, studies have shown positive impacts on biodiversity (Pe'er et al. 2016). Therefore, the effect on biodiversity can vary depending on which EFAs the Member States decides to implement, the effect on biodiversity can vary (Pe'er et al. 2016). The effect on biodiversity can also vary depending on how farmers decide to implement them. For example, buffer strips could be more or less beneficial for biodiversity depending on the flora sown in the buffer strips (Mante & Gerowitt 2009).

Additionally, researchers often bring up the possibility for collaboration between farmers as one possible way to increase the effectiveness of environmental measures for biodiversity (McKenzie et al., 2013; Kuhfuss et al., 2016). This approach is based on the need for a landscape scale management in biodiversity conservation. The reason why landscape scale management is needed is because it would increase patch sizes managed by AES, as well as creating a heterogeneity in the farmland landscape (Leventon et al. 2017) This landscape perspective might not be possible to accomplish unless neighbouring farmers collaborate to allocate areas and manage habitats to create a heterogeneous landscape mosaic (Ekroos et al. 2016). However, the majority of the studies upon collective participation in agricultural management is based on results from countries outside of the EU (Siebert et al. 2006). Within the EU, the Netherlands is the only country having a longer experience of collective participation in agri-environmental measures (Siebert et al. 2006).

There are also studies showing that the willingness to accept and adopt environmental measures amongst farmers increases with a higher level of education and knowledge in sustainable agriculture (Villanueva et al., 2017). If the willingness to accept and adopt environmental measures increases, combined with an improved policy design and implementation, the overall effect of the measures on biodiversity might increase with it. This could have a variety of explanations, one of them being that if an increased area of agricultural land would be enrolled in the measures; this could increase the probability to reach up to the ecological thresholds in habitat size and connectivity needed for increased biodiversity (Pe'er et al. 2016; Pe'er et al. 2014).

A clear and wider perspective of the different reasons and solutions to why the measures still fails to improve biodiversity in agricultural landscapes is needed. This study aims to summarise and compare farmers' preferences towards mandatory and voluntary environmental measures, with focus on how collaboration between farmers regarding both voluntary and mandatory environmental measures could increase the positive effect on biodiversity. I aim to bring together results from current studies in a literature review. The study is meant to explain farmers' preferences towards relevant measures within the EU. I therefore excluded studies done outside of the EU, where conditions for farming and general livelihood could be expected to differ. Additionally, the study will focus on possible solutions to the stated results, focusing on collaboration and increased knowledge amongst farmers, and how the policy design could be developed and improved. The results and suggestions presented in this study could be used by policy makers and politicians when evaluating the process in which environmental measures are implemented in member states of the EU.

Questions that will be answered in this study include:

- Since collaboration between farmers regarding environmental measures could increase biodiversity, how could collaboration be increased?
- Should the suggested approach differ between mandatory and voluntary environmental measures amongst farmers?
- Depending on where the obstacles for farmers are to enrol in and collaborate around environmental measures, how could the policy design be developed and improved to facilitate for farmers to do so?

Method

In order to answer the questions assessed above, I have conducted a systematised literature review (Haddaway et al. 2015). To compose relevant search phrases, a general literature review was conducted during the initial scoping phase. From these articles a wide spectrum of relevant words and search phrases were suggested. These were then tested for relevance in additional searches in databases such as Scopus and Web of Science. The final search phrases, which can be seen in table 1, were used in Web of Science (core collection), Scopus and LUBsearch. The search for literature was conducted between April 15th and May 2nd, 2017 and resulted in 161 individual research articles.

Table 1 Search phrases and number of results
Results from the final search phrases when used in Scopus, Web of Science (core collection) and LUBsearch. *=When ”Agri-environmental schemes” AND incentiv*” was used in LUBsearch, the results were sorted after the field ”agri-environmental schemes” and as peer reviewed only, to increase the initial relevance. Duplicates are not removed in these results.

Search phrase	Scopus	Web of Science (core collection)	LUBsearch
”Ecological focus areas” AND collective	3	2	3
”Ecological focus areas” AND preference*	6	4	7
”Ecological focus areas” AND incentiv*	6	1	3
”Agri-environmental measures” AND preference*	10	13	18
”Agri-environmental measures” AND collective	2	2	3
”Agri-environmental measures” AND incentiv*	18	17	24
”Agri-environmental schemes” AND preference*	33	46	46
”Agri-environmental schemes” AND collective	12	12	12
”Agri-environmental schemes” AND incentiv*	39	48	27*
”Common agricultural policy” AND greening AND incentiv*	4	4	3

To decide whether or not the individual papers found during the literature search were relevant enough to be included in my study, I assessed the collected literature from the final searches at progressively greater levels of detail, as suggested by Haddaway et al. (2015). The literature has initially been assessed based on the title. After this step, 61 of the originally found articles were still included. In the next step, the articles were assessed and ranked based on their abstract. Each article was given a

grade from a 1-3 scale, based on the level of relevance and their ability to answer my study questions (table 2). The grading system was based on the following criteria:

- Does the literature cover collaboration between farmers regarding AEM?
- Does the literature show preferences amongst farmers regarding AEM?
- Does the literature give examples of incentives for farmers to join AEM?
- Does the literature discuss how policy development and implementation could benefit for farmers to join AEM?

Table 2 Articles sorted after relevance

The total number of articles, with duplicates both included and removed, and the number of articles graded based on their relevance. Relevant articles, which was 61 articles, are those who were left after the total number of articles with duplicates removed (161), were sorted between either relevant or irrelevant articles.

Assessment	Number of articles
Total number of articles (duplicates included)	428
Total number of articles (duplicates removed)	161
Relevant articles	61
Relevance "3"	31
Relevance "2"	23
Relevance "1"	6

For the literature to be given the highest priority "3", the literature had to be focused on either one of these criteria fully, or parts of several of them. For example, an article could be given 3 if it focuses solemnly on collaboration between farmers regarding AEM, or if it partly focuses on collaboration *and* farmers' preferences regarding AEM. The middle priority "2" was given if the literature covered at least one of the criteria stated above, but not with the exact focus aimed for in this study. For example, this could be an article about farmers' preferences regarding AEM, but described by policy makers instead from the farmers' perspective. The lowest priority, "1", was given to articles that had in principal the right focus, for example regarding farmers' preferences or collaboration between farmers, but with an approach that made it irrelevant for this study. For example, this could be if the study was based on results from outside of the EU.

Once the literature has been sorted and graded after relevance, the articles with the highest priority (3) were taken out and included in the results.

Results

The overall trend within the literature found is that there is a great value in understanding farmers' preferences when designing agri-environmental measures and developing the common agricultural policy. Unfortunately, there is a clear difference between the amount of research made on the agri-environmental measures focused on in this study; ecological focus areas (EFA) and agri-environmental schemes (AES). Farmers' preferences towards AES regarding both individual and collective contracts have been widely investigated, however, the same attributes towards EFA has not yet been examined to the same extent (table 3).

Farmers' perceptions and preferences can be categorised in different ways. In this study, I use a concept presented by Pe'er et al. (2016) based on the three different determinants explaining farmers' preferences regarding ecological focus areas (EFA); "economical determinants", "administrative restrictions" and "farmers' perception and knowledge". Under each of these categories, I will present findings regarding the different types of environmental measures separately. To include the collective aspect, the payments will then be separately presented regarding "collective participation". Within each section, the determinants will initially be explained for voluntary measures (AES), and then for mandatory measures (EFA).

Table 3 Articles focus area/areas
The number of articles with focus on "agri-environmental schemes", "ecological focus areas", "collective AES" and "collective EFA", respectively. Note that some articles focus on many areas, such as both AES and EFA, which explains the increased total number of articles.

Topic	Number of articles
Agri-environmental schemes	31
Ecological focus areas	5
Collective AES	12
Collective EFA	1
Total number of articles considered	31

Economical determinants

Voluntary measures

The adoption of AES primary depends on the economical compensation received, rather than other motives such as administrative restrictions or farmers' perception and knowledge (Josefsson et al. 2017). This is supported by results presented by Franzén et al. (2016), explaining that high costs are the main reason for not wanting to enrol AES on wetland creation in the agricultural landscape surrounding Stockholm, Sweden. Villanueva et al. (2015b) has showed similar results, where farmers show a high interest in the economical compensation that AES enrolment implies. Also, farmers who receive high direct payments are less willing to enrol AES (Villanueva et al. 2015b). It is also shown that farmers would be more positive towards AES if they received compensation for the implementation of the measures before the implementation started (Lienhoop et al. 2015). Additionally, it would be beneficial if the total compensation would cover both the lost income the enrolled land could have given if it would be in full production, as well as the opportunity costs (Lienhoop et al. 2015).

According to Villanueva et al. (2017), preferences vary between farmers within the same cropping-systems in permanent olive groves in southern Spain. If farms within the same sub-system are affected differently by climate, their preference towards AES varies (Villanueva et al. 2017). An example from this is that farms who were located on mountain slopes were more positive towards AES than farms located in the valley, probably since farmland located in the mountains are more sensitive to environmental issues such as erosion (Villanueva et al. 2017). This origins in economical determinants since environmental damage such as erosions could affect the harvest negatively, causing a loss in production and thus also yield.

It seems that AES uptake is higher in extensive farmland, compared to intensive farmland (Villanueva et al. 2017). One possible explanation for this is the risk of lost production and thus decreased profit from the yield within intensive farmland could be too high and inhibit the farmer from enrolling AES. It could also be connected to farmers' perception, since it could possibly feel more complicated for farmers with intensive agricultural land to be suitable and "fit in" to an already outlined AES.

Mandatory measures

Pe'er et al. (2016) describe that economic considerations, including effects on productivity, are crucial parts for farmers when considering and choosing EFA. They also conclude that farmers tend to select EFAs that are the most productive and

cheapest, which goes in line with results from other studies, for example Villanueva et al. (2015a). Preferably, the EFA should as well be easy to implement, something that also was shown in that some Member States had a very large proportion of "easily implemented EFAs" chosen by farmers, such as cover crops and green cover (Pe'er et al. 2016). It was also shown that in areas with low land-rental prices and low productivity, farmers' preferences towards EFA was more positive (Pe'er et al. 2016), something that could be complemented by to the results presented by Villanueva et al. (2015b). They showed that farmers who need to use special mechanical equipment to farm their land, e.g. for irrigation, find it harder to give up their land as EFA, possibly due to higher opportunity costs (Villanueva et al. 2015b). Concluding the economical determinants presented by Pe'er et al (2016), it is stated that farmers are unlikely to give up or have a negative approach towards the greening payments such as EFA, since the cost in terms of lost direct payments are higher than the implementation costs for the measures. However, this is not the conclusion in other studies on the subject. Villanueva et al. (2015a) showed that in a study on permanent crop land in southern Spain, done before the implementation of EFA was done in Member States, that farmers' willingness to allocate parts of their land as EFA drastically decreases if the minimum area would go above 2-3% (Villanueva et al. 2015a). However, when this was evaluated after the implementation farmers within the EU have allocated 10% of their arable land as EFA, which exceeds the current 5% limit for the payments connected to EFA (Pe'er et al. 2016). This could be explained by EFAs having different weighing factors, where 1 ha of catch crops (weighing factor 0,3) only counts as 0,3 ha EFA, while 1 ha of fallow land (weighing factor 1) counts as 1 ha EFA (Pe'er et al. 2016). However, the suggestion of increasing the minimum EFA area from 5 % to 7 % (Regulation [EU] No 1307, 2013), would thus not make a difference in farmer enrolment (Pe'er et al. 2016).

Administrative restrictions

Voluntary measures

The current structure of AES implementation is managed from a top-down perspective, where farmers are free to choose from an already existing set of AES (Westerink et al. 2016). This has been proved to affect farmers' willingness to participate in AES in a negative way (Siebert et al. 2006; Josefsson et al. 2017). Changing this perspective to a more bottom-up approach could benefit AES uptake in many ways, for example by creating schemes based on farmers' abilities and knowledge (Westerink et al. 2016). This could not only simplify participation on a single-farm level, but also regarding collective AES (Westerink et al. 2016). A change

in the management and implementation of AES from a top-down perspective to a bottom-up perspective could also increase the collaboration between farmers, nature organisations and the government (Westerink et al. 2016). This could increase the farmers' feeling of having control over their land (Westerink et al. 2016), something that is shown to be important for farmers when considering AES uptake (Josefsson et al. 2017; Pe'er et al. 2016).

It is shown that farmers prefer shorter AES compared to longer participation in AES (Lienhoop et al. 2015; Kuhfuss et al. 2016), and that they want to return to their original farming practices after the scheme has ended (Lienhoop et al. 2015). The flexibility within the scheme has a great impact on farmer uptake (Villanueva et al. 2015a; Kuhfuss et al. 2016). If the AES are perceived to be too constraining, the willingness amongst farmers to enrol the scheme decreases (Kuhfuss et al. 2016).

Another factor effecting farmers' willingness to enrol AES is the strict deadlines on when farmers can apply and enrol an AES, where less strict deadlines could increase farmers' willingness to enrol AES (Lienhoop et al. 2015).

Mandatory measures

One factor that can strongly influence farmers' preferences towards EFA are administrative restrictions (Pe'er et al. 2016). Since the implementation of EFA is continuously controlled by authorities, and the criteria are often strict, this could cause an increased fear amongst farmers of losing the payments. This could explain the low uptake of EFAs that have strict criteria, such as buffer strips and landscape features (Pe'er et al. 2016). Apart from choosing EFAs that have looser criteria, there is not much farmers can do to avoid these administrative restrictions, since allocating 5% of the arable land is voluntary. It was also shown that if the farmer knows or feel that the future of the farm is secure, for example if the whole area is owned (and thus not rented) by just one farmer, the farmer would find it easier to accept EFA as parts of their land (Pe'er et al. 2016).

Farmers' perception and knowledge

Voluntary measures

According to Lienhoop et al. (2015), farmers are unwilling to enrol AES that they are unfamiliar with. Farmers' general knowledge about AES greatly affects their consideration to enrol AES, where increased knowledge leads to an increased probability for farmers to join AES (Lienhoop et al. 2015). On the other hand, if the

scheme could increase the recreational access by the public, the probability of farmers to enrol the scheme decreases (Lienhoop et al. 2015).

When farmers see themselves as "conservationists", understanding that conservational management on their farmland greatly influences their production in a positive way, the willingness to enrol AES increases (Pe'er et al. 2016). Farmers may also choose to implement AES to follow a social norm, wishing to achieve or maintain a reputation in having a high productivity and conservational management amongst their neighbours (Pe'er et al. 2016). This is strengthened by results presented by Kuhfuss et al. (2016), where they explain that farmers often compare themselves in relation to others in their social group. Josefsson et al. (2017) also show results that could be compared to the self-perception as "conservationists", where farmers who already have contact with environmental organisations are more positive towards enrolling AES. However, Franzén et al. (2016) found contrasting results, presenting that farms with an environmental approach (for example organic farms) did not have an increased willingness to enrol AES on wetland creation, compared to farmers with no or little environmental approach.

There is a connection between advisory assistance and knowledge amongst farmers and their AES uptake (Villanueva et al. 2017; Lienhoop et al. 2015), as well as social learning (Westerink et al. 2016). Westerink et al. (2016) shows that continuous meetings and workshops increase the social learning, both between farmers and between farmers and government. When social learning increases, the understanding amongst farmers of the different roles farmers and the government has regarding AES design, which in turn could increase the AES uptake (Westerink et al. 2016).

The farm size also affects the AES uptake, where farmers with large areas of arable land are less willing to enrol AES (Villanueva et al. 2017). However, Siebert et al. (2006) show the opposite, meaning that farmers with smaller areas of arable land are more willing to enrol AES. Contrary to what is presented by both Villanueva et al. (2017) and Siebert et al. (2006), Franzén et al. (2016) show that farm size does not at all affect the probability of farmers to enrol AES. Franzén et al. (2016) also showed that if the farmer own the land themselves, they are more likely to enrol AES.

Farmers who have already been a part of an AES seem to be more positive towards enrolling a new AES than farmers who have never been a part of an AES (Villanueva et al. 2015b; Lienhoop et al. 2015; Kuhfuss et al. 2016). This could create a continuous positive effect, when more farmers enrol AES they are themselves more positive to enrol AES again, and they also affect the social norm in their neighbourhood (Kuhfuss et al. 2016). Similar to this, Josefsson et al. (2017) shows that farmers who already cooperate with environmental organisations are more willing to enrol other environmentally friendly measures, such as AES. However, there are also results from other studies where there is no significant positive effect

on AES uptake if the farmer has previously been enrolled in an AES (Howley et al. 2014; Franzén et al. 2016).

Mandatory measures

Several factors have been shown to influence farmers' preferences concerning EFA. One of these is farming intensity, where farmers on less intensive farms have a higher acceptance to set aside parts of their land as EFA than highly intensive farms (Villanueva et al. 2017). On the other hand, contrary to the same factor for AES, their results also showed that larger farms have a higher acceptance to devolve parts of their land as EFA, compared to smaller farms. This could be because larger farms easily can give up parts of their land that gives the lowest yield.

It seems like the traditional land-use plays a role when farmers decide upon which EFA practices to choose (Pe'er et al. 2016). EFA practices such as hedges, which could be a part of the original farming landscape, could then be easily enrolled as EFA without any additional effort. Other attributes that could positively affect farmers' decisions is the availability of new and necessary technologies and knowledge that could make the implementation of some EFAs easier (Pe'er et al. 2016). Connected to this, farmers' preferences towards EFA also vary with the climate in the region, which may affect the type of EFAs that are chosen, and thus also the impact on biodiversity (Pe'er et al. 2016).

Also, described by Pe'er et al. (2016) is that farmers see themselves primarily as producers, whose main task is to ensure a steady production of crops and food for society, rather than conservationists. This could also explain why farmers value productivity higher than biodiversity in their decision-making.

Villanueva et al. (2017) also showed that factors such as professional training in agricultural practices increases the acceptance regarding EFA for some farmer groups within the same study system of olive groves in southern Spain, which goes in line with other studies (for example Villanueva et al. 2015b). Villanueva et al. (2015b) also suggests that and at least secondary-school education or equivalent increase the probability of farmers to have a positive attitude towards EFA. It was also shown that if farmers are more affected by environmental change, such as farms located in steep slopes where soil erosion is more substantial, they seem to be more positive towards EFA than farmers located in areas where these environmental changes are not as noticeable within the same study system (Villanueva et al. 2017). Similarly, farmers who perceive themselves as "conservationists" are more positive to enrol into further environmentally friendly practices (Pe'er et al. 2016). Worth noting is that in the studies made by Villanueva et al. (2017) is done in permanent olive groves, and that preferences could differ between permanent crop land and arable land. This has also been discussed by Villanueva et a. (2015b).

Collective participation

Voluntary measures

The possibility of farm-takeover greatly affects the collective participation in AES amongst farmers (Villanueva et al. 2015b; Villanueva et al. 2017). If there is a high possibility of farm-takeover, the willingness to enrol collective AES decreases (Villanueva et al. 2015b; Villanueva et al. 2017). This may be true for example in family farms, where the current farmer wants to pass the farmland on to his or her successor in at least the same condition as it was when he or she started managing the farmland, thus not wanting to take of the any additional risks that may arise with collective implementation of AES (Siebert et al. 2006). This could not only be affecting farmers' collective participation in AES, but also to be an economical determinant, since the risks of enrolling AES could lead to decreased productivity and income. Additionally, older farmers (over 60 years old) are more negative to collective AES than younger farmers, something that could be related to farm-takeover (Villanueva et al. 2017).

Farmers also express concerns about the environmental impacts when considering collective AES, questioning if it would create any benefits for the environment (Villanueva et al. 2015b). Another concern regarding collaborating participation regarding AES amongst farmers are the composition of the collective groups, and the fear of having other farmers interfering with their farmland management (Villanueva et al. 2015b). Related to the group composition, farmers express concerns for collective punishments in case one of the farmers in the group does not meet the requirements needed (Villanueva et al. 2015b). However, it is shown that if farmers have already been in some kind of agricultural cooperative, and thus have experience in collaborating with others, they are more positive to join collective AES (Villanueva et al. 2017). This could be due to farmers already knowing the benefits of collaboration, such as shared experiences, mutual learning and the possibility to buy expensive equipment together (Kuhfuss et al. 2016).

There are connections between administrative restrictions and collective participation. A change in how collective AES are managed and implemented from a top-down approach to a bottom-up approach could increase the willingness for farmers to enrol collective AES (Westerink et al. 2016). This way farmers could develop and give suggestions on AES as a group, leading to a scheme designed for collective participation rather than for single farm participation (Westerink et al. 2016).

Mandatory measures

There are not many articles discussing the possibility of collective participation regarding EFA, as can be seen in table 3. However, there are some suggestions given by Pe'er et al. (2016), saying that collective participation regarding EFA between farmers could be advantageous. It could help farmers to reach up to ecological thresholds such as habitat size and connectivity (Pe'er et al. 2016; Pe'er et al. 2014). This may be beneficial for both biodiversity and farmers, since it would create more stable habitats for wildlife and biodiversity.

Discussion

The aim for this study was to a) see how collaboration between farmers regarding EFA and AES could be increased, b) if the suggested approach differs between mandatory and voluntary environmental measures amongst farmers, and c) how could the policy design be developed and improved to facilitate for farmers to enrol and collaborate around environmental measures. When searching for literature for this study, the focus was to see how farmers' preferences could differ between mandatory and voluntary environmental measures. However, when discussing policy design and implementation, it is important to bear in mind that a policy cannot be designed to only please farmers. Since farmers can choose which EFAs to implement, or which AES to enrol, they can choose measures that don't have a positive effect on biodiversity (Pe'er et al. 2016). Therefore, it is important to design a policy that motivates farmers to choose measures with high environmental impact, since the main reason for the policy is to increase biodiversity.

In this discussion, I will first present comparisons between the voluntary and mandatory measures, presented in different sections depending on if they derive from economical determinants, administrative restrictions, farmers' perception and knowledge or collective participation. After that, I will explain the reasons for the study design, as well as the restrictions derived from that.

Economical determinants

Since the policy regulations for AES and EFA originate from different pillars in the CAP, and thus, differ in their specific requirements, there will be differences regarding farmers' preferences towards the two. AES are voluntary to join, meaning that the compensating payments could only be obtained if the farmer voluntarily choses to enrol an AES. EFA, on the other hand, is mandatory, and the farmer needs to set aside 5 % of his or her arable land as EFA in order to obtain the direct payments from the EU. These differences have implications for policy design that increases the uptake of measures by farmers; When it comes to EFAs, farmers choose types that are easy and cheap to implement, preferably if they at the same time still can be used for crop production. However, according to the results brought together in my literature review, it seems like AES does not necessary need to be

easily implemented. Instead, for AES it seems to be more important that there are enough compensating payments that will cover both the opportunity costs, as well as the implementation and maintenance costs.

When farmers choose EFAs based on how easy they are to implement, there is a risk for farmers choosing EFAs that have no or little positive impact on biodiversity (Pe'er et al. 2016). This is seen when farmers choose to have EFAs that contributes to farm production, such as nitrogen fixing crops, which have no or little impact on biodiversity (Pe'er et al. 2016). This is important to take into account when designing policies. In the case of the EFA, one way of mitigating this behaviour may be to only allow EFA types that are known to be beneficial for biodiversity (see e.g. Pe'er et al. 2016).

Administrative restrictions

There does not seem to be any clear pattern concerning farmers' preferences for voluntary and mandatory measures regarding administrative restrictions. The results brought together in my literature review indicate that the administrative regulations regarding voluntary measures seem to be rather complex, concerning the whole process regarding AES design and implementation. Administrative regulations could affect farmers' preferences towards AES in a negative way, since having the top-down approach in governmental designing of AES could make farmers feel like they don't have control over their farmland, and thus decrease the possibility of AES uptake amongst farmers (Westerink et al. 2016).

However, there could be some similarities drawn between the two measures regarding flexibility. For AES, a high flexibility within the scheme increases farmers' willingness to enrol the scheme. Thus a low flexibility (or strict criteria) could make farmers more concerned regarding the scheme, leading to the choice not to enrol. Similar to this, farmers are concerned about not fulfilling the strict criteria regarding EFAs, which may lead to them suffering from sanctions in terms of decreased payments. However, farmers can choose to not enrol AES, and thus avoid the strict criteria, while they have no choice to avoid the criteria for EFA other than choosing EFAs with less strict criteria, since it is mandatory. Thus, designing policies with incentives for farmers to choose EFAs with a high ecological value is of great importance.

Farmers' perceptions and knowledge

One thing that stood out regarding farmers' perceptions and knowledge for both AES and EFA was farmers' perception as being "conservationists" and understanding that conservational management on their farmland greatly influences their production in a positive way (Pe'er et al. 2016). This can affect which EFAs farmers choose (Pe'er et al. 2016). Based on this, it could be suggested that actions to increase farmers' knowledge about how conservational management could be valuable in order to both increase AES uptake and create possibilities for farmers to choose EFAs that are more environmentally effective (Villanueva et al. 2015a). This is also connected to the fact that increased knowledge and training increase the willingness to adopt AES (Villanueva et al. 2015b; Villanueva 2017). For example, workshops and meetings between the government and groups of farmers increases the social learning, which may lead to an increased acceptance for environmental measures (Westerink et al. 2016). An overall increased knowledge about AES and its implementations could possibly reduce the unwillingness amongst to enrol AES that they are unfamiliar with (Lienhoop et al. 2015).

Farm stability seems to affect AES uptake. Family-owned farms can create a sense of farm stability, having a clear future with a high possibility of farm-takeover. This seems to affect the uptake of AES negatively, since farmers do not want to hand over AES that the successor did not choose himself (Villanueva et al. 2017).

Regarding farm size, this seems to affect farmers' preferences towards AES and EFA differently. Regarding AES uptake, larger farms seem to have a more negative approach towards enrolling AES, compared to smaller farms (Villanueva et al. 2017). However, if this is true or not could be discussed since other results argue against this (Siebert et al. 2006; Franzén et al. 2016). Regarding preferences towards EFA, farmers on large farms seems to have a higher acceptance towards EFAs than farmers on smaller farms (Villanueva et al. 2017). It seems like it is easier for farmers with large areas of arable land to dispose their worst land as EFA, compared to farmers with smaller areas of arable land (Villanueva et al. 2017). However, when applying farm intensity, the preferences shift. Farmers on less intensive farms seems to have a higher acceptance towards dedicating parts of their land as EFA, compared to highly intensive farms (Villanueva et al. 2017).

Collective participation

Regarding collective participation in AES, the possibility of farm-takeover has a negative effect on farmers' willingness to enrol collective AES (Villanueva et al. 2015b; Villanueva et al. 2017). This is related to the risks farmers perceive they take if

they would implement a collective AES, and their desire to pass the farmland on to his or her successor in at least the same condition as it was when he or she started managing the farmland (Siebert et al. 2006).

Farmers are questioning the environmental impact of collective AES (Villanueva et al. 2015), even though there are studies showing that the connectivity that could be given by collective AES could increase biodiversity and increase the probabilities of farmers to reach up to the ecological threshold (Pe'er et al. 2014; Pe'er et al. 2016). Promoting the sense of control amongst farmers over the environmental management on their farm could increase the acceptance towards collective AES (Josefsson et al. 2017). To handle the questioning amongst farmers regarding this, actions on increasing farmers' knowledge about the benefits regarding collective AES could be needed (Josefsson et al. 2017).

Incentives need to be created in order for farmers to see the advantages collective AES could give. One such incentive has been presented by Kuhfuss et al. (2016), meaning that a "collective bonus" could increase farmers' willingness to enrol collective AES. They explain that if adding a collective bonus, the willingness of individual farmers to achieve the extra payment would lead to more farmers joining the collective AES, something that could increase the impact on biodiversity since a larger proportion of land is managed in an environmentally effective way (Kuhfuss et al. 2016).

Study design and restrictions

Instead of conducting a traditional literature review, where the risk of subconscious bias could be high (Roberts et al. 2006), the search process for this review had a systematic approach to minimize this. The method used was based on recommendations described by Haddaway et al. (2015) on how to do a traditional literature review more systematically approached when resources or time is scarce – as was the case in this study. The systematic approach mainly means that a) the literature search is done in a systematic and transparent way, allowing other researchers to repeat the procedure, and b) all articles from the searches are collected and rated according to their relevance for the subject. This results in a wider and less biased selection of articles than if relevant articles would be hand chosen from the beginning. However, using this approach in the very restricted timeframe may also have disadvantages. When minimizing bias through a restricted number of search phrases in a systematised literature review, there is a risk of important literature to not be included if it didn't fit in with my search phrases. Since time has been scarce, the risk of not being able to critically analyse all articles would have been high if I expanded my search phrases, leading to a narrower search range.

The number of articles that discussed farmers' preferences towards EFA was drastically lower than the number of articles that discussed farmers' preferences towards AES (table 3). This is also shown by Villanueva et al. (2017), stating that literature regarding farmers' preferences towards EFAs has not yet been published in a great extent. The same was shown for preferences towards collective participation in EFA, where only 1 article discussed this (table 3). However, this result is not too surprising since EFAs was implemented only recently after the latest CAP reform in 2015 (Regulation [EU] No 1307, 2013).

Conclusion

The questions aimed to be answered in this study are: a) Since collaboration between farmers regarding environmental measures could increase biodiversity, how could collaboration be increased? b) Should the suggested approach differ between mandatory and voluntary environmental measures amongst farmers? and c) Depending on where the obstacles for farmers are to enol in and collaborate around environmental measures, how could the policy design be developed and improved to facilitate for farmers to do so?

Collaboration between farmers could be increased by reducing the uncertainty amongst farmers regarding the environmental benefits (but also farming benefits in terms of e.g. increased yield) of collective AES. By actively offering support and knowledge about the benefits regarding collective AES to farmers, such as the possibility of buying expensive equipment collectively, the overall perception towards AES, both regarding single schemes and collective schemes, could be increased. Economic incentives need to be considered as well, since economical compensation have been shown to have a great impact on farmers' preferences and uptake of AES (Josefsson et al. 2017; Franzén et al. 2016; Villanueva et al. 2015b). Kuhfuss et al. (2016) gives good suggestion on economic incentives, presenting the possibility of including a collective bonus in the design of AES. However, more research on clear economic incentives regarding collective AES needs to be done.

There are some differences in the approach towards voluntary and mandatory agri-environmental measures amongst farmers. There seems to be a connection between the flexibility and criteria of the different measures and farmers' attitude towards them. A fear of not being able to fulfil the criteria, and thus losing payments or risking sanctions, decreases farmers' preferences towards both AES and EFA. If AES and EFAs have flexible criteria, the fear of not reaching up to the criteria decreases and an increased enrolment and uptake could be possible. However, there could be a risk of losing the ecological aspects and the aim to increase biodiversity if the criteria would be less strict than they are today.

The results brought together in my literature review showed that farmers want to go back to their original farming practices after the AES has ended (Lienhoop et al. 2015; Kuhfuss et al. 2016). Policy makers need to consider incentives that would increase the willingness to join another AES after the previous one has ended, or other ways motivating farmers to continue using environmentally friendly practices. However, more research is needed in this area, clarifying what is needed for farmers

to be willing to continue managing their farmland in an environmentally effective way.

Regarding administrative constraints, there seem to be clear issues in the current top-down approach affecting farmers negatively when they consider enrolling collective AES. If Member States would change this approach to a more bottom-up based implementation process, there could be advantages to gain regarding AES uptake amongst farmers.

Even if economical determinants have a great impact on farmers' preferences towards AES (Josefsson et al. 2017; Franzén et al. 2016; Villanueva et al. 2015b), other determinants such as administrative restrictions and farmers' perceptions and knowledge play a crucial role when explaining farmers' preferences towards both AES and EFA. This means that when developing agri-environmental measures in the CAP in the future, policy makers must take a holistic approach, including both economic incentives, good administrative conditions for farmers to be willing to enrol collective AES. Additionally, regarding not only collective AES, but also EFA and individual uptake, policy makers as well as the Member States must create possibilities and motivations for farmers with different environmental prerequisites to be able to enrol AES and EFA with the same premises.

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Pe'er, G., Dicks, L.V., Visconti, P., Arlettaz, R., Báldi, A., Benton, T.G., Collins, S., Dieterich, M., Gregory, R.D., Hartig, F., Henle, K., Hobson, P.R., Kleijn, D., Neumann, R.K., Robijns, T., Schmidt, J., Shwartz, A., Sutherland, W.J., Turbé, A., Wulf, F. & Scott, A.V. 2014. EU agricultural reform fails on biodiversity. Science, 344: 1090-1092.

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Appendix 1

Table 1 List of relevant literature and their ranking.
Literature left after irrelevant articles and their ranking. Duplicates removed.

Literature	Rank
Westerink, J., Opdam, P., Van Rooij, S. & Steingrover, E. 2017. Landscape services as boundary concept in landscape governance: Building social capital in collaboration and adapting the landscape. *Land Use Policy,* 60, 408-418.	3
Villanueva, A. J., Rodríguez-Entrena, M., Arriaza, M. & Gómez-Limón, J. A. 2017. Heterogeneity of farmers' preferences towards agri-environmental schemes across different agricultural subsystems. *Journal of Environmental Planning & Management,* 60, 684-707.	3
Villanueva, A. J., Glenk, K. & Rodríguez-Entrena, M. 2017. Protest Responses and Willingness to Accept: Ecosystem Services Providers' Preferences towards Incentive-Based Schemes. *Journal of Agricultural Economics*.	2
Villanueva, A. J., Arriaza, M., Rodríguez-Entrena, M. & Gómez-Limón, J. A. 2015. The design of agri-environmental schemes: Farmers' preferences in southern Spain. *Land Use Policy,* 46, 142-154.	3
Villanueva, A. J., Arriaza, M., Rodríguez-Entrena, M. & Gómez-Limón, J. A. 2015. Assessment of greening and collective participation in the context of agri-environmental schemes: The case of Andalusian irrigated olive groves. *Spanish Journal of Agricultural Research,* 13, 16p.	3
Vedel, S. E., Jacobsen, J. B. & Thorsen, B. J. 2015. Contracts for afforestation and the role of monitoring for landowners' willingness to accept. *Forest Policy and Economics,* 51, 29-37.	3
Siebert, R., Toogood, M. & Knierim, A. 2006. Factors affecting European farmers' participation in biodiversity policies. *SOCIOLOGIA RURALIS,* 46, 318-340.	3
Sauer, U. & Fischer, A. 2010. Willingness to pay, attitudes and fundamental values - On the cognitive context of public preferences for diversity in agricultural landscapes. *Ecological Economics,* 70, 1-9.	3
Raymond, C. M., Reed, M., Bieling, C., Robinson, G. M. & Plieninger, T. 2016. Integrating different understandings of landscape stewardship into the design of agri-environmental schemes. *Environmental Conservation,* 43, 350-358.	3
Pe'er, G., Zinngrebe, Y., Hauck, J., Schindler, S., Dittrich, A., Zingg, S., Tscharntke, T., Oppermann, R., Sutcliffe, L. M., Sirami, C., Schmidt, J., Hoyer, C., Schleyer, C. & Lakner, S. 2016. Adding Some Green to the Greening: Improving the EU's Ecological Focus Areas for Biodiversity and Farmers. *Conservation Letters*.	3

Morris, C. & Potter, C. 1995. RECRUITING THE NEW CONSERVATIONISTS - FARMERS ADOPTION OF AGRI-ENVIRONMENTAL SCHEMES IN THE UK. *Journal of Rural Studies,* 11, 51-63.	3
Mathijs, E. 2003. Social capital and farmers' willingness to adopt countryside stewardship schemes. *OUTLOOK ON AGRICULTURE,* 32, 13-16.	3
Mante, J. & Gerowitt, B. 2009. Learning from farmers' needs: Identifying obstacles to the successful implementation of field margin measures in intensive arable regions. *Landscape and Urban Planning,* 93, 229-237.	3
Lienhoop, N. & Brouwer, R. 2015. Agri-environmental policy valuation: Farmers' contract design preferences for afforestation schemes. *Land Use Policy,* 42, 568-577.	3
Kuhfuss, L., Preget, R., Thoyer, S. & Hanley, N. 2016. Nudging farmers to enrol land into agri-environmental schemes: the role of a collective bonus. *European Review of Agricultural Economics,* 43, 609-636.	3
Kuhfuss, L., Le Coent, P., Préget, R. & Thoyer, S. 2015. Agri-environmental schemes in Europe: Switching to collective action. *Protecting the Environment, Privately.*	3
Josefsson, J., Lokhorst, A. M., Part, T., Berg, A. & Eggers, S. 2017. Effects of a coordinated farmland bird conservation project on farmers' intentions to implement nature conservation practices - Evidence from the Swedish Volunteer & Farmer Alliance. *Journal of Environmental Management,* 187, 8-15.	3
Howley, P., Yadav, L., Hynes, S., Donoghue, C. O. & Neill, S. O. 2014. Contrasting the attitudes of farmers and the general public regarding the 'multifunctional' role of the agricultural sector. *LAND USE POLICY,* 38, 248-256.	3
Horst, D. V. D. 2011. Incentive based environmental policies and collective response trends: Spatio-temporal patterns of land managers' adoption of agri-environmental measures. *Handbook of Environmental Policy.*	3
Home, R., Balmer, O., Jahrl, I., Stolze, M. & Pfiffner, L. 2014. Motivations for implementation of ecological compensation areas on Swiss lowland farms. *JOURNAL OF RURAL STUDIES,* 34, 26-36.	3
Grammatikopoulou, I., Pouta, E., Salmiovirta, M. & Soini, K. 2012. Heterogeneous preferences for agricultural landscape improvements in southern Finland. *Landscape and Urban Planning,* 107, 181-191.	3
Franzén, F., Dinnétz, P. & Hammer, M. 2016. Factors affecting farmers' willingness to participate in eutrophication mitigation — A case study of preferences for wetland creation in Sweden. Ecological Economics, 130, 8-15.	3
Espinosa-Goded, M., Barreiro-Hurle, J. & Ruto, E. 2010. What Do Farmers Want From Agri-Environmental Scheme Design? A Choice Experiment Approach. *JOURNAL OF AGRICULTURAL ECONOMICS,* 61, 259-273.	3
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Christensen, T., Pedersen, A. B., Nielsen, H. O., Morkbak, M. R., Hasler, B. & Denver, S. 2011. Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones-A choice experiment study. *Ecological Economics,* 70, 1558-1564.	3

Breustedt, G., Schulz, N. & Latacz-Lohmann, U. 2013. Factors affecting Participation and Compensation Requirements in Agri-Environmental Schemes: Insights from a Discrete Choice Experiment. *German Journal of Agricultural Economics,* 62, 244-258.	3
Boon, T. E., Broch, S. W. & Meilby, H. 2010. How financial compensation changes forest owners' willingness to set aside productive forest areas for nature conservation in Denmark. *SCANDINAVIAN JOURNAL OF FOREST RESEARCH,* 25, 564-573.	3
Baur, I., Dobricki, M. & Lips, M. 2016. The basic motivational drivers of northern and central European farmers. *Journal of Rural Studies,* 46, 93-101.	3
Bartolini, F., Gallerani, V. & Viaggi, D. 2011. What do agri-environmental measures actually promote? An investigation on AES objectives for the EU 2000-2006 rural development program. *SPANISH JOURNAL OF AGRICULTURAL RESEARCH,* 9, 7-21.	3
Bartolini, F., Gallerani, V., Raggi, M. & Viaggi, D. 2012. Modelling the Linkages between Cross-Compliance and Agri-Environmental Schemes Under Asymmetric Information. *JOURNAL OF AGRICULTURAL ECONOMICS,* 63, 310-330.	3
Allo, M., Loureiro, M. L. & Iglesias, E. 2015. Farmers' Preferences and Social Capital Regarding Agri-environmental Schemes to Protect Birds. *Journal of Agricultural Economics,* 66, 672-689.	3
Zinngrebe, Y., Pe'er, G., Schueler, S., Schmitt, J., Schmidt, J. & Lakner, S. 2017. The EU's ecological focus areas – How experts explain farmers' choices in Germany. *Land Use Policy,* 65, 93-108.	2
Watzold, F. & Drechsler, M. 2014. Agglomeration payment, agglomeration bonus or homogeneous payment? *RESOURCE AND ENERGY ECONOMICS,* 37, 85-101.	2
Viaggi, D., Bartolinia, F. & Raggi, M. 2009. Incentive-compatible targeting for the provision of public goods in agriculture. *Environmental Regulation: Evaluation, Compliance and Economic Impact.*	2
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