EKLIPSE

Knowledge & Learning Mechanism
on Biodiversity & Ecosystem Services

Understanding farmer uptake of measures that support biodiversity and ecosystem services in the Common Agricultural Policy (CAP)

An EKLIPSE Expert Working Group report

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Glossary

Abbreviation	Term	Definition
AECM	Agri-Environmental and Climate Measure	Voluntary payment scheme for environmental measures as part of the Rural Development Support in pillar II
AES	Agri-environment Scheme	
CAP	Common Agricultural Policy	The EU's agricultural policy
DG ENV	Directorate-General for Environment	
EC	European Commission	
ECA	European Court of Auditors	
EFA	Ecological Focus Areas	One of three "Greening" measures that condition 30% of Direct Payments (pillar 1) to environmental requirements
EP	European Parliament	
EU	European Union	
EWG	Expert Working Group	Refers to the group of experts that were involved in producing this report
FGD	Focus group discussions	
GAEC	Good Agricultural and Environmental Conditions	
IEEP	Institute for European Environmental Policy	
IUCN	International Union for the Conservation of Nature	International Environmental Organisation
MS	Member State	
RDP	Rural Development Programme	Support scheme for rural Areas as part of pillar 2
	Measures	Refers to agricultural practices supported or supportable through the CAP (e.g. agri-environmental measures etc.)
	Greening	Measures intended to benefit farmland biodiversity for which farmers receive direct payments under the CAP Pillar 1

Report summary

Recent scientific research highlights the urgent need to protect Europe's remaining – and rapidly declining – biological diversity. The Common Agricultural Policy (CAP) is one of the major tools with which policy-makers in the European Union (EU) can achieve this aim. However, so far, the CAP has proved largely ineffective – or even detrimental – to this goal. With relatively localised exceptions, the Policy's notable success in ensuring supplies of food and fiber by supporting Europe's farmers has been at the expense of environmental objectives. This report presents the findings of an Expert Working Group (EWG) convened to explore the ways in which the Common Agricultural Policy could be made more effective in protecting biodiversity and delivering associated ecosystem services, particularly through the implementation of effective biodiversity measures by Europe's farmers.

The EWG was established with a focus on Ecological Focus Areas (EFAs), a policy instrument introduced to the CAP in the period 2014 - 2020, who broadened this remit to also consider evidence from other measures. In the first of three main strands of research (Step A), we synthesised the findings of recent reviews that investigate the most beneficial measures for biodiversity on farmland. In the second (Step B), we reviewed the factors affecting the design and selection of these measures at European, national and farm scales. In the third (Step C), we used our findings to develop recommendations for improving the impacts of the CAP on biodiversity and associated ecosystem services. The bulk of our work focused on Step B, in particular a new assessment of factors affecting farmer's uptake of relevant measures, and a series of interviews with farmers' representatives to further develop our insights and findings.

Our main findings are as follows:

The current situation

- Some existing measures that have been supported through the CAP as EFAs have substantial, proven benefits for biodiversity under certain conditions, in particular, agroforestry, buffer strips, landscape elements and land lying fallow.
- Other measures, such as the use of catch crops, green cover or nitrogen-fixing crops, provide few benefits for farmland biodiversity if grown within conventional, intensively-managed farms.
- Of the measures available, those with fewer benefits for biodiversity are far more commonly applied than those with more benefits.
- The uptake of less beneficial measures is partially attributable to the lack of associated management requirements for enhancing biodiversity, allowing technical compliance to be achieved with little or no beneficial change in farm management.

How this situation arose

- The original regulations proposed by the EU Commission for the CAP in the period 2014-2020 were weakened during negotiations with the European Parliament and Council as agro-economic interests dominated over biodiversity interests.
- Member States further reduced the scope for measures to benefit biodiversity by prioritising ease of administration, consistency with existing agricultural practices and political acceptability over environmental impacts or effectiveness.

- Farmers tended to adopt measures that required the least management change and that were most aligned to agricultural production, and these were usually the measures with the least benefits for biodiversity.

How this situation can be improved

- Strengthening transparency and participation in the decision-making process related to CAP design and implementation can increase legitimacy and ensure consistency with societal interests.
- A clear distinction should be made between those measures that are effective in protecting or enhancing biodiversity, and those that primarily serve other purposes such as nitrogen fixation or soil protection. Subsidies allocated to biodiversity-friendly measures should be restricted to the first group.
- Tailored grouping and concerted implementation of measures that assure connectivity at farm and landscape scales should be encouraged to maximise general benefits to biodiversity and the provision of ecosystem services.
- Expected benefits of interventions to biodiversity should be clearly defined, effects measured and transparently communicated (where possible), ensuring that any new measures have recognisable impacts on biodiversity. This would be likely to increase their acceptability and uptake; it would also form a basis for designing and implementing robust results-oriented payments.
- In order to make the potential effects of interventions more tangible, the transparent use of scientific evidence and varied stakeholder perspectives to inform policy-making should be increased.
- The rationale for and requirements of measures should be communicated to farmers through place-specific trusted sources rather than political channels.
- Policy changes should proceed concurrently with further research into the benefits of different measures and their applicability in under-researched regions and with other policy goals.
- Notwithstanding these changes, evidence about policy development and farmer uptake suggests that reversing the long-term trend of biodiversity loss on European farmland may require a comprehensive transformation of the CAP from area-based subsidies towards the provision of biodiversity conservation.

Introduction

Background to the report

The conservation of biodiversity has become a central element of the EU's Common Agricultural Policy (CAP). Agri-Environment Measures (AEMs) were introduced in 1992 to incentivise management practices with benefits for biodiversity on European farms, and similar forms of incentive have remained in place ever since (see Box 1). However, despite this consistent financial support, biodiversity in European agricultural landscapes continues to decline at an alarming rate (EEA, 2015; EEA, 2017; IPBES, 2018; Pe'er et al., 2014; van Swaay et al., 2015).

In this context, the EKLIPSE project (EKLIPSE 2018) received and selected a request from the International Union for the Conservation of Nature[1] and the Swedish Board of Agriculture[2] to identify ways of improving uptake of agricultural practices with benefits for biodiversity on European farms. In response, EKLIPSE released a Call for Experts (EKLIPSE CfE.2/2017), and ultimately selected 12 researchers from 9 European countries (Czechia, Denmark, Finland, Germany, Greece, Hungary, Spain, Sweden and the United Kingdom) to form an Expert Working Group (EWG). This EWG conducted literature reviews and primary research to better understand farmer motivations and the design of promising measures for supporting biodiversity and ecosystem services. As per the original request, this work was intended to support policy development for the next iteration of the CAP (2021-2027) while taking into account administrative feasibility, social implications and farm economics.

Concurrently in 2017, the EU started the review and reform process that will determine budgets and guidelines for the 2021-2027 financing period. The European Commission (EC) proposes the "preservation of landscapes and biodiversity as one of nine general objectives" for the CAP post-2020, and specifies eco-schemes (Pillar 1) and agri-environment climate measures (Pillar 2) as instruments to support biodiversity measures (EC, 2018). Existing studies and expertise on the implementation of such instruments are therefore highly relevant to ongoing policy development, and it is on these that we build in this report. In doing so, we go beyond the original focus of the request on Ecological Focus Areas, in particular to consider evidence on the uptake of a broader range of measures, developing recommendations relevant to the evolving policy landscape.

In this context, this report addresses the following research questions:

1. **Which of the measures available to farmers through the CAP are most beneficial for biodiversity? (Step A)**
2. **What are the factors influencing the design and selection of these measures at the EU level? (Step B1)**
3. **What are the factors influencing the selection of these measures by different Member States (MS)? (Step B2)**
4. **What are the factors influencing the selection of these measures by farmers? (Step B3)**
5. **How can improved uptake of these measures be achieved in the future? (Step C)**

These research questions were addressed using dedicated methods described for each Step below and in Appendix 1 (see also Figure 1). These methods were first elaborated in a Methodological Protocol

[1] https://www.iucn.org/regions/europe

[2] http://www.jordbruksverket.se/

(http://www.eklipse-mechanism.eu/cap_activities) that was made publicly available and peer-reviewed. Eight reviews of the draft protocol were received (these reviews are available on the EKLIPSE website), and the Protocol was subsequently revised and published online. Following this, further changes were made to the Protocol to allow the work to be completed within available time and resource constraints.

Step A: Compile a list of measures available as either Ecological Focus Areas (EFAs) or other measures that are proven to effectively enhance biodiversity on farmland, with a summary of the supporting evidence:

1. Review the evidence for the benefits of available measures;
2. On the basis of this evidence, determine which measures are the most beneficial for biodiversity, accounting for different farming/geographic/management conditions;
3. Identify any other factors affecting the effectiveness of these measures.

This Step allowed the remainder of the report to focus on factors that particularly affected the uptake of beneficial measures for biodiversity, rather than generic factors affecting uptake of all measures.

Step B: Assess factors that influence the uptake of these (and other environmentally-beneficial) measures:

1. at EU level (via literature review);
2. at MS or other relevant sub-level (via literature review and expert interviews);
3. at farm level (via literature review and expert interviews)

This Step provided evidence of factors affecting uptake of the measures identified in Step A, as well as broader evidence related to measures that could have relevance to the CAP in the future.

Step C: Provide recommendations to improve the design, availability and uptake of biodiversity measures in the CAP, based on knowledge gained about the most effective measures and factors determining their uptake.

The outcomes of each of these Steps is presented in detail below.

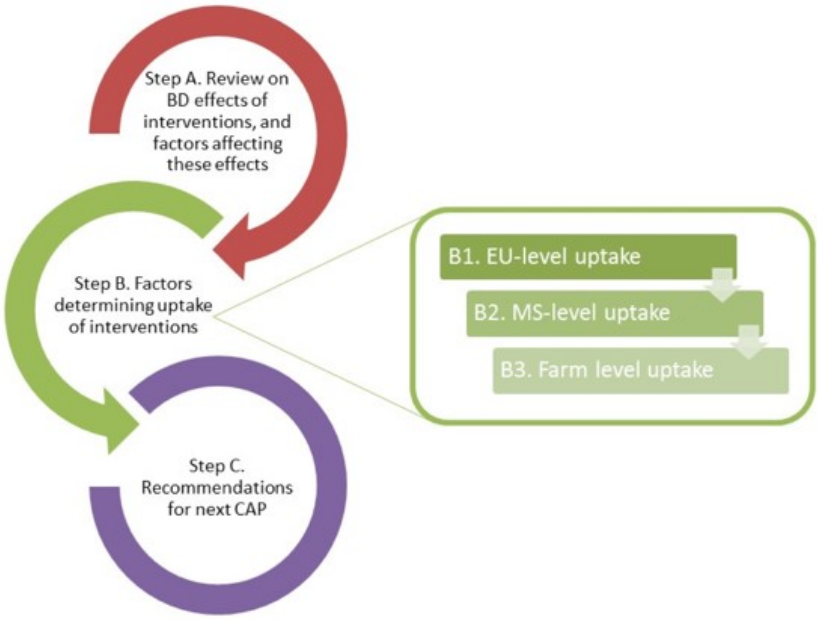

Figure 1: Knowledge synthesis framework used by the EWG.

Box 1. Measures supporting biodiversity in the current (2014-2020) CAP

Prior to the formulation of the CAP for the 2014-2020 period, the conservation status of habitats on agricultural lands was found to be particularly poor (EEA, 2010, Poláková et al., 2011). A public consultation on the reform of the CAP towards 2020 (see EC, 2010), as well as the EU Biodiversity Strategy adopted in 2011 (EC, 2011a), also played significant roles in shaping the legal proposal and its negotiations at this stage. The results of the consultation reflected that environmental concerns were a central challenge for the CAP and that farmers needed further incentives and support for conservation (EC, 2010). In response, the EC identified three specific objectives for the period (EC, 2011c).

- Viable food production;
- Sustainable management of natural resources and climate action;
- Balanced territorial development

The conservation of biodiversity and improved environmental performance of European agriculture was also identified as a key target of the 2013 reform. In order to achieve this target, the EC (2011b) suggested new conditioned direct payments under the CAP's Pillar 1 – expected to go beyond already existing 'Cross Compliance' requirements for farmers to respect basic environmental principles. The conditioned direct payments, or *Greening*, comprised management practices or interventions intended to directly benefit farmland biodiversity. These were duly included in the 2014-2020 CAP Pillar 1.

Broadly, Greening aims to ensure that all EU farmers receiving income support deliver environmental and climate benefits as part of their agricultural activity. Since 2015, 30% of Pillar 1 direct payments have been dedicated to Greening (EU, 2013). Particular agricultural practices are favoured: these include crop diversification, maintenance of permanent grassland and the dedication of 5% of arable land to 'Ecological Focus Areas' (EFAs). Farmers with more than 15 ha of farmland have to select among the nationally available options to meet EFA requirements. EFA obligations are intended, as other Greening practices, to be simple, generalised and annual (Hart, 2015).

Aside from EFAs, Rural Development Programmes (RDPs) in the CAP's Pillar 2 also support some environmental objectives. RDPs are implemented and co-funded by Member States or sub-national governments with a high degree of flexibility. Agri-environment and climate measures (AECMs) form part of the RDPs and provide additional incentives for environmentally and climatically beneficial measures.

A number of recent studies have shown that Greening measures (mainly EFAs) have failed to deliver their expected environmental benefits (EC, 2017a, 2017b; ECA, 2017; Hart et al., 2016; Pe'er et al., 2016). These reports suggest that the flexibility available to national authorities responsible for implementing Greening, intended to allow the tailoring of these measures to local conditions, have instead resulted in weak and ineffective requirements. A study by the Institute for European Environmental Policy concluded that "the general pattern in most of the MS reviewed has been to offer farmers maximum flexibility in terms of implementation" (Hart, 2015), rather than to ensure the maintenance of rigorous environmental standards. These findings, along with those that show continuing loss of Europe's biodiversity, can now inform development of the next iteration of the CAP (2021-2027).

STEP A: Measures that benefit farmland biodiversity

The purpose of Step A was to identify the measures that have been found to be most beneficial for biodiversity. A number of recent reviews have also addressed this question, and so Step A involved a synthesis of these (EC, 2017a, 2017b; Hart et al., 2016; Pe'er et al., 2016; Shackelford et al., 2017; Sutherland et al., 2017). The findings below are intended to inform subsequent steps and do not represent recommendations of the report. This synthesis is also presented with the caveat that the effects of different measures are known to vary geographically, according to local environmental and agricultural conditions (Díaz & Concepción, 2016). Understanding of causes of this variability should ideally inform the choice of measures and their regional targeting in each Member State. It could be unnecessary to delineate such geographical restrictions at EU level according to the principle of subsidiarity. Whenever there is specific evidence for geographical and other restrictions, we mention these under each measure. We also highlight a lack of evidence concerning the effects of measures on below-ground biodiversity. Further methodological details are available in Appendix 1. Step A also underpins the assessments made in Step B by highlighting the issues that may need to be taken into account by authorities when choosing which measures to offer to farmers.

The resulting list of measures found to be effective for biodiversity included 24 options (wherein landscape elements, and agroforestry and forested land are regarded separately). There was significantly differential uptake between measures by individual MS. The Netherlands was the only country that implemented nationally-defined equivalent practices (with arable strip packages and Skylark Certificates). The evaluated beneficial impacts on biodiversity were contrasted with the uptake of the options in Table A1.

Table A1: List of measures and assessment of their respective support for biodiversity conservation. Positive benefit for biodiversity is represented in the table by the number of "+" symbols and negative impacts by "-". These are based on the grading or evaluation done in the reviews (EC, 2017a, 2017b; Hart et al., 2016; Pe'er et al., 2016; Shackelford et al., 2017; Sutherland et al., 2017). Benefits that are not straight-forward, benefits of a particular type contingent on context or land management are shown in brackets.

Measure	Uptake (number of MS)	Benefit for biodiversity*
Nitrogen-fixing crops	27	(+)
Fallows	26	+++
Agroforestry	11	+++
Field margins	16	+++
Trees in a line	16	++
Catch and green cover	19	+
Forest edges	9	+
Buffer strips	17	(+)
Ditches	15	(+)
Terraces	8	(+)
Trees in groups/field	17	+/-
Afforested land	14	+/-
Short rotation coppice	20	(-)

** the benefit evaluations in the revised reviews are not directly comparable and the numbers of positive and negative signs are based on both quantitative grading and qualitative descriptions.*

From the table above, it can be seen that the **Fallows measure was evaluated as the most favourable measure for biodiversity**. It is also an almost universally available Greening measure across the EU. Fallow is a most suitable option for land with marginal productivity. Suggested improvements concern establishment and management of fallow areas: i) rotational, perennial, or long-term types; ii) their placement in the landscape (e.g., in open landscape or near forests); iii) use of diverse seed mixtures optimised for biodiversity; and iv) management to support the highest rates of biodiversity (e.g., mowing dates and methods). Pe'er et al. (2016) suggest that fallow measures be given a higher priority within the offered EFA options due to their 'win-win' standing, as positive for both conservation and indirectly (via ecosystem services) to agricultural production on the farm/landscape level.

Agroforestry was evaluated exclusively positively for biodiversity as well as several ecosystem services. However, it is made available only in 11 Member States. The most likely reason for this measure's limited availability is that agroforestry systems are currently geographically restricted to certain regions, and are not commonly developed as production systems in temperate regions (den Herder, et al., 2016). In some parts of Europe, traditional agroforestry systems such as wooded pastures and grazed forest in the boreal zone are not regarded as agroforestry, though they share the same principles.

Most **Landscape elements**, and especially margins, trees in line and forest edges, have been evaluated as beneficial for biodiversity. However, as Hart et al. (2016) observed, the landscape features, buffer strips and terraces included in EFA options are mainly those that are already protected under cross-compliance, which undermines their additional environmental benefits. To maximise additionality (that is, additional benefit delivered by this policy tool as compared to the already enforced ones), these options could be combined with other measures with positive effects on biodiversity. Examples could include the placement of fallow land neighbouring landscape elements, or enhancing management for biodiversity (such as mowing in stages, or sowing with mixtures of native plants). However, strategic grouping of options is not currently supported by EFA options, but should be considered. Importantly, it has been frequently documented (e.g. Diaz & Concepción, 2016) that high vertical features (such as tree lines and hedgerows) tend to have negative effects on some priority biodiversity species adapted to open environments. Implementation of such elements should be targeted by the regional, landscape types, priority species, and resolving specific trade-offs may need further research.

The direct benefits for biodiversity of **Catch and green cover crops** seem to be poorly established across the EU. Where evidence exists, it points to some potential benefits, particularly to soil macrofauna and for providing additional resources for above-ground species as they provide a prolonged period of cover maintenance (e.g., Underwood and Tucker, 2016). However, this potential remains poorly realised due to monocropping, the use of simple seed mixtures, and/or short durations between cover crops' termination with herbicides and mowing for weed control. These factors lead to serious concerns around the measure's additionality. Improvement may require better targeting, the sowing of seed mixtures with proven potential for above-ground biodiversity, and the development of agronomy practices with minimal inputs and disturbance. The latter is feasible: for example, according to Hart et al. (2016), Germany appears to have restricted the use of fertilisers and pesticides on these crops.

By the number of Member States, the most popular EFA measure is **Nitrogen-fixing crops**. To justify the inclusion of the options, Member States were supposed to submit evidence that the nitrogen-fixing crops they allow are such that they contribute to biodiversity. However, Hart et al. (2016) has not been able to source this for the countries reviewed. The measure is the most controversial in respect to biodiversity. It received both positive and negative evaluations from the collated evidence base. Evidence is generally limited to the fact that these crops are dependent on insect-mediated pollination, and thus provide

resources to some pollinator groups. There is also some evidence of certain crops being important habitats for birds (reviewed in Underwood & Tucker, 2016). However, low intensity management necessary to realise these benefits (with infrequent cutting, long cropping periods and little other disturbance) has not been introduced as part of EFA packages in most Member States. Above all, of all the measures, nitrogen-fixing crops are most compatible with intensive farm production. Many farmers implement the measure with considerable ease, which also presents questionable benefits beyond production.

There is an urgent need for evidence on the potential environmental and specifically biodiversity benefits of the nitrogen-fixing measure, such as through improved soil structure, reduced need for mineral fertilisers (particularly relevant to aquatic and soil biodiversity) and reduced greenhouse gas emissions (Bues et al., 2013). The introduction of this option to the EFA menu was justified also by reducing the quantity of imported soya and therefore reducing "pressure on international land-use change" (i.e. deforestation ibid). If this were the case, benefits to biodiversity globally would accrue. However, there is no evidence as yet that such potentials have been realised by nitrogen-fixing crops. Similarly, as acknowledged by Bues et al. (2013), the risks of including this option in the EFA should be evaluated if the option is to be considered for retention in the reformed policy. These risks include concerns around additionality, particularly in regions where legumes are already part of normal cropping; possible reductions in non-cropped areas sown newly for nitrogen-fixing crops; and increasing areas affected by the measure in regions with excess nitrogen due to concentrated livestock production. Moreover, it has also been argued that the option may not be suitable as an EFA measure as all protein crops are marketable products and can be encouraged with coupled support (Pe'er et al., 2016), as indeed is already the case in several Member States (Underwood & Tucker, 2016). To enhance biodiversity benefits of nitrogen-fixing crops, its organic agronomy should be further developed and possible additional restrictions introduced to justify the use of the option specifically as an EFA: for example, in Scotland, the crop cannot be harvested before 1st August in order to protect ground-nesting birds, and there must be at least two different EFA nitrogen-fixing crops to extend the flowering period for pollinators.

Buffer strips is a well targeted measure (placed along water courses) but requires the resolution of management conflicts for different ecosystem services. The main conflict arises when vegetation is mown early in season and/or repetitively, and large quantities of biomass is removed, which lowers soil fertility and prevents nutrient leaching into water courses, which has benefits for aquatic biodiversity. However, such management can be destructive for some species groups (mainly invertebrates and birds). It is also a measure that suffers particularly from administrative complexity, which deters its implementation for the risk of sanctions (Pe'er et al., 2016; Zinngrebe et al., 2017).

Terraces, though evaluated as positive for biodiversity by experts in some countries, are already part of compulsory Good Agricultural and Environment Conditions (GAEC; which is part of cross-compliance), which need to be maintained for direct payment support through the CAP. This means that their 'added value' as a Greening option is unclear.

Though **Short rotation coppice** is made available in the majority of Member States, it has a limited uptake by farmers. Only Pe'er et al. (2016) gave its expert evaluation for biodiversity, which was generally negative.

Additional measures (i.e. not currently available within the EFA options) with a high likelihood of benefiting some biodiversity include **planting wildflower strips** (mainly for pollinating insects) and using **organic rather than mineral fertilizer** (mainly for soil biodiversity). In Mediterranean countries, planting or

maintaining **ground cover in orchards** and planting **hedgerows** would be beneficial to biodiversity. See, however, above on the need for the regional targeting of hedgerow establishment.

Some Greening measures have been shifted from the compulsory GAEC rules to become a part of 'Greening' options. Apart from considerations to whether this results in added biodiversity value, Hart et al. (2016) noted that in consequence, sound practices that were previously widespread will now apply on a much smaller proportion of land and with considerable variations between Member States. However, the fact that such requirements are related to a payment, with more stringent associated controls, means that higher levels of compliance may occur in practice. Pe'er et al. (2016) found that 73.1% of the total EFA-area in the EU is covered by "productive options", fundamentally questioning the added 'green' value of the current approach to EFAs. The current design and implementation of Greening measures, and particularly EFAs, make little use of the experience gained from extant agri-environment measures (Pe'er et al., 2016).

Underpinning these implementation reviews, a 2017 European Court of Auditors report on Greening concluded that Greening in its current form as a whole adds very little benefit to the environment and climate, and that it is more of an income-support mechanism than an environmental incentive to farmers. Greening is estimated to have led to changes on only 5% of EU farmland, with an administrative complexity that is not considered justified. The report also included a suggestion that "*When Member States are given options to choose from in their implementation of the CAP, they should be required to demonstrate, prior to implementation, that the options they select are effective and efficient in terms of achieving policy objectives*". The report also highlights the problematic nature of the most popularly selected measure of nitrogen-fixing crops, due to concerns around its additionality, and its moderate-to-uncertain biodiversity benefits.

Conclusions: Step A

Based on the review, the EWG decided to focus further work on the following list of measures:

- Fallows (with caveats regarding species composition and management)
- Agroforestry (including wood pastures and grazed forest)
- Landscape elements, especially in association with other measures
- Buffer strips, especially with diverse vegetation types and structure, and
- Wildflower strips – that are currently not explicitly included into Greening but are suggested in some reviews as a potential additional option.

These measures were the basis for the subsequent analyses in Step B.

STEP B: Factors influencing the uptake of biodiversity conservation measures at EU, MS/regional and farm levels

Step B examines the uptake of biodiversity measures at a number of scales. These scales are reflected in our methods (Appendix 1), and our work here is divided into four sections:

1. Section B.1 summarises the policy processes framing the evolution of Greening measures originally made available by the European Commission at the European level.
2. Section B.2 analyses qualitative interviews undertaken with National-level interlocutors with substantial practical experience in the development of the Greening.
3. Section B.3 consists of a Rapid Evidence Assessment of research published within Europe over the past decade on the factors relevant to farmers' uptake and participation in environmentally-friendly or 'green' measures;
4. Section B.4 presents an empirical inquiry across 6 Member States to extend the findings of Section B.3 about the range of factors influencing farmers' uptake of the current range of Greening measures.

Table B1: Summary of the methods used in Step B

Data source	Scope	Purpose
Literature review	302 papers full review process	To assess the findings in research published within Europe over the past decade on the factors relevant to farmers' uptake and participation in environmentally-friendly or 'green' measures
Interviews at national scale	6 decision-makers in Czechia, Finland, Germany, Greece, Hungary, Sweden	To explore the reasons for choosing different sets of measures to offer to their farmers
Interviews at farmer scale	31 semi-structured interviews	To assess the extent to which financial, farmer and farm characteristics, administrative work-load, and effectiveness factors affect the adoption of biodiversity conservation measures

B.1. EU-Level decision-making

In this section, we consider the political processes at the EU level that provides the policy framework for the Greening. This policy framework evolved within formal and informal governance processes, which were driven by various motives and interests, shaping the CAP 2014-2020 as a whole and thus the final set of EFA options.

Evolution of CAP Greening objectives post-2013

The definition and design of EFAs as an instrument of the CAP has been the result of a long-term multi-level governance process. Ever since the creation of the Common Agricultural Policy with the Treaty of Rome in

1957, EU agricultural policy has had a strong economic dimension[3]. The CAP has undergone several reforms since the 1980s, with a strong discourse around multifunctionality developing since the early 1990s, partly as a result of overproduction of food. This discourse emphasises the responsibility of agriculture to maintain environmental conditions as well as fulfil food requirements (Erjavec K., Erjavec E. & Juvančič, 2009). As this discourse entered into the political agenda, it served as one driver for the evolution of environmental measures within the CAP, including obligatory set-aside rules, cross-compliance and voluntary agri-environmental schemes.

With the adaptation of the Treaty of the Functioning of the European Union (TFEU) entering into force at the end of 2009, the CAP's decision-making process changed. One main change concerned the role of the European Parliament: while in the past the European Parliament was primarily only consulted on decisions concerning the CAP, it was now recognised as a "true co-legislator" as the "ordinary legislative procedure" for the CAP (European Parliament, 2018). Co-decision processes involve the European Commission, the Council and the Parliament. Yet, there was some legal uncertainty as to which parts of the CAP the ordinary legislative procedure applies, especially in the fields of budget and aid, leading to legal and political problems during the negotiations on the post-2013 CAP (EP, 2018).

A key mechanism introduced with the 2009 Lisbon Treaty, that has characterised recent CAP negotiations, is the introduction of the distinction between implementing and delegated acts. This now means that for many Greening measures, implementation is not defined in the main legal act; it may be subject to an implementing or delegated act[4,5].

Negotiating Greening/EFA design in the EU

The design of EFAs evolved in its technical details throughout the political process (see Table B2). After the European Commission proposed EFAs and the conditions for its implementation, the European Parliament and the Council determined their positions. The first proposed legal foundation for EFAs by the European Commission (EC, 2011c) was that 30% of direct payments be linked to management practices that contribute to climate change mitigation and environmental protection. However, environmental organisations opposed the inclusion of Greening to Pillar 1 as they preferred targeted measures to be contained in Pillar 2 (Hart, 2015). Furthermore, the proposal did not specify technical details nor expected environmental impacts for those 30% of direct payments (Hart, 2015).

[3] The Treaty of Rome in 1957 defined five initial targets:

1. Increase agricultural productivity
2. Fair standard of living for the agricultural community
3. Stabilise markets
4. Assure the availability of supplies
5. Ensure that supplies reach consumers at reasonable prices.

[4] Basic EU law can be complemented or supplemented by so called implementing and delegated acts, for whose adoption a simplified process can be followed; this allows e.g. for more flexibility, if e.g. issues specified in acts are likely to have to be adapted on short notice. The opportunity of Parliament and Council to authorize the Commission to adopt such acts on certain subjects (at a later stage), may also facilitate to find a compromise on the basic act concerned. The decision, whether subjects are addressed within implementing or delegated acts also goes along with decision-making power: While the Commission can adopt an implementing act (usually after consulting a committee in which every MS is represented), delegated acts are adopted by the Commission after having consulted expert groups, and Council and Parliament have two months after adoption to express objections, before the act enters into force.

Table B2: Development of proposals for EFA design and their key characteristics.

	Share of DP condition-ned on Greening	Share of agricultural land requi-red as EFAs	EFA options included	Exemptions	Potential co-funding with Pillar 2
Original Proposal (EC, 2011c)	30%	7%	Fallow land; terraces; landscape elements, tree assemblies, field margins; buffer strips (with no production), afforested areas	"green by definition" (organic farms, Natura 2000 sites)	Against double funding – AECM "must go beyond Greening"
EP position 13 March 2013 (after MFF decision)	30%	3% in 2014, rising to 5% in 2016	All proposed by EC plus stonewalls, in field trees and ponds, **nitrogen fixing crops**, buffer strips (allowing production without fertilisers and pesticides), excluding permanent pasture and permanent crops	Exclusion for green by definition: 75% permanent grassland, Pillar 2 beyond Greening, funding should not be allowed; EFAs only for farms >10ha	Against double funding
EU Council position	30% + 25 % extra penalty for non-compliance	5% in 2015 excluding permanent grassland) rising to 7% in 2018	All proposed by EC, plus buffer strips with permanent grassland, agroforestry systems, areas under agri-environmental agreements, areas of permanent crops on slopes >10% gradient, short crop rotation, **catch crops, nitrogen fixing crops**, **proposing weighting factors**	All proposed by EC and EP, plus those with >75 in regionally certified env. scheme, or 75% covered grassland or legume cover; EFAs **only for farms >15ha**	Allowing, making EFAs and AECMs complementary, giving strong flexibility to MS for choosing measures
EU Council position 19 March 2013	30% + 25 % extra penalty for non-compliance	5% in 2015 excluding permanent grassland) rising to 7% in 2018	All proposed by EC, plus buffer strips with permanent grassland, agroforestry systems, areas under agri-environmental agreements, areas of permanent crops on slopes >10% gradient, short crop rotation, **catch crops, nitrogen fixing crops**, **proposing weighting factors**	All proposed by EC and EP, plus those with >75% in regionally certified env. scheme, or 75% covered grassland or legume cover; EFAs **only for farms >15ha**	Allowing, making EFAs and AECMs complementary, giving strong flexibility to MS for choosing measures
Final legislative agreement Nov-Dec 2013*	30% (penalty + 25% extra penalty phased over time)	5%, subject to review in 2017	All measures initially proposed: Buffer strips with permanent grassland Agroforestry Strips along forests Short rotation coppice Afforested areas **Catch crops/ green cover** **Nitrogen fixing crops**	Green by definition: organic farms, participants in small farmers' schemes, Natura 2000 – only some measures, penalty; >15 ha; MSs with >50% forest cover	Pillar 2 payments must go beyond the Greening requirements to avoid double funding

** EP approved the 4 CAP regulations: Nov.2013; Council adopted the 4 CAP regulations: Dec.2013*

Compared to the EC proposal, the European Parliament (EP) weakened the regulation by including more farm types into the list of "green by definition" (i.e. those that did not have to alter management practices to achieve compliance with the legislation). The EP also introduced further exceptions, supported a lower share of agricultural land to be dedicated to EFAs, introduced "light-green" EFA options, such as nitrogen-fixing crops (see Step A), voted against double funding, and for lower penalties for non-compliance. Moreover, the EP proposed to only condition three percent of agricultural land on Greening obligations. In the final approval process of the EP, the issues of double funding and exemptions to Greening obligations as well as the thresholds of farm sizes in the context of crop diversification were strongly debated and decisions were subject to small majorities (Knops & Swinnen, 2014).

It has to be noted that there were not only different opinions between co-legislators, but also within the Parliament (and within its Committee for Agriculture and Rural Development) and between Member States/Ministers of Agriculture. The Committee on Agriculture and Rural Development in the EP is dominated by the European People's Party (EPP) and the Progressive Alliance of Socialists and Democrats (S&D). Both major parties had internal differences about whether a more flexible "menu approach" should be taken to select measures, or whether Greening obligations should instead be strengthened (Knops & Swinnen, 2014). Additionally, the Committee as a whole tended to support farmers' productivist interests, as 31% of its members had either owned a farm or been members of a farmers' association (Roederer-Rynning, 2014). In line with these interests, the Committee advocated the inclusion of further options for AECM funding into the legal framework, such as afforestation, agroforestry systems and animal welfare payments. Finally, they maintained that penalties should remain lower than Greening payments, and that double funding should be possible for the same measures under EFA and AECMs (Knops & Swinnen, 2014).

The European Council introduced catch crops, supported higher flexibility to Member States with regard to Greening implementation and introduced further exceptions to farms that could be excluded from Greening obligations as well as proposed thresholds for farm sizes for the application of crop diversification. Concerns about stronger EFA regulations included costs to farmers, risks to food security due to reduced agricultural lands and threatened rural livelihoods (Hart & Baldock, 2011; Matthews, 2013; Knops & Swinnen, 2014).

Overall, with the adoption of the Regulation (EU) No 1307/2013 in December 2013[5], this process resulted in a weakening of the legislation that was in fact anticipated by the European Commission during the development of the CAP. Their 2011 Impact Assessment (EC, 2011b) presciently warned:
"For the Greening to be effective, it is key not to go for a 'menu' approach with a list of measures, offering choice to Member States and/or farmers. Such an approach would very much watering down the Greening effect, especially if the payment does not match the efforts required by farmers, leading them to choose the measures with which they comply already or the measures with the least cost, thus bringing less environmental benefits."

This weakening also poses a risk for the new (2021-2027) CAP, and it is important that lessons are learned at all levels to ensure more robust policy design on this occasion. This plainly presents a trade-off between the necessary flexibility of measures that enable local socioeconomic and ecological realities to be taken into account, and the need to ensure consistent environmental outcomes are achieved.

[5] With relevance for the implementation of the Greening, this regulation was supplemented among others by and the Implementing Regulation (EU) No 641/2014 and the Delegated Regulation (EU) No 639/2014, which was later amended by Regulation (EU) 2017/1155, with a range of implications for the requirements for the implementation of the Greening.

B.2. National-level interviews with decision-makers

Different EU Member States chose substantially different sets of measures to offer to their farmers, substantially constraining the scope for uptake of the most beneficial measures in many countries. The number of EFA measures available to farmers ranged between 4 and 18 in the nine Member States covered by the EWG, and included a number of divergent options. All nine countries selected fallow land, while eight selected nitrogen-fixing crops (the exception being Denmark). Short-rotation coppice and catch crops or green cover were selected by six countries, buffer strips by five, and afforested areas and agro-forestry by four. The least popular EFA measures were strips of land along forest edges without production (chosen only by Hungary) and strips along forest edges with production (selected by Hungary and Germany). The EWG undertook a set of interviews with decision-makers in Czechia, Finland, Germany, Greece, Hungary and Sweden to explore the reasons for these differences. While the small number of interviews makes the findings tentative, each interviewee had substantial expertise on the selection processes in their country.

B.2.1. Stakeholder engagement and consultation

Our interviews revealed a number of effects of different political cultures across the six countries surveyed. This was notably evident in the range of opportunities for stakeholder participation in the formal decision-making process. Dedicated working groups for the debate and investigation of EFAs were established in Hungary (informally established) and Finland (formally established), while Greece and Germany did not establish working groups. However, Germany undertook formal federal consultations between federal State Ministries, who individually consulted with stakeholders. Legal proposals were subsequently approved by the Government and Federal Council. Sweden similarly undertook an internal, closed consultation process. In contrast, Czechia undertook a prolonged consultation process in which farmers also had an opportunity to comment. This formed part of an annual series of consultations in which farmers' experiences with subsidy programmes were evaluated.

In all studied states that undertook consultation, the stakeholder group involved encompassed a range of governmental, NGO and farmers' representative organisations. However, several policy-makers involved expressed frustration with the timeframes imposed by the EC, arguing that these were too short to allow for full consultation. The lack of standardisation of the participatory processes across Europe may also allow consultations to be focused on individual interest groups, reducing transparency and the resulting legitimacy of the governmental decision-making processes on EFA selection. Nevertheless, differences in consultation processes were not obviously reflected in either the measures selected or the reasons given for selection, in our sample, suggesting some convergence between government and stakeholder priorities.

B.2.2. Scientific engagement

In sharp contrast to the generally strong engagement with stakeholders, scientific and other external engagement was either limited or entirely absent from member states' decision-making processes. This was explicitly acknowledged by several of the interviewees. For example, in Hungary, the aim of the selection process was "to capture experience of farmers through the consultation process rather than reviewing reports", and, like Sweden, no specific documents were taken into account. In Finland, "research was taken into account" where it involved national evaluations of agri-environmental schemes, and in Germany scientific hearings were conducted by the Bundestag. In Czechia, some review of unspecified research documents was said to have occurred, but interviewees could not account for how these reports informed decision-making.

B.2.3. Selection of measures

The most commonly identified factor determining selection of measures was their relevance to agricultural practices across the country in question, listed by interviewees from Hungary, Greece, Czechia, Germany and Sweden. Hungary selected all but one of the measures, with the exception (stone walls) arising as there are no such features in the Hungarian landscape. The driving motivation behind EFA list options was "to provide farmers with the largest range of options possible, so that they could get the most out of the direct payments of the CAP"; this sentiment was echoed by the interviewees from Czechia and Greece. Thus, it is noteworthy that "the choice of EFAs was not based on environmental benefits but on the benefits that producers may have" (Greece).

'Efficiency' (for example of measurement, in Greece), ease of implementation, realistic verification of compliance (Finland) and low costs (Finland, Greece) were also identified as important. In Czechia, EFAs were felt to be flexible and accommodating of a wide range of other measures. For example, boundary strips could include wooded strips, and landscape features could be included in pre-existing categories. In contrast, our German interviewee stated that sustainability and biodiversity-related factors were central to their decision-making, leading to the selection of measures "in the interest of a sustainable agriculture" justified, for example, by the current public focus on the insect extinction crisis (although this developed after the selection for the last CAP).

Reasons for not selecting particular measures were more diverse. Most commonly, measures that replicated options already available as part of agri-environment measures in Pillar 2 or GAEC were not selected (Sweden, Finland, Greece, Czechia). In the case of Finland only three provinces are required to have EFA (the rest are exempted for their high forest area). For this reason, some of the potential measures demonstrated to be effective, namely catch and cover crops, were not included in the EFA. Including such measures in the EFA would have meant that they had to be excluded from the Agri-Environment Scheme (AES) package for the whole country and hence the farmers in the exempted provinces would not have been able to join.

As mentioned above, measures were also excluded where they were felt to be irrelevant to the country (Sweden, Hungary, Finland, Czechia (which did not select agroforestry alone for irrelevance)). Countries also did not select measures with which they expected difficulty in monitoring or otherwise with ensuring compliance (for e.g., prohibitively high costs of mapping watercourses in Finland; lack of institutional access to maps in the water ministry in Hungary; and other difficulties in Greece and Czechia). The interviewee from Czechia also made the case with several measures that they were not only inapplicable, but that they were not "traditional", with particular reference to stone walls, hedges, field margins as landscape features, and buffer strips. When countries identified controversies or contentious points in the selection of measures, they were technical in nature; for example, how best to measure and monitor land areas for new green schemes (Hungary, Czechia). Some countries noted specific reservations about the effectiveness of measures, such as catch crops and nitrogen-fixing crops (Germany), but these concerns were generally secondary to the main motivations for selection above.

B.2.4. Reasons for focus on area-based measures

Overall, area-based measures (those requiring the dedication of a certain area of land to a defined use) were often favoured. In particular, nitrogen-fixing crops, cover crops and fallows were regarded as being popular with farmers because they permit many farmers to "pursue a productionist viewpoint" (Hungary). The preference for area-based measures was also supported by the ease with which they could be

measured and quantified. Nevertheless, these measures were claimed to generate substantial environmental benefits beyond biodiversity preservation. For example, nitrogen-fixing crops were seen as reducing the need for mineral fertilisers (and energy for their production) and imported protein crops (and the associated deforestation in S. America) (Finland, Sweden). These opinions were partially, though not entirely, shared by farmers, according to our literature review and interviews described below.

B.2.5. Past and future changes to the CAP

Most countries have made no changes to the measures that qualify as Greening or EFAs since the initial selection of measures took place (Hungary, Greece, Germany, Greece). In two cases (Greece, Sweden), changes in weightings of measures were made in order to simplify payments. However, a number of suggestions for future improvements were made by interviewees, as follows:

- Establishment of a working group and better consultation with more stakeholders for selection of measures (Greece, Czechia);
- Better requirements for monitoring and measurement (Czechia and Finland).
- Introduction of incentives for cooperative behaviour between farmers (Hungary);
- More timely and transparent negotiations on behalf of the EC (Hungary);
- Very clear targets and, much simpler policy (Finland, Sweden);
- Adoption of current proposals for cross compliance (Germany);
- Bringing AEM measures into Pillar 1first pillar (Czechia);
- Establishment of more concrete biodiversity-friendly measures amongst areas of intensive agriculture, such as making some measures (e.g. crop rotation) compulsory for everyone (Czechia);

Along with these suggestions for improvements, a number of interviewees dealt specifically with the upcoming reform of the CAP. In Hungary, it was felt that there was too much uncertainty about possible structural changes to Pillars 1 and 2, and that these changes might reduce the effectiveness of agri-environment schemes, and result in too little support for rural development. However, **"***the Hungarian government is fully supportive of further Greening to the CAP, as they think it has had a positive effect on farmers' mindsets, in that farmers are slowly realising that they cannot do anything they want on their land*". Similarly, the government was thought to favour conditionality and cross-compliance, supporting the preservation of landscape features across multiple land holdings, which requires a further shift in the mindset of Hungarian farmers, "who are difficult to encourage to work together".

In Finland, a simplification of all levels of the CAP was hoped for, for instance by pooling all the obligatory or semi-obligatory measures together. It was suggested that Greening had so far had little effect in Finland, partly due to the irrelevance of measures, such as retention of permanent grassland or the requirement level not exceeding the common practice (crop diversification). In contrast, in the future, the CAP needs "to be able to demonstrate that it does bring environmental and other benefits to society". Swedish responses were very similar, emphasising the current complexity and cost of implementing the CAP, the need to links measures to overall benefits, and to ensure that intended benefits are realised.

These sentiments were echoed in Greece, where a number of "major problems in the current CAP" were identified. These problems included unclear instructions and high administrative costs associated with the avoidance of funding duplication, particularly between the RDPs (Pillar 2) and Pillar 1. It was also felt that the difficulty of avoiding double-payments had contributed to making Greening an inhibiting factor for the

implementation of other beneficial measures (such as the establishment of wildflower strips for pollinators).

In Germany, clearer targets were suggested as a necessary improvement, as well as exceptions related to particular contexts and farming systems. In particular, the German government supported cross-compliance to ensure ecological outcomes (e.g. minimum areas of fallow land). In Czechia, however, current proposals have caused some concern, as reporting burdens on Member States could become too high. Although the idea of more tailored measures was welcomed overall, this was felt to risk fragmentation of overall goals as well as a substantial administrative burden if results had to be gathered by individual Member States and passed back to the EU. For these reasons, developments made to the CAP need to take into account the administrative capacities of individual Member States.

B.3. Literature review

The EWG focused in particular on factors affecting farmer's uptake of measures supported through the CAP. A primary method used here was a Rapid Evidence Assessment (Collins, Miller, Coughlin & Kirk, 2014; Tricco et al., 2015) of research published within Europe over the past decade on the factors relevant to farmers' uptake and participation in environmentally-friendly or 'Green' measures. The methods for this review are described in Appendix 1, and 302 papers were included in the full review process. Findings based on these papers are presented in this section.

Geographically, we found a predominance of studies from western Europe, and particularly from the UK (82 papers), Germany (61 papers) and Spain (36 papers, Figure B3.1). This suggests strong imbalances in the evidence base, with absence of evidence making our findings potentially of little relevance in recent EU accession countries and most of central and eastern Europe.

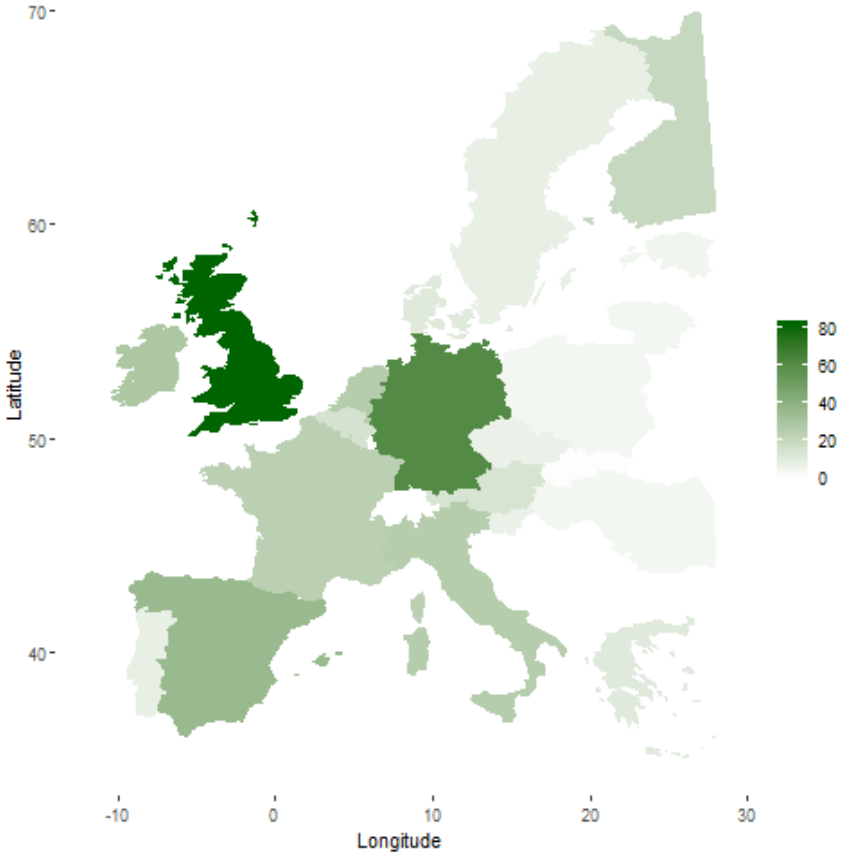

Figure B3.1: Number of studies including evidence from each Member State of the EU.

The literature review permitted the identification of seven broad classes of factors relevant to informing farmers' participation and decision-making in pro-environmental programmes or AES, with papers distributed between them as shown in Figure B3.2. The most commonly-researched factors were structural (120 papers), with large numbers of studies also considering financial (100 papers), policy-related (99 papers) and socio-demographic factors (91 papers) (Figure B3.2). These studies overwhelmingly found that many farmers are motivated by the financial incentive to participate in pro-environmental programmes, including AES. It is crucial that the transaction costs (i.e. information and contractual related costs) of participation remain low, and that subsidy payments exceed opportunity costs (i.e. the forgone income from alternative land uses). However, this pattern is subject to a number of nuances, with different effects

being apparent among different farmers or groups of farmers, particularly with respect to the size of their landholdings.

While farm size as such influences farmer propensity to participate in pro-environmental programmes, our review showed that there is high contextual variability around the size effect. Indeed, we found a relatively even division between studies that found that small or large farms were more likely to enlist in pro-environmental schemes. However, a clear pattern was that farmers on marginal, low-yielding land, and those with less intensive management practices were more likely to be scheme participants.

Other factors that appear to generally limit participation include a lack of available land or farm labour, and tenancy arrangements. These are constraints that either preclude achievement of area or time requirements, or that introduce an element of risk into the decision to participate.

Studies that investigated relationships between farmers and the state and/or the relevant agency responsible for interfacing with farmers in order to realise pro-environmental schemes are very few (n = 7). Such studies consistently found that the quality of such relationships, and the level of trust and communication within them, were strong determinants of levels of uptake. Similarly, the comparatively rare studies of farmers' attitudes to ecological factors (n = 28) found that these could provide strong non-economic motivations for AES participation. The relative lack of research into these classes of factor may be partly attributable to the methodological difficulties in understanding farmers' experiences at this detailed level while also generating large, generalisable samples.

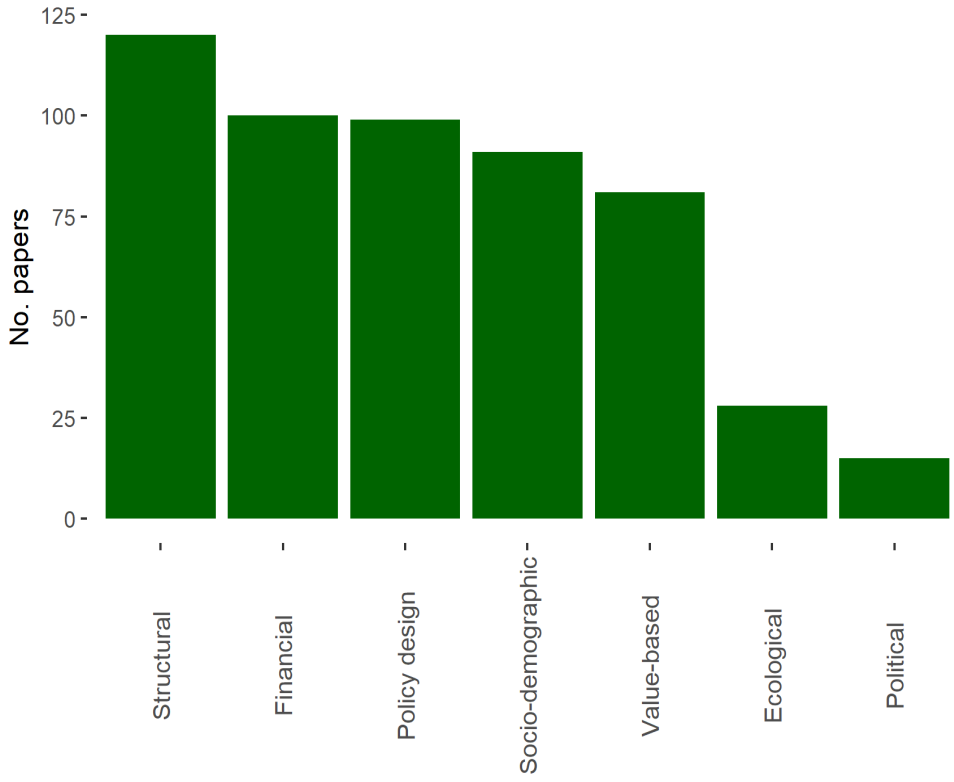

Figure B3.2: Broad factor classes and the number of papers including evidence about their effects on farmer uptake of environmental measures

B.3.1. Financial factors

The clearest pattern across the literature was that environmental schemes with higher payments (or lower costs) achieve greater uptake (Figure B3.3). This well-established and intuitive relationship already informs many policies, albeit subject to obvious funding constraints and the principle of calculating the payment rate by "costs incurred and income forgone". Nevertheless, some nuances were suggested by the literature. Firstly, a need for payments to exceed the (perceived) opportunity cost of implementing a scheme was identified in some papers, and even then there was a tendency for farmers to select the cheapest (or most cost and labour 'efficient') option to implement. Conversely, a number of review studies found that low transaction costs correlated with reduced participation, sometimes because of concerns about ecological effectiveness or other aspects of utility (see sections below). Payment per-unit-area was also identified as a positive factor in some cases, suggesting a need for payments to scale proportionately to farm size, although economies of scale in implementation may mitigate this need.

In a relatively small number of papers, 'push' factors affecting participation were recorded; these included fear of sanctions or fines, economic dependency on farm income, risks associated with agricultural markets, possible effects of uptake on land values, and stress or financial problems. The limited available evidence did not always clearly identify effects of these factors, suggesting that they may encourage or discourage uptake, perhaps depending on their context. However, it appears that stress or financial problems may encourage uptake, while perceived risks and negative effects on land values, where they occur, may have the opposite effect.

All of these findings may be subject to geographical and methodological differences, which, for the most part, are not assessable due to the limited evidence available. It is notable that all three papers that suggested a negative relationship between higher payments and AES uptake were based on models (multinomial and principal-agent) rather than directly on survey data. The five papers that found a neutral relationship were from Germany, Austria, the Netherlands and Scotland. These countries are characterised by relatively high levels of wealth (amongst the general population, if not farmers) and well-developed extension services for farmers.

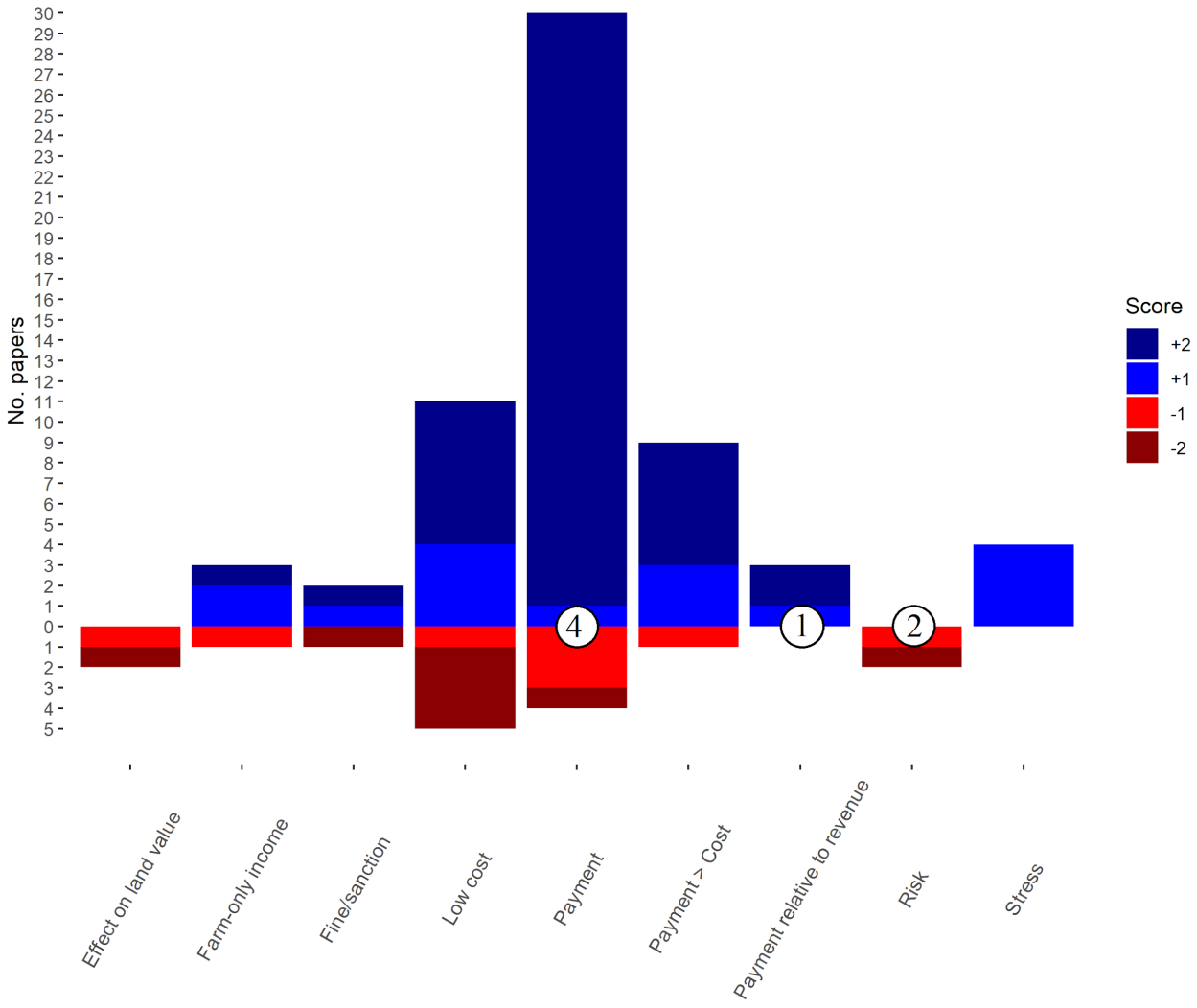

Figure B3.3: Spread of relative importance (-2= strongly negatively influences, +2 strongly positively influences) of financial factors that affect farmer engagement with agri-environment or other green measures. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar. 'Farm-only income' indicates that farmers have no other source of income.

B.3.2. Structural factors

Structural factors were also widely investigated, often with contrasting results between different studies. For instance, four studies (two from England, one from Germany and one from Slovenia) found that farmers with larger farms were far more likely to participate in environmental schemes, while four others (from Finland, Austria, Spain and Switzerland) found that participation was more likely amongst smaller farmers. Similar variability was found in the literature for most of the structural factors assessed, suggesting substantial context dependency in terms of AES features and their match to farm characteristics, and also, perhaps, region-specific implications of farm characteristics for farmer attitudes.

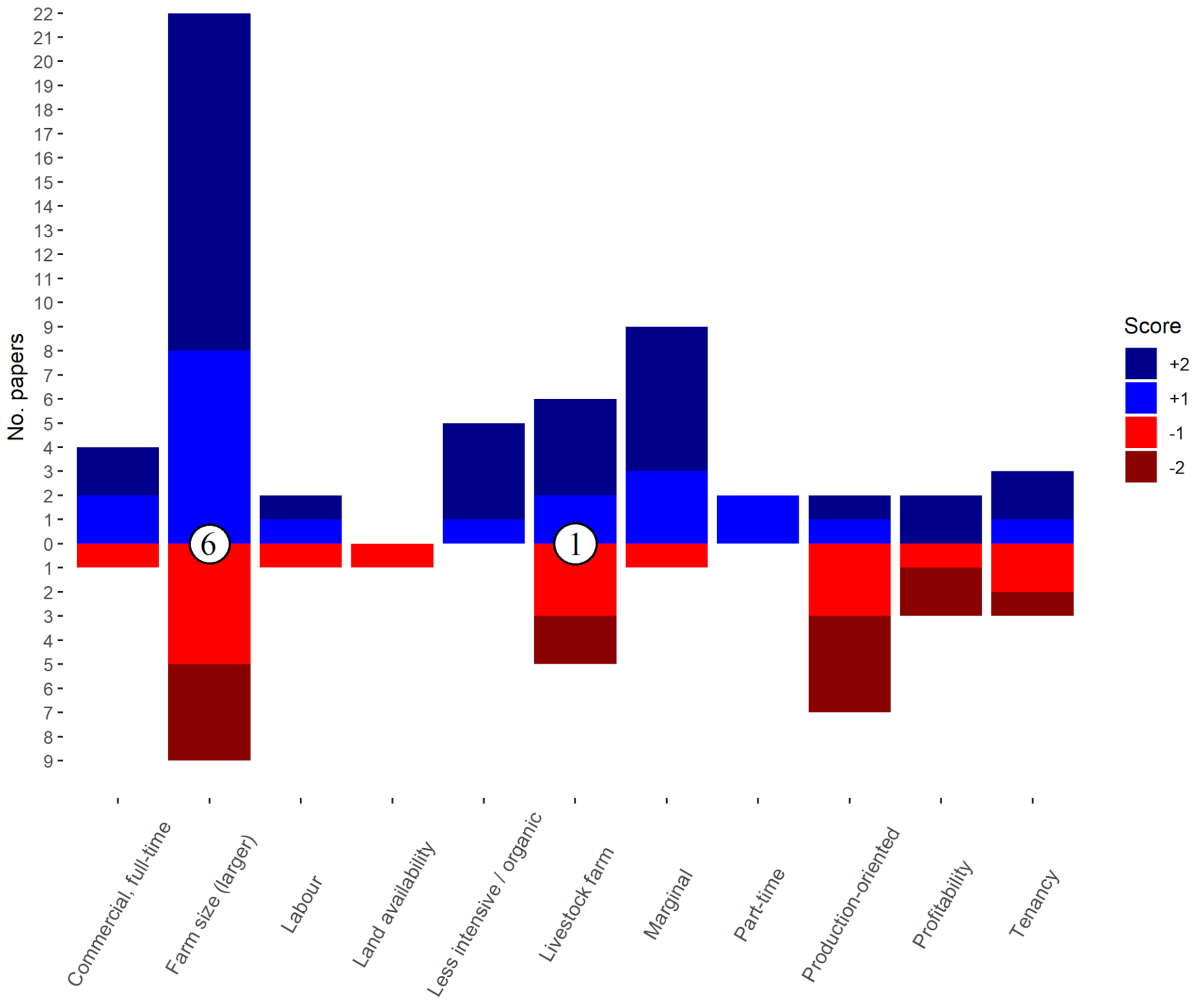

Figure B3.4: Strength and direction of the effect of structural factors on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar. 'Labour' refers to more labour-intensive farming operations; 'Marginal' to farms with marginal yields or profits, and 'Production-oriented' to farms structured towards high production levels (as opposed to farmers with productionist values, considered below).

The ways in which presence of livestock influenced participation in environmental schemes also varied (Figure B3.4). This could be due to variation in scheme applicability to livestock farming. Nevertheless, particular specialisations in dairy and livestock rearing and a strong commitment to livestock increases the likelihood for participation in environmental schemes in many cases (e.g. the Netherlands: Polman & Slangen, 2008; Borsotto et al., 2008). There are also a number of geographical differences in participation across the structural factors, although these are not surprising as schemes frequently target specific environmental features of farms and the landscape. However, the number of papers that evaluated specific environmental features was relatively low (Table A2.1 in Appendix 2).

B.3.3. Socio-demographic factors

There is conflicting evidence from across Europe as to how likely older farmers are to participate in schemes which likely indicates geographical variation. Even within countries, different studies found very different uptake rates among age groups: for instance, evidence from Greece and Germany suggests that older farmers may be both the most and the least likely group to participate, depending on context. Overall, there is no clear weight of evidence in either direction (and no clear differences in results produced by different methods), suggesting that age may play a more case-specific role than has been previously recognised and that targeted methods to increase uptake among farmers of different ages have substantial potential in some contexts.

Relatively few studies have looked into differences between male and female farmers (n= 2). To the extent that evidence exists (one study from Spain and Sweden each), it suggests that female farmers are less likely to adopt new schemes, but further work is clearly needed to test this and to identify how any such imbalance (if it exists) could be tackled. It may also reflect the fact that there are substantially fewer female farmers.

In contrast, there is strong evidence that higher levels of education, knowledge, training and social connectedness all increase uptake, suggesting that methods to reach farmers with lower levels of these should be developed. A key factor influencing participation is farmers' awareness and prior experience of environmental schemes (with the only study that finds a negative effect of this being based on econometric modelling: Espinosa-Goded et al., 2013). Clustering in these factors is evident for some countries (and in studies conducted by the same researchers), as with the apparent importance of professional and technical training to farmers in Spain (three papers, Calatrava Leyva, Martinez & Roa, 2007 and Villanueva et al., 2015a & b). Furthermore, the role of education and knowledge has been tested almost entirely in western European countries, namely Germany, Spain, Scotland, Ireland, Italy and Greece.

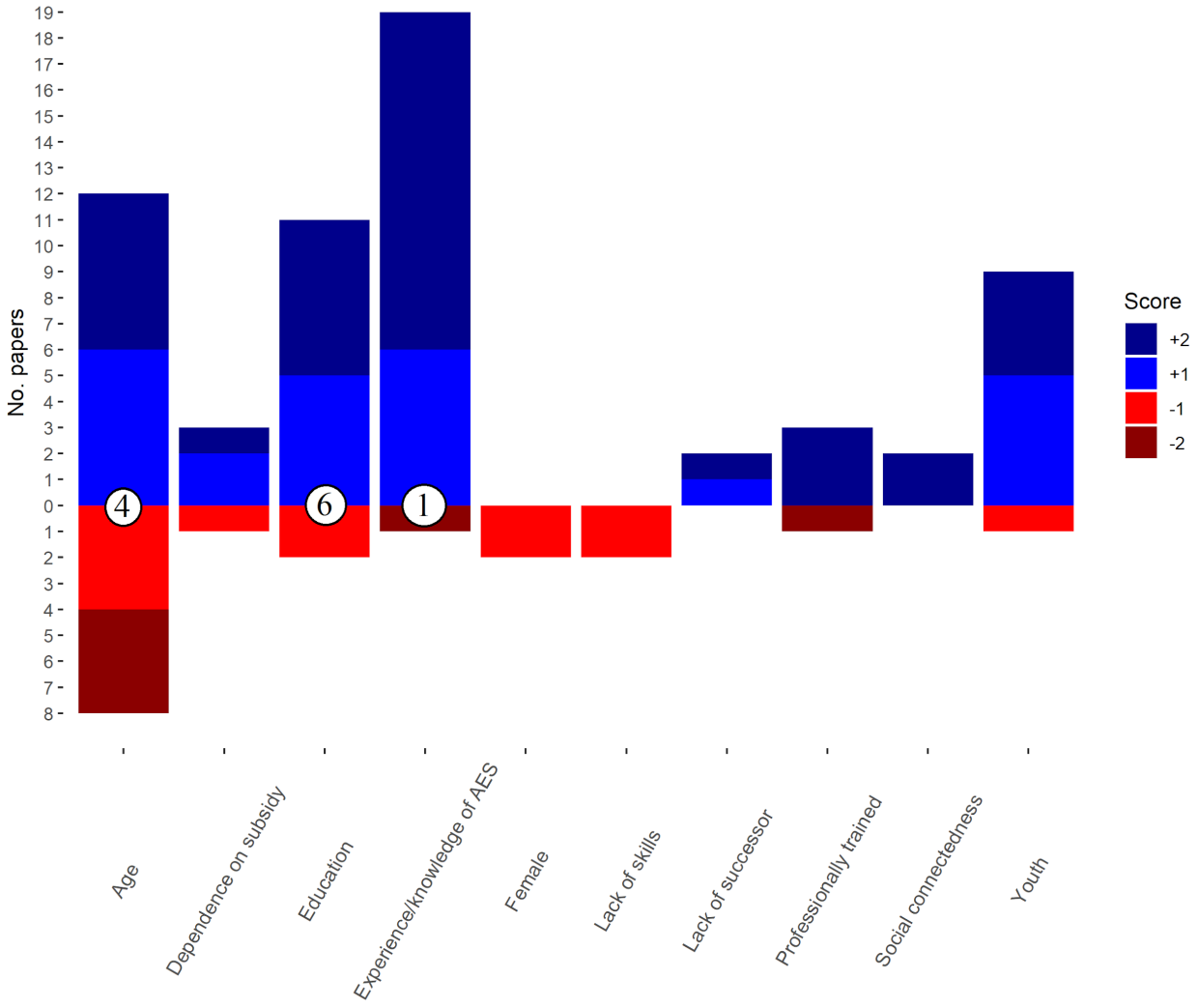

Figure B3.5: Strength and direction of the effect of socio-demographic factors on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar.

In some cases, socio-demographic factors were the subject of strong findings at European scale (Table A2.2 in Appendix 2). Notably, this was not the case with (increasing) farmer age, with studies producing contrasting results even at this scale, suggesting hidden context-dependencies in the results. Nevertheless, youth, increasing education and the lack of a successor were all found to have consistently positive effects on participation where EU-wide evidence was combined.

B.3.4. Attitudinal factors, interests and values

A number of factors relating to attitudes, interests and values were found to be important. Attitudes to subsidies were reported as affecting uptake across European countries. This may, however, be partly the result of other underlying factors. For example, levels of trust in government have been shown to also play a substantial role: determining to a large extent whether farmers are willing to enter contracts with government agencies. Interestingly there are no obvious geographic patterns for this evidence, with positive attitudes reported as increasing uptake for Europe as a whole (van Zanten et al., 2014), and negative attitudes reported as decreasing uptake in Hungary, Greece, Germany and Spain (Andalusia).

Another widespread finding relates to productionist to agriculture, which are found to consistently limit participation in schemes. Conversely, farmers with a greater sense of environmental or cross-generational responsibility are far more likely to participate. Given the fundamental nature of these attitudes, policies are likely to be more successful in accounting for them (e.g. by aligning environmental production with traditional practices) than in attempting to alter them. This is also true of risk aversion, which has been found to decrease uptake. Finding methods to make schemes (appear) less risky to farmers is therefore an obvious way in which uptake could be increased. However, some attitudes may be more amenable to change. This includes attitudes to collective participation schemes, which have been found to have greater environmental benefit (Kuhfuss et al., 2016; Franks & Mc Gloin, 2007). In this case, positive incentives and experiences may be able to affect the underlying attitude and therefore the final rate of uptake.

Figures B3.6 to B3.9 show factors broken down into farmer sociality, attitudes on behalf of farmers towards the environment, orientation of farmers towards their farms (traditionalist, productivist, modernist mindsets), and action as a result of/through identity.

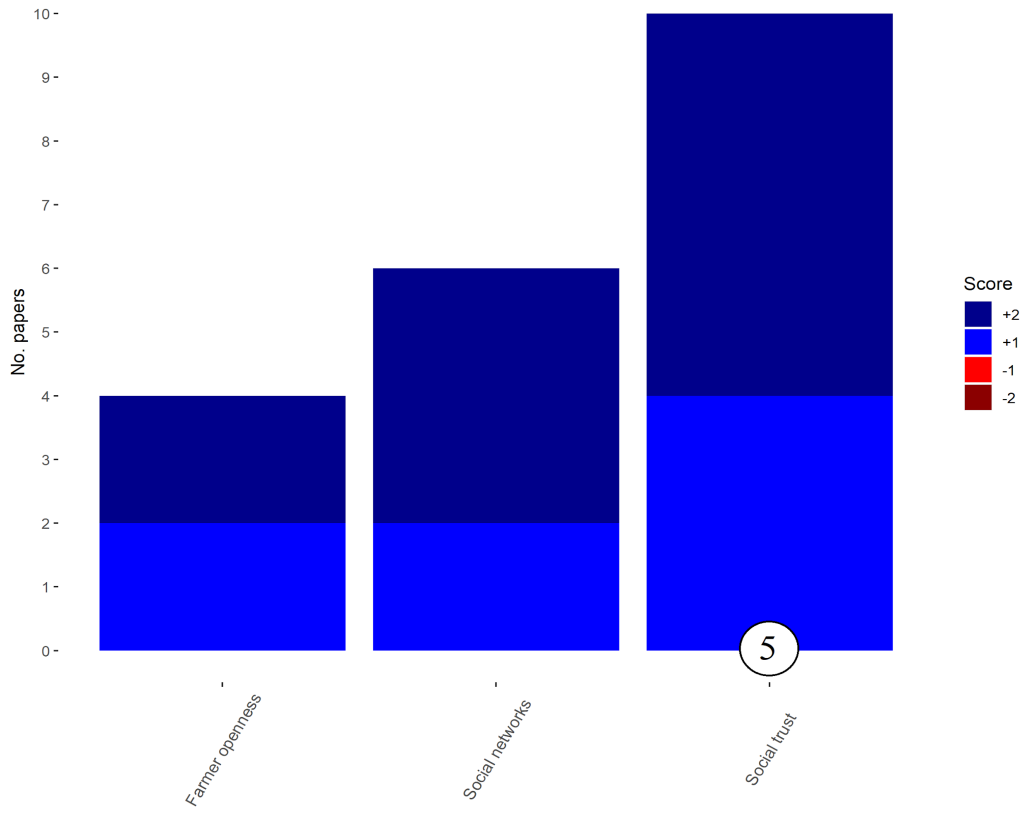

Figure B3.6: Strength and direction of the effect of farmer sociality factors on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar.

There was substantial variation in the importance of social connections, neighbourly 'nudges' and group norms for determining farmer participation in environmental schemes (Figure B3.6). The studies that found these to be unimportant or relatively insignificant factors originated mainly from the UK (Inman et al., 2018; Schroeder et al., 2015) but also from the Netherlands, Germany and Hungary, while in many other countries social connections and 'cultural capital' did affect farmer decision-making and encouraged participation in Green measures (including in the UK, McCracken et al., 2015). A slightly different

perspective is provided by the three studies that tried to capture farmer 'openness' to new measures or experimentation (from Germany, Greece and Spain), which found that such openness had strong positive effects on participation. Although not currently proven, these differences may relate to the dominant culture among farmers, with social connectedness perhaps reinforcing productivist attitudes in some places but overcoming risk aversion in others.

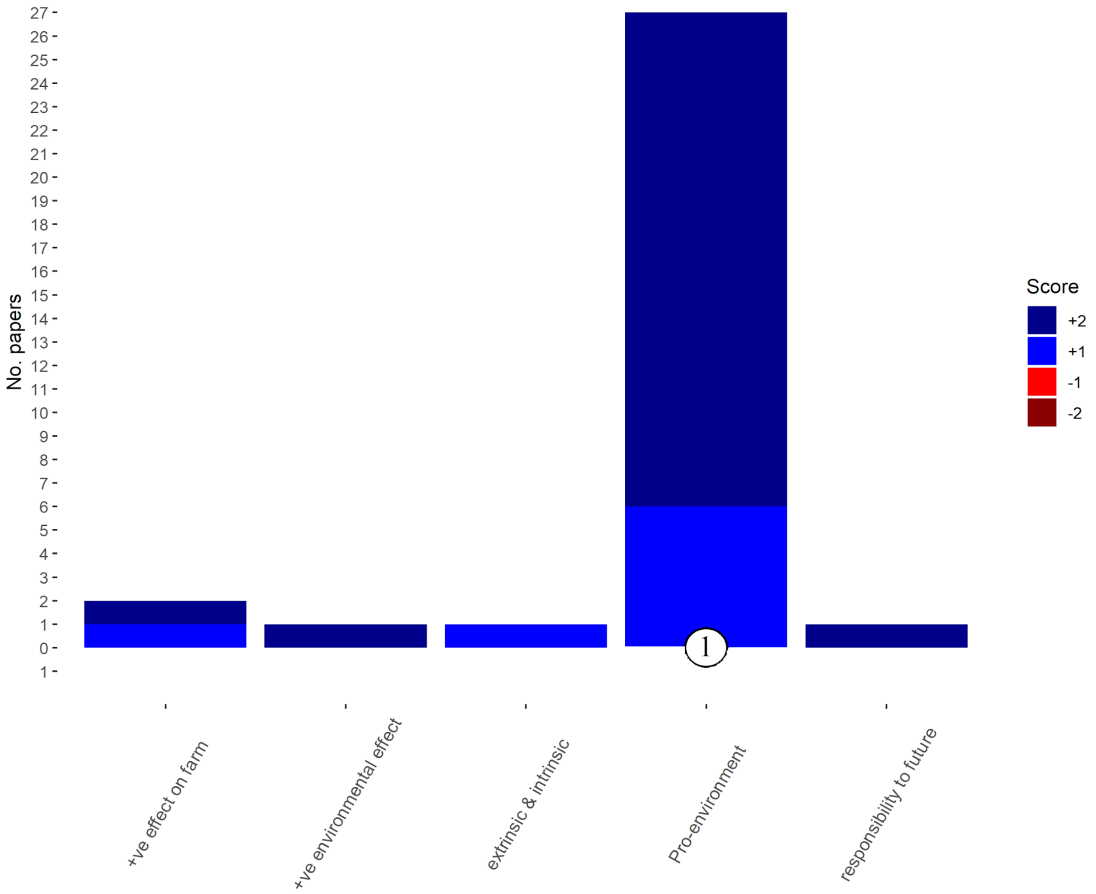

Figure B3.7: Strength and direction of the effect of farmers' environmental attitudes on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar. The first two factors indicate farmers' beliefs about the effects of measures.

One of the clearest findings of the review is that positive attitudes to the environment relate to increased rates of participation in environmental schemes across Europe. This suggests that predisposition (subjective norm) towards 'green' measures may result in substantial levels of uptake even where other factors are unfavourable. However, very few studies explored wider attitudes to conservation, farms' role in landscapes and local histories or the ways in which environmental values rise to prominence and are maintained. This is reflected in the fact that research on this theme has taken place overwhelmingly in Western Europe, where there has been a longer history and tradition of landscape and private conservation. If environmental values can be firmly enough held to influence decision-making (i.e.to bridge the values/action gap), then better understanding of the ways in which such attitudes are formed and develop is crucial for grounded support to achieve "green" policy objectives.

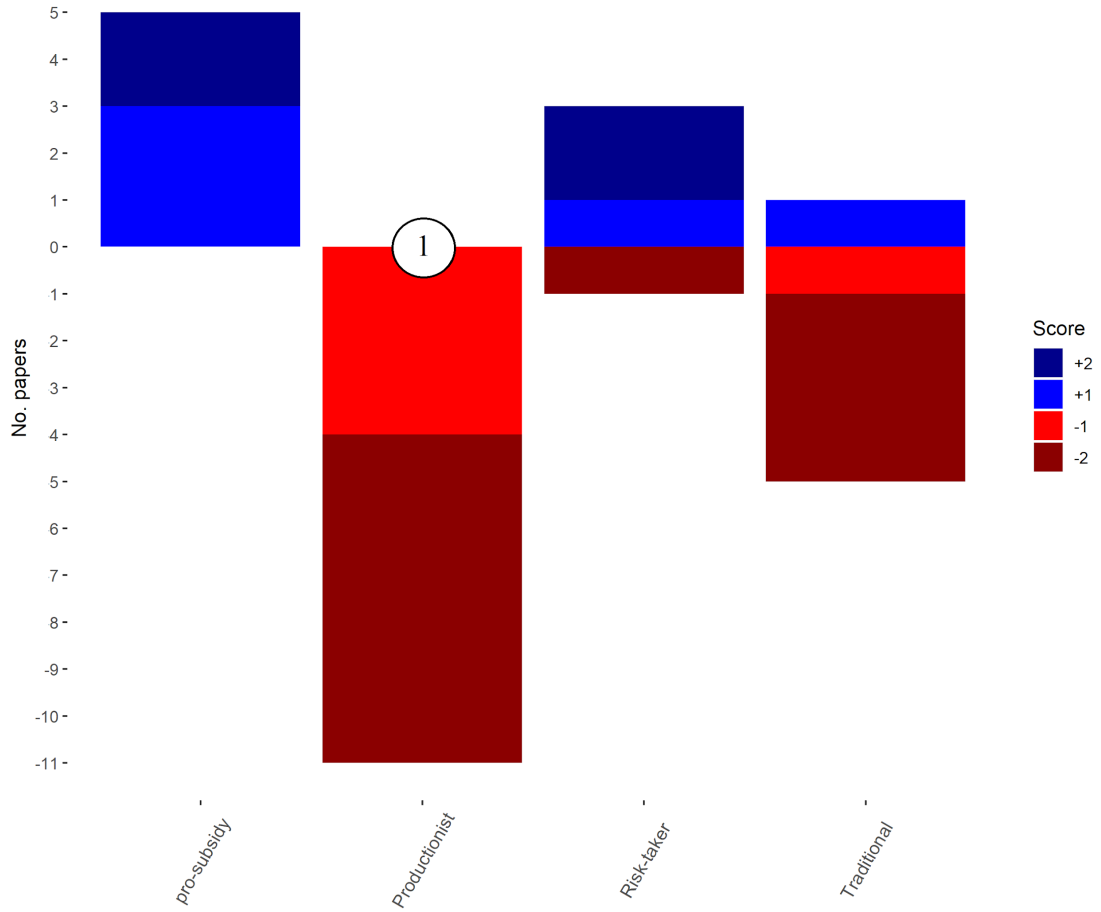

Figure B.3.8: Strength and direction of the effect of farmers' orientation towards agriculture on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar.

Research that investigated farmer attitudes and expectations from their enterprises found that those who expressed productionist preferences (or indeed had the capacity to bring in high yields) were less inclined to participate in green measures. There is strong pan-European research, literature review and analysis evidence to support this finding (see reviews by Pe'er et al., 2016 and van Vliet et al., 2015). However, 'traditional' attitudes are not always productionist in nature, having a slightly more balanced effect on participation. Willingness to take risk and positive attitudes to subsidies usually had positive relationships with participation.

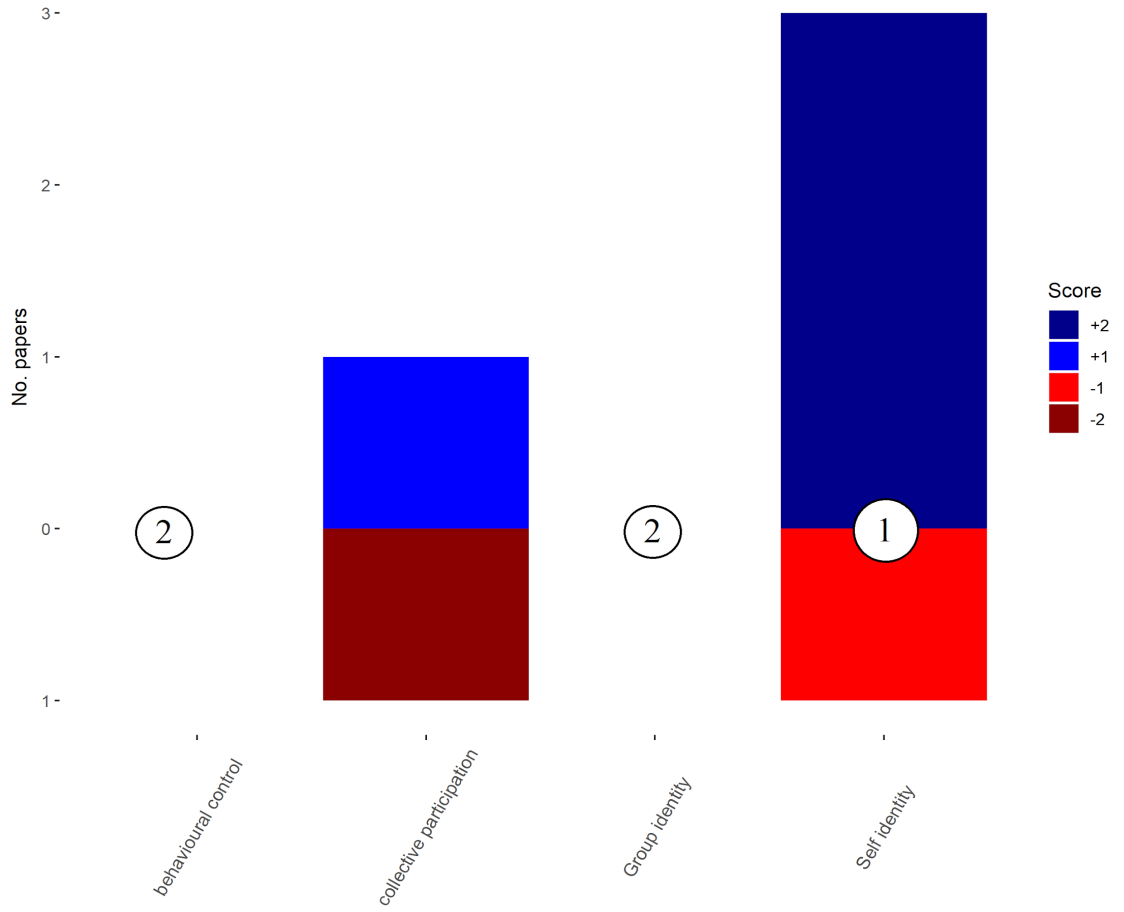

Figure B.3.9: Strength and direction of the effect of 'identity through action' factors on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar. 'Self-identity' refers to agricultural management being an important part of farmers' perceived identity.

The most notable aspect of studies into farmers' action-related identities (i.e. how farming activities interact with farmers' perceptions of themselves) is their inconclusiveness. Few studies have addressed these issues (we found a total of 10), and these have either produced neutral or contradictory findings. Furthermore, these studies are almost entirely focused on northern Europe, with just one exception (from Greece). The variation in results therefore most clearly suggests a need for further research, and potentially also that these effects are weak and/or context dependent. It is also plausible that divergent findings simply reflect the diversity of human experiences and attitudes that inevitably inform farmer decision-making.

B.3.5. Policy design

A number of the above attitudinal factors can be accounted for in policy design. For example, lack of trust in government may be mitigated by the use of independent or scientific justifications for policies, which have been found to improve uptake, while transparent expectations expressed as well-defined, meaningful indicators can overcome hostility to monitoring. This also has the advantage of reducing administrative burdens on farmers, and so increases likelihood of uptake even further. Also of considerable and general importance are the availability of trusted advice, and a lack of administrative burdens and complexity (Figure B3.10)

Other policy design issues are more problematic. Farmers prefer voluntary participation or short-term, unrestrictive contracts (albeit with long-term security) over the more detailed and binding requirements that may guarantee desired environmental outcomes. In this case, it appears from the literature that clear explanation of the scheme design, along with a well-justified and light-touch monitoring approach may allow more demanding schemes to be implemented successfully.

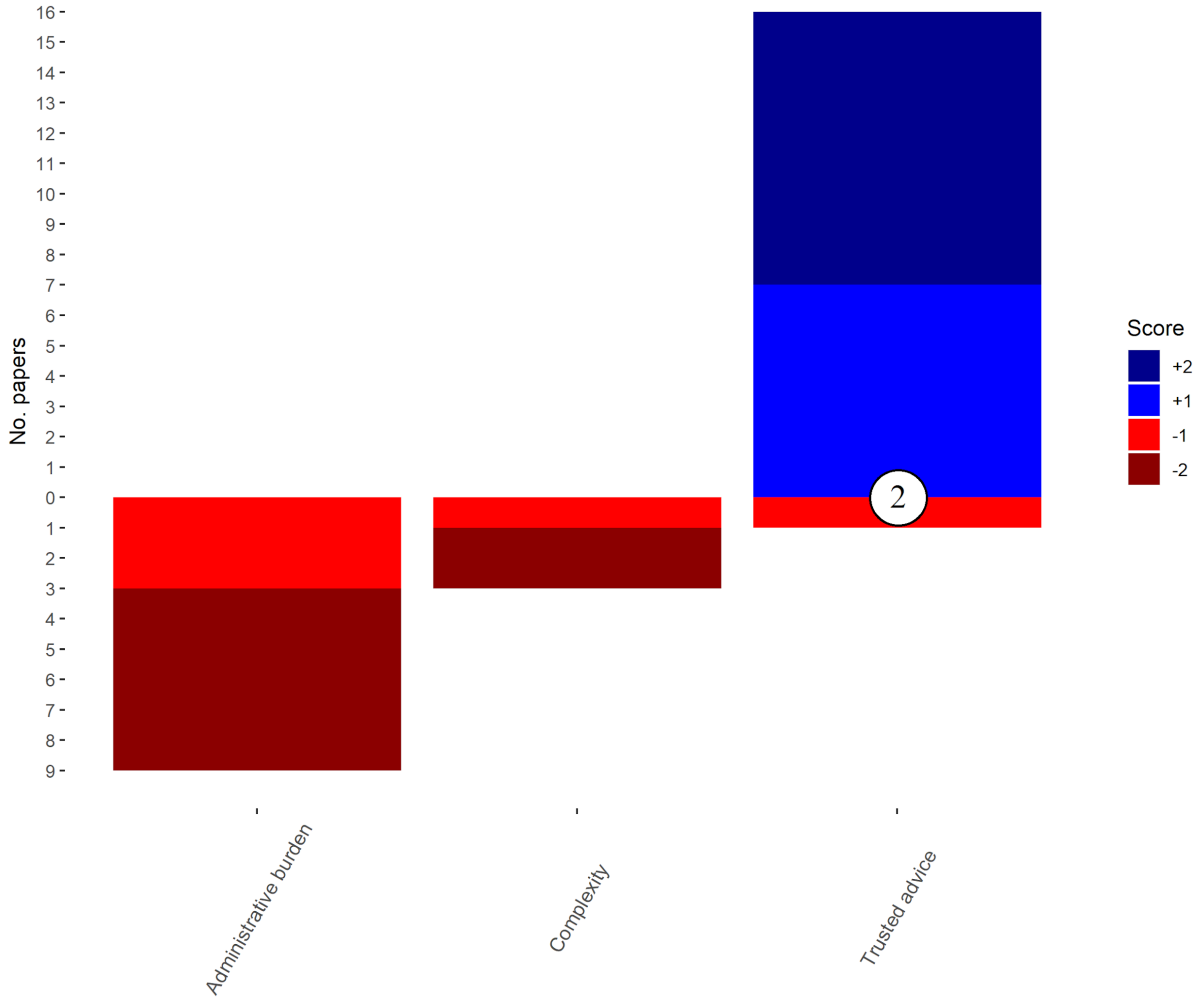

Figure B3.10: Strength and direction of the effect of general policy design factors on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar. 'Trusted advice' refers specifically to advice coming from trusted sources, as opposed to general availability of advice (below).

At the contract level, a number of other tentative findings have been made. Most clearly, positive effects on uptake consistently arise from contract flexibility, cancellability or voluntary participation, as well as the involvement of farmers in contract design. These imply negative effects of prescriptive schemes, unless ameliorated by other factors. Strong negative effects have been found to arise from long contract lengths, strict rules, and rules that are incompatible with local agricultural conditions or practices (Figure B3.11). Once again, however, the strongest evidence for these findings comes from western Europe, and divergent results relating to inter-farmer relationships and farmer-state relationships from other areas of Europe suggest scope for differentiation in these factors too.

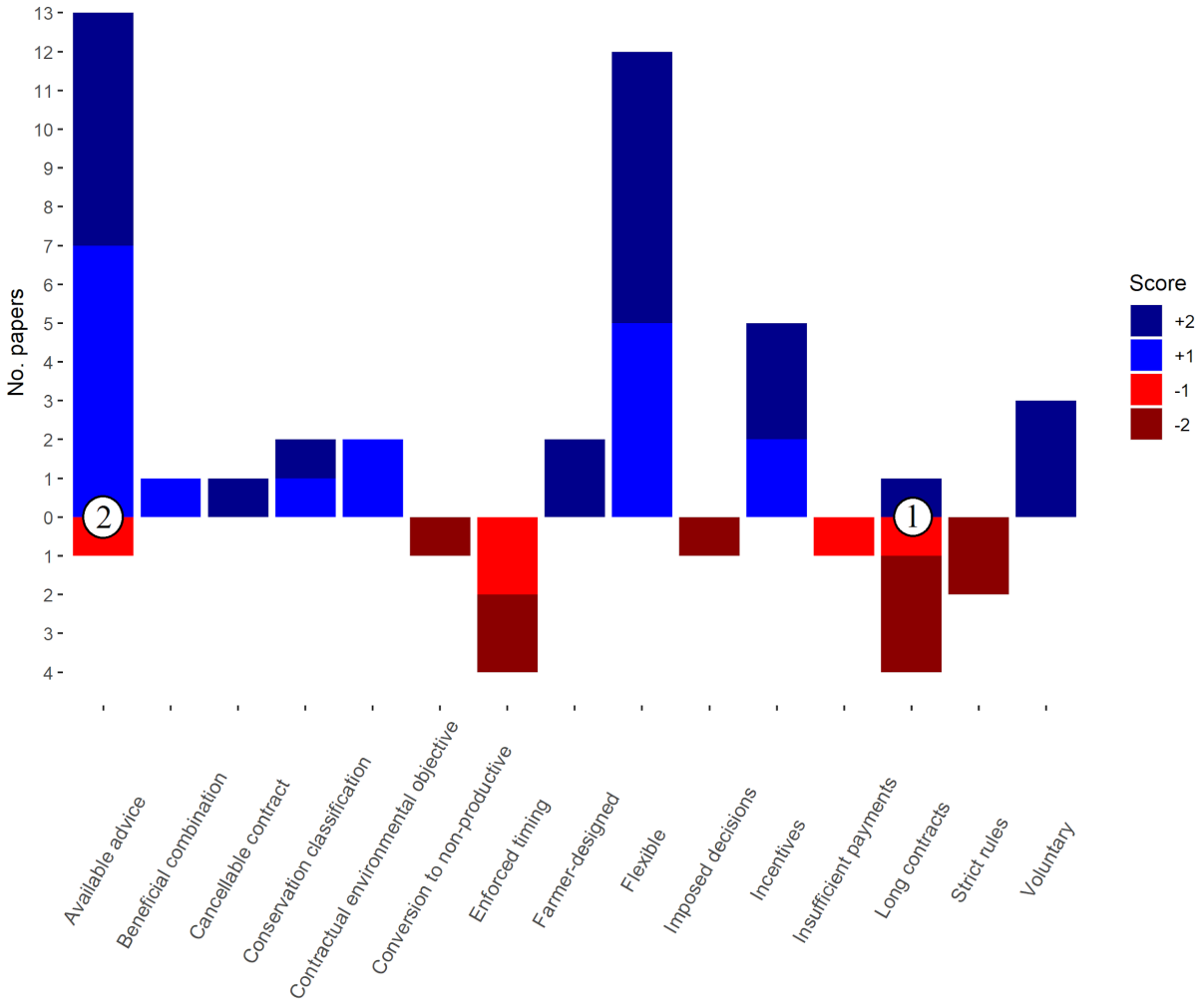

Figure B3.11: Strength and direction of the effect of specific policy design factors on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar.

B.3.6. Ecological factors

As above, positive attitudes towards the environment are found to positively influence uptake in general. Beyond this, perceived environmental degradation or need for protection increased uptake, as did perceived environmental benefits, in western Europe at least. These findings suggest that policies may be more successful where they clearly articulate an environmental problem that they target, objectives that they hope to achieve, and concrete aspects of environmental protection or improvement that are relatable for most farmers (e.g. increasing numbers of particular species rather than more generally increasing biodiversity). Together with clear preferences for transparent, trusted information and measurable policy effectiveness, these suggest that results-based payments could be successful in increasing uptake in some circumstances. In any case, the societal context and level of environmental awareness beyond the farming community may have an additional effect that it not noted in the literature we reviewed.

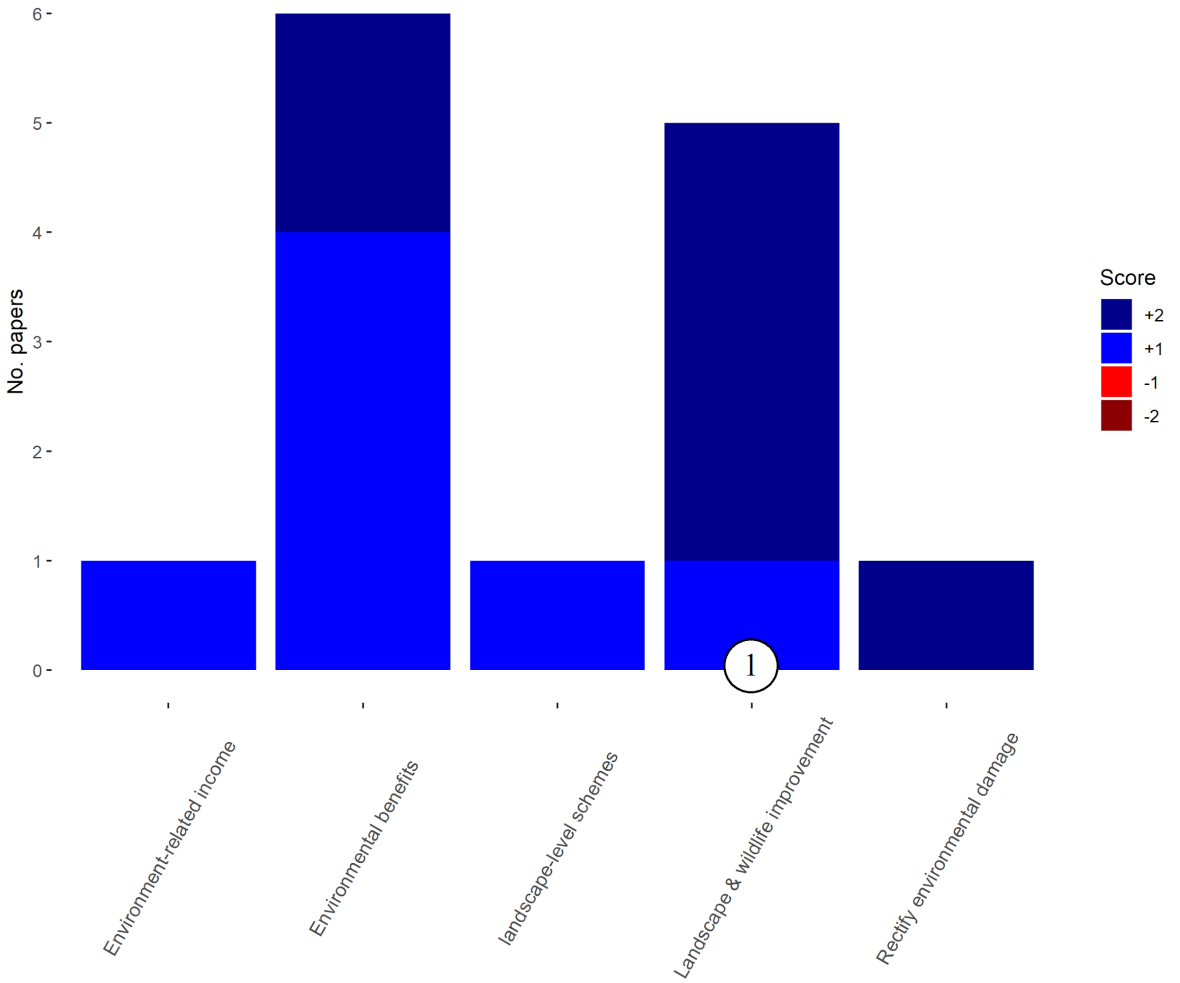

Figure B3.12: Strength and direction of the effect of environmental features on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar.

B.3.7. Political factors

Relationships between farmers and their governments (in many forms: local, regional, national, as well as perceptions of the objectives of the EU and its legitimacy) was found to be an important factor in farmers' attitudes to greening measures, even though relatively few studies evaluated this. The one literature review available on the role of trust in government (van Zanten et al., 2014), found that through Europe the presence of trust was a positive factor in the decision-making of farmers to participate in schemes, while unsurprisingly, distrust negatively influenced willingness to take part in studies originating from Hungary, Greece, Germany and Andalusia.

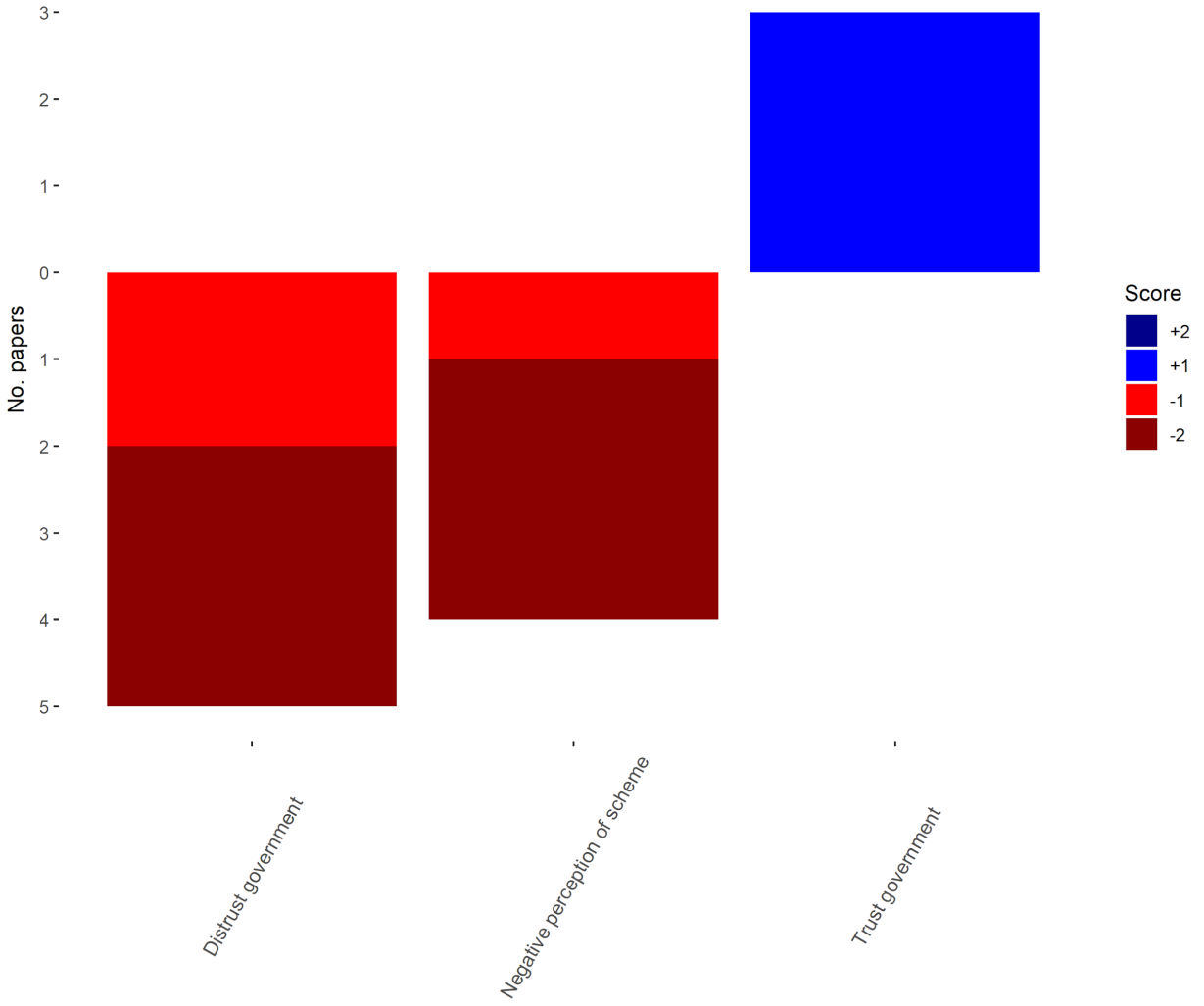

Figure B3.13: Strength and direction of the effect of political factors on uptake, by paper numbers. The number of papers (if any) that found that each particular factor had no effect is shown in circles at the base of each bar.

B.3.8. Methodological considerations

It is important to note that we found several methodological shortcomings in the research reviewed here, meaning that many of our findings can only be tentative. In particular, there exist geographical gaps and biases in the literature, with a clear dominance of studies from Western European countries that limits generalisability of the findings (see Fig B3.1). Even allowing for this, we found substantial variation in how factors were reported to affect uptake of measures. Farmer age, for instance, had different relationships with uptake of measures in different contexts. In some cases, such differences appeared to correlate with geography, for example with an apparent lack of trust in inter-personal and personal-state relationships affecting uptake in Eastern European countries. This is a challenge for EU-wide policy design, and an inherent difficulty with hierarchically imposed (top-down) or inflexible regulatory instruments. Contextual factors' impacts on farmers' willingness to participate in biodiversity measures should be an obvious future research focus.

Application of a broader suite of methods would also be beneficial to better understanding farmers' experiences of the CAP and the national agencies that oversee it. These insights require greater depth of engagement at farm level, using qualitative data collection techniques that may yield small sample sizes and thus datasets that are less generalisable. However, considerable insight could be gained from more widespread adoption of such methods, complementing the more established findings of quantitatively-oriented research into financial, structural or socio-demographic attributes affecting farmer uptake. Furthermore, many of the papers we reviewed did not distinguish between effects that were expected and effects that emerged from their analyses, meaning that there is substantial risk of findings having been inadvertently pre-defined. Similarly, we did not distinguish between studies of past, intended, hypothetical or reported behaviour, which may affect the veracity or generality of some findings, and we did not attempt to investigate or correct for publication bias.

A final set of issues relate to the studies factors themselves. There are inextricable relationships between many of the farm-level factors explored in the literature, hampering accurate evaluation of their separate effects. For instance, the question of farm profitability is both a financial and a value-based factor (i.e. whether profitability is the primary consideration to farm owners), with subsequent structural consequences for how farmers pursue their land management. These interlinkages mean that many studies could not or did not tease apart the roles of farm characteristics and farmers' values or motivations in determining uptake of particular measures. As a result, many studies summarise characteristics of participating farms without providing insight into how such descriptors account for action (the typical 'value/action gap' or "not walking the talk" (Blake, 1999; Kennedy et al., 2009).

In consequence, we strongly recommend that future studies on farmers' behaviour and decision-making adopt a wider range of methods across more diverse geographical areas, explicitly identify factors of interest as well as factors subsequently found to be important, and target a deeper, qualitative understanding of the ways in which farmers respond to these factors.

B.4. Interviews with farmer representatives from across the EU

Following the review described above, a series of interviews were undertaken with farmer representatives from across some Member States represented by the EWG (Greece, Hungary, Spain, Sweden, Finland, Germany) in order to explore and build on the insights gained during the review. In this section, we summarise our results from these completed surveys and open-ended interview questions. Interviewees were asked to assess the extent to which monetary factors, farmer and farm characteristics, administrative workload, and effectiveness factors affect the adoption of biodiversity conservation measures. The importance of a range of factors, from assessment of profitability, payment rates, implementation costs, and a range of farm and farmer characteristics, were ranked. These focuses were specifically designed in some cases as identified 'gaps' in the literature review undertaken at Step B2, in particular to probe variation in responses between participating Member States. The numbers of surveys carried out can be found in Table A2.1 (Appendix 1).

The results below need to be interpreted with caution due to the low number of the interviews conducted. It was not possible to perform a stratified random sampling method within countries due to time and resource constraints. Instead, targeted sampling was undertaken with farmer representatives who work in farm extension services, or unions, or have farmed at a large scale for a number of years. In many cases, farmers and agrarian sector representatives spoke for a specific geographical area within the country. In consequence, our results are somewhat descriptive and point to interesting patterns at the level of individual uptake and between Member States, but require further investigation for more robust interpretation.

B.4.1. Monetary Factors

The first section of our survey asked interviewees the extent to which they consider different monetary factors to be a barrier or an incentive for the implementation of buffer strips, landscape elements and fallow land. Factors included monetary compensation, the implementation costs, the potential income losses and the production risks (see Figure B4.1).

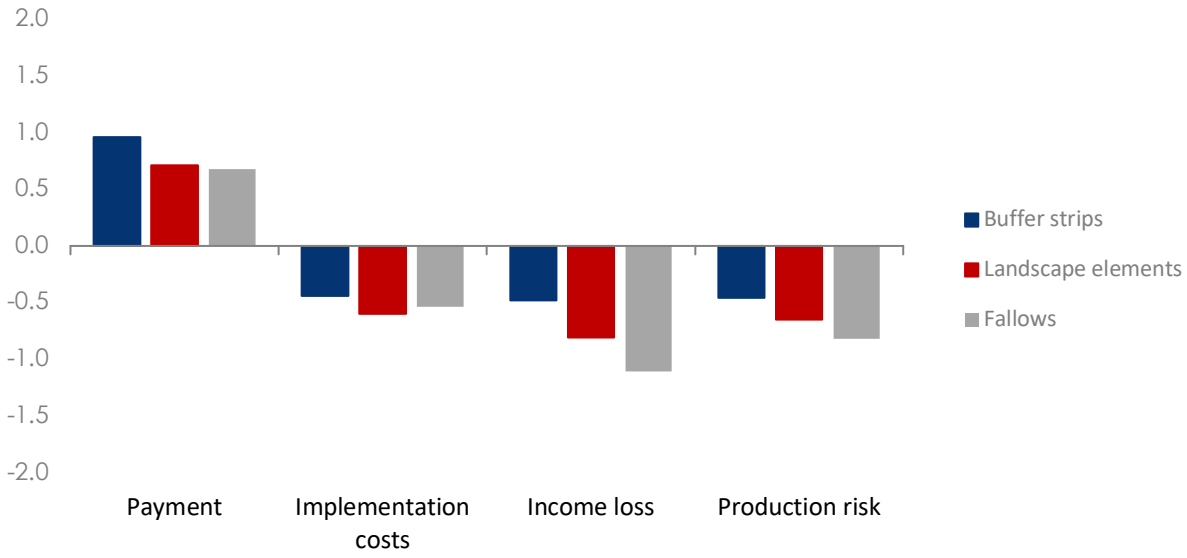

Figure B4.1: Average assessments of monetary factors. Please note for all graphs in this section: Possible scores range from -2 (strong barrier) to +2 (strong incentive). Given the different sizes of country subsamples, data were first averaged by country and then averaged for the whole sample. Commentaries on a per country basis are based on averages, and are available upon request.

As expected, the level of monetary compensation (see "payment" variable) for implementing measures constitutes an incentive for farmer uptake, while implementation costs, income loss and production risks associated with the measure represent barriers. Economic incentives are key to farmers, arising from their need to remain in business. This was clear in the responses of Hungarian and Spanish interviewees and their claims about the need for policy-makers to understand that farmers are mainly business people who need to think about the monetary returns of their activities.

Also, there were only slight differences across the buffer strip, landscape element and fallow measures. One would expect monetary factors to hold less saliency for the fallow measure given its well-known positive effects on soil productivity; however, we did not find a clear trend in this direction. This is likely due to the different sensitivities to having fallow land across contexts. As pointed out by Spanish interviewees, in areas where crop productivity is low, fallow is already a common practice, and this is not the case in highly productive and intensively cultivated areas.

In terms of differences across countries, Swedish interviewees stand out for showing no concerns about payments (for all measures), income loss (buffer strips) or production risks (landscape elements); and Czech interviewees stand out for implementation costs not acting as a barrier to the adoption of any measure. Alternatively, Hungarian representatives manifested the strongest concern about the need to properly compensate farmers and minimize implementation losses and risks.

B.4.2. Farm characteristics

Interviewees were asked the extent to which they consider different farm characteristics to be a barrier or an incentive for the implementation of buffer strips, landscape elements and fallow land. Factors included the profitability and size of farms, tenure insecurity or whether the conservation measures fit current practices (see Figure B4.2).

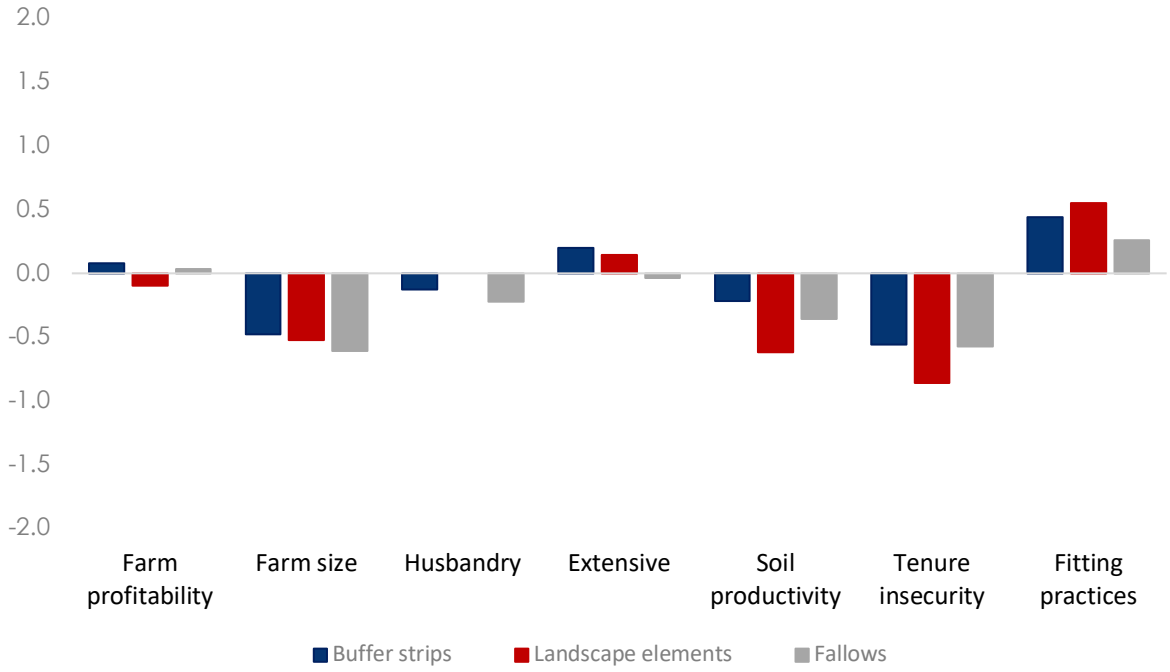

Figure B4.2: Average assessments of farm characteristics. 'Fitting practices' refers to management practices already consistent with the measures being considered. Possible scores range from -2 (strong barrier) to +2 (strong incentive).

Large farm size, soil productivity, farm profitability and tenure insecurity showed the clearest negative trends, acting as barriers to the adoption of biodiversity measures. On the other hand, husbandry and extensive agricultural practices were positive incentives to adoption. The results on perceived trade-offs between the measures and soil productivity is probably the most interesting given the well-known positive effects of fallow land on productivity and of buffer strips on soil erosion control. The results about tenure insecurity are also telling, given the high amount of land across Europe that is cultivated under rent or share-cropping arrangements. The findings about farm size have to be taken with caution as they may reflect the influence of other factors such as the business model (i.e., large industrial farms vs. family farms).

Again, we did not find strong differences across the measures. The landscape elements measure was considered difficult when compared with the other two measures (see soil productivity and tenure insecurity).

Finally, interesting differences across countries include the rather positive evaluation by Czech interviewees about (large) farm size. This is congruent with the caveat mentioned earlier, i.e., about the high correlation and thus potential confounding effects between certain factors, such as farm size and their associated business model (professionalization of agriculture tends to result in farm enlargement). Finland representatives also stand out for their positive stance on soil productivity (fallow and buffer strips); and Sweden for its rather neutral views on tenure insecurity (for all measures). In Finland, most attention under the national AES has been on water protection (erosion, buffers) and soil fertility (including fallow). Finally, Hungarian representatives see “fitting practices” as a barrier to fallow land uptake. As explained by interviewees from this country, measures require farmers to carry out practices that they already implement (for example, fallow land). To farmers, this demonstrates a lack of knowledge of local realities by policy- makers, as well as producing a lack of additionality.

B.4.3. Farmer characteristics

Interviewees were surveyed about the extent to which they consider different farmer characteristics to be a barrier or an incentive for the implementation of buffer strips, landscape elements and fallow land. Factors included their age and dedication to agriculture, their knowledge of biodiversity benefits or trust in government (see Figure B4.3).

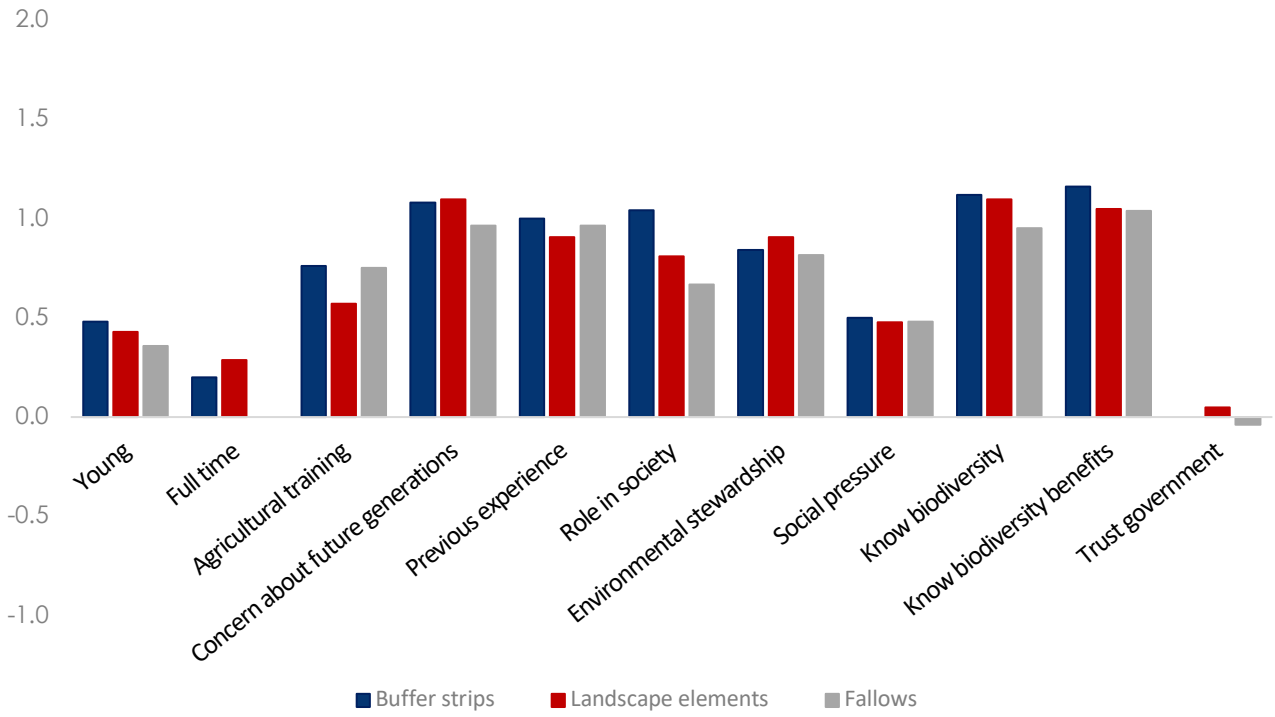

Figure B4.3: Average assessment of farmer characteristics across the three evaluated biodiversity measures. Possible scores range from -2 (strong barrier) to +2 (strong incentive).

Almost all farmer characteristics constituted an incentive for interviewees. Concern about future generations, previous experience with conservation, environmental stewardship, and knowledge about biodiversity value and benefits were the most positively and/or most consistently (i.e. across measures) valued features. Trust in government seems to have a negligible effect on the adoption of biodiversity measures. Further research is required to better understand the effects of standing relations between farmers and state institutions on participation and environmental attitudes in some countries of the EU.

B.4.4. Administrative factors

Finally, interviewees were asked about administrative factors (see Figure B4.4).

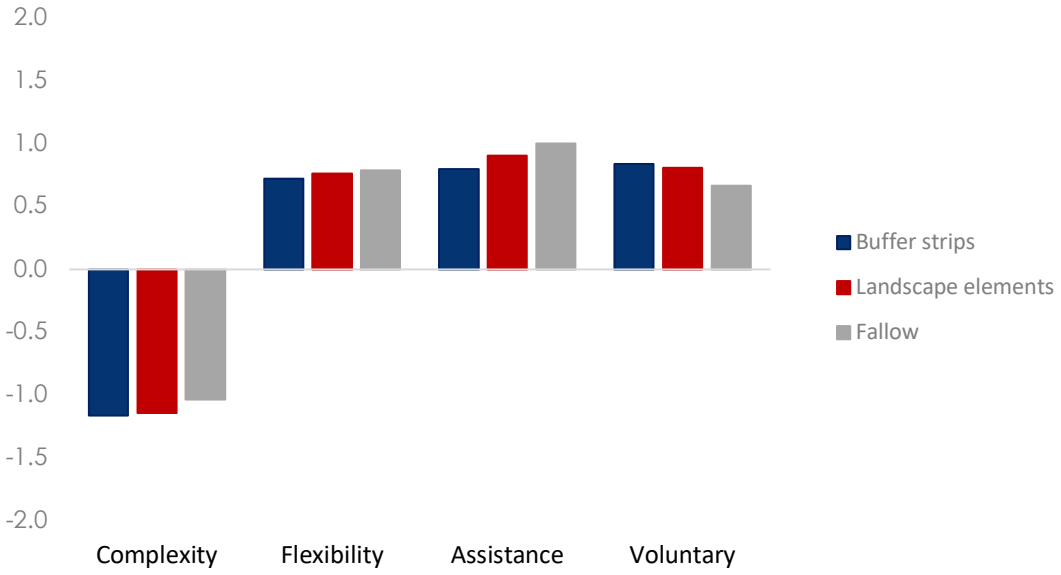

Figure B4.4: Average assessment of administrative characteristics. Possible scores range from -2 (strong barrier) to +2 (strong incentive).

As expected, flexibility, assistance with measure requirements, and the voluntary nature of measures were evaluated as incentives for the adoption of biodiversity measures. On the other hand, complexity was evaluated as a barrier.

There are no clear differences across the three measures. The only minor difference is for the adoption of fallows, where its voluntary character was regarded as less relevant compared with the other two measures.

B.4.5. Statements about positive and negative impact

In a second round of questions farmers were asked about whether they agree/disagree with a series of statements about the positive or negative impact of certain factors on farmer uptake of biodiversity measures.

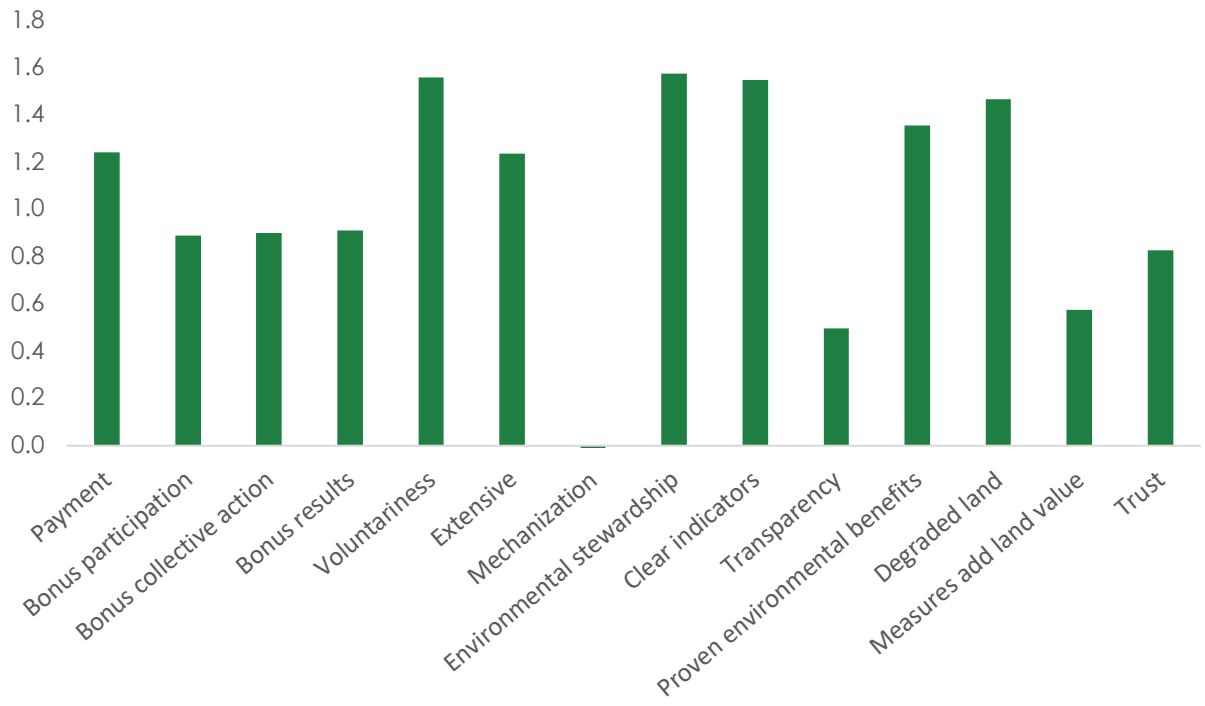

Figure B4.5: Average agreement with statements about factors that contribute to uptake. **Note**: the original scores went from 1 to 5, where 1=strongly disagree and 5=strongly agree. The scores were rescaled to facilitate reading (scores below 0 depict disagreement).

Regarding positive impact factors, interviewees mainly agreed with the importance of well-defined, meaningful indicators and low administrative burdens to facilitate the uptake of biodiversity measures. This aligns with the opinion that farmers prefer biodiversity measures that are easier or cheaper to implement in their farms. The respondents also agreed that the uptake of the measures by farmers is motivated by a perceived risk of land degradation or actual degradation, as well as by measures that may potentially increase the value of land.

The aspect with which most respondents agreed the least relates to farm mechanization. This clearly differed across countries. Participants from Germany, Czechia and Spain mostly did not agree that farmers' technological or mechanization capacity positively influenced their participation in biodiversity measures. However, participants from Sweden, Greece and especially Finland thought the opposite. This finding deserves further investigation.

Importantly, the possibility that farmers receive a bonus payment if a sufficient proportion of farmers in an area engaged in the measures (so called agglomeration bonus) was not judged homogenously across countries: this idea was welcomed mainly in Germany and Finland, whereas in Sweden and Spain the respondents were neutral.

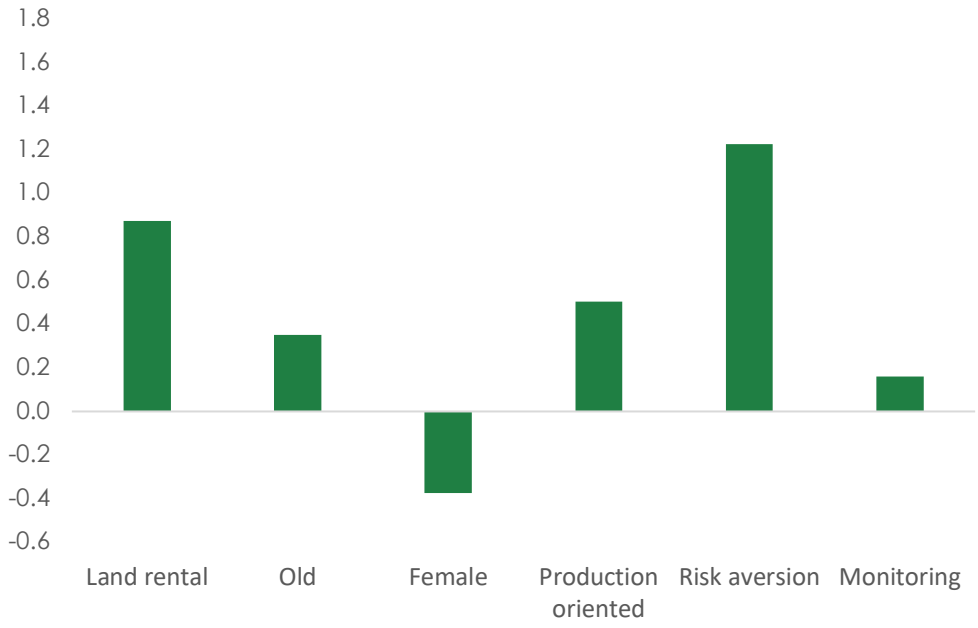

Figure B4.6: Average agreement with statements hindering biodiversity measure uptake.

Regarding negative impact factors, one of the strongest factors hindering the uptake of biodiversity measures was risk aversion (that is, with a wide interpretation of risk, whether to farm income or farm profitability). Most participants strongly agreed that this was a relevant factor in all countries except Greece. Farmer representatives also cited land rental as a hindrance to participation in biodiversity measures agreements. However, there were differences across countries. Greek respondents did not think the fact of renting land influenced biodiversity measures' uptake, whereas Spain, Germany and Czechia (in this order) strongly agreed with this idea. When asked whether gender influenced uptake, Finnish, German and Greek respondents did not think it a strong factor, while Spanish respondents strongly disagreed that gender influenced participation.

In all countries, the respondents mostly agreed that farmers who care only about production were far less likely to take up biodiversity measures. Finally, there was also a strong difference across the countries regarding the idea about clearer rules and monitoring structures around the scheme. All countries except Spain agreed that the monitoring of the outcomes had some negative impact on uptake, as farmers were generally wary about being monitored and evaluated from afar or by authorities.

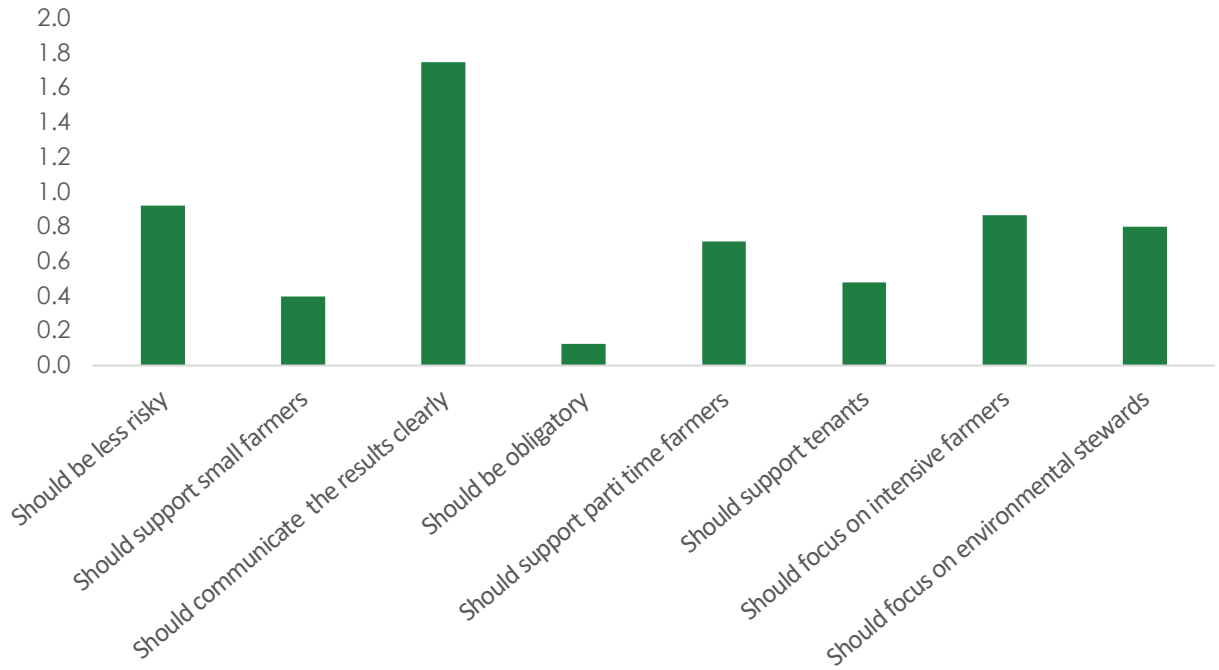

Figure B4.7: Average agreement with statements about conservation schemes.

Finally, participants were asked about aspects they believed should be emphasised in future policies.

Across all surveyed, there was a high degree of agreement on the need for clearer communication of the benefits of measures to increase their uptake. Proven environmental benefits of a measure would thus positively influence the uptake.

Although most ideas were on average positively scored, there were some differences between countries. For example, in most countries, and especially in Greece and Spain, respondents agreed that small-scale farmers should have some support to adopt biodiversity measures, except in Czechia, where they mostly disagreed. In Germany and Sweden, the respondents were neutral. This may reflect the fact that in the Mediterranean countries, a general aim exists to support small-scale family farms. On the voluntary vs. compulsory character of measures, most interviewees think they should be compulsory except Spain with a strong position against. Czechia and Germany were neutral in this regard.

There was a diversity of opinions in statements about whether there should be more support to part-time farmers and farms oriented towards maximising production. Czechia and Spain were the only countries against both ideas: they did not agree that such farms should receive extra support in order to encourage their uptake of biodiversity measures. The remaining countries, mainly Germany and to a lesser extent Greece responded that part-time farmers should have higher support.

STEP C: Discussion, conclusions & recommendations

Recent scientific research highlights the urgent need to protect Europe's remaining – and rapidly declining – biological diversity. Dramatic losses of populations and species have recently caught public and political attention, and suggest that reversing the downward trend will be a major international challenge (EEA, 2015; 2017; Hallmann et al., 2017; IPBES, 2018; Pe'er et al., 2014; van Swaay et al., 2015). Indeed, an overwhelming weight of evidence now shows that Europe's socio-ecological systems will be unable to deliver many of their current services (or Nature's Contributions to People) without substantial, concerted efforts to change land management practices (Holman et al., 2017; IPBES, 2018; Mouchet et al., 2017).

In this context, the CAP may prove an inadequate tool, subject to too many competing pressures and objectives. The tension between ensuring supplies of food and fibre and maintaining biodiversity may prove too great for the policy as currently structured. Nevertheless, the CAP does represent a crucial opportunity for the European Union to effectively intervene and deliver general societal benefits. In this section, we consider our main findings relating to the design and uptake of biodiversity-supporting measures in the CAP, and opportunities for their future improvement. We do not limit this discussion to the current development of the 2021-2027 CAP, but build on all of the evidence and knowledge available to us to derive generally-relevant conclusions, independently of the political considerations that will ultimately determine implementation.

C.1. Summary and discussion of key findings

Our synthesis of recent reviews was intended to answer the question "Which of the measures available to farmers through the CAP are most beneficial for biodiversity?". Despite limitations in the geographical specificity of the literature, our synthesis confirmed that the agricultural management measures with greatest benefits for biodiversity across Europe appear to be:

- land lying fallow
- agroforestry
- landscape elements
- buffer strips
- wildflower strips.

Conversely, the overall balance of evidence indicates that the production-oriented EFA options of catch and cover crops and nitrogen-fixing crops provide few benefits for farmland biodiversity, if grown under the conventional intensive management typical for such crops (i.e., with fertiliser and pesticide use, and relatively short cropping/cutting periods). Even these few benefits apply only to a limited number of species (although there is little evidence about effects on below-ground biodiversity).

The availability of production-based EFA measures within the CAP, without specific management conditions to enhance biodiversity, provides a strong incentive to producers to aim for technical compliance with greening obligations without altering their normal practices. This, in turn, reduces the uptake of the more beneficial measures listed above, all of which are more difficult or costly to implement. The current CAP required changes on only 5% of EU farmland, and as a result, "*(65%) [of farmers] are able to benefit from the green payment without actually being subject to Greening obligations"* (ECA, 2017).

C.1.1. European level

The dominance of easily-implementable measures with few benefits for biodiversity originates with the development of the CAP itself. Our EU-level review traced how the original proposals for EFA regulations from the European Commission were weakened throughout negotiations with Parliament and Council (also see Knops and Swinnen, 2014; Roerderer-Rynning, 2014). The Parliament reduced the required share of agricultural land dedicated to EFA measures, introduced nitrogen- fixing crops and added further exemptions. The Council further introduced catch crops as an EFA measure and exempted farms with less than 15 ha of arable land. The weakening of EFA design during the CAP negotiations jeopardises the effectiveness of a policy that had initial potential to deliver substantial benefits for biodiversity.

C.1.2. National level

At national level, we reviewed the factors influencing the selection of measures by different Member States. Our review suggests that the main consideration when selecting measures from the Greening 'menu' has been the ease with which they can be implemented, revealing a clear desire to minimise administrative burdens on governmental institutions as well as on farmers. This is further demonstrated in a widespread aversion to burdensome requirements for monitoring and reporting, and a lack of consideration (or knowledge) of scientific evidence for measures' benefits for biodiversity, both revealed in our national-level interviews. We found that Member States are willing in principle to adopt more robust requirements, but also that **the measures with the greatest relevance to farmers within each country will usually be preferred to those with the greatest environmental benefits.**

C.1.3 Farmer level

The bulk of our work focused on understanding the factors influencing farmers' selection of measures beneficial to biodiversity. We found that two key factors reduced the environmental benefits of Greening across Europe: the availability of measures that required little or no change in farming practice in order to receive payment, and an aversion amongst farmers to measures perceived as undermining a productivist approach to agriculture. Our literature review showed that profit is certainly not the only driver of farmers' decision-making, but did reveal a widespread desire to maximise production, which aligned with a propensity to minimise individual responsibility and accountability under the CAP regulations. As a result, **the tendency has been for farmers to select measures that maximise production, require fewer changes to their management practices, and result in fewer long-term obligations**.

We also found significant shortcomings and gaps in the research available to support policy-making. Our Rapid Evidence Assessment review identified an insufficiency of evidence from Eastern Europe, and an abundance and over-reliance on large-scale, quantitative methods. Even the partial evidence available contained a number of conflicting findings about farmer motivations, suggesting the existence of undetected contingencies in the uptake of beneficial measures. **There is a clear need for better understanding of farmers' decision-making related to the adoption of management practices with benefits for biodiversity, particularly in order to inform more context-specific policy design**.

At a general level, it is notable that we found no clear, single factors that determine uptake of the measures identified in Step A. Rather, a range of political, social, personal and environmental considerations affect eventual on-the-ground implementation. Therefore, rather than specific changes to particular measures, we recommend that all measures intended to benefit biodiversity and associated ecosystem services across Europe should be designed with the goal of maximising uptake, as described below.

C.2. Recommendations

Building on the findings outlined above, the EWG has developed a number of recommendations for improving the uptake of measures supporting biodiversity (and associated ecosystem services) within the CAP. These recommendations are based on the EWG's considered interpretation of the evidence presented in this report, and are not intended simply to repeat recommendations already found in the literature. It is also important to note that these recommendations are largely based on an analysis of measures that were set by the EU, omitting other, potentially effective measures. However, there is still an overarching need for more context-specific evidence for identification of measures that fit to local environments and agricultural practices.

The recommendations must also be considered in the context of the widely acknowledged failure of the CAP to achieve biodiversity targets in the past, suggesting a need for significant modifications. Reconciling the requirements for both consistency and change will be a difficult challenge, particularly in terms of maintaining the level of choice and support that Member States and farmers expect while reversing the trend towards easily implementable but ineffective measures. Our recommendations are intended to maximise the potential benefits to biodiversity while respecting, and where possible mitigating, this basic tension.

Another caveat of general relevance is the European focus of this report and its recommendations. This means that any global impacts of changes in agricultural production in the EU are not considered. Nevertheless, it is clearly important for policy-makers and others to consider this broader context, ensuring, for instance, that efforts to safeguard biodiversity in Europe do not simply displace food production to elsewhere in the world, undermining policies related to global biodiversity or climate change (e.g. EC, 2013). Again, the following recommendations attempt to account for such tensions where possible, but would ideally be complemented by a detailed, formal review of international impacts, policy synergies and trade-offs.

Recommendations for the design of biodiversity measures

- Measures that align with productive farm management (e.g. catch crops and nitrogen-fixing crops) currently dominate selection at both Member State and farm levels, but have little or no clear benefit for biodiversity. These options should be excluded from the measures intended to support biodiversity under Pillars 1 and 2, in the absence of further evidence.
- Where evidence of benefits to biodiversity exists, management practices that guarantee these benefits should be specified.
- More emphasis and support should be provided for measures with confirmed benefits for biodiversity, in order to overcome the greater barriers to implementation these measures face.
- To ensure a basic level of EU-wide relevance, biodiversity measures should have confirmed benefits for multiple taxa and mostly irrespective of the context, except where highly context-specific measures are shown to have greater benefits. Systematic evidence-gathering across the EU would support this.
- Within farms, strategic grouping of EFA or similar measures should be encouraged (for example, mixing fallow with field margins).
- Measures should be designed with complementarity in mind, to allow for landscape-scale planning for conservation value and habitat connectivity.

- To further encourage complementarity and supplementarity, support should be provided for cooperation amongst farmers for joint implementation. This could take the form of higher payments for collaborating farmers.
- The additionality principle should apply across supported measures, and individual measures should only be eligible for support under one stream of the CAP (e.g. cross-compliance, EFA, or AECM/AES).
- Evidence-based policy design should be prioritised, and result-oriented payments should be favoured, where feasible.
- Geographic variation in measure design and selection should be protected, but should not supersede requirements for beneficial measures to be implemented. Instead, variation should be used to ensure that context-specific benefits are realised and communicated in appropriate ways (i.e. involving local practices and information sources), perhaps through regionalised guidelines of the kind that already exist in some countries.
- We found that the aims of measures are often seen as divorced from the concerns of farmers and the general public. A programme of public engagement could address this issue, providing extra oversight and motivation for implementation of measures beneficial to biodiversity.
- To encourage uptake, flexibility and ease of monitoring should be maximised as far as possible without reducing effectiveness.

Recommendations relating to policy development at EU and Member State levels

- At EU-level, increased stakeholder involvement in policy-making processes is likely to result in both improved design and measure uptake. This involvement should be prioritised, and encouraged initially through improved transparency of policy processes.
- Existing rules requiring measures to be demonstrably effective and efficient in achieving stated objectives need to be enforced at each stage of policy development to avoid the preferential selection of less suitable measures.
- Our national-level interviews revealed that in the majority of cases, decision-makers from Member States did not make use of any scientific studies or research assessments to guide decision-making processes on CAP measures. The consideration of scientific evidence should become an inherent and mandatory part of designing and selecting policy measures.
- A predominant motivation for Member States was found to be easing the burdens on farmers of implementation and administration of measures. The delivery of benefits for biodiversity should therefore be set as a mandatory criterion for the selection of measures, to ensure that more challenging but effective measures are not filtered out at national level.
- Member States' institutional capacities and needs for delivering farmer extension, support and monitoring services should inform the selection of measures at national level, so that measures can be implemented successfully.

Recommendations relating to farm-level implementation

- A clear finding from our literature review and interviews was that farmers are often motivated by environmental benefit as much as by profit, and are unwilling to implement measures that they see as ineffective. In addition to the improvements in design and transparency suggested above, we

recommend that measures have demonstrable benefits for biodiversity, as well as providing farmers with adequate recompense for any burdens imposed.

- Where measures' benefits for biodiversity can be justified (as well as potential related benefits for production), we also recommend that they have clear, explicit conditions framing their implementation that relate to those benefits.
- The benefits of measures also need to be communicated through trusted sources; agencies with political affiliations are, we find, viewed with suspicion in some cases (particularly in Greece and Hungary).
- Benefits for biodiversity should be measured where possible, both to facilitate communication with farmers and for monitoring of outcomes.
- Further research is urgently needed into issues and regions currently under-represented in the literature. Of particular importance are knowledge gaps for Eastern European countries, agroforestry systems, and synergies and trade-offs between climate change mitigation and biodiversity conservation through agri-climate-environment policy (e.g., in supporting certain agronomic practices such as use of nitrogen-fixing crops).
- We found that higher levels of education, knowledge, training and social connectedness increase the uptake of agri-environment-climate measures. We therefore recommend that higher and vocational agricultural education incorporate environmental sustainability more prominently into their curricula to assist farmers in their management decisions.

References

Arata, L., Sckokai, P. (2016). The impact of agri-environmental schemes on farm performance in five EU member states: a DID-matching approach. Land Economics, 92(1), 167-186.

Baur, I., Dobricki, M., Lips, M. (2016). The basic motivational drivers of northern and central European farmers. Journal of Rural Studies. 46, 93-101.

Blake, J. (1999). Overcoming the 'value-action gap' in environmental policy: Tensions between national policy and local experience. Local environment, 4(3), 257-278.

Boardman, J., Bateman, S., Seymour, S. (2017). Understanding the influence of farmer motivations on changes to soil erosion risk on sites of former serious erosion in the South Downs National Park, UK. Land Use Policy, 60, 298-312.

Bock, A., Sparks, T.H., Estrella, N., Menzel, A. (2013). Changes in the timing of hay cutting in Germany do not keep pace with climate warming. Global Change Biology, 19(10), 3123-3132.

Boncinelli, F., Bartolini, F., Brunori, G., Casini, L. (2016). Spatial analysis of the participation in agri-environment measures for organic farming. Renewable Agriculture and Food Systems, 31(4), 375-386.

Borsotto, P., Henke, R., Macrì, M.C., Salvioni, C. (2008). Participation in rural landscape conservation schemes in Italy. Landscape Research, 33(3), 347-363.

Bues, A., Preissel, S., Reckling, M., Zander, P., Kuhlman, T., Topp, K., Watson, C., Lindström, K., Stoddard, F.L., Murphy-Bokern, D. (2013). The environmental role of protein crops in the new Common Agricultural Policy. Brussels: European Parliament: Directorate-General for Internal Policies, Policy Department B: Structural and Cohesion Policies, Agriculture.

Collins, A., Miller, J., Coughlin, D., Kirk, S. (2014). The Production of Quick Scoping Reviews and Rapid Evidence Assessments: A How to Guide. Joint Water Evidence Group, UK

den Herder, M.D., Moreno, G., Mosquera-Losada, R., Palma, J.H.N., Sidopoulou, A., Santiago Freijanes, J.J., Crous-Duran, J., Paulo, J.A., Tomé, M., Pantera, A., Papanastasis, V., Mantzanas, K., Pachana, P., Papadopoulos, A., Plieninger, T., Burgess, P.J. (2016). Current extent and trends of agroforestry in the EU27. Deliverable Report 1.2 for EU FP7 Research Project: AGFORWARD 613520.

Díaz, M., Concepción, E.D. (2016). Enhancing the effectiveness of CAP Greening as a conservation tool: a plea for regional targeting considering landscape constraints. Current Landscape Ecology Reports, 1(4), 168-177.

EEA (2010). EU 2010 Biodiversity Baseline. EEA Technical Report No 12/2010, European Environment Agency, Copenhagen.

EEA (2015). The European environment — state and outlook 2015: synthesis report. European Environment Agency, Copenhagen.

EEA (2017). Environmental indicator report 2017 — In support to the monitoring of the 7th Environment Action Programme, European Environmental Agency, Copenhagen.

Espinosa-Goded, M., Barreiro-Hurlé, J., Dupraz, P. (2013). Identifying additional barriers in the adoption of agri-environmental schemes: The role of fixed costs. Land Use Policy, 31, 526-535.

Espinosa-Goded, M., Barreiro-Hurlé, J., Ruto, E. (2010). What do farmers want from agri-environmental scheme design? A choice experiment approach. Journal of Agricultural economics, 61(2), 259-273.

Erjavec, K., Erjavec, E., Juvančič, L. (2009). New wine in old bottles: critical discourse analysis of the current common EU agricultural policy reform agenda. Sociologia Ruralis, 49(1), 41-55.

European Commission (2010). The reform of the CAP towards 2020. Consultation document for impact assessment, Brussels.

European Commission (2011a). Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions." Our life insurance, our natural capital: an EU biodiversity strategy to 2020." Brussels.

European Commission (2011b). Impact assessment. Common Agricultural Policy towards 2020. Brussels.

European Commission (2011c). Proposal for a Regulation of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy, COM(2011)0625; Proposal for a Regulation of the European Parliament and of the Council establishing a common organisation of the markets in agricultural products (CMO Regulation), COM(2011)0626; Proposal for a Regulation of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD),COM(2011)0627; Proposal for a Regulation of the European Parliament and of the Council on the financing, management and monitoring of the common agricultural policy, COM(2011)0628. Brussels.

European Commission (2013). The impact of EU consumption on deforestation: Comprehensive analysis of the impact of EU consumption on deforestation. Study funded by the European Commission, DG ENV, and undertaken by VITO, IIASA, HIVA and IUCN NL, Publications Office of the European Union, Luxembourg.

European Commission (2014). Commission Delegated Regulation (EU) No 639/2014 of 11 March 2014 supplementing Regulation (EU) No 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and amending Annex X to that Regulation.

European Commission (2014). Commission Implementing Regulation (EU) No 641/2014 of 16 June 2014 laying down rules for the application of Regulation (EU) No 1307/2013 of the European Parliament and of the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy.

European Commission (2016). Commission Staff Working Document. Review of Greening after one year. Brussels.

European Commission (2017a). Evaluation study of the payment for agricultural practices beneficial for the climate and the environment - Final Report. Alliance Environnement and the Thünen Institute. Brussels.

European Commission (2017b). Report from the Commission to the European Parliament and the Council on the implementation of the Ecological Focus Area obligation under the green direct payment scheme. Brussels.

European Commission (2017c). Commission Delegated Regulation (EU) 2017/1155 of 15 February 2017 amending Delegated Regulation (EU) No 639/2014 as regards the control measures relating to the cultivation of hemp, certain provisions on the greening payment, the payment for young farmers in control of a legal person, the calculation of the per unit amount in the framework of voluntary coupled support, the fractions of payment entitlements and certain notification requirements relating to the single area payment scheme and the voluntary coupled support, and amending Annex X to Regulation (EU) No 1307/2013 of the European Parliament and of the Council.

European Commission (2018). Proposal for a Regulation of the European Parliament and of the Council establishing rules on support for strategic plans to be drawn up by Member States under the Common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulation (EU) No 1305/2013 of the European Parliament and of the Council and Regulation (EU) No 1307/2013 of the European Parliament and of the Council. Brussels.

European Court of Auditors (2017). Greening: a more complex income support scheme, not yet environmentally effective. Publications Office of the European Union, Luxembourg.

European Parliament (2018). Fact Sheet on the Functioning of the European Union – The Common Agricultural Policy (CAP) and the Treaty.

European Union (2013). Regulation (EU) No 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009.

Franks, J.R., Mc Gloin A. (2007). Environmental co-operatives as instruments for delivering across-farm environmental and rural policy objectives: lessons for the UK. Journal of Rural Studies, 23(4), 472-489

Grammatikopoulou, I., Pouta, E. and Myyrä, S. (2016). Exploring the determinants for adopting water conservation measures. What is the tendency of landowners when the resource is already at risk? Journal of Environmental Planning and Management, 59(6), 993-1014.

Hallmann, C.A., Sorg, M., Jongejans, E., Siepel, H., Hofland, N., Schwan, H., Stenmans, W., Müller, A., Sumser, H., Hörren, T., Goulson, D. (2017). More than 75 percent decline over 27 years in total flying insect biomass in protected areas. PloS one, 12(10), p.e0185809.

Hart K (2015). Green direct payments: implementation choices of nine Member States and their environmental implications. IEEP London.

Hart, K., Baldock, D. (2011). Greening the CAP: Delivering environmental outcomes through pillar one. Institute for European Environmental Policy, 26.

Hart, K., Baldock, D., Buckwell, A. (2016). Learning the lessons of the greening of the CAP, a report for the UK Land Use Policy Group in collaboration with the European Nature Conservation Agencies Network. Institute for European Environmental Policy, London.

Herzon, I., Mikk, M. (2007). Farmers' perceptions of biodiversity and their willingness to enhance it through agri-environment schemes: A comparative study from Estonia and Finland. Journal for Nature Conservation, 15(1), 10-25.

Holman, I.P., Brown, C., Janes, V., Sandars, D. (2017). Can we be certain about future land use change in Europe? A multi-scenario, integrated-assessment analysis. Agricultural systems, 151, 126-135.

Hynes, S., Farrelly, N., Murphy, E., O'Donoghue, C. (2008). Modelling habitat conservation and participation in agri-environmental schemes: A spatial microsimulation approach. Ecological economics, 66(2-3), 258-269.

Hynes, S., Garvey, E. (2009). Modelling farmers' participation in an agri-environmental scheme using panel data: An application to the Rural Environment Protection Scheme in Ireland. Journal of Agricultural Economics, 60(3), 546-562.

Inman, A., Winter, M., Wheeler, R., Vain, E., Lovett, A., Collins, A., Jones, I., Johnes, P. and Cleasby, W. (2018). An exploration of individual, social and material factors influencing water pollution mitigation behaviours within the farming community. Land Use Policy, 70, 16-26.

IPBES (2018). Summary for policymakers of the regional assessment report on biodiversity and ecosystem services for Europe and Central Asia of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [M. Fischer, M. Rounsevell, A. Torre-Marin Rando, A. Mader, A. Church, M. Elbakidze, V. Elias, T. Hahn, P.A. Harrison, J. Hauck, B. Martín-López, I. Ring, C. Sandström, I. Sousa Pinto, P. Visconti, N.E. Zimmermann and M. Christie] IPBES secretariat, Bonn.

Kennedy, E.H., Beckley, T.M., McFarlane, B.L. and Nadeau, S. (2009). Why we don't" walk the talk": Understanding the environmental values/behaviour gap in Canada. Human Ecology Review, pp.151-160.

Knops, L., Swinnen, J., Matthews, A., Swinbank, A., Olper, A., Kovacs, A., Christilla Roederer-Rynning, C., Ferto, I., Hart, K., Garrone, M. (2014). The First CAP Reform under the Ordinary Legislative Procedure: A Political Economy Perspective. Brussels: European Parliament: Directorate-General for Internal Policies, Policy Department B: Structural and Cohesion Policies, Agriculture.

Kuhfuss L., Préget R., Thoyer S., Hanley N. (2016). Nudging farmers to enrol land into agri-environmental schemes: the role of a collective bonus. European Review of Agricultural Economics, 43(4), 609–636.

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

Lennox, G.D., Armsworth, P.R. (2011). Suitability of short or long conservation contracts under ecological and socio-economic uncertainty. Ecological modelling, 222(15), 2856-2866.

Calatrava Leyva, J., Martínez, J.A., Roa, M.C. (2007). Analysis of the adoption of soil conservation practices in olive groves: the case of mountainous areas in southern Spain. Spanish Journal of Agricultural Research, 5(3), 249-258.

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(3-4), 229-237.

Matthews, A. (2013). Greening agricultural payments in the EU's Common Agricultural Policy. Bio-based and Applied Economics, 2(1), 1-27.

Matzdorf, B., Lorenz, J. (2010). How cost-effective are result-oriented agri-environmental measures? An empirical analysis in Germany. Land use policy, 27(2), 535-544.

McCracken, M.E., Woodcock, B.A., Lobley, M., Pywell, R.F., Saratsi, E., Swetnam, R.D., Mortimer, S.R., Harris, S.J., Winter, M., Hinsley, S., Bullock, J.M. (2015). Social and ecological drivers of success in agri-environment schemes: the roles of farmers and environmental context. Journal of Applied Ecology, 52(3), 696-705.

Mouchet, M.A., Rega, C., Lasseur, R., Georges, D., Paracchini, M.L., Renaud, J., Stürck, J., Schulp, C.J., Verburg, P.H., Verkerk, P.J., Lavorel, S. (2017). Ecosystem service supply by European landscapes under alternative land-use and environmental policies. International Journal of Biodiversity Science, Ecosystem Services & Management, 13(1), 342-354.

Murphy, G., Hynes, S., Murphy, E., O'Donoghue, C. (2014). An investigation into the type of farmer who chose to participate in Rural Environment Protection Scheme (REPS) and the role of institutional change in influencing scheme effectiveness. Land use policy, 39, 199-210.

Pascucci, S., de-Magistris, T., Dries, L., Adinolfi, F., Capitanio, F. (2013). Participation of Italian farmers in rural development policy. European Review of Agricultural Economics, 40(4), 605-631.

Pe'er, G., Dicks, L. V., Visconti, P., Arlettaz, R., Báldi, A., Benton, T. G., Collins, S., Dieterich, M., 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(6188), 1090-1092.

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, 10(5), 517-530. doi: 10.1111/conl.12333

Poláková, J., Tucker, G., Hart, K., Dwyer, J., Rayment, M. (2011). Addressing biodiversity and habitat preservation through Measures applied under the Common Agricultural Policy. Report prepared for DG Agriculture and Rural Development, Contract No. 30-CE0388497/00-44, Institute for European Environmental Policy: London.

Polman, N.B.P., Slangen, L.H.G. (2008). Institutional design of agri-environmental contracts in the European Union: the role of trust and social capital. NJAS - Wageningen Journal of Life Sciences, 55(4), 413-430.

Roederer-Rynning, C. (2015). COMAGRI and the 'CAP after 2013' Reform: In search of a collective sense of purpose. In: Swinnen J. (ed.), The political economy of the Common Agricultural Policy. An imperfect storm. Rowman & Littlefield International, Brussels: 331-356.

Ruto, E. and Garrod, G. (2009). Investigating farmers' preferences for the design of agri-environment schemes: a choice experiment approach. Journal of Environmental Planning and Management, 52(5), pp.631-647.

Santos, R.F., Antunes, P., Ring, I. and Clemente, P. (2015). Engaging Local Private and Public Actors in Biodiversity Conservation: The role of Agri-Environmental schemes and Ecological fiscal transfers. Environmental Policy and Governance, 25(2), pp.83-96.

Shackelford, G. E., Kelsey, R., Robertson, R. J., Williams, D., Dicks, L. V. (2017). Sustainable Agriculture in California and Mediterranean Climates: Evidence for the effects of selected interventions. Synopses of Conservation Evidence Series, University of Cambridge, Cambridge.

Schroeder, L.A., Chaplin, S., Isselstein, J. (2015). What influences farmers' acceptance of agri-environment schemes? An ex-post application of the 'Theory of Planned Behaviour'. Landbauforschung, 65(1), 15.

Schroeder, L.A., Isselstein, J., Chaplin, Peel, S. (2013). Agri-environment schemes: Farmers' acceptance and perception of potential 'Payment by Results' in grassland—A case study in England. Land Use Policy, 32, 134-144.

Sutherland, W.J., Dicks L.V., Ockendon N., Smith R.K. (2017). What Works in Conservation 2017. Cambridge, UK: Open Books Publishers.

Tricco, A.C., Antony, J., Zarin, W., Strifler, L., Ghassemi, M., Ivory, J., Perrier, L., Hutton, B., Moher, D., Straus, S.E. (2015). A scoping review of rapid review methods. BMC Medicine 13, 224.

Underwood, E., Tucker, G. (2016). Ecological Focus Area choices and their potential impacts on biodiversity. London: Institute for European Environmental Policy, BirdLife Europe and the European Environmental Bureau.

Van Swaay, C.A.M., Van Strien, A. J., Aghababyan, K., Åström, S., Botham, M., Brereton, T., Chambers, P., Collins, S., Domènech Ferrés, M., Escobés, R., Feldmann, R., Fernández-García, J. M., Fontaine, B., Goloshchapova, S., Gracianteparaluceta, A., Harpke, A., Heliölä, J., Khanamirian, G., Julliard, R., Kühn, E., Lang, A., Leopold, P., Loos, J., Maes, D., Mestdagh, X., Monasterio, Y., Munguira, M. L., Murray, T., Musche, M., Õunap, E., Pettersson, L. B., Popoff, S., Prokofev, I., Roth, T., Roy, D., Settele, J., Stefanescu, C., Švitra, G., Teixeira, S. M., Tiitsaar, A., Verovnik, R., Warren, M. S. (2015). The European Butterfly Indicator for Grassland species: 1990-2013. Wageningen.

van Vliet, J., de Groot, H.L., Rietveld, P., Verburg, P.H. (2015). Manifestations and underlying drivers of agricultural land use change in Europe. Landscape and Urban Planning, 133, 24-36.

Van Zanten, B.T., Verburg, P.H., Espinosa, M., Gomez-y-Paloma, S., Galimberti, G., Kantelhardt, J., Kapfer, M., Lefebvre, M., Manrique, R., Piorr, A. and Raggi, M. (2014). European agricultural landscapes, common agricultural policy and ecosystem services: a review. Agronomy for sustainable development, 34(2), 309-325.

Villanueva, A.J., Gómez-Limón, J.A., Arriaza, M., Rodríguez-Entrena, M. (2015a). 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(4), 0108.

Villanueva, A.J., Gómez-Limón, J.A., Arriaza, M. and Rodríguez-Entrena, M. (2015b). The design of agri-environmental schemes: Farmers' preferences in southern Spain. Land Use Policy, 46, 142-154.

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, 68(3), 801-821.

Zimmermann, A., Britz, W. (2016). European farms' participation in agri-environmental measures. Land Use Policy, 50, 214-228.

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.

Appendix 1: Methods

STEP A

Hundreds of research papers are published every year addressing the broad question of how the CAP affects farmland biodiversity or, more recently in a lower number of papers, ecosystem services. Step A did not seek to conduct an in-depth review of all such papers of relevance. Rather it focused on drawing conclusions specific to the biodiversity focus of this request from the much smaller number of in-depth reviews which have been conducted in recent years.

Two sources of such information were highlighted in the original request:

- Pe'er, G., Y. Zinngrebe, J. Hauck, S. Schindler, A. Dittrich, S. Zingg, T. Tscharntke, R. Oppermann, L.M.E. Sutcliffe, C. Sirami, J. Schmidt, C. Hoyer, C. Schleyer, and S. Lakner (2016), Adding Some Green to the Greening: Improving the EU's Ecological Focus Areas for Biodiversity and Farmers. Conservation Letter, 10(5), 517-530 [Expert consultation]
- Sutherland, W.J., Dicks, L.V., Ockendon, N., Smith, R.K. (2017), *What Works in Conservation 2017*. Cambridge, UK: Open Books Publishers, 2017. [systematic map, synopsis & summary PLUS multiple expert consultation with Delphi]

Pe'er et al. considered only available EFA options, while Sutherland et al. considered a large set of 119 farm management actions, some of which can be matched to the EFA options. Both reports only looked at measures drawn from northern temperate Europe. The Mediterranean perspective has recently been provided by:

- Shackelford, G. E., Kelsey, R., Robertson, R. J., Williams, D.R., Dicks, L. V. (2017), *Sustainable Agriculture in California and Mediterranean Climates: Evidence for the effects of selected interventions*. Synopses of Conservation Evidence Series. University of Cambridge, Cambridge, UK

For both Sutherland et al. and Shackelford et al., all the individual papers considered are summarised, and the summaries are available on http://www.conservationevidence.com/.

The EWG used these three sources together with the following three in order to draw out information on measures which are effective for biodiversity provision:

- European Commission (2017), Report from the Commission to the European Parliament and the Council on the implementation of the Ecological Focus Area obligation under the green direct payment scheme. Brussels, 29.3.2017 COM(2017) 152 final. [Rapid Evidence Assessment]
- Hart, K., Baldock, D., Buckwell, A. (2016), Learning the lessons of the Greening of the CAP, a report for the UK Land Use Policy Group in collaboration with the European Nature Conservation Agencies Network, Institute for European Environmental Policy, London
- European Commission (2017), Evaluation study of the payment for agricultural practices beneficial for the climate and the environment - Final Report. Alliance Environnement and the Thünen Institute. Brussels. Report available at: https://ec.europa.eu/agriculture/sites/agriculture/files/fullrep_en.pdf

In the first European Commission report cited above, the main assessment tool used was the Ecological Focus Areas Calculator and hence it only considered current EFA options.

The report by Hart et al. reviews the original rationale for Greening Pillar 1 and the many alterations made to the proposals during the negotiation process. It then provides an overview of the potential environmental impacts of these measures and highlights some of the challenges of determining their environmental additionality.

Step A used Hart et al.'s report as a starting point to develop a list of EFA options collecting and contrasting the current insights on EFA effectiveness with a focus on the reviews listed above. Additionally, it offers some preliminary thoughts on some possible future options for Greening, with a focus on alternative means of delivering improved environmental management across the farmed countryside in the EU-28. The insight on environmental effects of each option was complemented with available insights on facilitators and barriers for implementing each of the options.

The evaluations of the benefits in the revised reviews are not directly comparable. We drew together both quantitative grading wherever available and qualitative descriptions, and based on these derived the numbers of positive and negative signs for each measure. These should, of course, be seen as estimates rather than firm evidence.

STEP B

Step B includes a number of research questions related to the selection of EFA options at EU, MS, where relevant regional, and farmer levels. Specific methods were used to address each question (Table A1.1).

Table A1.1: Study questions and methods used in Step B

Study question	Method
What are the factors influencing the choice of biodiversity measures at EU-level?	Non-systematic literature review
Which biodiversity measures are preferred by different MS?	Non-systematic review MS-level
Which factors determine MS preferences for biodiversity measures?	Summary of EFA option uptake at MS-level based on existing literature and land-use data Interviews at MS-level
Which factors determine famers' uptake of biodiversity-positive measures?	Rapid Evidence Assessment at farm-level Interviews with farmer representatives

Step B1: What are the factors influencing the choice of EFA/AECM-types at EU-level?

This section used a non-systematic review of the design and selection of measures at EU level to understand why particular measures were included or excluded. The portfolio of available biodiversity measures that may be selected by MSs provides a first overview of the measures that have been preferred at the EU level. However, it is important to learn why certain options have been made available and others not, making it essential to have an understanding of formal and informal governance processes at EU-level, which have led to decisions on Greening.

Methodological approach

- Provision of a brief overview of formal and informal governance structures at EU level, which are important in the context of decisions on the CAP Pillar 1 (2014-2020).
- Elaboration of a timeline with mains steps in the decision-making process on EFAs/ the Greening (2014-2020), including e.g. consultations and adoption of regulations.
- Conduction of a non-systematic literature review (including grey literature) exploring the motivation for the selection of certain EFA options at different stages.

Besides the choice of EFA measures, other aspects may influence decision-making and implementation of measures at this level and, hence, were taken into account. Such aspects include amongst others the design of EFA options, potential management requirements and decisions on weighting factors and areal requirements, but also issues of governance, power and influence of different stakeholder groups in the decision-making processes.

Step B2: What were the factors that influenced the selection of measures by different Member States?

- Summary of EFA options at MS-level based on existing literature

This summary (drawn from existing (EU) documents) provides an overview of the options selected by each MS. This was complemented by interviews with national government representatives.

- Interviews at MS-level

Semi-structured interviews were carried out with one national-level decision-maker in each of the six countries (Hungary, Sweden, Greece, Czech Republic, Germany and Finland) explaining the national selection process of EFA options (see interview guideline below). These individuals worked in policy either directly within the relevant agricultural Ministry, with a direct stake and participation experience in European-level negotiations, or as part of a stakeholder group closely aligned or with insight into national decision-making processes. Interview responses were transcribed and categorised and coded for themes and variation around set questions. Of particular significance were insights into the political processes for decision-making within different member states (for example, efforts made for wider stakeholder consultation, the forms and sources of results that were taken into account during the decision-making process); and crucially, what factors influenced the uptake or rejection of individual EFA measures with proven biodiversity benefits.

Interview Process

Reading out:

*"We are a group of scientists selected to analyse the implementation of Ecological Focus Areas across Europe. We will use this interview and all information we collect in a confidential, anonymous manner to reflect the current experiences of implementing this measure. Ecological Focus Area has been first implemented in 2015, being one of three Greening measures coupled to the CAP's direct payments. After the EU introduced a list of more than XX EFA measures to choose from, Member States selected two to XX for their farmers to implement. *name of country* has chosen XX,XY, XZ, while not selecting XA, XB, XC."*

Initial opening question:

*"Could you please describe the process of selecting selected the EFA measures for national implementation in *name of country*?"*

Optional: Did you observe any controversies among different actors in the negotiation process?

Optional: How did you make use of existing evaluations/reports

Optional: Who was on the committee? Were there farmers/scientists involved?"

Followed by showing the list of selected EFA options defined by Step A.

"Based on a literature survey, our team identified the following EFA options as most effective:

1. *Fallows (with caveats re: species composition and management)*
2. *Agroforestry (e.g. production systems in their context that are compatible with agroforestry principles)*
3. *Landscape elements, especially in association with other measures*
4. *Buffer strips, especially with diverse vegetation type and structure*
5. *Wildflower strips*
6. **Use of organic rather than mineral fertilizers*
7. **Maintaining ground cover in orchards in Mediterranean regions*
8. **Planting hedgerows in Mediterranean regions*

Can you please tell us about the key reasons for selecting EFA measure X for national implementation?"

Can you please tell us the key reasons of rejecting some of the proposed EFA measure Y for national implementation?

Has the originally selected portfolio of EFA options been adapted over time? If yes, for which reasons?

Looking at the upcoming CAP reform, how do you the EFA options on the EU level and the ones selected in your country expect to change?

How can the political process selecting EFAs on the national level be improved?

What is your country's official position on the EU EFA policy?

In light of all these questions, which other person would be important to talk to regarding the EFA selection on the national level in 'name of country?"

Table A1.2: Overview of interviews

Member State	Interview with national/ regional representa-tives	Organisation	Interview with farmer representa-tives	Organisation/ background of representative
Hungary	1	Hungarian Ministry for Agriculture and Rural Development	3	Farm administrators from the National Chamber for Agriculture (NAK)
Spain	0	--	6	Regional chapter of farmer associations, regional cooperatives in Aragon (3) Technicians in a cooperative of Navarre (Spain) Advisor _Cereal cooperative Advisor to proceed with PAC in large cooperative of Navarre (Spain)
Greece	1	Ministry of Rural Development and Food	3	Public sector agronomist working in a Regional Unit (administrative unit of Greece) on EU-funded programmes Both farmer & agronomist -also member of IFOAM EU (European umbrella organisation for organic farming and food) Both farmer & agronomist (also member of a local farmers' association)
Czechia	1	Ministry of Agriculture	3	Association of private farms Association of young farmers
Sweden	1		4	
Finland	1	Ministry of Agriculture and Forestry	13	1.Metsähallitus (state owned, responsible of 1/3 of Finland's surface area) 2.Centre for economic development, transport and the environment 3-4. No organization, just active farmers 5-13. ProAgria –Rural advisory services
Germany	1	Ministry for Agriculture	3	Private farmer Untere Naturschutzbehörde (local level nature conservation agency)

Step B3: Which factors determine famers' uptake of EFA/AECM?

B3.1 Rapid evidence assessment

We undertook a rapid evidence assessment of academic titles to find all published peer-review articles dealing with farmer uptake of environmentally-focused measures within the European Union. Prior to the

formal review, the members of the working group identified papers of relevance to the topic based on their knowledge. This yielded a list of 80 papers, which was trimmed by the same criteria as the full review (time period, geographical focus and agriculture focus; see below). The step resulted in 22 papers that were later used as a check-list for the article list from the review. We also used the initial list as a 'pilot' dataset to identify classes of factors that could be relevant in the final review. We subsequently refined the classes to reflect the final findings.

Literature was identified through a search in Web of Science in early 2018 with the following terms: *((Agri-environmental OR agrienvironment OR agrienvironmental OR Agri-climate-environment OR agri-environment OR "ecological focus area*" OR "compulsory Greening") AND (measure OR scheme OR program OR programme) AND (behaviour OR behavior OR attitude OR participation OR uptake OR compliance OR adoption OR choice OR decision* OR preference*))*. The search was limited to the time period 2007-2018 to give 10 years' worth of results, covering the entire period of both the previous and current CAP (2007-2013 and 2014-2020). This returned 642 papers, including 17 of the 22 papers suggested by members of the group (77% coverage of suggested papers), thus meeting our internal criterion and expectations for the representativeness.

We assessed the resulting list in three consecutive stages. In the first stage papers were trimmed using title and abstract to retain only papers dealing with agriculture in the European Union (papers were retained wherever it was not possible to ascertain this from the title or abstract).

Secondly, we ranked papers' titles and abstracts on the following scale:

1) Paper contains review/meta-analysis of farmers' behaviour with relation to conservation measures;
2) Paper deals directly with AECM/EFA/Greening uptake;
3) Paper is generally about farm management and conservation;
4) None of the above.

Four group members conducted the ranking, and each of them cross-checked the ranking of a randomly-selected paper from each of two other reviewers. There were no ranking disagreements involving the exclusion criteria. We then excluded papers with a score of 4 from further analysis, as these had no relevance to the review. This left 302 papers for the full review.

In the third step, one of 11 reviewers read each of the remaining papers and extracted information according to a review spreadsheet designed to capture the factors that have been found to affect farmer uptake of environmental-oriented schemes, as well as a range of contextual information. Each reviewer cross-checked one random paper entry of two other reviewers. We found some differences in the presentation of extracted information but no differences in the substance.

B3.2 Interviews with farmer representatives

Interviews with farmer representatives were conducted by each expert in his/her country of residence, in order to assess and analyse information about factors affecting farmers' uptake of EFA and other potentially relevant measures. The interviews explored rationales for past, present and potential future choices, as did the interviews with MS representatives (see above). The interviews in all MSs followed the same general framework, but the specific questions asked were flexible enough to allow adaptations to each country's unique socio-economic, bio-geographic and administrative conditions.

Participant selection

The participants were chosen for their strong experience of the CAP system and farming conditions and practices in the MSs concerned. They have also had regular contact or exposure to a wide range of farmers and their land use decision-making, particularly in relation to Greening and agri-environment measures. Interviewees were generally farm advisors or farmer extension service personnel.

Appendix 2: Further results, Rapid Evidence Assessment (Step B3)

Table A2.1: Papers evaluating the effects of specific environmental features on the uptake of measures

	-2	-1	0	1	2
Generic location variables			EU (Zinngrebe et al., 2017); Finland large geographical variation (Grammatikoupoulou et al., 2016); Portugal (Santos et al., 2015)		Italy (Boncinelli et al., 2016); in mountain area Italy (Borsotto et al., 2008)
Environmental features present on farm					England (Schroeder et al., 2013); unnamed country (Lennox & Armsworth, 2011); UK (McCracken et al., 2015)
Spatial heterogeneity, extensive land use					Spain (Espinosa-Goded 2010); Ireland (Murphy et al., 2014); Germany (Hart et al 2016); Ireland (Hynes & Garvey, 2009)
Semi-natural habitat presence	UK (interviews, McCracken et al., 2015)				Ireland (Hynes et al., 2008)
Share of grassland				Estonia (Herzon & Mikk, 2007)	Germany (Mante & Gerowitt, 2009, Matzdorf & Lorenz, 2010)
Use of chemicals		15 EU countries (DID matching estimator, Arata & Sckokai, 2016)			
Ground harvesting of olives, cover crop management	Spain (choice experiments, Villanueva et al., 2015b, 2017)				
Species pool size	UK (McCracken et al., 2015)				
High degree of mechanisation		Italy (Pascucci et al., 2013)			
Exposure to soil erosion					UK (Boardman et al., 2017); soil type (Hynes and Garvey, 2009)
Temperature increases		Germany (Bock et al., 2013)			UK (Boardman et al., 2017); soil type (Hynes and Garvey, 2009)

Table A2.2: Papers evaluating the effects of socio-economic factors on the uptake of measures at European scale.

	-2	-1	0	1	2
Age		EU (Zimmerman & Britz, 2016); 10 EU countries (Ruto & Garrod, 2009);		5 EU countries (Arata and Sckokai 2016); Europe (systematic review, van Vliet et al., 2015	EU (systemic review, Lastra-Bravo et al., 2015)
Youth				North-central Europe [Austria, Denmark, Finland Germany, Nthlands, Sweden, Switzerland, Baur et al., 2016)	
Education				10 EU countries (Ruto & Garrod, 2009); EU (systemic review, Lastra-Bravo et al., 2015)	
Lack of successor				Europe (systematic review, van Vliet et al., 2015);	

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