CONSOLE

CONtract **SOL**utions for **E**ffective and lasting delivery of agri-environmental-climate public goods by EU agriculture and forestry

Research and Innovation action: H2020 - GA 817949

Preliminary framework

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Quality check: The document went through four rounds of internal review, comments and additions by partners between July 2019 and May 2020

Project	CONSOLE
Project title	**CON**tract **SOL**utions for **E**ffective and lasting delivery of agri-environmental-climate public goods by EU agriculture and forestry
Work Package	1
Deliverable	D1.1
Period covered	M1-M15
Publication date	02/11/2020
Dissemination level	Public

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Project Consortium

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1 Objectives of the document

1.1 Objective

The objective of this document is to provide an initial conceptual framework for the project CONSOLE. The initial framework aims at providing a basis for interpretation of the project activities, hence connecting project objectives, approach and the state of the art about the topic.

In order to achieve this objective, this initial version of the framework takes mainly the approach of an organized broad literature review in support of the project expected activities. It also aims at identifying the relevant definitions and scope for the project. Finally and foremost, it investigates the tentative logic of a preliminary conceptual framework to be further developed into an operational framework in the following tasks of WP1 (and of the project as a whole).

In order to meet these tasks, the literature considered is not restricted to the specific contract types addressed by the project (see below), but rather attempts to contextualise these contract types in the wider literature on agri-environmental-climate public goods (AECPGs) provision by agriculture and forestry. In doing so, we acknowledge the wide variety of hybrid and mixed solutions that may be relevant in practice.

In addition, we have tried to review specifically the most recent scientific literature, including the most debated issues; some classical concepts that are well established in the literature may be neglected or under-represented here.

This document reflects activities carried out in task 1.1 of the project:

Task 1.1 Initial conceptual framework (M1-M3)

Leader: UNIBO; Contributors: ALL

In this task, an initial conceptual framework will be set up based on desk work and it will be operationalised to form the basis for the contractual framework to be developed in next steps of WP1 and for the other WPs in the project, especially in WP2. The conceptual framework will bring together different aspects of contract solutions, drivers, farm and context variables highlighting the interplay among them. It will also tentatively identify dimensions/parameters in contract design and potential assessment criteria (such as longevity, acceptability, legal and technological aspects – see section 1.3) and indicators for evaluation, to be further investigated in the next steps."

The task is expected to yield a deliverable:

D1.1 Conceptual framework (M3) - Report illustrating the developed conceptual framework and its components, features, references, including structuring conclusions for the next steps (T1.1).

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This deliverable was initially due in month 3. While a first version of the document was actually ready on time, the submission has been delayed and the document used as a living document to collect decisions taken until the set-up of WP2 and the third project meeting (month 11) in order to accompany the identification of innovative solutions for further steps in the project. It has then been finalised by month 13.

1.2 Why develop a single comprehensive framework

The CONSOLE strategy is to analyse the different (aspects of) contractual options for the lasting delivery of agri-environmental-climate public goods (AECPGs) by EU agriculture and forestry, using approaches from different disciplinary fields in combination and within the same framework. Their integration is being pursued through the development of the unified conceptual framework developed at the beginning of the project and tested/improved throughout, and by continuous interaction with a wide range of stakeholders in an actor-led policy support/development process. By the end of the project, it is expected to achieve the transformation of the initial framework into an effective operational tool able to support decision making in AECPGs contract solutions.

There are at least three meanings of "single comprehensive" framework here. The first one concerns the fact that we address different contract types and want to analyse all of them under the same framework. The main reason motivating the development of a unified framework in that respect is that the contract "types" addressed by the project (see next chapter) are attached to individual contract features that can be used not only as alternatives but also in combination, considering in addition a wide range of intermediate options. For example, some scholars suggest implementing combined (uniform+results-related) payment schemes depending on uncertainty levels and degree of information asymmetry (Derissen and Quaas, 2013). Another example is land tenure systems that, besides being a potential instrument for direct AECPGs provision, may be regarded as a determinant of longevity (linked to incentive and income for landowners/tenants with and without AECPGs practices/payments). Also result-based solutions can be applied to collective contracts or value chain solutions.

Second, there are sector-dependent issues at stake, while we want a framework potentially working across different sectors and steps in the value chain. While the focus is mainly on agriculture, we also extend our scope to the provision of AECPGs in forestry. Activities at the interface between agriculture and forestry, including measures affecting water courses and forest edges are considered in principle. Besides primary production sectors, the framework needs to consider downstream actors until final consumers. In addition, interaction among different

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policy fields, e.g. agriculture and water policy, will have a major role in understanding the working and effectiveness of contract solutions.

Finally, there are a number of disciplines involved, with different conceptual starting points (and definition issues-see below form more); the idea here is to sue insights from different disciplinary fields and to use them to contribute to the same consistent framework, in order to support inter and trans-disciplinary research.

1.3 Outline

As this document is the starting point to develop the contents of the task but also of CONSOLE in general, the next section will report key objective and approach of the project, also aimed to justify the identification of the framework. Section 3 will illustrate the general framework logic. Section 4 will get into the details of the framework components. Section 5 discusses methods to analyse contract solutions and to support implementation, with a special emphasis on stakeholders' participation. Section 6 will conclude with the work ahead.

2 Project objectives and approach

2.1 Objectives

The CONSOLE project focuses on promoting the delivery of (AECPGs) by agriculture and forestry through the development of improved contractual solutions (mainly intended as contracts between farmers/foresters and other parties with provisions for the production of public goods; see below for clarifications and definitions). The (difficulty in the) provision of public goods is related to major challenges such as trade-offs between environmental performance and farm profitability, the time lag between changes in practices and impact, and the potential mismatch between the scales of actions and effects (Ekroos et al., 2014) as well as to the nature of public goods whereby the non-excludability and non-rivalry characteristics prevent the market from working for these goods. As a result, several AECPGs, such as water, air and soil quality, control of soil erosion, carbon sequestration, animal and plant biodiversity and space for recreation are characterised by under-provision. Agricultural policy in the EU has partially re-oriented its objective towards the provision of public goods in rural areas acknowledging today's societal demands (Erjavec and Erjavec, 2015). In the legislative proposal for the next CAP programming period it is foreseen to pursue this path further. The recent Green New Deal by the European Commission, and follow up initiatives (e.g., Farm to Fork strategy and Biodiversity strategy) tend to strengthen and to qualify this orientation.

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While there is already a large literature (e.g., Cooper et al., 2009; Jones, Silcock and Uetake, 2015) and long experience in the EU with Agri-Environmental Schemes (AES), the actions aimed at the delivery of AECPGs are still considered unsatisfactory in terms of longevity, effectiveness and efficiency, e.g., see European Court of Auditors (2011). Improvements may come from a flexible mix of promising new instruments (Herzon et al., 2018), such as new environmental-related tenure systems (e.g. environmental lease), result-based payments or collective approaches, as well as by better value chain strategies, but these have been so far poorly tested in practice in the EU (Schilizzi and Latacz-Lohmann, 2016). An effective implementation of these solutions requires a consistent multi-level contractual framework accounting for surrounding context variables, such as jointness with market goods, price systems, business networks, social capital, quality of extension services, farmers' attitude and expertise and EU/national/local framework legislation. Dessart et al. (2019) classified behavioural factors that influence farmers' decisions to adopt environmentally sustainable practices into three clusters: dispositional factors, social factors, and cognitive factors. The contractual framework also needs to account for social (e.g. multi stakeholder projects in some territories), organisational and technological innovation processes, as well as for the local and global specificities of desired outcomes. Finally, feasibility may depend on wider implications of different approaches, e.g. green box conformity of WTO, budgetary constraints and policy coherences within the different environmental regulations and the CAP. Concerning contract options and their relationships with these context variables, a huge amount of literature exists, mainly at national/local level, in particular for those schemes that have been financed through the CAP (i.e., reduction of CO_2 emissions), but not only. In addition, there is a lot of "hidden" knowledge from sparsely distributed local experience in the EU and outside. However, this knowledge is not systematically available and largely unable to contribute to the improvement of AECPGs-related contracts and initiatives. A comprehensive, innovative and collaborative approach to the topic (both in research and practice) is needed to ensure a systematic upgrade of AECPGs provision in the European Union.

The general objective of CONSOLE is to boost innovation in the lasting delivery of AECPGs by EU agriculture and forestry, by building a Community of Practice (CoP), by designing and testing effective and efficient cooperation models and by developing a contractual framework supporting implementation by multiple actors. The main expected outcome of the project is a framework to better design and implement AECPGs contracts, built together with a CoP able to apply the framework in a real-life context (see section 2.3 below). The CoP will be at the heart of the development of the contractual framework and at the core of the CONSOLE impact strategy, involving, among others, the main typologies of potential end-users. The CONSOLE CoP involves different groups of

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local actors (local CoPs in some cases) connected to AECPGs provision initiatives in selected case study areas, as well as a pan-European network of practice, intended to knowledge creation and mutual learning through mainly virtual contacts. Examples of participants include public administrations, rural development agencies, farmers and farmers' organisations, landowners, chambers of commerce, local NGOs, consumers, citizens'/residents' associations, both, from and outside the CONSOLE consortium.

Specific objectives (from DoA) are to:

obj. 1 "Develop an operational contractual framework which would serve the development of improved and new contracts, accompanied by solutions tailored to local contexts to facilitate policy making, stakeholder interplay and to incentivise contract uptake;

obj. 2 Distil lessons learned from past and ongoing experiences through the structured qualitative assessment of successful innovative and effective contract solutions in the EU and in third countries for the delivery of specific or multiple AECPGs;

obj. 3 Develop understanding of the acceptability and ease of implementation of innovative contract solutions through surveys involving a wide range of farmers, rural landowners and other key contract actors in 12 EU Member States;

obj. 4 Assess the economic, social and environmental performance of new and innovative contract design options by in-depth empirical exploration and model simulation;

obj. 5 Build a CoP with practitioners and actors involved and interested in AECPG provision to facilitate co-constructing, testing and implementation of new solutions, as well as contributing to impacts through participatory co-training;

obj. 6 Making CONSOLE results operative and easily accessible for a wide target audience of interested actors and stakeholders (farmers, farm advisors, administration, business along value chains, NGOs, etc.), hence contributing to a major transition in the way AECPGs are delivered in Europe."

2.2 Concept and approach

The topic addressed by CONSOLE implies the multi-, inter- and trans-disciplinary understanding of very detailed contract mechanisms in the context of much wider issues such as environmental situation and local ecosystems, market forces, prices scenarios and variability, value chain strategies, institutional setting, social capital, legal context, available technologies.

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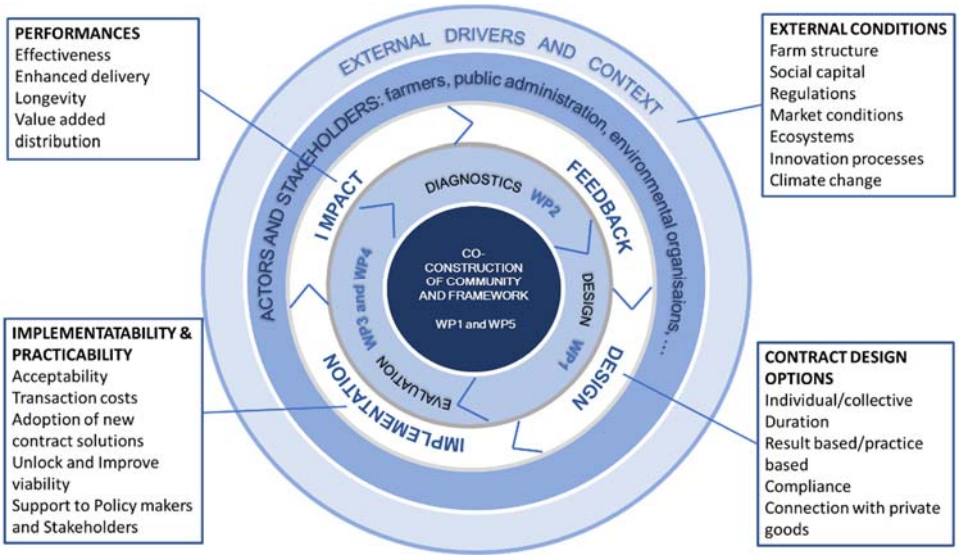

Figure 1. The CONSOLE Strategy

This also requires a transdisciplinary (stakeholders-led) and multi-scale/multilayer (accounting for different levels of geographical/administrative aggregation) strategy. The unifying logic of CONSOLE is that of a multi-actor learning process benefiting from knowledge generated synergistically by different conceptual and disciplinary research and operational perspectives. The CONSOLE project will boost innovation in contract solutions to promote the delivery of AECPGs through a co-constructed process running analogously with the steps of the classical policy cycle with the help of knowledge building and learning processes activated in the context of a CoP environment (see Figure 1). Considering available conceptual references, the process starts with a comprehensive diagnostic of success and failure reasons of existing experiences, benefiting of an intense dialogue with actors involved in promising national and regional initiatives. Based on this, CONSOLE will build up improved contract solutions for the future that will be checked for feasibility by farmers and other stakeholders and evaluated through simulations. Resulting contractual models and good practice guidance will be tested in interaction with members of the CoP and showcased for the use by a wide audience of stakeholders and potential end-users.

2.3 Expected contents of the final framework

According to DoA, the final version of the framework will include the following:

a) a catalogue showcasing existing successful experiences and good practices in AECPGs contracting based on the case studies developed in WP2 and

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presented in a usable form as examples for practitioners including hints for replication;

b) improved AECPGs contract solutions suitable to be used as models for future design, including their assessment and the role of different levels of governance (from local to EU) and implementation;

c) a "design guide" intended as a systematic comprehensive process for the design of AECPG contracts, including the conceptual framework, design variables, determinants, legal and technological aspects and roles of different governance levels in implementation;

d) documentation, training and supporting materials.

The structure and actual contents will be revised and co-designed with stakeholders and actors involved in the project.

2.4 Scope and definitions

This section summarises some definitions and topics related to the purposes of CONSOLE. A systematic collection of definition and glossary will be developed in the next steps of the project.

2.4.1 Contractual nature

A contract can be defined as: "A written or spoken agreement, especially one concerning employment, sales, or tenancy, that is intended to be enforceable by law" (Oxford Dictionary).

A contract is an instrument designed by a proponent to delegate a task to an agent (or a group of agents) with private information. Its functioning and effects are linked to a number of features including risk sharing and transaction costs.

It is important to make a distinction between administrative acts and contracts under public law.

Instruments for the production of public goods can be classified in different ways. A classical distinction is between Command and control regulation, economic instruments, information-based instruments. For our purposes, an important distinction is between:

1. Mandatory measures: specifying a requirement for the achievement of an environmental goal;
2. Voluntary measures: payments addressed to farmers to incentivize the supply of public goods

Mandatory measures in some cases can be interpreted using contract categories (e.g. in terms of compliance); however, the scope of the project includes only VOLUNTARY measures.

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Besides this broad definition, the project addresses actions related to the provision of public goods using contract-based categories and conceptual interpretations (e.g. from the economics of contracts), but it is not bound to consider only what is legally considered as a contract. E.g. Some CAP payment that may not be seen as a contract in legal terms may be considered here if compatible with the scope of the project.

In the context of this broad scope, the project addresses a wide range of contract types, not only from EU co-financed schemes, but also from private-public (e.g. with local administration for compensation measures carried out by farmers for infrastructure) and private-private schemes (e.g. cooperation with honey producers, green corridors for hunting beneficial for farmland birds), commodity contracts with processors/food industry with sustainability requirements. The project will also explore the transferability of contracts used in non-EU countries.

2.4.2 Solution (Contract) types

The scope of the project in delimited by solutions for the provision of AECPGs that respond to the four features identified in the topic (land-tenure-related, collective, result-based, value chain) irrespective of whether they are proper contracts.

In section 4 we elaborate on the notion of contract type after a better discussion of the literature and of the framework.

This broad identification of contract types to be investigated in CONSOLE applies to the whole project, but is only partially used to discriminate cases used for factsheets in WP2; indeed, cases for first level analysis in task 2.2 may include exceptions on the above as long as they may be interpreted as providing useful lessons learned for the future investigation of the categories of solutions mentioned above.

2.4.3 Case study

In the CONSOLE project, a case study is intended as a case of real implementation of a specific contract solution (limited to contracts consistent with the scope above) in an area or region. It can involve several participating actors and farms, and several individual cases of implementation of the same contract; for the purposes of covering failures, it can also include real life proposals of contract solutions that for some reasons have never arrived at the stage of generating impact, but that can provide insights from their story, e.g. measures that opened calls without participation; contract proposals with no uptake, etc.

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This concept is used in particular in WP2, that works ex-post on the diagnostics of existing solutions.

3 The general version of the initial conceptual framework

The general version of the initial conceptual framework is reported in Figure 2.

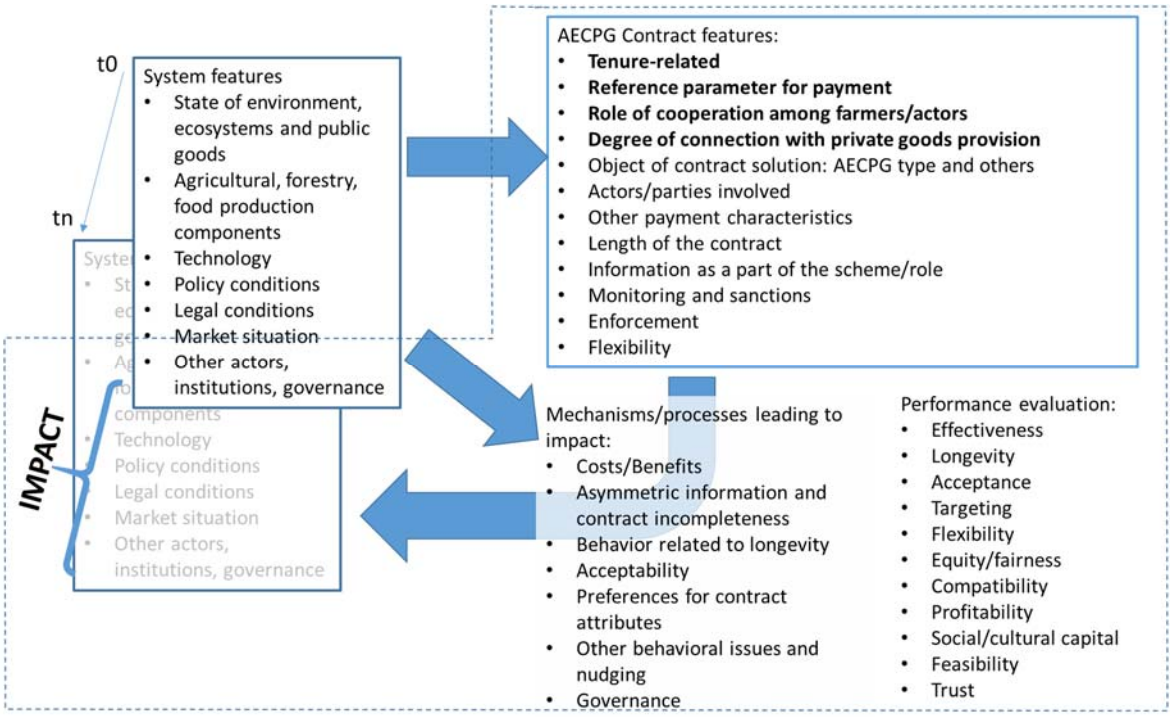

Figure 2: Initial conceptual framework

The proposed framework is intended to study how the contract solutions available for AECPG provision interact with the context and produce effects. The idea works in a cyclical way resembling the process depicted in Figure 1, but highlighting the causal chain from factors behind contract design to its impact and then leading to the next round of contract design. Around this cycle, the main relevant categories of the system are highlighted in the four boxes.

On the left-hand side, the loop starts with context variables (related to agriculture, food and forestry systems (or, more widely, bioeconomy systems) determining processes that allow and shape the definition of contract solutions. In turn, contract solutions lead to impact on the systems themselves. The way contract solutions affect the system may be described through processes, mostly related to human or environment/ecosystem behaviour. The overall effect can be measured thorough environmental/ecosystem improvements over time and can be related to contract features to evaluate their performances. Hence

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performance somehow connect the other three dimensions, and can be used as a way to assess different contract solutions (in context).

The context features are described by a number of variables. These variables play a multiple role for the interactions with contract solutions:

- They determine needs and context values at stake (e.g. perceived value of biodiversity);
- They affect the decision to adopt a specific solution and its design (e.g. legal feasibility of result-based payments);
- They affect the process towards impact (e.g. markets determining opportunity costs);
- They are affected by the contract solutions and hence their change can be used to measure impact (e.g. nutrient load will change due to contract solutions implemented).

This will be detailed in section 4.1.

AECPG contract features are a product of the system they are embedded in. Contracts are defined/qualified by a set of different features that can be presented in different combinations and variants. For the purposes of CONSOLE, these features and their interactions allow to identify the main contract types studied in the project (land-tenure related provisions, collective, result-based, value chain). They are better detailed in section 4.2.

The interactions and hence the functioning of the contracts can be interpreted through conceptual and practical categories used to describe the processes leading to impact. Different disciplines have highlighted these processes from different perspectives, e.g. incentive structure in economics, impact pathway in ecology, preferences and behaviour in economics and social sciences, etc. This will be detailed in section 4.3.

Finally, the performances of the process can be evaluated. This requires an understanding of impacts and appropriate impact parameters. However, the evaluation of the solutions goes beyond impact/effectiveness measurement, ad implies connecting the impact with the design parameters (contract features and resources). For example, cost effectiveness may be assessed by linking impact to the cost of the contract solution, which is linked to some contract feature. Also, some procedural issues, e.g. transaction costs, may be used as a component of the measure of performance. This will be detailed in section 4.4.

Though the "separation" among these blocks is somehow artificial, it allows to put emphasis on contract features as the focal point of the project and the operational issues related to their design, impacts and evaluation. It also allows to highlight the main areas of attention for decisions-makers willing to set up contract solutions for AECPG production, i.e. context (state and flow variables) and its changes (impacts), contracts, processes, performances.

In order to avoid confusion, it should be kept in mind that some "items" (terms) could be in more than one block (box in the figure), but playing a different role. For example, farmers could be everywhere: they are part of the system, they may enter as parties in the contract, their behaviour describes the processes and their

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final changes in practices or income contribute to measure impact. The aspects highlighted are however different in each of the boxes.

All elements listed below are coming from a preliminary literature review, past experience and contributions by partners; they are a starting material for the setting up of the framework during the project's life.

4 Framework components and interactions

4.1 Context features/determinants/state variables

4.1.1 Introduction

This section describes the variables used to describe the context and to measure impacts, through their change over time and space. They interact with contract features in determining their feasibility and impact. In a way, this is the most significant component of the framework. The scope of these variables may be very wide, as the concept of context may be connected to a very wide set of features, ranging from locally-specific topics to global issues and worldwide phenomena, such as market trends and climate change. However, most of them are intended as being represented by some features of the bioeconomy system (intended as the aggregate of sectors using biological resources plus related natural resources themselves, in particular biological resources and resources connected to life such as water).

Also, the categories included here may include state variables, flow variables (e.g., ecosystem services) and changes in state or flow variables over time (and derived trends).

4.1.2 State of environment, ecosystems and public goods

The typology of public goods produced in the reference area is a key element for interpreting the potential role of contract features, as they determine policy priorities. All features and ecosystem services are potentially relevant here, however not all components of the environment and ecosystem services are PG. Several lists of public goods are available from the literature. Consistently with the project scope, we focus on environmental-climate public goods, thus specifically addressing the natural resources water, air and soil as well as biodiversity plus measures of climate conditions. In addition, landscape and its use are looked at.

A list of agricultural and forestry-related PGs, available from the PROVIDE project, includes the following:

- landscape and scenery;
- farmland biodiversity;
- water quality and water availability;

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- air quality;
- soil health;
- climate regulation;
- resilience to flooding, landslides and fire;
- rural viability and vitality;
- quality and security of products;
- farm animal health and welfare.

Note that some of these may also have the role of object of the contract (see 4.2).

Besides the typology of PGs, also other features may be important; in particular:

- functional relationships, e.g. thresholds, cross-PG relationships, etc.;
- connection with agricultural/forestry practices (ranging from full jointness to totally independence of PG), also somehow interacting with the previous point;
- current level of provision/under-provision, which determines potential for change;
- social value attributed to public goods, including its monetary estimation;
- scale of provision and scale of demand; the two scales might not coincide; an usual distinction is Local vs. global PGs;
- point vs. non-point sources, usually used to qualify pollution-related public goods or bads.

4.1.3 Agricultural, forestry, food production components

A number of characteristics are used to describe the sectors/industry involved, intended as the system of enterprises and their organization.

First, different economic subsectors are usually distinguished:

- agriculture is the main sector in focus as the producer of AECPGs and as the addressee of the main policies studied by the project (notably the CAP);
- forestry is also of growing importance and has several peculiarities (type and timing of production, types of AECPG produced) that makes it different from agriculture;
- food production and retail are considered as it is an engine of incentives to farmers and may provide incentives for the provision of public goods besides marketing and communication with consumers;
- other bioeconomy sectors (e.g. biofuels, biorefineries plants, bio-based value chains) may be strong determinant of incentives at the farm level by affecting the farmers opportunity costs and directly involved in the provision of public goods (e.g. CO2 or renewable energies).

For each of these categories (separately and together), in order to support an understanding of AECPGs provision, the relevant features may be roughly classified into:

- structural characteristics;
- economic performance/features;

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- actors' preferences/ attitudes towards environment, innovation, and contract features;
- internal organization, governance and institutional arrangements;
- value chain organization (vertical, integrated) and networking;
- distance to or degree of connection with the final consumers.

Macro categories qualifying the production systems as a whole may allow a better overall understanding of the incentive system and potentialities, as well as of the degree of the elaboration of collective solutions, hence finally the plausible approaches in each area.

A relevant example is the list below, slightly adapted from the classification used in the H2020 PROVIDE project (Viaggi, 2014):

- intensive agricultural areas (high trade-offs with public goods);
- areas characterized by tourism opportunities or linked to urban areas (high opportunities linked to recreation etc.);
- areas affected by abandonment/internal areas (low trade-offs: Merckx and Pereira, 2015);
- agricultural areas with low income/low development;
- forest areas;
- areas with natural and environmental constrains (Natura 2000).

Historical trends and trajectories of system evolution matter and are worthy of consideration, in order to identify reasons for the current state of play and also better understand dynamic phenomena, like transition and path dependency.

4.1.4 Technology

Technology refers to the broad set of technologies available in the system in and by which the contract is implemented. The stock of available technologies determines production possibilities, trade-offs between private and PGs, production costs and profitability; this also includes information technology suitable to reduce input use (precision farming, satellites, etc.), or to manage transactions, or to monitor results and the environment itself.

From the point of view of CONSOLE, technology is relevant under three main aspects:

- the set of potential technologies/practices that can be proposed/adopted to increasing AECPGs delivery (AECPGs production is often connected to changes in technology or practices), which can affect the design of measures (note that this is different from the choice of specific practices in the design of the contract);
- technology in the field of digitalisation, potentially usable for monitoring, evaluation, and traceability of measures/contracts; here some options such as satellite monitoring,

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block chain, etc. have the potential to bring even radical changes in the approach to contract design and in the feasible contract options;

- information technologies can also have a major role in reducing transaction costs and information asymmetries in coordination and management, e.g. in collective solutions.

The CONSOLE project is especially concerned with the second point, as long as new technology options can also be key to determine the feasibility of some type of contracts, in particular result-based or collective. The implementation of these solutions is indeed typically limited by the ability to monitor results. More generally, this can support coordination among actors and communication connected to contract implementation. In addition, through interoperability and in some cases big data exploitation, connection between land use, recorded practice and results can be achieved. This has implications also for contract design, e.g. level and distribution of transaction costs, sanction systems, etc. The third point can also be key in several contexts.

The combination of points 2 and 3 can also bring completely new ways in producing information and assess measures. A case is that of crowdsourcing databases. As another example, Rosário et al. (2019) illustrates Geocaching, an outdoor game that uses Global Positioning System (GPS) for assessing values and ES indicators. In general, smartphone technologies are expected to open the way not only to smoother communication, but also to a more active role of farmers monitoring and contract management.

Some of the topics above point to the general issue of Big data, which are expected to have an important role in sustainability, but their potential is still largely unexploited and difficult to grasp (Weersink et al., 2018).

4.1.5 Policy conditions[1]

Under policy conditions we include mainly public policies acting on the bioeconomy and resources system mainly through regulation and incentives. This includes specifically provision of incentives to the adoption of AECPGs contract solutions, consistent with the contract types in the focus of the project. Many policy measures can be interpreted as well through contract categories.

Connection with policy includes in particular connection with the CAP, in particular in relation to integration of environmental requirements (but see full policy coverage in the project) and supports the policy-related exploitation of CONSOLE results. The EU has already envisioned the use of collective measures in the first and second (AECPGs schemes) pillar and provided the possibility for result-based approaches.

[1] Policy and legal conditions could be described under the same chapter as they are often connected to each other; given the focus of the project, we keep them separated.

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Besides individual policies, also the policy mix and the combined working of different policy measures is important. In particular, the evolution of the policy mix and environmental regulation within the CAP (i.e. cross-compliance-; greening and AES) is important. Within this, we will keep a focus on post 2020 CAP reforms.

The wider policy context (again connected to the legal aspects) also includes policy principle and affects the definition of property rights. An example is the threshold between polluter pays principle (PPP) (cross-compliance) and provider gets principle (AESs), which in fact affects the definition of Public Goods vs. Public "Bads".

In the timeframe of the project, policy demands coming from the European Green Deal and by the related Farm to Fork and biodiversity strategy will be of particular relevance for the project, as well as the delayed process of CAP reform and the preparation of the National Strategic Plans.

The ongoing discussion about CAP implementation as well as the Green Deal and the related Farm to fork and biodiversity strategies have been released towards the end of the preparation of this document and will be the key policy references for the next steps of the project.

4.1.6 Legal conditions

We consider here any type of legal frameworks that can affect contract working and that can in particular affect AECPGs provision. It concerns in particular the legal bases of agriculture and environmental policy. Legal conditions are especially relevant to identify the feasibility of innovative solutions, e.g. to what extent result-based payments are consistent with the current legislation, or which legal changes need to be made. Legal thinking is becoming urgent under the application of payments for environmental services (Langlais, 2019). Further key areas of concern are WTO and competition laws, and land tenure regulation (national and local).

The contribution of the legal reflection for CONSOLE is organized around three points:

- the identification and in-depth analysis of the different forms of individual contracts likely to provide environmental goods and services. This typology of the contracts to be studied within the project is to be carried out with reference to the contracts identified as key for CONSOLE, having regard also to the expected contractual characteristics (duration of contract, for example). This should make it possible not only to analyse the legal feasibility of the contractual proposals made, but also to make suggestions for improvements so as to meet the various desired requirements.

- the different legal models for collective supply of environmental goods and services, whether in a vertical form (along value chains) or a horizontal form (such

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as agricultural producer groups offering their environmental goods and services together in order to, for example, combat flooding at a landscape level).

- in addition to such formal contracts, there will be exploration of the surrounding legal framework which must effectively be analysed in order to assess contracts, tools widely used in environmental law and therefore the contract law associated with it here, the various forms of law useful for analysing the feasibility and improvement of CONSOLE's contractual solutions. In this context, reference will be made to, *inter alia*: competition law, including state aid; WTO law; public procurement law; and, rural law. And it will also be necessary to address this framework at the articulation between different levels (international law; European Union law; and national law, including regional and local application).

4.1.7 Market situation

Markets are related to AECPGs provisions and specifically to contracts in different ways.

First, by determining prices of goods, the market situation can affect trade-offs and opportunity costs attached to the provision of AECPG, when they imply reduction of income. Note that in this interplay not only the market of agricultural products, but also the market of agricultural input (e.g., energy, fertilisers, etc.) can be very relevant.

A key role in connection to AECPGs can be played by market of diversification activities (i.e. recreation activities, rural development initiatives, among others).

On the other hand, markets can provide remuneration of AECPGs components when there is a positive willingness to pay by consumers for PGs attached to private goods. This in practice is also connected to marketing strategies, value chain structure, general economic situation of potential consumers (e.g., income), potential segmentation options. An important role in this direction may be taken by instruments such as standards, labels and certification schemes.

4.1.8 Other actors, institutions, governance

In this category we include at large other actors than agricultural, forestry, food production firms and that interact with the working of the bioeconomy system.

Farm extension and advice (and the Agricultural Knowledge and Innovation system – AKIS - as a whole) are key players as they support farms decision making and the costs of change.

A central role may be played by consumers and by their willingness to pay for sustainable production, but any important player in the system may be relevant, especially public bodies and connecting institutions, such as NGOs, parks etc. The interaction among these players affects directly or indirectly the provision of AECPG by agriculture and forestry and the related initiatives (and have a special

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role in the kind of instruments addressed by the project, e.g. collective measures). Their interaction is affected by existing institutional relationships and connections. This also allows or hampers the feasibility of contracts and facilitate coordination in some cases.

Other actors of the value chain may have an important role; e.g., input suppliers and processors of agricultural products.

The same applies for a variety of other actors, such as municipalities.

With respect of the specific initiatives these categories can take the role of actors when they are actively involved in the action or as parties in the contract, or stakeholders, if they have a stake in it but are not directly active or contractually involved.

Note that, in a circular bioeconomy and ecosystem services vision, the different and social components are more and more interconnected and spatially related. As a result, besides individual actor groups and features, it is important to identify categories to qualify the whole system, much beyond agriculture and forestry, such as those proposed by the literature on socio-ecological systems.

4.2 Contractual features

4.2.1 Introduction

Contractual features refer to the characteristics that can describe a contract. It is well-known that a difficulty with contract analysis is the complexity of potential contract design dimensions and how the different contract prescriptions interact among themselves and affect the outcome.

In order to relate the contract features to the scope of the project we identify two sets of features:

a. Features characterising selected AECPG contract typologies:
    1. tenure-related prescriptions (qualifying environmental-related tenure contracts);
    2. reference parameter for payment (qualifying result-based approaches);
    3. role of cooperation among farmers/actors (qualifying collective approaches);
    4. degree of connection with private goods provision (qualifying value chain approaches).
b. Other features, e.g. Length (etc.)

Features listed in group a) have been identified in the project (and in the literature) as so important as to characterise the functioning of the contract for the purposes of policy analysis. For these reasons we use also them in the project to identify **contract types**. However, they are not exclusive, meaning that hybrid

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forms can exist. Features of group b) can be relevant per se and in combination with some of the feature of group a).

The four contract features mentioned above and illustrated below are not mutually exclusive, i.e. they can be included in a contract in combination. So, we use the term contract feature to identify an element of the contract and contract type for specific combination of these features. One prevailing feature may characterise a contract type, e.g. result-based payments. A specific topic for contract design is actually concerning the combination of these features.

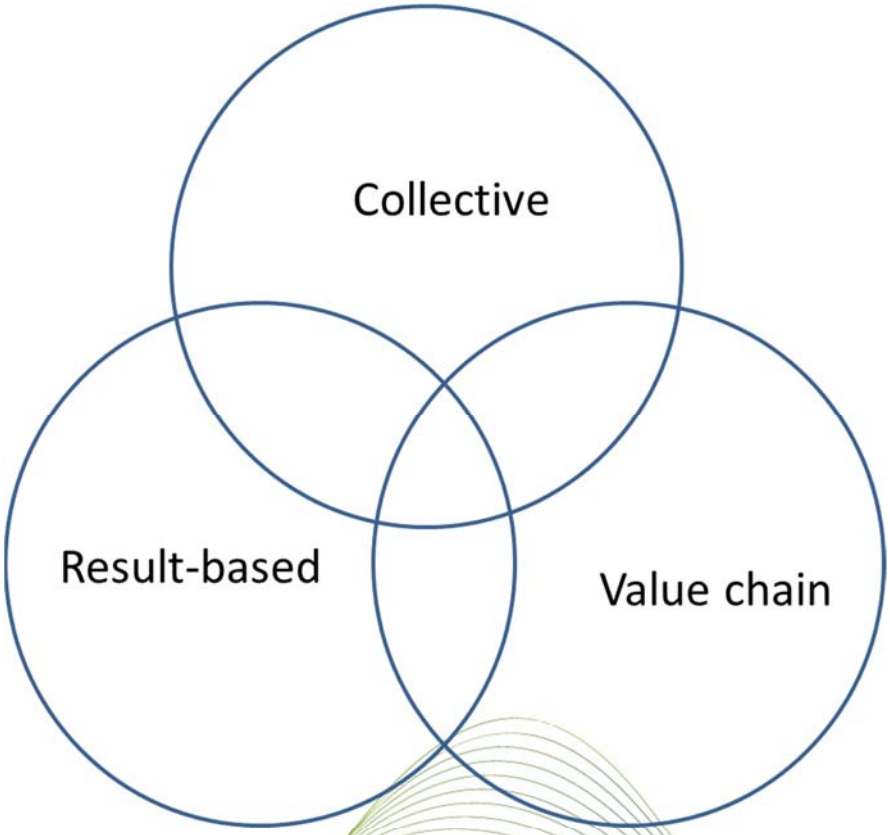

Figure 3: Potential classification of contract types based on features 2-4

A review of available studies estimating preferences for different contract characteristics is available in appendix 1.

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4.2.2 Feature used to identify contract types in the project

4.2.2.1 Tenure-related environmental prescriptions (qualifying also environmental-related tenure contracts)

Environmental prescriptions can be related to tenure. These characteristics of contracts may in principle include a wide variety of cases.

Some examples of environmental-related actions connected to land tenure are available in the literature. Zabel, Bostedt, and Ekvall (2018) provide an example of tax system on forest landowners in Sweden and related design problems. More are reported but little studied. For example: leasing by parishes constrained to cultivate with organic technology (Austria) and collective lease agreements to manage abandoned land (Italy);

The trade-off between purchasing environmental goods and purchasing land has been discussed in the literature for a long time. As a recent example, Schöttker and Wätzold (2018) analysed the cost-effectiveness of purchasing land vs. compensation for practice adoption, using a case study in a Natura 2000 conservation area in Schleswig-Holstein.

The specific characteristic of interest for CONSOLE is that of tenure contracts involving also environmental prescriptions; this may involve different combinations of private and public actors and be associated or not to incentives such as tax reliefs.

4.2.2.2 Reference parameter for payment (qualifying some categories of result-based approaches)

Payments to farmers for the provision of AECPGs may be calculated in different ways. In general, the payment can be divided into a fixed component and a variable component. The latter can take more or less into account the actual results (in terms of PG provision) of the actions taken by the farmers.

Hanley et al. (2012) preferred the contract classification as action-based and outcome-based. White and Hanley (2016) further provided a classification of contract types for the production of public goods:

1. Output-based contracts: payments targeted at output (such as better water quality);
2. Input-based contracts: payments targeted at the management of input (or actions) that are supposed to influence the output (such as change in fertilizer use);
3. Asset-based contract: payment targeted at the maintenance of an ecosystem asset (Hart and Moore, 1988; Aghion and Holden, 2011)

Result-based approaches (also known as payment for outcomes) are payments based on performance or output, in contrast to action-, practice- or input-based approaches; result-based approaches connect payments to environmental effects (Derissen and Quaas, 2013; White and Hanley, 2016; European Network

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for Rural Development, 2016) or in or terminology, to the amount of AECPGs provided. Note however that this may not be exhaustive of result-based approaches at large, as result-orientation can be taken into account in different ways (e.g. in the application selection process).

Usually agri-environmental payments in the EU CAP are targeted to management actions (input based) typically because these are thought to be easier to observe and because environmental outputs are determined by a wide range of factors, some of which are not under the direct control of farmers. However, there might be the case that some management action is expensive to the regulator to observe and/or the regulator might not be aware about the best method for investing in the ecosystem asset. Under these circumstances an output-based contract might be more cost-effective.

CONSOLE focuses on the analysis of proper result-based payments, i.e. payment based (also) on measurable results originated from farm practices. Output-based or results oriented are here intended as distinct categories from result-based. However the consideration of alternative mechanisms either input-based or using approximation of results (results oriented or computed results) may be relevant both for comparison (Moxey and White, 2014) and because they can yield insights about feasible alternatives.

Action-based AES are considered providing too little impact. Recent evidence corroborate this, pushing for higher flexibility (Arnott et al., 2019). In addition, the main rationale from the literature for adopting result-based approaches is that they are more economically efficient (Reed et al., 2014), including providing incentives for farmers to innovate (Burton and Schwarz, 2013) and together with a broader scope of effect, such as flexibility, higher intrinsic motivation and improved continuous adaptation (Matzdorf and Lorenz, 2010). Advantages of payment by results are thoroughly identified and described by Herzon et al. (2018).

However, obstacles and disadvantages are identified such as given below (Matzdorf and Lorenz, 2010; Reed et al., 2014):

- scientific uncertainty and lack of pricing of ecosystem services;
- timing of payments;
- increased risk to farmers; specifically risk of not achieving the objective for reasons independent from the farmers' actions and consequence on contract acceptability;
- compliance with World Trade Organization regulations;
- barriers to cross-boundary collaboration in the management of ecosystem services at habitat, catchment or landscape scales;
- transaction costs;
- dependence of the expected performances on the behaviour and information assumptions (see next section).

Hence, while offering theoretically better performances, these solutions put more risk on the participating land managers and hence require a careful design, in

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particular in case of high uncertainty of the outcome (Matzdorf and Lorenz, 2010). Strategies are proposed to make the result-based solutions more acceptable, such as the combination with insurance schemes (Reed et al., 2014) and other options that transfer the risk of not achieving the objectives on e.g. investors.

Various papers address the problem from a theoretical or modelling point of view. For example, Drechsler (2017) develops a conceptual model to analyse the performance of Input- and Output-based Payments for the Conservation of Mobile Species. White and Hanley (2016) model the relative performance of result-based payments under asymmetric information.

A broad review of existing result-based agri-environmental schemes in Europe is provided by Burton and Schwarz (2013) focusing on two key 'problem areas': the increased risk for farmers and the difficulties of developing and monitoring indicators. They also propose a framework to examine the advantages of result-based approaches, identifying three main dimensions: proportion of the result-oriented payment; sensitivity of payments, and duration of the schemes (and payments). The work also highlights the role of this kind of payments to promote cultural/social change and the need to ensure cultural embeddedness.

Several examples of result-based payments or empirical analysis of hypothetical schemes are available in the literature.

Matzdorf and Lorenz (2010) present the results of 90 interviews with farmers who have participated in a result-oriented AEM in Baden-Wuerttemberg (Germany). The main finding is a positive impact on cost-effectiveness, but the results also highlight that the concrete design and the implementation process play a crucial role for their successful application.

Zabel (2019) reports result-based program for biodiversity on alpine pastures in Switzerland. The largest part of the variation of payment levels can be explained by livestock density, livestock species composition, property rights, individual versus collective management, and social capital. In this case the option to provide some payment in advance is also an interesting incentive solution, while monitoring and extra payment is provided 8 years later.

Relevant initiatives are those using "prize" schemes, e.g. *prairies fleuries* in France. Incentives derive by both the payment and the acknowledgement by peers (winners are acknowledged at the prestigious agriculture exhibition in Paris of the prize by the Agriculture Ministry), the neighbouring farmers meet together with technicians to "judge" the best pasture and attribute winner, it is a sort of social capital-based scheme (Fleury et al., 2015).

Palm-Forster, Suter and Messer (2019) reported experiment-based solutions to link payments to reduce pollution to water quality, also testing innovative design.

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Wezel et al. (2018) analysed result-based solutions in the context of mountainous farming in different Alpine countries, by carrying out 79 interviews with farmers in different case study regions in Germany, France, Austria, Italy, and Switzerland.

Russi et al. (2016) analysed MEKA-B4, the result-based agri-environment measure in place in Baden-Württemberg (Germany) between 2000 and 2014, which aimed to preserve species-rich grassland.

Birge et al. (2017) designed a hypothetical payment-by-results scheme for biodiversity conservation on environmental grasslands in Finland, based on indicators related to a number of species. Farmers were positive, but the advisors brought doubts about the implementability of the scheme and the compatibility with the current policy context.

Schroeder et al. (2013) investigated farmers' acceptance and perception of potential 'Payment by Results' (PBR) in grassland. The results show that the majority of farmers accepted result-based payments. Acceptance was significantly influenced by farmers' age, experience with AES, farm size and abundance of pre-existing environmental features. An approach combining differentiated options, including payment options with different target levels emerged as a possible way forward.

Various alternative options also do exist to avoid the direct measurement of results in a result-oriented approach (Reed et al., 2014), such as the use of pressure-response functions and modelling approaches (establishing causal links between management and ecosystem service delivery, as well as reducing the costs of monitoring). For example, Muenich et al. (2017) developed a PFP system that uses a unique application of one of the leading agricultural models, the USDA's Soil and Water Assessment Tool, to evaluate the nutrient load reductions of potential farm practice changes based on field-level agronomic and management data. This support spatial targeting that can be interpreted as a result-oriented approach.

The literature also provides a number of other results-oriented solutions that are, in principle, outside the scope of CONSOLE. An example is payment-by-results conservation procurement auctions (Groth, 2011). In turn these solutions reveal trade-offs compared with non-payment-by result version, e.g. because of higher transaction costs (Coggan, Whitten and Bennett, 2010; Palm-Forster et al., 2016). Some failed initiatives are also reported (cfr. Task 2.3) where the complexity (and cost) to achieve an actual monitoring of results determined the failure of the scheme (e.g., In S. America reported by the World Bank as cited by Schomers and Matzdorf, 2013).

4.2.2.3 Role of cooperation among farmers/actors (qualifying collective approaches)

Interplay among farmers and/or other actors can take different forms. In a broad sense, collective approaches are schemes for which the individual rewards

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depend by design on actions/decisions taken by others or collectively. For example, on a similar issue, (Kotchen and Segerson, 2018) define the key feature of group approaches as “the creation of regulatory interdependency among group members.” The "team production” problem was first addressed by Holmstrom (1982). The premium of an agent depends on the production of other agents. With team production new moral hazard problem arise (collusion, renegotiation).

Two main elements can be potentially used to qualify collective approaches. The first one is a horizontal collective action element, i.e. a group of farmers arranges a cooperative agreement in order to deliver environmental public goods. The second one is the inclusion of a collective conditionality constraint added to a contractual arrangement, i.e. the contracts are between (or is activated to) a group of agents, rather than to individuals, to carry out actions in order to deliver agri-environmental public goods. The agglomeration bonus is an example of this type of mechanisms. The agglomeration bonus is a two-part scheme where in additional to a traditional per-hectare payment, a bonus is added in case plots of enrolled land are connected to each other (Parkhurst et al., 2002; Wätzold and Drechsler, 2014).

Note that albeit important, ambient mechanisms fall out of the mechanisms analysed in CONSOLE as they lack, at least in their original form, a voluntary character (Segerson, 1988; Romstad, 2003).

Actually, within this definition, a major issue is the distinction between cases in which individuals are affected by others, but decided individually, and cases in which the decision itself is taken collectively. CONSOLE will focus on the latter, but we mention first examples of the former, as they can be relevant as complementary solutions. The agglomeration bonus provides an example of how a contracts solution can fall in either one of the cases depending on how on how the mechanisms is specified.

CONSOLE will focus in particular on collective solutions involving mainly collective implementation of practices where different farmers, or farmers and other actors, collaborate in producing one or more AECPGs. The key definitory character is that a single payment is delivered to a group of farmers (or, less in focus, other actors).

This type of solution is particularly suitable to deal with landscape-scale configuration of public goods provision; however, it may involve higher coordination costs (Uetake, 2012; Lefebvre et al., 2015; European Network for Rural Development, 2016a).

Various cases of collective solutions are appearing in the literature, also providing more generalised insights about their functional features. Westerink et al. (2017) reported case studies from five EU member states in North West Europe and analyse their collaborative governance arrangements. They investigate the

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distribution of governance tasks among actors and the changes of this distribution over time.

Groeneveld et al. (2018) used multi-objective modelling to assess collective participation in Dutch AES schemes and its impact on biodiversity

Riley et al. (2018) analysed collective measures in UK, also providing a theoretical contribution in linking their working with trust and the concept of good farmer.

Westerink, Melman and Schrijver (2015) studied the role of scale and self-governance in agri-environment schemes, considering two alternative approaches in the Netherlands using collective solutions.

Franks and Emery (2013) investigated 18 Environmental Stewardship Scheme (ESS) agreements in UK. They found that the number of stakeholders and their range of interests (rather than the land area covered by the agreement), are the major determinants of transaction costs on large-area agreements.

Zavalloni, Raggi and Viaggi (2019) theoretically analysed a mechanism that rewards farmers in case they cooperate on habitat when biodiversity provides ES benefits for the agricultural production.

Sheremet et al. (2018) considers the problem of designing PES-type contracts to encourage participation and spatial coordination amongst private forest owners in Finland.

The consideration of collective/collaborative actions can go beyond collective participation of farmers to AES. For example, Pinna (2016) studied the link between Alternative Food Networks, agro-biodiversity and landscape protection in connection to two rural parks. Initiatives such as Producers Organisation (PO) may be examples in this direction, as well as variety of multi-actor initiatives. These may provide relevant insights even if in principle outside the scope of CONSOLE.

4.2.2.4 Degree of connection with private goods provision (qualifying value chain approaches)

Production of public goods may have different degrees and types of connection with the provision of private goods. In many cases, in addition, ecosystem services and climate-related goods are not pure public goods.

While a lot of research has been devoted to governmental support of AES, much less is known about value chain approaches in which consumers of a private good also accept to pay for some attached public good. However, a growing literature from business studies is investigating new business models and strategies to make the supply chains more sustainable by internalizing the added value that society demands. These studies describe for example the drivers of corporate social responsibility, the creation of shared value across the supply chain (Porter and Kramer, 2011) or the development of the inclusive business model (Chamberlain and Anseeuw, 2019)(.

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Key players in this context are industrial food producers and retailers. Results from recent studies show that food companies have an interest in the documentation of environmental benefits of supplying farms and that this can be used for their marketing strategies. They are also willing to provide support through finance and appropriate contract design (Kempa, 2013) or through technology and knowledge.

In CONSOLE, value chain approaches will be addressed as an additional mechanism and a cross-cutting theme of solutions for valorisation of AECPGs through the market.

4.2.3 Other relevant features

There will be several other features also interacting with the above. We list some of most relevant below.

Other payment characteristics

Besides the way the payment is connected to output and input, also other characteristics may be relevant. The most widespread parameter relevant for decision making is of course the level of payment.

In addition, there could be other issues, such as the presence of bonuses and the timing of payment delivery (relevant for farm finance).

Enforcement

Enforcement can take place in different ways, the main distinction being third party (the court) vs self-regulation solutions. Self-regulation involves the private provision of public goods and private redistribution and takes place outside the institutions of government and, hence, in the realm of private rather than public policy (Baron, 2010).

Monitoring and sanctions

The monitoring and sanction system is related to enforcement. Monitoring concerns the actions taken to check implementation or effects. The sanction system concerns penalties expected in case of non-compliance.

Length of the contract

Time-horizon (length) is the duration of the contract. Long-term contracts may have different environmental effects but also different preferability for famers

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than short-term contracts. For example, barriers to participation may be faced by tenant farmers who only have short-term security concerning land availability (which may be also an explicit legal requirement).

The length of the contract also has a relevant implication in term of risk behaviour. Ridier (2012) shows that a long-term contract is preferred by risk-adverse farmers when the decision is affected by high uncertainty (for example, on commodities prices).

Contract incompleteness brings to frequent renegotiation and, consequently, to short term contractual cancellation (Fraser, 2002; Fraser, 2012). Drechsler, Johst and Wätzold (2017) analyse with a conceptual ecological-economic model how the cost-effectiveness of short versus long contract lengths depends on different ecological and economic parameters. Moral hazard, targeting and contract duration in agri-environmental policy are investigated by Fraser (2012).

Actors/parties involved

Actors are the parties involved in the contract. This may include (at least two) single actors, a group of actors, multilevel actors.

Scale of the contract, e.g. farm level, landscape level, watershed, region, etc. is also important in connection with the parties involved.

Object of contract solution: AECPG type and others

The object of the contract for our purposes can be mainly defined based on the PG intended to be produced. It can be any of those listed in section 4.1. Some of them may be excluded from the list here as they are not environmental/ecosystem service/climate PG, for example Rural viability and vitality and Quality and security of products.

The AECPG(s) intended to be produced are important as there is a connection with the performance and suitability of the different contract types/features discussed above. For example, result-based solutions may be more suitable for some biodiversity parameters and carbon stocks, but much less (or not at all) for diffuse pollution.

An important point is if contract features concern one single service, multiple services or have a holistic (environmental) approach. Only rarely contracts include a system approach (e.g. organic production); most often they address specific assets, management practices or PGs.

Besides the general list provided above, also new types of PG are emerging, each requiring appropriate instruments for analysis, as well as policy instruments (Davies and Hodge, 2006). A recent example is provided by Mato-Amboage, Pitchford and Touza (2018) who conceptualise a novel biosecurity (interpreted

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as an emerging type of public good) instrument relying on formal compensation private–public partnerships using contract theory.

In practice the definition of the PG in the contract specification is much more detailed, e.g. water quality may be identified through one or more different parameters of quality etc. It can also be qualified in different ways, e.g. as an expected change, the respect of a threshold or some other definition.

In many cases, the contract is defined in terms of technical prescriptions, e.g. on pesticides use. Amount/size of the contract can also be important, e.g., the amount of land involved.

Information as a part of the scheme/role

Information and advice may be provided to famers as part of the scheme. Information provision may interact with other contract features, for example ability to implement collective action (Opdam et al., 2016).

Flexibility

Flexibility is an important characteristic of the contract. Flexibility may apply to several parameters, such as the length of contracts, the selection of measures, the prescriptions to be undertaken, the area under contract, etc.

4.2.4 Relationship with payments for ecosystem service (PES) literature

In the CONSOLE project we do not discriminate if the contract types addressed can be classified or not as PES as long as they respond to the characteristics described above. The literature and definition debate about PES is already quite complex and we do not enter into that debate (Schomers and Matzdorf, 2013; Waylen and Martin-Ortega; 2018). This also applies for the different performances of PES as compared to other instruments (Ando and Langpap, 2018).

4.3 Mechanisms/processes

4.3.1 Conceptual and disciplinary references

On the disciplinary side, CONSOLE entails an understanding of both individual and collective actions, as well as the study of how this translates into environmental and/or climate benefits.

Behavioural aspects may be particularly relevant for the collective implementation of environmental conservation practices which requires horizontal coordination and action among independent landowners and

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managers. In addition, monetary incentives (either individual or collective) coming from public policy may be not the only mechanism affecting decisions. While it is understandable that farmers have little incentive to continue the provision of practices related to public goods without payments, due to lack of remuneration by the market (Hodge, 2001), the literature also highlights the potential of vertical cooperation with AECPGs valorisation through product chain strategies and the connection of beneficial AECPGs practices with social capital and innovation (Saxby, Gkartzios, and Scott, 2018). The literature also suggests that simple monetary assessment of incentives might fail to explain the emergence of cooperation (Ostrom, 1990). Institutional consideration, fairness in the distribution of benefits and costs, monitoring, transaction costs are all elements that become relatively more important when the collective implementation of resource conservation is targeted. The degree of interplay in these cases is so relevant that, in some cases, not participating by one lead to complete failure (lack of implementation) or non-achievement of the initial objective.

CONSOLE covers broadly all the main dimensions of contract design. The approach requires understanding of four main aspects: a) mechanisms in their stylised form, usually addressed by economic incentives through simple behavioural assumptions and formal mathematical analysis or mathematical modelling; b) the actors' (e.g. farmers) expected behaviour in relation to the solutions proposed, often addressed through the theory of planned behaviour, or more in general, behavioural economics using often experiment-based instruments; c) the institutional understanding of arrangements and solutions among stakeholders' interactions, which needs interfacing transaction costs economics, socio-ecological systems, legal perspectives and transitions in collective actions; d) the impacts on environmental goods and bundles of ecosystem services, and their interaction, which requires interfacing with sustainability and environmental sciences/landscape ecology. CONSOLE proposes a problem-oriented integration of these fields of expertise using a combination of selected instruments. Legal aspects (current legal framework and needed changes) will have a prominent role in the project in order to ensure the feasibility of more effective ways for the delivery of public goods in agriculture. Not only the EU legislative framework and WTO rules ("green box") will be addressed, but also national contract law will be looked at (Brink, 2009; Bureau, 2017). The link between agricultural policy program and indicators of provision of AECPGs needs to be strengthened also through common methodological standards and structured databases. A specific emphasis will be put on the role of new technology, in connection with result-based payments and for involvement in chain valorisation.

Most of the items listed in the mechanism's categories are somehow related to behaviour and decision making. A holistic framework concerning adoption of agro-ecological practice is provided by (Schoonhoven and Runhaar 2018) and applied to Andalusia.

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4.3.2 Costs/Benefits

The most classical economic basis to analyse behaviour is to consider costs and benefits of the proposed practices (determined also through the results they generate). Costs and benefits for farmers are the most common focus, but the whole distribution of costs and benefits including also other actors involved (e.g. public administration, chain actors, input providers, etc.) should be taken into account.

Not only total costs, but also cost structure may be very important in AECPGs provision. For example, Espinosa-Goded et al. (2013) analysed the role of fixed costs in AES adoption.

The relevance of transaction costs is a general issue in environmental policy (Coggan et al., 2010). Specifically private transaction costs on the one hand and public transaction costs in the form of administrative costs (Weber, 2014, 2015) may be determinant for policy feasibility (European Commission, 2019).

4.3.3 Asymmetric information and contract incompleteness

A large part of literature related to agri-environmental contracts addresses the problem from the perspective of asymmetric information and contract incompleteness.

If there are no informational asymmetries between the members of the group and between the group and the proponents of the contract (public and private institutions), then the solution to the problem of contract design is trivial. The problem becomes more complex when, as in real life, there are asymmetries of information or no complete contingent contract can be written.

With 'Asymmetric information' we mean condition in which one party in a transaction has relevant information that is not known by or available to the other party (Merriam-Webster Unabridge) (Ferraro, 2008).

Also, problems can arise when contracts are incomplete. "An incomplete contract has gaps, missing provisions, and ambiguities and has to be completed (by renegotiation or by the courts) with strictly positive probability in some states of the world." (Hart and Moore, 1999).

A classification of contractual problems under asymmetric information is the following (Laffont and Martimort, 2001).

- **Adverse Selection:** Asymmetric information arise before the parties negotiate the contract. The agent has some private knowledge about his cost that is ignored by the proponent of the contract (the Principal).
- **Moral Hazard:** Asymmetry of information arises during the relationship. The agent takes an action that cannot be observed by the Principal. The Principal observes only a noisy signal of the action (that is usually based on the performance achieved by the agent).

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- **Non-Verifiability:** The involved parties are symmetrically informed and observe the state of the world, but they cannot verify it to the courts. Therefore, contracts are incomplete.

In an AECPG contract, it is normally assumed that farmers are better informed than the public decision maker about implementation costs and results. Usually asymmetric information is one way, but can also be two-ways. Bilateral asymmetric information in AES is addressed by Cho and Blandford (2018).

The information conditions may affect the choice and the design of the instrument according to the different parameters listed in the previous section. For example, White and Hanley (2016) compare input-based vs. result based contracts. They found that under perfect information inputs or outputs-based contracts are equivalent. Under asymmetric information with adverse selection, input-based contracts are more cost effective in reducing the informational rent compared to output-based contracts. Mixed contracts are also cost-effective. The paper also analyses contracts under moral hazard, and repeated contracting.

4.3.4 Behaviour related to longevity

Evidence about determinants of temporal patters is still poor. Longevity is a term actually used for different situations.

One is that of continuation of participation to contracts by farmers or foresters. Farmers decision to continue in AES is analysed by Gatto, Mozzato and Defrancesco (2019). They found that farmers continuation of an agri-environmental scheme for a long period of time is the outcome of a mix of concurring factors, among which attitudes, motivations and social factors. It also depends on social pressure and choices of neighbouring farms. Núñez-Regueiro et al. (2019) found that PES on better land have shorter lifetime for forestry.

Another issue is that of longevity intended as the permanence of actions producing AECPGs once the payment is over, which is largely related to private incentives to maintain the adopted practices/technologies once the intervention is finished.

4.3.5 Acceptability

In general acceptability is the quality of a contract to be satisfactory or to be agreed on by potential participants, in particular farmers. This may be connected to some contract feature.

For example, cultural acceptability of result based are analysed by Birge and Herzon (2019). They distinguish “four categories of farmers based on their integration of ecological results into farming. These are determined by nature

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values being: 1) central to farmer thinking, 2) well-integrated, 3) viewed positively, but with limited actions and, 4) mainly absent."

4.3.6 Preferences for contract attributes

Farmers show preference for different (levels of) contract attributes. A collection of studies investigating preferences related to different contract attributes relevant for AECPGs provision is reported in appendix 1. Preferences may also concern some of the contract features used to identify types, e.g. the character of being result-based (Wezel et al., 2018).

4.3.7 Other behavioural issues and nudging

Behaviour research also investigates several other aspects of contract design and adoption.

One emerging topic relate to practice adoption is nudging. Experiments on nudging and compliance with water protection rules are investigated by Peth et al. (2018). Kuhfuss et al. (2016) investigated nudges, social norms, and permanence in agri-environmental schemes.

Among interesting behavioural-related issues one can also include farmers' self-initiated activities. A study of Dutch self-initiated activities through a farmers survey is provided by Runhaar et al. (2018), highlighting the different variables having a positive (e.g. organic farming) or negative (degree of intensity) on such activities.

Awareness is also a key to understanding behaviour and promoting behavioural changes, and related impact on AECPG production. Okumah et al. (2018) provide an example related to mitigating agriculture diffuse pollution.

Learning and behavioural changes are also highlighted in the literature. For example, the interpretation of monitoring as a learning process (potentially a very important issue in result-based solutions) is highlighted by Darnhofer et al. (2017).

Behavioural issues are more often investigated to explain low participation rates; e.g., see Rolfe et al. (2018) for conservation tenders.

Pro-environmental behaviour is per se an issue. See for example the case of landowners in Southwestern Ontario, Canada as studied by Nebel et al. (2017).

Heterogeneity in behaviour and practice adoption is a very relevant issue (Rolfe and Harvey, 2017), often explicitly or implicitly neglected.

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4.3.8 Governance

Governance and institutional organisation in the provision of PGs are relevant issues already studies for AESs. For example different institutional organizations are explored by Mettepenningen et al. (2013) for Flanders, in Belgium; and the state of Arkansas, in the US. The study highlights the importance of flexibility.

Governance may include different aspects, such as: a) reliability of the instrument/contract (does the instrument do what it intends to do, is that well substantiated); b) reliability of the data (entered data (by farmer/forester/land owner, etc), and reliability of the standard data in the model; c) Self-regulation or third party control.

Different solutions from a governance perspectives in promoting nature conservation are explored by Runhaar et al. (2018) in the case of Dutch farmers.

Governance perspectives may be linked to behavioural issues and finally to contract design in several ways. For example, Huising and Silbey (2018) identifies four levers used at frontline of an organization to encourage compliance in organizations: "nudge (individual), bureaucracy (roles, rules, and procedures), relational governance (network), and organizational culture (assumptions, values, and artifacts)".

4.4 Performance/evaluation

4.4.1 Overview

Considering the current setting of the CAP and the emphasis on new and innovative solutions such as result-based and value chain-related design approaches, evaluation is a structural part of contracts and policy design and key issue to understand feasibility and impact itself.

In literature, a number of parameters impacting on and defining the performance of contractual solutions for AECPG provision are discussed. Most prominent are the design parameters of targeting, flexibility, equity/fairness, compatibility, profitability as well as the building of social/cultural capital, all impacting on the *higher-level* performance criteria of longevity, effectiveness and acceptance of the contracts. Moreover, partly context-related performance aspects such as feasibility of implementation are relevant.

Naturally, main parameters are characterised by underlying principles/variables/sub-criteria. For example, longevity, as one main performance parameter, is driven by aspects such as the length of the contracts, the stability of participation, but also by aspects related to education/advice/ training/ information and the related building of social/cultural capital, and/or the support by the farming community.

Eventually, performance parameters are interrelated, while performance in one performance parameter can have immediate effects on another and those effects can be reinforcing as well as adverse. For example, compatibility of the

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contract with the land users' business design and with the legal system will expectedly have a positive effect on acceptance.

Therefore, an important issue is that of clarifying trade-offs among different performance objectives. Trade-offs between participation and effort are addressed by Schilizzi and Latacz-Lohmann (2016). Design issues in managing trade-offs between equity and efficiency are addressed by Chu et al. (2019). Wu and Yu (2017) develop an analytic framework to analyze the trade-off between economic efficiency and distributional equity in targeting payments for ecosystem services (PES).

Figure 4 illustrates the main performance parameters and the underlying sub criteria, as well as some of the interrelations.

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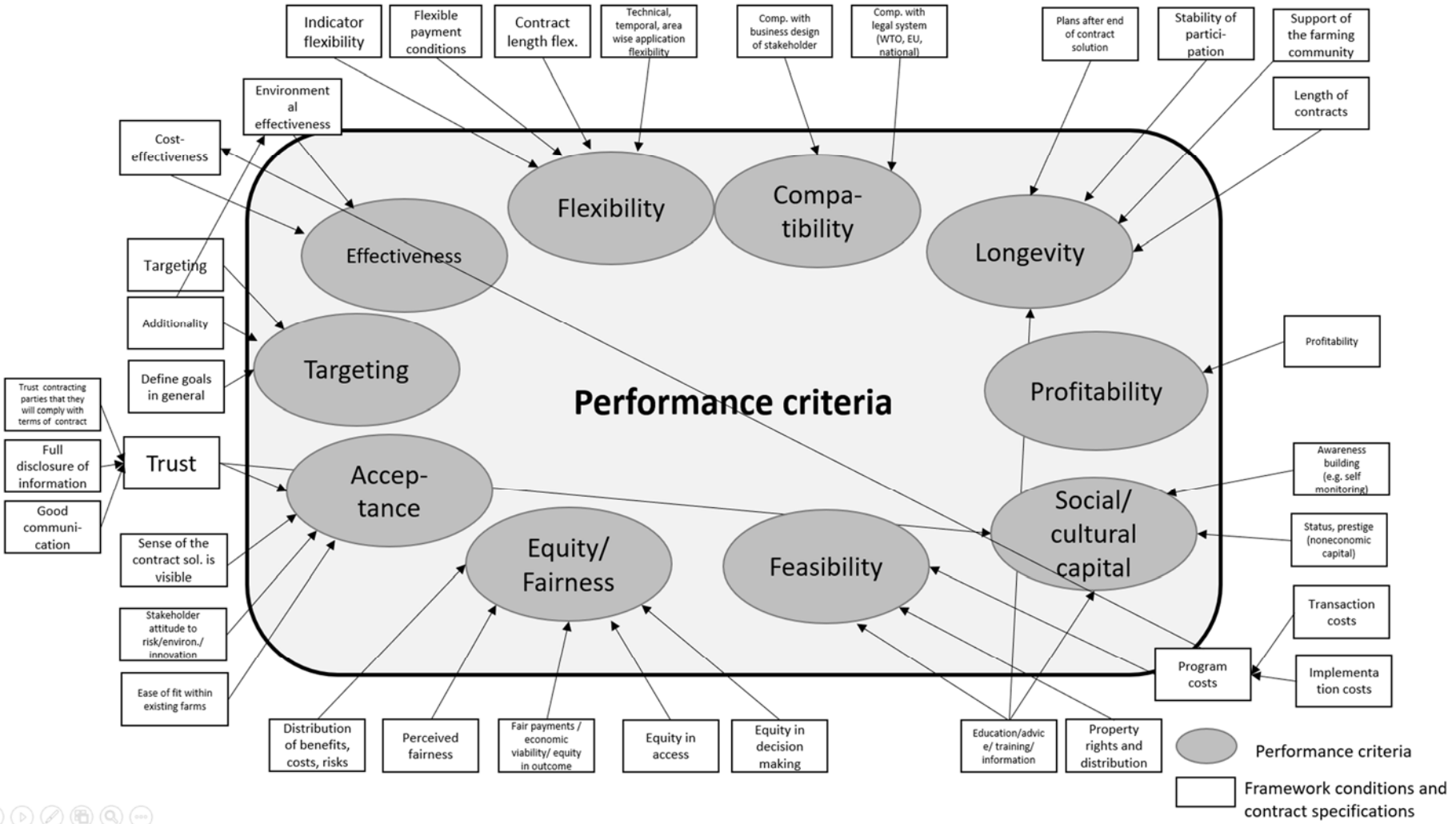

Figure 4: Performance criteria

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4.4.2 List of potential performance indicators

Below a list of potential performance indicators, is provided, including definitions and key references:

Effectiveness

The aspect of effectiveness involves environmental effectiveness as well as cost-effectiveness.

- **Environmental Effectiveness**: Environmental effectiveness can be defined as the level of provision of (total) AECPGs compared to the starting level and the achievement of the target in terms of provision of (single or multiple) AECPGs. For example define Börner et al. (2017), in their analysis of the the effectiveness of payments for environmental services schemes, environmental effectiveness is the change in the provision of services induced by the program, compared to a counterfactual without PES. While the use of targets as a reference for measuring environmental effectiveness is commonly used in RDPs, the interpretation can be problematic. If the target is set low, it will be easy to achieve (effectiveness is high), but the actual PG delivery is low. On the other hand, a higher-level target that is not entirely met might have more benefits in terms of PG delivery, while being evaluated as "less effective", because not met.
- **Cost-Effectiveness:** According to Batáry et al. (2015), the cost-effectiveness of solutions is defined by the relation between environmental outputs to cost (inputs), while costs to be potentially considered are program costs, transaction costs, farm implementation costs, etc. The comparison of cost-effectiveness of different contract solutions might be of particular importance for solutions funded by public money.

Longevity

The longevity is impacted by the length of the contracts, the stability of participation in the measures (avoiding exit from measures schemes before the end of contract), the duration of practices promoted by measures beyond the contract period, by the continuity of measures across different programming periods (i.e. integrated or organic production), by the support of the farming community (de Snoo et al., 2013) and by the education, advice, training, and information provided (Morris, 2004; Batáry et al., 2015; Meyer et al., 2015).

Acceptance

Acceptance refers to the willingness of a person (e.g. landmanagers/-owners) to participate in a programme, for example an AES or new contract solution, based on a positive attitude towards this programme. Acceptance by affected actors is a precondition for successful implementation. Acceptance is influenced by a broad number of endogenous and exogeneous factors, such as framework conditions, behavioural aspects, education and knowledge, etc. The construct of acceptance is also affected by other constructs (performance criteria) such as trust, equity and fairness, compatibility etc.

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Additional drivers of acceptance are

- **Ease of fit** within existing farms and farming systems (Batáry et al., 2015)
- **Ease of fit with actors/stakeholders attitude** to risk, environment, and innovation (Herzon et al., 2018)
- **Visibility of the sense of the contract solution** to the participants (Batáry et al., 2015)
- **Moral conviction,** meaning that participants think that the performed tasks in the contract solution are necessary and not morally questionable (Burton and Paragahawewa, 2011).

Targeting

Poor targeting of contract objectives is a major criterion for low economic and environmental effectiveness (Robalino et al., 2008). Improved targeting involves the following aspects:

- **Spatial/geographical targeting** aims to target resources to a defined area/region in order to address specific environmental criticalities (OECD, 2012).
- **Cost/benefit targeting**, combining spatial targeting with auctions or performance payments (Schomers and Matzdorf, 2013);
- **Structural targeting,** aims to target specific farm and forestry types to be covered (OECD, 2012).
- **Environmental (AECPG) targeting**, setting well-defined environmental objectives (Herzon et al., 2018; OECD, 2012).
- **Additionality,** dealing with the topic of deadweight effects in the implementation of environmental programs. An example for deadweight effects is that farmers only participate in programs they already fulfil the requirements. Additionality in contrast, means that the contract solution causes direct changes in land/resources use among participants compared to a baseline of "no contract solution". These changes in land/resource use have an actual effect on the provision of additional environmental services.

Flexibility

Increased flexibility enables the adaptation of contract solutions to different context situations, conditions and challenges (Waylen and Martin-Ortega, 2018).

- **Contract length flexibility**: Meyer et al. (2015), in their review on the influence of contract length on AEM success, hypothesise that flexibility in contract length is relevant as it influences participation (Mettepenningen et al., 2013). There are clear preferences for different contract lengths by farmers (Ruto and Garrod, 2009). Societally optimal contract lengths vary with socio-economic and ecological factors (Ando and Chen, 2011) The flexibility of the contract length, which considers the conditions, can benefit the success of agri-environmental programs (Khanna and Ando, 2009).
- **Technical, temporal, area wise application flexibility:** Meyer et al. (2015) and Siebert, Toogood and Knierim (2006) state that flexibility of agri-environmental measures is crucial for success: flexibility in AEMs in terms of application might be given through choosing the enrolled land (Mettepenningen et al., 2013) or by choosing the farm

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management measures and applied techniques (Ruto and Garrod, 2009). Primdahl et al., 2010 and Mettepenningen et al., 2013 highlight that the main advantage of flexible measures is, that the farmer's knowledge of the local context can be considered. Also, in terms of participation, farmers have positive preferences for flexibility over the enrolled land and over the applied techniques (Ruto and Garrod (2009).

- **Flexible payment conditions:** Herzon et al. 2018 argue that inflexible payment conditions can be one of the key reasons for poor effectiveness.
- **Voluntary vs. prescriptive participation:** Voluntary participation has been the main philosophy in promoting environmentally friendly forms of agriculture (e.g. in European agricultural policy). Measured by the impact on land use and/or farmer participation e.g in the CAP, this approach appears to be successful (Burton and Paragahawewa, 2011).

Equity/Fairness

Equity and fairness in the context of payments for ecosystem services in literature are discussed mainly in the context of developing countries. However, in connection to innovative contract solutions in CONSOLE and particularly when taking into account value-chain based solutions, involving actors with differing bargaining powers, the aspect appears relevant. Moreover, equity is also mentioned as a "key element to be taken into account when designing and implementing [...] PES" (Corbera et al., 2007). According to Schomers and Matzdorf, (2013), equity in the context of payments for environmental services include three elements, namely equity in access (who participates), equity in decision making (procedural fairness within the project framework) and equity in the outcome and fair payments (distribution of project outcomes among actors, in particular payments and their perceived fairness of their distribution) (Schomers and Matzdorf, 2013). Perceived fairness is influenced mainly by the perception of risk, costs, and benefits.

Compatibility.

- **Compatibility with the business design of participants:** It is obvious that farmers' acceptance of environmental friendly measures depends on the degree of integrability in their farming concept. The effectiveness of agro-environmental programs could therefore be improved by creating more customised, tailored schemes, fitting to the farming styles (concept which integrates human attitudes , farming objectives and economic success) and business designs of the addressed landmanagers (structural targeting). (Schmitzberger et al., 2005; Wrbka et al., 2008).
- **Compatibility with the legal system:** In the design of new measures, WTO, EU as well as national law and regulations should be taken into account (Herzon et al., 2018).

Profitability

Contract solutions, particularly payments for Ecosystem Services (PES) or result based approaches, can be directly profitable for the farmers/foresters as well as for other actors in the contract solution. In contrast, contract solutions that don't (or just) cover the costs of management changes (e.g. opportunity costs) and therefore reduce (or at least don't increase) the profitability of contracting actors

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are assumed to be not well accepted or long-lasting or self-enforcing (see Deliverable 2.3 of the CONSOLE project).

Social/cultural capital

Effective AESs need to consider and build up non-economic forms of capital, particularly to achieve awareness building and guaranteeing longevity (Burton and Paragahawewa, 2011, Pretty, 2003).

Besides economic capital (resources as material property), capital exists in the forms of **social capital** (resources that can be mobilized via social connections and mutual obligations), and **cultural capital** (resources in the form of knowledge, skills, dispositions, and possession of culturally significant objects). Via symbolic capital (status, prestige, and reputation) capital is transferrable between its different forms (Burton and Paragahawewa, 2011).

Cultural capital can be built up, and eventually be measured by:

- Certificates from recognized farmers organizations (companies, farmers unions, breed societies), acknowledging e.g skills and achievements of land managers (Burton and Paragahawewa, 2011)
- Explicit teaching, about the connection between their land management practices and the environmental outcomes, measurable through agriculturally relevant educational qualifications and the status of the awarding institutions (Wacquant and Stones, 2006)
- Extension of skills and knowledge, which helps to change the behaviour of the farmers for a long term and so influences the effectiveness. (De Snoo et al., 2013)
- Increased trust (Burton and Paragahawewa (2011)
- Payments for reaching set of targets, instead of payments for prescribed activities, increases the cultural capital (Burton and Paragahawewa, 2011, p. 101)
- The individual's subjectively perceived level of skills, which likely determines behavioural choices (Fishbein and Ajzen, 1975; Ajzen, 1985)
- The amount of time engaged in a particular management/production relative to time spent in other activities. This measure assumes that in the production process, skills are continuously accumulated and social networks based around that form of production strengthened – for example, through meeting other farmers at sheep sales, breed society events, (Coughenour, 1976) (Holt, 1997, p. 109)
- Objectified cultural capital, such as the possession of equipment associated with the production of a particular commodity (Burton and Paragahawewa, 2011) e.g. for cereal farmers' new machinery or size of grain silo.

Feasibility

The feasibility of implementation of contractual solution is mainly challenged by program costs (transaction and implementation costs), as well as property rights and their distribution (Schomers and Matzdorf, 2013). Moreover, feasibility is driven by assistance to implementation while a lack of assistance can lead to frustration and the eventually to quitting participation in the contractual solution (Morris, 2004). To increase feasibility, land managers need to be provided with

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education, advice, training, and information (Meyer et al., 2015; Batáry et al., 2015).

Trust

A culture of trust between all stakeholders influences the effectiveness of the scheme (Herzon et al. 2018). Particularly this related to trusting that the contract partners fulfil the terms of the contract (Schomers and Matzdorf, 2013). In order to enhance trust, good and transparent communication is crucial. Such communication is characterized by e.g. the exchange rate, the involvement of all important contract partners in the communication process and the full disclosure of information.

Performance will need to be evaluated against a counterfactual/reference. Here we propose two different strategies:

- For the cases studies diagnostics in WP2, that are totally ex post, the performance is evaluated in principle according to RDP (CMEF) counterfactual thinking, i.e. comparing the state of the area involved would the measure not have been implemented. However, given the nature of the study (mostly qualitative) and the different state of implementation of measures in the different cases (more or less advanced), this was retained only as a conceptual guidance rather than a practical approach.
- For the purposes of WP4 a grid of different comparative measures is possible (and will be defined in the remaining of the project) and will possibly include: a) no measure; b) existing flat rate measures; c) one or more improved measures according to the design of innovative contracts and the selected WP4 cases.

4.4.3 Institutional evaluation and policy implementation

While this evaluation framework is based on the literature, the purpose of the project is to take into account as well the policy implementation needs. In particular, in the further steps we will consider to adapt this framework to take into account the future CAP monitoring framework and needs. Some already identified references for this are:

o the annex 1 of the CAP proposal (that define the impact, results and output indicators);

o the general guidelines for evaluation of interventions/instruments at EU level, that usually consider five criteria: effectiveness, efficiency, relevance, coherence and EU added value;

o the use of an intervention logic approach as adopted in evaluation studies, e.g., Bergevoet et al. (2019).

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5 Methods and stakeholder engagement

Many methods are used in the literature to study AECPGs provision. These methods can also support the design and implementation of contract solutions addressed in this project. This section does not have the ambition to provide a comprehensive review of methods, but just to recall some of the main methodological pathways of current research and to connect them with participatory decision making. Further insights may develop in view of WP3 and WP4 of the CONSOLE project.

A wide range of variants of stated preference methods and economic experiments (Colen et al., 2016) are used to analyse behavioural issues related to AECPGs. A collection of these studies with mainly reference to contract design features are reported in appendix 1.

Models are used in different variants. Here below some examples in addition to those cited in the previous chapters.

Drechsler (2017) analysed performance of Input- and Output-based Payments for the Conservation of Mobile Species using a conceptual model.

Groeneveld et al. (2018) provide a multi-objective model of collective participation in Dutch AES schemes to assess participation and impact on biodiversity.

Cho et al. (2019) investigate optimal targeting through multi-objective analysis in forestry.

Bamière et al. (2011) perform a farming system modelling for agri-environmental policy design, applied to the case of a spatially non-aggregated allocation of conservation measures.

Combined approaches are of growing importance. For example, Conrad and Yates (2018) couple stated preferences with a hydrological water resource model to inform water policies.

The role of stakeholder's engagement through participatory approaches is now recognised to be key for the study, design and implementation of policies and coordination instruments related to AECPGs. This is also a major aspect of the CONSOLE project. Civil society actors are recognised to be at the nexus of the ecosystem services concept and agri-environmental policies (Meyer et al., 2016) and are particularly relevant when looking at solutions implying voluntary participation, contracting or collaboration among actors. This is relevant to the framework, in order to help provide scientific support to procedural indications.

There is a growing literature on the topic. Sterling et al. (2017) identify three main types of stakeholder engagement (externally driven, self-organised, mixed). In relation to this, they identify the dimensions that affect the successful outcomes

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of an engagement process. They conclude that understanding of governance and social-cultural context plays an important role in all types of stakeholder engagement efforts.

Different studies provide evidence about the role of bridging organisations in fostering social learning and change by farmers. Dedeurwaerdere, Polard and Melindi-Ghidi (2015) provided an example from Wallonia finding that farmers having periodic contacts with network bridging organisations show a higher commitment to change.

Bridging social capital and the role of regionalization is analysed by de Krom (2017) that finds that these factors are key to lead to long-term, pro-environmental behaviour change of farmers.

Social capital is also linked to discourses and concepts used. For example landscape services can be interpreted as boundary concepts in landscape governance, in order to build social capital (Westerink et al., 2017).

The role of farm advisors can be pivotal, but their opinion is often little investigated. In a survey exploring private farm advisor perspectives of agri-environment schemes, Hejnowicz, Rudd, and White (2016) found that "the 'knowledge-exchange encounter' occurring between themselves, their clients and Natural England is fundamental to the environmental effectiveness of these schemes as well as their farm business compatibility"

Studying implementation of PG-related contracts in post socialist countries, Prazan and Theesfeld (2014) found that factors such as trust and reciprocity between farmers and state administrative bodies, information spreading and the availability of advisory services are key to scheme performances. Also, there is a dynamic aspect behind this, as trust tends to grow following a previous good experience.

Role of intermediaries to foster the implementation of innovative land management practice for ecosystem service provision can also involve directly researchers as active players (Schröter et al., 2015).

Some papers propose also procedures to use research outcomes in design processes. E.g., interactive modelling is proposed by Hassanzadeh et al. (2019), who also provide a framework for stakeholders' engagement related to water management.

6 Discussion, conclusions and the next steps

This document aims to build a preliminary conceptual framework for the project CONSOLE. The initial and intermediate drafts have been the basis for initial coordination among WPs. Specifically, this task supported WP2 in setting up the data collection protocols, the preliminary understanding of key behavioural

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topics for the survey in WP3, initial modelling issues in WP4, the identification of relevant actors and stakeholders for WP5 and WP6.

Some general remarks may be derived from the state of the art:

- The literature on the topics addressed by the project is growing and can benefit a lot from decades of literature on AECPGs provision in agriculture and forestry, though not specific of the type of contracts addressed by the project;
- However, the literature is still struggling with a debate on definitions and with the fact that the instruments addressed may take a huge variety of different forms and implementation strategies, due also to the variety of AECPGs considered;
- The empirical literature about tenure-related, result-based, collective and value chain solutions for the provision of AECPGs is still rather limited, also due to the low level of implementation of these solutions and in some cases due to uncertain environmental science about the outcomes of different solutions and the appropriate metrics to use.

Some of the developments of this document can be already envisaged; each of them can become part of the future operational framework:

- First, the general logic illustrated in section 2.3 may be confirmed;
- However, the categories used in the preliminary framework in chapter 4 may need to be revised against the empirical output of WP2;
- It would be useful to provide also a glossary linking empirically relevant or common understanding with scientific terminology;
- In this framework, understating trade-offs in design, providing a logical pathway to understand suitable solutions for each context and learning from examples of empirical applications should prevail on “recipes” for potential users;
- A section on methods could be considered, in order to support the operationalisation of the framework;
- In providing classifications and access keys to the framework, contract classification is important, but should not be too rigid, as different components may combine in different ways.

The direct follow-ups of this document will be in:

- D1.2: Identification of potential improved solutions (due month 13 though slightly delayed);
- D1.3: EIP-AGRI (practice) Abstracts on a framework for AECPG contract design – intermediate (due month 15 though slightly delayed);
- D1.4: Draft framework (due month 22).

Additionally, they are relevant to all other WPs.

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7 Acknowledgment

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

8 References

Ando, A. W. & Chen, X. 2011. Optimal contract lengths for voluntary ecosystem service provision with varied dynamic benefit functions. Conservation Letters, 4, 207-218.

Aghion, Philippe, and Richard Holden. 2011. "Incomplete Contracts and the Theory of the Firm : What Have We Learned over the Past 25 Years ?" *The Journal of Economic Perspectives* 25(2):181–97.

Ajzen, Icek. 1985. "From Intentions to Actions: A Theory of Planned Behavior." Pp. 11–39 in *Action control*. Springer.

Ando, A. W., and C. Langpap. 2018. "The Economics of Species Conservation." *Annual Review of Resource Economics* 10:445–67.

Arnott, D., D. Chadwick, I. Harris, A. Koj, and D. L. Jones. 2019. "What Can Management Option Uptake Tell Us about Ecosystem Services Delivery through Agri-Environment Schemes?" *Land Use Policy* 81:194–208.

Bamière, L., P. Havlík, F. Jacquet, M. Lherm, G. Millet, and V. Bretagnolle. 2011. "Farming System Modelling for Agri-Environmental Policy Design: The Case of a Spatially Non-Aggregated Allocation of Conservation Measures." *Ecological Economics* 70(5):891–99.

Baron, By David P. 2010. "Morally Motivated Self-Regulation." *American Economie Review* 100(4):1299–1329.

Batáry, Péter, Lynn V. Dicks, David Kleijn, and William J. Sutherland. 2015. "The Role of Agri-Environment Schemes in Conservation and Environmental Management." *Conservation Biology* 29(4):1006–16.

Bergevoet, R. H. M., Olivier Chartier, R. A. Jongeneel, Guillaume Pierre, C. P. A. van Wagenberg, MAPM van Asseldonk, Marjolein Selten, H. J. Silvis, Giulia Martino, and Irma Sani. 2019. *Improving Crisis Prevention and Management Criteria and Strategies in the Agricultural Sector*. EC.

Birge, T., and I. Herzon. 2019. "Exploring Cultural Acceptability of a Hypothetical Results-Based Agri-Environment Payment for Grassland Biodiversity." *Journal of Rural Studies* 67:1–11.

Birge, T., M. Toivonen, M. Kaljonen, and I. Herzon. 2017. "Probing the Grounds: Developing a Payment-by-Results Agri-Environment Scheme in Finland." *Land Use Policy* 61:302–15.

Börner, Jan, Kathy Baylis, Esteve Corbera, Driss Ezzine-de-Blas, Jordi Honey-Rosés, U. Martin Persson, and Sven Wunder. 2017. "The Effectiveness of Payments for Environmental Services." *World Development* 96(April):359–74.

Brink, Lars. 2009. "WTO Constraints on Domestic Support in Agriculture: Past and Future." *Canadian Journal of Agricultural Economics/Revue Canadienne d'agroeconomie* 57(1):1–21.

Bureau, Jean-Christophe. 2017. "Does the WTO Discipline Really Constrain the Design of CAP Payments." *Blog Post Http://Capreform. Eu/Does-the-Wto-Discipline-Really-Constrain-the-Design-of-Cap-Payments*.

Burton, R. J. F., and G. Schwarz. 2013. "Result-Oriented Agri-Environmental Schemes in Europe and Their Potential for Promoting Behavioural Change." *Land Use Policy* 30(1):628–41.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Burton, Rob J. F., and Upananda Herath Paragahawewa. 2011. "Creating Culturally Sustainable Agri-Environmental Schemes." *Journal of Rural Studies* 27(1):95–104.

Chamberlain, Wytske, and Ward Anseeuw. 2019. "Inclusive Businesses in Agriculture: Defining the Concept and Its Complex and Evolving Partnership Structures in the Field." *Land Use Policy* 83:308–22.

Chang, Sheng Han Erin, David Wuepper, Alois Heissenhuber, and Johannes Sauer. 2017. "Investigating Rice Farmers' Preferences for an Agri-Environmental Scheme: Is an Eco-Label a Substitute for Payments?" *Land Use Policy* 64:374–82.

Cho, S. H., M. Soh, B. C. English, T. E. Yu, and C. N. Boyer. 2019. "Targeting Payments for Forest Carbon Sequestration given Ecological and Economic Objectives." *Forest Policy and Economics* 100:214–26.

Cho, W., and D. Blandford. 2018. "Bilateral Information Asymmetry in the Design of an Agri-Environmental Policy: An Application to Peatland Retirement in Norway." *Journal of Agricultural Economics*.

Christensen, Tove, Anders Branth Pedersen, Helle Oersted Nielsen, Morten Raun Mørkbak, Berit Hasler, and Sigrid Denver. 2011. "Determinants of Farmers' Willingness to Participate in Subsidy Schemes for Pesticide-Free Buffer Zones-A Choice Experiment Study." *Ecological Economics* 70(8):1558–64.

Chu, L., R. Quentin Grafton, and R. Keenan. 2019. "Increasing Conservation Efficiency While Maintaining Distributive Goals With the Payment for Environmental Services." *Ecological Economics* 156:202–10.

Le Coent, Philippe, Raphaële Préget, and Sophie Thoyer. 2017. "Compensating Environmental Losses Versus Creating Environmental Gains: Implications for Biodiversity Offsets." *Ecological Economics* 142:120–29.

Coggan, A., S. M. Whitten, and J. Bennett. 2010. "Influences of Transaction Costs in Environmental Policy." *Ecological Economics* 69(9):1777–84.

Colen, L., S. Gomez y Paloma, U. Latacz-Lohmann, M. Lefebvre, R. Préget, and S. Thoyer. 2016. "Economic Experiments as a Tool for Agricultural Policy Evaluation: Insights from the European CAP." *Canadian Journal of Agricultural Economics* 64(4):667–94.

Conrad, S. A., and D. Yates. 2018. "Coupling Stated Preferences with a Hydrological Water Resource Model to Inform Water Policies for Residential Areas in the Okanagan Basin, Canada." *Journal of Hydrology* 564:846–58.

Cooper, Tamsin, Kaley Hart, and David Baldock. 2009. *The Provision of Public Goods through Agriculture in the European Union*. London.

Corbera, E., Kosoy, N. & Martinez Tuna, M. 2007. Equity implications of marketing ecosystem services in protected areas and rural communities: Case studies from Meso-America. Global Environmental Change, 17, 365-380.

Coughenour, C. M. 1976. A theory of instrumental activity and farm enterprise commitment applied to woolgrowing in Australia. Rural Sociology, 41, 76-98.

Darnhofer, I., M. Schermer, M. Steinbacher, M. Gabillet, and K. Daugstad. 2017. "Preserving Permanent Mountain Grasslands in Western Europe: Why Are Promising Approaches Not Implemented More Widely?" *Land Use Policy* 68:306–15.

Davies, Ben B., and Ian D. Hodge. 2006. "Farmers' Preferences for New Environmental Policy Instruments: Determining the Acceptability of Cross Compliance for

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Biodiversity Benefits." *Journal of Agricultural Economics* 57(3):393–414.

Dedeurwaerdere, T., A. Polard, and P. Melindi-Ghidi. 2015. "The Role of Network Bridging Organisations in Compensation Payments for Agri-Environmental Services under the EU Common Agricultural Policy." *Ecological Economics* 119:24–38.

Derissen, Sandra, and Martin F. Quaas. 2013. "Combining Performance-Based and Action-Based Payments to Provide Environmental Goods under Uncertainty." *Ecological Economics* 85:77–84.

Dessart, François J., Jesús Barreiro-Hurlé, and René van Bavel. 2019. "Behavioural Factors Affecting the Adoption of Sustainable Farming Practices: A Policy-Oriented Review." *European Review of Agricultural Economics* 46(3):417–71.

Drechsler, M. 2017. "Performance of Input- and Output-Based Payments for the Conservation of Mobile Species." *Ecological Economics* 134:49–56.

Drechsler, M., K. Johst, and F. Wätzold. 2017. "The Cost-Effective Length of Contracts for Payments to Compensate Land Owners for Biodiversity Conservation Measures." *Biological Conservation* 207:72–79.

Ekroos, Johan, Ola Olsson, Maj Rundlöf, Frank Wätzold, and Henrik G. Smith. 2014. "Optimizing Agri-Environment Schemes for Biodiversity, Ecosystem Services or Both?" *Biological Conservation* 172:65–71.

Erjavec, Karmen, and Emil Erjavec. 2015. "'Greening the CAP' - Just a Fashionable Justification? A Discourse Analysis of the 2014-2020 CAP Reform Documents." *Food Policy* 51(2015):53–62.

Espinosa-Goded, M., J. Barreiro-Hurlé, and P. Dupraz. 2013. "Identifying Additional Barriers in the Adoption of Agri-Environmental Schemes: The Role of Fixed Costs." *Land Use Policy* 31:526–35.

Espinosa-Goded, Maria, Jesús Barreiro-Hurlé, and Eric Ruto. 2010. "What Do Farmers Want from Agri-Environmental Scheme Design? A Choice Experiment Approach." *Journal of Agricultural Economics* 61(2):259–73.

European Commission. 2019. *Analysis of Administrative Burden Arising from the CAP*.

European Court of Auditors. 2011. *Is Agri-Environment Support Well Designed and Managed?*

European Network for Rural Development. 2016a. "Collective Approaches to AECM."

European Network for Rural Development. 2016b. *Result-Based Approaches to AECM*.

Ferraro, P. J. 2008. "Asymmetric Information and Contract Design for Payments for Environmental Services." *Ecological Economics* 65(4):810–21.

Fishbein, Martin, and Icek Ajzen. 1975. "Intention and Behavior: An Introduction to Theory and Research."

Fleury, Philippe, Claire Seres, Laurent Dobremez, Baptiste Nettier, and Yves Pauthenet. 2015. "'Flowering Meadows', a Result-Oriented Agri-Environmental Measure: Technical and Value Changes in Favour of Biodiversity." *Land Use Policy* 46:103–14.

Franks, J. R., and S. B. Emery. 2013. "Incentivising Collaborative Conservation: Lessons from Existing Environmental Stewardship Scheme Options." *Land Use Policy* 30(1):847–62.

Franzén, Frida, Patrik Dinnétz, and Monica Hammer. 2016. "Factors Affecting Farmers'

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Willingness to Participate in Eutrophication Mitigation — A Case Study of Preferences for Wetland Creation in Sweden." *Ecological Economics* 130:8–15.

Fraser, R. 2012. "Moral Hazard, Targeting and Contract Duration in Agri-Environmental Policy." *Journal of Agricultural Economics* 63(1):56–64.

Fraser, Rob. 2002. "Moral Hazard and Risk Management in Agri-environmental Policy." *Journal of Agricultural Economics* 53(3):475–87.

Gatto, P., D. Mozzato, and E. Defrancesco. 2019. "Analysing the Role of Factors Affecting Farmers' Decisions to Continue with Agri-Environmental Schemes from a Temporal Perspective." *Environmental Science and Policy* 92:237–44.

Greiner, Romy. 2016. "Factors Influencing Farmers' Participation in Contractual Biodiversity Conservation: A Choice Experiment with Northern Australian Pastoralists." *Australian Journal of Agricultural and Resource Economics* 60(1):1–21.

Groeneveld, A. N., J. H. M. Peerlings, M. M. Bakker, N. B. P. Polman, and W. J. M. Heijman. 2018. "Effects on Participation and Biodiversity of Reforming the Implementation of Agri-Environmental Schemes in the Netherlands." *Ecological Complexity*.

Groth, M. 2011. "Cost-Effective Biodiversity Conservation:Procurement Auctions and Payment-by-Results." *EuroChoices* 10(2):32–37.

Hanley, Nick, Simanti Banerjee, Gareth D. Lennox, and Paul R. Armsworth. 2012. "How Should We Incentivize Private Landowners to 'Produce'More Biodiversity?" *Oxford Review of Economic Policy* 28(1):93–113.

Hart, B. Y. Oliver, and John Moore. 1988. "Incomplete Contracts and Renegotiation." *Econometrica* 56(4):755–85.

Hart, Oliver, and John Moore. 1999. "Foundations of Incomplete Contracts." *The Review of Economic Studies* 66(1):115–38.

Hasler, Berit, Mikolaj Czajkowski, Katarina Elofsson, Line Block Hansen, Maria Theresia Konrad, Helle Ørsted Nielsen, Olli Niskanen, Tea Nõmmann, Anders Branth Pedersen, Kaja Peterson, Helen Poltimäe, Tobias Häggmark Svensson, and Katarzyna Zagórska. 2019. "Farmers' Preferences for Nutrient and Climate-Related Agri-Environmental Schemes: A Cross-Country Comparison." *Ambio* 48(11):1290–1303.

Hassanzadeh, E., G. Strickert, L. Morales-Marin, B. Noble, H. Baulch, E. Shupena-Soulodre, and K. E. Lindenschmidt. 2019. "A Framework for Engaging Stakeholders in Water Quality Modeling and Management: Application to the Qu'Appelle River Basin, Canada." *Journal of Environmental Management* 231:1117–26.

Hejnowicz, A. P., M. A. Rudd, and P. C. L. White. 2016. "A Survey Exploring Private Farm Advisor Perspectives of Agri-Environment Schemes: The Case of England's Environmental Stewardship Programme." *Land Use Policy* 55:240–56.

Herzon, I., T. Birge, B. Allen, A. Povellato, F. Vanni, K. Hart, G. Radley, G. Tucker, C. Keenleyside, R. Oppermann, E. Underwood, X. Poux, G. Beaufoy, and J. Pražan. 2018. "Time to Look for Evidence: Results-Based Approach to Biodiversity Conservation on Farmland in Europe." *Land Use Policy* 71(December 2017):347–54.

Hodge, Ian. 2001. "Beyond Agri-Environmental Policy: Towards an Alternative Model of Rural Environmental Governance." *Land Use Policy* 18(2):99–111.

Holmstrom, Bengt. 1982. "Moral Hazard in Teams." *The Bell Journal of Economics* 13(2):324–40.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Holt, Douglas B. 1997. "Distinction in America? Recovering Bourdieu's Theory of Tastes from Its Critics." *Poetics* 25(2–3):93–120.

Hope, Rob, Mamta Borgoyary, and Chetan Agarwal. 2008. "Smallholder Preferences for Agri-Environmental Change at the Bhoj Wetland, India." *Development Policy Review* 26(5):585–602.

Huising, R., and S. S. Silbey. 2018. "From Nudge to Culture and Back Again: Coalface Governance in the Regulated Organization." *Annual Review of Law and Social Science* 14:91–114.

Jones, James;, Paul; Silcock, and Tetsuya Uetake. 2015. *Public Goods and Externalities: Agri-Environmental Policy Measures in the United Kingdom*. Paris.

Kanchanaroek, Yingluck, and Uzma Aslam. 2018. "Policy Schemes for the Transition to Sustainable Agriculture—Farmer Preferences and Spatial Heterogeneity in Northern Thailand." *Land Use Policy* 78(September 2017):227–35.

Kempa, D. 2013. "Environmental Services Coupled to Food Products and Brands: Food Companies Interests and on-Farm Accounting." *Journal of Environmental Management* 127:S184–90.

Khanna, Madhu, and Amy W. Ando. 2009. "Science, Economics and the Design of Agricultural Conservation Programmes in the US." *Journal of Environmental Planning and Management* 52(5):575–92.

Kotchen, Matthew J., and Kathleen Segerson. 2018. "On the Use of Group Performance and Rights for Environmental Protection and Resource Management." *Proceedings of the National Academy of Sciences of the United States of America* 116(12):5285–92.

de Krom, M. P. M. M. 2017. "Farmer Participation in Agri-Environmental Schemes: Regionalisation and the Role of Bridging Social Capital." *Land Use Policy* 60:352–61.

Kuhfuss, L., R. Préget, S. Thoyer, N. Hanley, P. Le Coent, and M. Désolé. 2016. "Nudges, Social Norms, and Permanence in Agri-Environmental Schemes." *Land Economics* 92(4):641–55.

Kuhfuss, Laure, Raphaële Préget, Sophie Thoyer, Nick Hanley, Laure Kuhfuss, Raphaële Préget, Sophie Thoyer, and Nick Hanley. 2015. "Nudging Farmers to Sign Agri-Environmental Contracts : The Effects of a Collective Bonus To Cite This Version : HAL Id : Hal-01148581 University of St . Andrews Discussion Papers in Environmental Economics." (October).

Laffont, Jean-Jacques, and David Martimort. 2001. "The Theory of Incentives I : The Principal-Agent Model." (January 2001):1–382.

Langlais, Alexandra. 2019. *L'agriculture et Les Paiements Pour Services Environnementaux. Quels Questionnements Juridiques ?*

Latacz-Lohmann, Uwe, and Gunnar Breustedt. 2019. "Using Choice Experiments to Improve the Design of Agri-Environmental Schemes." *European Review of Agricultural Economics* 46(3):495–528.

Lefebvre, Marianne, Maria Espinosa, Sergio Gomez y Paloma, Maria Luisa Paracchini, Annette Piorr, and Ingo Zasada. 2015. "Agricultural Landscapes as Multi-Scale Public Good and the Role of the Common Agricultural Policy." *Journal of Environmental Planning and Management* 58(12):2088–2112.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Lienhoop, Nele, and Roy Brouwer. 2015. "Agri-Environmental Policy Valuation: Farmers' Contract Design Preferences for Afforestation Schemes." *Land Use Policy* 42:568–77.

Mato-Amboage, R., J. W. Pitchford, and J. Touza. 2018. "Public–Private Partnerships for Biosecurity: An Opportunity for Risk Sharing." *Journal of Agricultural Economics*.

Matzdorf, B., and J. Lorenz. 2010. "How Cost-Effective Are Result-Oriented Agri-Environmental Measures?-An Empirical Analysis in Germany." *Land Use Policy* 27(2):535–44.

Merckx, Thomas, and Henrique M. Pereira. 2015. "Reshaping Agri-Environmental Subsidies: From Marginal Farming to Large-Scale Rewilding." *Basic and Applied Ecology* 16(2):95–103.

Mettepenningen, E., V. Vandermeulen, K. Delaet, G. Van Huylenbroeck, and E. J. Wailes. 2013. "Investigating the Influence of the Institutional Organisation of Agri-Environmental Schemes on Scheme Adoption." *Land Use Policy* 33:20–30.

Meyer, C., S. Schomers, B. Matzdorf, C. Biedermann, and C. Sattler. 2016. "Civil Society Actors at the Nexus of the Ecosystem Services Concept and Agri-Environmental Policies." *Land Use Policy* 55:352–56.

Meyer, Claas, Michaela Reutter, Bettina Matzdorf, Claudia Sattler, and Sarah Schomers. 2015. "Design Rules for Successful Governmental Payments for Ecosystem Services: Taking Agri-Environmental Measures in Germany as an Example." *Journal of Environmental Management* 157:146–59.

Morris, Carol. 2004. "Networks of Agri-Environmental Policy Implementation: A Case Studyof England's Countryside Stewardship Scheme." *Land Use Policy* 21(2).

Moxey, A., and B. White. 2014. "Result-Oriented Agri-Environmental Schemes in Europe: A Comment." *Land Use Policy* 39:397–99.

Muenich, R. L., M. M. Kalcic, J. Winsten, K. Fisher, M. Day, G. O'Neil, Y. C. Wang, and D. Scavia. 2017. "Pay-for-Performance Conservation Using Swat Highlights Need for Field-Level Agricultural Conservation." *Transactions of the ASABE* 60(6):1925–37.

Nebel, S., J. Brick, V. A. Lantz, and R. Trenholm. 2017. "Which Factors Contribute to Environmental Behaviour of Landowners in Southwestern Ontario, Canada?" *Environmental Management* 60(3):454–63.

Núñez-Regueiro, M. M., R. J. Fletcher, E. F. Pienaar, L. C. Branch, J. N. Volante, and S. Rifai. 2019. "Adding the Temporal Dimension to Spatial Patterns of Payment for Ecosystem Services Enrollment." *Ecosystem Services* 36.

OECD. 2012. "Design and implementation of agri-environmental policies: Are guidelines feasible?", in *Evaluation of Agri-environmental Policies: Selected Methodological Issues and Case Studies*, OECD Publishing, Paris

Okumah, M., P. J. Chapman, J. Martin-Ortega, and P. Novo. 2018. "Mitigating Agricultural Diffuse Pollution: Uncovering the Evidence Base of the Awareness-Behaviour-Water Quality Pathway." *Water (Switzerland)* 11(1).

Opdam, P., I. Coninx, A. Dewulf, E. Steingröver, C. Vos, and M. van der Wal. 2016. "Does Information on Landscape Benefits Influence Collective Action in Landscape Governance?" *Current Opinion in Environmental Sustainability* 18:107–14.

Ostrom, E. 1990. "Governing the Commons: The Evolution of Institutions for Collective Action." *Governing the Commons: The Evolution of Institutions for Collective Action*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

32(2).

Palm-Forster, L. H., J. F. Suter, and K. D. Messer. 2019. "Experimental Evidence on Policy Approaches That Link Agricultural Subsidies to Water Quality Outcomes." *American Journal of Agricultural Economics* 101(1):109–33.

Palm-Forster, L. H., S. M. Swinton, F. Lupi, and R. S. Shupp. 2016. "Too Burdensome to Bid: Transaction Costs and Pay-for-Performance Conservation." *American Journal of Agricultural Economics* 98(5):1314–33.

Peth, D., O. Mußhoff, K. Funke, and N. Hirschauer. 2018. "Nudging Farmers to Comply With Water Protection Rules – Experimental Evidence From Germany." *Ecological Economics* 152:310–21.

Pinna, S. 2016. "Alternative Food Networks, Agro-Biodiversity and Landscape Protection: Lessons from Two Rural Parks." *Regional Studies, Regional Science* 3(1):455–62.

Porter, Michael E., and Mark R. Kramer. 2011. "The Big Idea: Creating Shared Value. How to Reinvent Capitalism—and Unleash a Wave of Innovation and Growth." *Harvard Business Review* 89(1–2).

Prazan, J., and I. Theesfeld. 2014. "The Role of Agri-Environmental Contracts in Saving Biodiversity in the Post-Socialist Czech Republic." *International Journal of the Commons* 8(1):1–25.

Pretty, J. 2003. Social Capital and the Collective Management of Resources. Science, 302, 1912-1914.

Primdahl, Jørgen, Jens Peter Vesterager, John A. Finn, George Vlahos, Lone Kristensen, and Henrik Vejre. 2010. "Current Use of Impact Models for Agri-Environment Schemes and Potential for Improvements of Policy Design and Assessment." *Journal of Environmental Management* 91(6):1245–54.

Pröbstl-Haider, Ulrike, Nina M. Mostegl, Julia Kelemen-Finan, Wolfgang Haider, Herbert Formayer, Jochen Kantelhardt, Tobias Moser, Martin Kapfer, and Ryan Trenholm. 2016. "Farmers' Preferences for Future Agricultural Land Use Under the Consideration of Climate Change." *Environmental Management* 58(3):446–64.

Reed, M. S., A. Moxey, K. Prager, N. Hanley, J. Skates, A. Bonn, C. D. Evans, K. Glenk, and K. Thomson. 2014. "Improving the Link between Payments and the Provision of Ecosystem Services in Agri-Environment Schemes." *Ecosystem Services* 9:44–53.

Ridier, Aude. 2012. "Farm Level Supply of Short Rotation Woody Crops: Economic Assessment in the Long-Term for Household Farming Systems." *Canadian Journal of Agricultural Economics/Revue Canadienne d'agroeconomie* 60(3):357–75.

Riley, M., H. Sangster, H. Smith, R. Chiverrell, and J. Boyle. 2018. "Will Farmers Work Together for Conservation? The Potential Limits of Farmers' Cooperation in Agri-Environment Measures." *Land Use Policy* 70:635–46.

Robalino, J., Pfaff, A., Sanchez-Azofeifa, G., Alpizar, F., Leon, C., Rodriguez, C., 2008. Deforestation impacts of environmental services payments: Costa Rica's PSA program 2000–2005. Environment for Development Discussion Paper—Resources for the Future (RFF) 08–24, pp. 1–16.

Rocchi, L., L. Paolotti, and F. F. Fagioli. 2017. "Defining Agri-Environmental Schemes in the Buffer Areas of a Natural Regional Park: An Application of Choice Experiment Using the Latent Class Approach." *Land Use Policy* 66(April):141–50.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Rodríguez-Entrena, M., A. J. Villanueva, and J. A. Gómez-Limón. 2019. "Unraveling Determinants of Inferred and Stated Attribute Nonattendance: Effects on Farmers' Willingness to Accept to Join Agri-Environmental Schemes." *Canadian Journal of Agricultural Economics* 67(1):31–52.

Rolfe, J., and S. Harvey. 2017. "Heterogeneity in Practice Adoption to Reduce Water Quality Impacts from Sugarcane Production in Queensland." *Journal of Rural Studies* 54:276–87.

Rolfe, J., S. Schilizzi, P. Boxall, U. Latacz-Lohmann, S. Iftekhar, M. Star, and P. O'Connor. 2018. "Identifying the Causes of Low Participation Rates in Conservation Tenders." *International Review of Environmental and Resource Economics* 12(1):1–45.

Romstad, Eirik. 2003. "Team Approaches in Reducing Nonpoint Source Pollution." *Ecological Economics* 47(1):71–78.

Rosário, I. T., R. Rebelo, P. Cardoso, P. Segurado, R. N. Mendes, and M. Santos-Reis. 2019. "Can Geocaching Be an Indicator of Cultural Ecosystem Services? The Case of the Montado Savannah-like Landscape." *Ecological Indicators* 99:375–86.

Roussel, Sébastien. 2019. "Compensation Écologique et Agriculture : Est-Ce Compatible ?" 70.

Runhaar, H., N. Polman, and M. Dijkshoorn-Dekker. 2018. "Self-Initiated Nature Conservation by Farmers: An Analysis of Dutch Farming." *International Journal of Agricultural Sustainability* 16(6):486–97.

Russi, D., H. Margue, R. Oppermann, and C. Keenleyside. 2016. "Result-Based Agri-Environment Measures: Market-Based Instruments, Incentives or Rewards? The Case of Baden-Württemberg." *Land Use Policy* 54:69–77.

Ruto, E, and G. Garrod. 2009. "Investigating Farmers' Preferences for the Design of Agri-Environment Schemes: A Choice Experiment Approach." *Journal of Environmental Planning and Management* 52(5):631–47.

Ruto, Eric, and Guy Garrod. 2009. "Investigating Farmers' Preferences for the Design of Agri-Environment Schemes: A Choice Experiment Approach." *Journal of Environmental Planning and Management* 52(5):631–47.

De Salvo, Maria, Giuseppe Cucuzza, Salvatore Luciano Cosentino, Lea Nicita, and Giovanni Signorello. 2018. "Farmers' Preferences for Enhancing Sustainability in Arable Lands: Evidence from a Choice Experiment in Sicily (Italy)." *New Medit* 17(4):57–70.

Santos, Rui, Pedro Clemente, Roy Brouwer, Paula Antunes, and Rute Pinto. 2016. "Landowner Preferences for Agri-Environmental Agreements to Conserve the Montado Ecosystem in Portugal." *Ecological Economics* 118:159–67.

Saxby, Heidi, Menelaos Gkartzios, and Karen Scott. 2018. "'Farming on the Edge': Wellbeing and Participation in Agri-Environmental Schemes." *Sociologia Ruralis* 58(2):392–411.

Schilizzi, S, and U. Latacz-Lohmann. 2016. "Incentivizing and Tendering Conservation Contracts: The Trade-off between Participation and Effort Provision." *Land Economics* 92(2):273–91.

Schilizzi, Steven, and Uwe Latacz-Lohmann. 2016. "Incentivizing and Tendering Conservation Contracts: The Trade-off between Participation and Effort Provision." *Land Economics* 92(2):273–91.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Schmitzberger, I., Th Wrbka, B. Steurer, G. Aschenbrenner, J. Peterseil, and H. G. Zechmeister. 2005. "How Farming Styles Influence Biodiversity Maintenance in Austrian Agricultural Landscapes." *Agriculture, Ecosystems and Environment* 108(3):274–90.

Schomers, S., and B. Matzdorf. 2013. "Payments for Ecosystem Services: A Review and Comparison of Developing and Industrialized Countries." *Ecosystem Services* 6:16–30.

Schoonhoven, Y., and H. Runhaar. 2018. "Conditions for the Adoption of Agro-Ecological Farming Practices: A Holistic Framework Illustrated with the Case of Almond Farming in Andalusia." *International Journal of Agricultural Sustainability* 16(6):442–54.

Schöttker, O., and F. Wätzold. 2018. "Buy or Lease Land? Cost-Effective Conservation of an Oligotrophic Lake in a Natura 2000 Area." *Biodiversity and Conservation* 27(6):1327–45.

Schroeder, L. A., J. Isselstein, S. Chaplin, and S. Peel. 2013. "Agri-Environment Schemes: Farmers' Acceptance and Perception of Potential 'Payment by Results' in Grassland-A Case Study in England." *Land Use Policy* 32:134–44.

Schröter, B., B. Matzdorf, C. Sattler, and G. Garcia Alarcon. 2015. "Intermediaries to Foster the Implementation of Innovative Land Management Practice for Ecosystem Service Provision - A New Role for Researchers." *Ecosystem Services* 16:192–200.

Segerson, Kathleen. 1988. "Uncertainty and Incentives for Nonpoint Pollution Control." *Journal of Environmental Economics and Management* 15(1):87–98.

Sheremet, O., E. Ruokamo, A. Juutinen, R. Svento, and N. Hanley. 2018. "Incentivising Participation and Spatial Coordination in Payment for Ecosystem Service Schemes: Forest Disease Control Programs in Finland." *Ecological Economics* 152:260–72.

Siebert, Rosemarie, Mark Toogood, and Andrea Knierim. 2006. "Factors Affecting European Farmers' Participation in Biodiversity Policies." *Sociologia Ruralis* 46(4):318–40.

de Snoo, Geert R., Irina Herzon, Henk Staats, Rob J. F. Burton, Stefan Schindler, Jerry van Dijk, Anne Marike Lokhorst, James M. Bullock, Matt Lobley, Thomas Wrbka, Gerald Schwarz, and C. J. M. Musters. 2013. "Toward Effective Nature Conservation on Farmland: Making Farmers Matter." *Conservation Letters* 6(1):66–72.

Sterling, E. J., E. Betley, A. Sigouin, A. Gomez, A. Toomey, G. Cullman, C. Malone, A. Pekor, F. Arengo, M. Blair, C. Filardi, K. Landrigan, and A. L. Porzecanski. 2017. "Assessing the Evidence for Stakeholder Engagement in Biodiversity Conservation." *Biological Conservation* 209:159–71.

Uetake, Tetsuya. 2012. "Providing Agri-Environmental Public Goods through Collective Action : Lessons from New Zealand Case Studies." in *OECD Trade and Agriculture Directorate*. Tahuna Conference Centre – Nelson, New Zealand.

Vedel, Suzanne Elizabeth, Jette Bredahl Jacobsen, and Bo Jellesmark Thorsen. 2015. "Contracts for Afforestation and the Role of Monitoring for Landowners' Willingness to Accept." *Forest Policy and Economics* 51:29–37.

Viaggi, Davide. 2014. "PROVIding Smart DElivery of Public Goods by EU Agriculture and Forestry."

Villamayor-Tomas, Sergio, Julian Sagebiel, and Roland Olschewski. 2019. "Bringing the Neighbors in: A Choice Experiment on the Influence of Coordination and Social

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement GA 817949

Norms on Farmers' Willingness to Accept Agro-Environmental Schemes across Europe." *Land Use Policy* 84(March):200–215.

Villanueva, A. J., M. Rodríguez-Entrena, M. Arriaza, and J. A. Gómez-Limón. 2017. "Heterogeneity of Farmers' Preferences towards Agri-Environmental Schemes across Different Agricultural Subsystems." *Journal of Environmental Planning and Management* 60(4):684–707.

Villanueva, Anastasio J., José A. Gómez-Limón, and Macario Rodríguez-Entrena. 2017. "Valoración de La Oferta de Bienes Públicos Por Parte de Los Sistemas Agrarios: El Caso Del Olivar de Montaña En Andalucía." *Economia Agraria y Recursos Naturales* 17(1):25–57.

Wacquant, Loïc, and Rob Stones. 2006. "Key Contemporary Thinkers." *Londres/Nueva York: Macmillan*.

Wainwright, Warwick, Klaus Glenk, Faical Akaichi, and Dominic Moran. 2019. "Conservation Contracts for Supplying Farm Animal Genetic Resources (FAnGR) Conservation Services in Romania." *Livestock Science* 224(March):1–9.

Waylen, K. J., and J. Martin-Ortega. 2018. "Surveying Views on Payments for Ecosystem Services: Implications for Environmental Management and Research." *Ecosystem Services* 29:23–30.

Weber, Anja. 2014. "How Are Public Transaction Costs in Regional Agri-Environmental Scheme Delivery Influenced by EU Regulations?" *Journal of Environmental Planning and Management* 57(6):937–59.

Weber, Anja. 2015. "Implementing EU Co-Financed Agri-Environmental Schemes: Effects on Administrative Transaction Costs in a Regional Grassland Extensification Scheme." *Land Use Policy* 42:183–93.

Weersink, A., E. Fraser, D. Pannell, E. Duncan, and S. Rotz. 2018. "Opportunities and Challenges for Big Data in Agricultural and Environmental Analysis." *Annual Review of Resource Economics* 10:19–37.

Westerink, J., R. Jongeneel, N. Polman, K. Prager, J. Franks, P. Dupraz, and E. Mettepenningen. 2017. "Collaborative Governance Arrangements to Deliver Spatially Coordinated Agri-Environmental Management." *Land Use Policy* 69:176–92.

Westerink, J., D. C. P. Melman, and R. A. M. Schrijver. 2015. "Scale and Self-Governance in Agri-Environment Schemes: Experiences with Two Alternative Approaches in the Netherlands." *Journal of Environmental Planning and Management* 58(8):1490–1508.

Westerink, J., P. Opdam, S. van Rooij, and E. Steingröver. 2017. "Landscape Services as Boundary Concept in Landscape Governance: Building Social Capital in Collaboration and Adapting the Landscape." *Land Use Policy* 60:408–18.

Wezel, A., A. Vincent, H. Nitsch, O. Schmid, M. Dubbert, E. Tasser, P. Fleury, S. Stöckli, M. Stolze, and D. Bogner. 2018. "Farmers' Perceptions, Preferences, and Propositions for Result-Oriented Measures in Mountain Farming." *Land Use Policy* 70:117–27.

White, B., and N. Hanley. 2016. "Should We Pay for Ecosystem Service Outputs, Inputs or Both?" *Environmental and Resource Economics* 63(4):765–87.

White, Ben, and Nick Hanley. 2016. "Should We Pay for Ecosystem Service Outputs, Inputs or Both?" *Environmental and Resource Economics* 63(4):765–87.

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Wrbka, T., S. Schindler, M. Pollheimer, I. Schmitzberger, and J. Peterseil. 2008. “Impact of the Austrian Agri-Environmental Scheme on Diversity of Landscapes, Plants and Birds.” *Community Ecology* 9(2):217–27.

Wu, J., and J. Yu. 2017. “Efficiency-Equity Tradeoffs in Targeting Payments for Ecosystem Services.” *American Journal of Agricultural Economics* 99(4):894–913.

Zabel, A. 2019. “Biodiversity-Based Payments on Swiss Alpine Pastures.” *Land Use Policy* 81:153–59.

Zabel, A., G. Bostedt, and H. Ekvall. 2018. “Policies for Forest Landscape Management – A Conceptual Approach with an Empirical Application for Swedish Conditions.” *Forest Policy and Economics* 86:13–21.

Zavalloni, Matteo, Meri Raggi, and Davide Viaggi. 2019. “Agri-Environmental Policies and Public Goods: An Assessment of Coalition Incentives and Minimum Participation Rules.” *Environmental and Resource Economics* 72(4):1023–40.

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9 Annex 1 – Preferences for different contract attributes based on stated preference

	REFERENCE & SUMMARY	ATTRIBUTE DESCRIPTION	ATTRIBUTE LEVELS (X, Y)	RESULTS OF STUDY
1.	(Eric Ruto and Garrod, 2009)	1. Minimum length of agreement (years): Duration of AES contract	5, 10, 20	- Farmers prefer • shorter contract lengths • greater flexibility over what areas of the farm are entered into the scheme • greater flexibility over scheme prescriptions or measures to undertake • prefer lower levels of paperwork
		2. Flexibility over what areas of the farm are entered into the scheme: whether or not the scheme allows flexibility over which areas of the farm are entered into the scheme	No, Yes	
		3. Flexibility over undertaking some of the measures required under the scheme: whether or not the scheme allows flexibility over adherence to scheme prescriptions	No, Yes	- farmers require greater financial incentives to join schemes if they do not meet the above requirements
		4. Average time spent on paperwork/ administration: levels of administration as measured by	Low (1-2 h), Medium (2-5 h), High (> 5 h)	- Existing scheme participants were found to be more *'low-resistance adopter'* segment than the contrasting *'high-resistance adopter'* segment

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the amount of time spent on non-operational aspects of the scheme, such as on paperwork and information gathering		
5. Additional payment per ha: the per hectare payment rate made under the scheme	5%, 10%, 20%	

- Low resistance adopters tend to be better educated, younger, with larger farm holdings and have more positive attitudes to the environment. Thus, more likely to join schemes.
- High resistance adopters were more likely to be tenant farmers and to rely of the farm business for a greater proportion of their household incomes

- to ensure better participation in a more restrictive scheme, higher incentives could be made available in areas with 'high-resistance adopters' population

- Less generous incentives may achieve desired participation levels if less restrictive scheme parameters are adopted or in areas where there are likely to be more 'low-resistance adopters'

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2.	(Espinosa-Goded, Barreiro-Hurlé, and Ruto, 2010)	1. Flexibility over the amount of land to be enrolled in the AES	Free, 50% eligible surface	- farmers are willing to participate for lower compensation in programmes that allow the maintenance of agricultural activity (i.e. grazing in enrolled surface) and do not impose stringent restrictions on farm management (i.e. enrolment of at least 50% of eligible land). - Higher payments could be offered to induce farmers to participate - Substantial savings can be obtained by including a fixed component per contract in the AES premium - Provision of compulsory technical assistance and monitoring can also be used to reduce the premiums necessary to secure participation - as long as the main environmental objectives are met, relaxing the grazing restriction could lead to
		2. Flexibility over grazing in the land under AES	Free, Limited (limitations could be specific months or all year round)	
		3. Availability of a compulsory and free of charge technical training and advisory service	No, Yes	
		4. Availability of a 1000 € one-off payment per contract independently of the area enrolled payable on the first year	Yes, No	
		5. Payment level per ha and year	60, 80, 100, 120 (€/ha/year)	

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				significant increase in farmer up-take at lower budgetary costs as farmers would be willing to participate for less compensation - including a fixed component in the compensation premium could reduce overall contract costs - More flexibility in AES management prescriptions is needed to encourage greater farmer participation
3.	(Santos et al., 2016)	1. Area size: the share (%) of the eligible area of the property under contract	25%, 50%, 75%	- results show that the minimum willingness to accept financial compensation for current contractual agreements and their terms and conditions is higher by a factor of six than actual pay-out levels - Also points at the low financial incentives and the lack of information among farmers as the
		2. Cattle density: the number of livestock units allowed per hectare of forage area on the farm	0.2, 0.5, 0.7	
		3. Tree density: the number of cork and holm oak trees per hectare on the contracted land by the end of the contract period	20, 30, 40	

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4. Contract duration: the lifetime of the contract (years), corresponding to the period during which the farmer must comply with the contract terms and conditions	5, 10, 20	main reasons why they do not participate in the program - Cattle density, tree density, contract length and financial compensation all have a significant impact on choice behaviour
5. Compensation: the compensation in euros per hectare per year to manage and maintain the land according to the contract specification over the contract lifetime	100, 250, 450 (€/ha/year)	- Contract characteristics like cattle density and contract length are more important for farmers' decision to participate when compared to tree density or area size. - most important factor influencing farmers' participation in future AEAs is compensation of their opportunity costs, followed by technical support. - 82% of the farmers consider the ecological effectiveness of the scheme important when deciding to participate or not.

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- Farmers prefer higher cattle density and lower tree density rates. They also prefer short-term contracts

- There exists a clear trade-off between willingness to accept financial compensation and farmers' opportunity costs measured through varying cattle and oak trees density levels.

***Robustness of the CE:**
- careful survey design
- information should be policy relevant so it can be used in instrument design
- CE was thoroughly pre-tested
- CE preceded by a small-scale farm household survey and in-depth consultation of stakeholders for identifying relevant contract characteristics and their levels

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4.	(Wainwright et al., 2019)	1. Contract Length (in years)	5, 10	**Contract Preferences:** - farmers demonstrated a clear willingness to participate in conservation programmes for rare breeds - Participation may be reduced by up to 84% if farmer preferences for non-financial attributes are not taken into consideration - Farmers demonstrated a preference for shorter contract durations (a common finding in other studies) - While bovine farmers preferred individually managed conservation programmes ovine farmers preferred community managed schemes - However, farmers enrolled in AES schemes were more likely not to select a contract option,
		2. Scheme support	2 Levels: - Basic application assistance - Additional advisory support (e.g. extra training)	
		3. Structure of conservation scheme	2 levels: - community managed conservation programme - individually managed conservation programme	
		4. Subsidy (per animal per year)	-Bovines 90, 270, 530, 890 (Lei/year) - Ovines 5, 15, 25, 45 (Lei/year)	

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	*monetary attribute in local currency (Lei per year) was based on a percentage (10%, 30%, 60% and 100%) of the proposed monetary reward outlined in the RDP; the premise being that some farmers may be willing to accept (WTA) a lower reward, depending on contract design	suggesting overlap with existing contractual schemes may deter farmers from participating **Contract participation:** - Estimates reveal a trade-off between nonmonetary attributes and financial incentives - Contrary to expectations, farm size, education level and age did not have a significant effect on participation **Barriers to uptake:** - clear barriers to entry for smallholder farmers wishing to participate in incentive schemes -EU rural development policy is not clearly communicated. In this study, only 21% of farmers were aware of RDP funding support for farmers rearing endangered breeds **Payment Results:**

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				- Average bovine farmer needs to be paid €122 per annum per animal extra in order to enrol in a 10-year community managed conservation contract. - For ovines, an additional incentive price of €8.3 would be required for farmers to enrol in a 10-year individually managed conservation contract
5.	(Kanchanaroek and Aslam, 2018)	1. Agricultural diversification: adopting drought-tolerant crops or agroforestry practices	2 levels: - Drought tolerant cropping - Agroforestry	- respondents show reluctance to adopt higher reduction in chemical use while they show a preference towards adoption of drought tolerant crops over agroforestry
		2. Use of chemicals: to reduce chemical use on arable farms by x %	25%, 50%, 75%, 100%	
		3. Length of agreement: no. of years	1, 2, 5, 10	- farmers with larger household size show aversion to reduction of chemicals and prefer to adopt agroforestry. Similarly, farmers with higher number of labourers also show a preference towards agroforestry
		4. Compensation: annual payments for participation (baht/rai/year)	500, 1000, 2500, 5000, 7500, 10,000	

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				- Interaction of agricultural income with contract length reveals a preference towards shorter contracts - farmers with more agricultural experience require lower compensations - farmers are more likely to participate when a scheme offers higher compensations when other things are equal
6.	(Villanueva et al., 2017)	1. Cover crops area: percentage of the olive grove area covered by cover crops 2. Cover crops management: farmer's management of the cover crops	25%, 50% Free management, Restrictive management *former implies no restrictions other than those that are part of cross-compliance,	- Cover crops area: farm management and farmer knowledge and perceptions of AES are found to influence their WTA. Results observed harvesting of ground olives increased and previous participation in AES decreased the farmers' WTA for cover crops area

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	while the latter restricts the use of both tillage and herbicide in cover crops management	- Cover crops management: farmer characteristics and perceptions are determinants of their preferences. • farmers who perceive cover crops as a profitable farming practice would have fewer objections to restricting their cover crops management options
3. Ecological focus areas (EFA): percentage of the olive grove plots covered by ecological focus areas	0%, 2% *considering green payments and CAP regulations	- Ecological Focus areas: farmers' preferences towards ecological focus areas is influenced by a variety of factors. • not having undergone agricultural professional training increases the WTA for both extensive and intensive sub-systems • higher the farmer perception of EFA being environmentally beneficial, lower is the WTA for mountainous groves
4. Collective participation: participation of a group of farmers (at least 5) with farms located in the same municipality	Individual participation, Collective Participation *Collective contracts can help in reducing transaction costs (mainly public) while increasing the environmental effectiveness of policy instruments	- Collective Participation: farm and farmer characteristics and farmer perceptions play a role in farmers' preferences towards collective participation

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5. Monitoring: percentage of farms monitored each year	5%, 20% *studies have shown that level of monitoring influences farmers' preferences towards AES	• farm size negatively affects farmer willingness to participate in collective AES • farmers over the age of 60 years show a higher WTA for collective participation than younger ones (in plain irrigated and plain rain-fed olive groves) • when farmer perceive that there will be no farm takeover, they are more willing to participate in AES collectively and their WTA is reduced
6. Payment: yearly payment per ha for a 5-year AES contract	100€, 200€, 300€ and 400€ per ha per year	

- Monitoring: this attribute influences farmers' WTA only in rain-fed plain groves as them having a greater fear of heightened levels of monitoring

- Overall Results indicate that mountainous grove farmers would participate in AES schemes, both individually and collectively, in return for a lower payment than farmers of plain rain-fed or irrigated groves. Farmers of plain rain-fed

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				groves would take highest payments for participating in AES
7.	(Villamayor-Tomas, Sagebiel, and Olschewski, 2019)	1. Location of trees: location of trees along the border of the farm of a neighboring participant	Coordinated, Not coordinated	- For the preference in location of the trees, 63% Spanish, 60% Germans, and 74% Swiss participants at the Spanish, German and Swiss sites preferred to concentrate them in one plot than to spread them out in different plots
		2. Share of farm: percentage of farm dedicated to the measure	1%, 5%, 10%	
		3. Recommendation: whether the program has been selected over others by a reference group	3 levels: -Recommended by farmers -Recommended by scientists - No particular recommendation	- results support the current knowledge about the opportunity costs of devoting agricultural resources (i.e., land) to conservation in landscapes with intensified agricultural production and the eagerness of farmers to avoid or minimize costs
		4. Payment for action: annual individual payment in € per hectare, in addition to the reimbursement of planting costs and other governmental subsidies	50, 100, 150, 200 (€/ha/year)	- Most of the farmers (>70%) at all 3 sites perceived that most of the farmers in their county would not be interested in the tree planting measure, and neither in obtaining

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the consent of their neighbors and hence, planting trees in the border of their farms would not be easy

- Only at Swiss sites, the attribute of 'farmer recommendation' had a significant positive impact as compared to the absence of any recommendation in particular. In contrast, the attribute 'scientist recommendation' had no significant impact at any of the sampling sites

- the farmers prefer the ecosystem services with a higher share of private to public benefits. Thus, soil conservation, and maybe also, biodiversity, are expected to contribute more to farm productivity and farmer's benefits than water conservation, which mostly benefits downstream users. This shows that the willingness of farmers to participate in conservation programs varied

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				depending on the goals of conservation. - the 'payment' attribute had a positive and significant impact on utility across all countries. - around 37% of all farmers systematically chose the opt-out option.
8.	(De Salvo et al., 2018)	1. Protection of soil from water erosion	- Turfing sloping surfaces - Construction of temporary furrow sinks at a distance of: • 20m • 40m • 80m	- Majority of farmers were aware on the rules of eco-conditionality locally in force, and positively welcomed the opportunity to exercise more restrictive eco-friendly agricultural practices - farmers stated positive preference towards the maintenance of soil fertility and the control of the risk of soil erosion. - In particular, turfing sloping surfaces was preferred to furrows-
		2. Maintenance of soil organic matter	- Grazing stubble, straw, and crop residue	

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	- Creation of firebreaks and burying of crop residues - Burning of crop residues	sinks. Among furrows sinks, farmers declared to prefer more closed sinks.
3. Maintenance of landscape features	- excellent - very good - good - sufficient	- For practices aimed at protecting soil fertility, grazing stubble was considered the most appropriate respect to firebreaks, burying and burning crop residues.
4. Agro-biodiversity conservation (%)	75%, 50%, 25%, 0%	- Practices to protect soil from water erosion and to maintain its fertility influenced positively the choice among alternative AES.
5. Additional compensation (€/ha)	1000, 800, 600, 400, or 0	- Farmers perceived negatively the maintenance of countryside landscape elements, and the cultivation of old local varieties of grains. - Estimates revealed also that farmers' preferences were heterogeneous respect to the protection of soil from water erosion, the maintenance of soil

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				organic matter, and the cultivation of local endangered varieties. - Spatial econometric analysis revealed the existence of a "neighbor effect" influencing farmers' preferences for the cultivation of endangered varieties. - It suggests that in design of AES, policy makers should account that famer's preferences vary among practices but also among local contexts. Focus on local context might improve the acceptability of AES and achieve cost-effectiveness goals.
9.	(Franzén, Dinnétz, and Hammer, 2016)	1. Annual economic subsidy per hectare SEK Arable land (other land use) (SEK/ha/year) 2. Time frame for subsidy and commitment: Min years of	Current level: 3000 (1500) Improved level: 4000 (2250) Current level: 5 (20)	- Landowners were 3.5 times more willing to create a new wetland than were the leaseholders since a long-term and costly commitment such as wetland creation (up to 20 years) could be difficult and risky for a leaseholder.

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commitment (max extension of commitment in years)	Improved level: 10 (30)	
3. Practical support	Current level: No practical assistance for projecting and design of wetland Improved level: A collaboration forum, and practical assistance with projecting and designing a wetland	- younger farmers were more likely to be willing to create a wetland than older ones - the organic farming and farmers that were already applying environmental measures did not show an increased willingness to create wetlands as compared to conventional farmers. - analysing the results from the choice experiment, the level and composition of financial support was found to be the most important attributes for farmers' willingness to participate.
4. Economic compensation for construction (% of cost within ceiling)	Current level: 50 – 90 Improved level: 100	
5. Cost ceiling for compensation (SEK)	Current level: 100,000 Improved level: 200,000	- According to the CE, an increase of the economic compensation to 100% for wetland construction costs, within the current cost ceiling, was the most important factor to increase the willingness to create wetlands. The second most

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important factors were an increase of the cost ceiling for the compensation, and an increase of the yearly subsidy level.

- Hence, an increase in financial support could be a partial solution to attract more farmers.

- Nevertheless, approximately 70% of the respondents were not willing to create wetlands on their land.

- One of the major reasons given by the respondents for not participating in wetland creation schemes was high costs.

- Thus result-oriented schemes can be more motivating by encouraging farmers to innovate to allow for their farm to deliver ecosystem services.

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10. (Greiner, 2016)	1. Conservation requirement: expresses the environmental service to be remunerated. Focus is on broad-scale biodiversity conservation by removing cattle from the contract area either completely for the duration of the contract period or temporarily (i.e. 'spelling' the contract area every year) during times when biodiversity is particularly sensitive to grazing. Defined relative to cattle grazing and associated opportunity cost	3 levels - Short spelling - Long spelling - Total exclusion	- Results show that pastoralists and graziers require a greater monetary incentive to sign up to longer contract periods or alternatives causing higher opportunity costs, and they prefer flexibility - the principal factors explaining participation choice across the northern pastoral industry are the contract attributes, especially the conservation requirement and level of stewardship payment offered. - Across the industry, participation is distinctly positively influenced by favourable attitudes towards biodiversity and towards PES. This finding highlights the importance of complementing new PES-style programs with education and extension
	2. Annual conservation payment: The contract stipulates and annual per hectare conservation payment (in $/ha/year)	1, 2, 4, 8, 16, 32 ($/ha/year 5, 10, 20, 40 years	
	3. Contract length	Flexibility, No Flexibility	
	4. Flexibility: flexibility to contract conditions	External, Self	

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		5. Monitoring (conducted by)		- Introducing some level of contract flexibility positively influences contract adoption
11.	(Vedel, Jacobsen, and Thorsen, 2015)	1. Purpose of afforestation: different levels used in this attribute have different significance. Biodiversity implies that the afforested area mainly consists of broadleaved trees. Ground water protection implies that the ground preparation is minimal and no pesticides/herbicides can be used, and recreation implies that there has to be established walking paths and parking areas 2. Option of cancelling the contract: The contract is either binding or may be cancelled within 5 or 10 years. If the contract is cancelled, the compensation has to be paid back to the state (with a specified interest rate) and	3 levels: - Biodiversity - Ground water protection - Recreation 3 levels: - Option of cancelling within 10 years - Option of cancelling within 5 years - Binding contract 1%, 10%, 25%	- 7% and 63% of the landowners hold social preferences for monitoring when choosing between agri-environmental contracts - For the large subgroup consisting of 63%, the combined effect of monitoring and the interaction term on WTA varies from e.g. €194 in required additional compensation for a contract with 1% monitoring and the lowest subsidy level to a reduction in WTA of €1263 for a contract with 25% monitoring and the highest subsidy level.

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		the landowner is then free to return the area to arable land 3. Monitoring: A fraction of the landowners who accept a contract will receive a visit by the authorities in order to check landowners' commitment (%) (Monitoring, 0% is reference) 4. Compensation: The compensation is the amount the landowner receives as a one-time payment per ha	€3620–5525 per ha (in steps of €400)	
12.	(Lienhoop and Brouwer, 2015)	1. Forest size (%): size of the afforestation area expressed as percentage of farmland 2. Forest type: Commercial production forest with one or two species (the revenues of which stay with the farmer) vs. a non-commercial mixed forest containing a greater diversity of	5, 10, 25, 50 Commercial forest, Non-commercial forest	- Although only 50% of farmers regard afforestation as an important countryside issue, CE reveals that majority of farmers (67%) are willing to trade-off the offered afforestation contract design features against the subsidy level - The questionnaire analysis reveals that farmers require the subsidy

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plants and wild animals and generating less revenue		level to be as lucrative as their current land uses (i.e. they should cover the opportunity costs of afforestation)
	Yes, No	
3. Technical advice: availability of technical advice by rangers to plant and manage the forest throughout the duration of the contract	Yes, No	- Analysis of forest size attribute suggest that farmers have a strong disutility for large forests.
4. Recreational access: allowing public recreational access (expenses for setting-up walking paths and benches will be covered by the contract)	Yes, No	- Large-scale afforestation projects are not attractive, farmers would require considerable subsidy payments, and hence their implementation could only be achieved at a very high cost.
5. Return to agriculture at end of contract	10, 25, 50 years	- regarding other attributes, study observed that farmers prefer shorter to longer contracts and have a strong preference for the option to return to agriculture after the contract ends
6. Contract length (years)	500, 750, 1000, 1500, 2000, 3000	
7. Subsidy: financial compensation in the form of subsidies per year and hectare to compensate for forest management and income loss (€/ha/year)	(€/ha/year)	- 74% farmers preferred flexibility in their contract duration and considered the opportunity to

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				terminate the contract at any time to be an important precondition - If offered technical advice, farmers would accept lower levels of subsidies for planting and managing the forest, since the majority of farmers have no experience with forestry - Species' diversity (provided through non-commercial forests), timber production (provided through commercial forests) and recreation do not play a significant role in choosing contract alternatives
13.	(Christensen et al., 2011)	1. Contract length 2. Flexibility to release from contract	1 year, 5 year Yes*, No *Yes: Can be released from contract without costs once a year	- CE results show that there is a great deal of uncertainty among farmers concerning the consequences of enrolling in subsidy schemes with respect to the degree of overlap with other subsidy schemes, and the extent to

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		which cross compliance might be put into force.
3. Buffer zone width	2 levels: - Between 6 and 24 m - 6 m	- Study also found a considerable lack of trust in authorities among farmers.
4. Changed agricultural practice	2 levels: – Fertilizer can be used in buffer zones – Pesticides or artificial manure cannot be used in buffer zone	- CE shows that the vast majority of farmers (86%) are willing to trade off scheme requirements against the size of the subsidy.
5. Application method	2 levels: – Assistance free of charge from extension service to send in application form – Application for subsidy on common application form	- Results also show farmers can pay in monetary terms for being released of administrative burden. Thus, they are willing to accept a lower payment in exchange for free assistance for enrolling in a scheme
6. Size of subsidy (Euro/ha/year)	134, 228, 336, 510 (Euro/ha/year)	

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14.	(Kuhfuss et al., 2015)	1. Herbicides used on the farm during the contract: Global reduction of herbicide use on the enrolled area (in proportion of present use) (%)	-30%, -60%, -100%	- CE results show that the introduction of a collective dimension to agri-environmental contracts could effectively enhance efficiency of AES in three ways with winegrowers: 1. it would enhance farmers' initial participation provided there is a conditional bonus in the contract 2. The negative willingness to accept the bonus means that the payment for a contract can be lowered by this amount if a relatively small bonus is included. So, even if a bonus has to be paid to each farmer who has signed a contract (because the threshold has been reached), the cost of the scheme per hectare is reduced 3. Study found that the collective bonus does encourage the farmers to enrol a larger share of their vineyard in the scheme - study also reports that farmers are more willing to make environmental efforts when their neighbours do so
		2. Localized use of herbicides: Supplementary localized use of herbicides beyond the committed reduction	Allowed, Forbidden	
		3. Collective and final conditional bonus: 150€/ha after five years, provided that, at the end of the 5 years, 50% of the area of interest is engaged in a process of herbicide use reduction	Final bonus (150€/ha equivalent to 30 €/ha/year), No bonus	
		4. Administrative and technical assistance: Free administrative and technical assistance included in the contract and provided by a local technician	Yes, No	

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		5. Individual annual payment per enrolled hectare	90, 170, 250, 330, 410, 500 (€/ha/year)	- In conclusion, contracts with the conditional bonus incite the winegrowers to enter the AES
15.	(Latacz-Lohmann and Breustedt, 2019)	1. Fertilisation	3 levels: - organic and mineral allowed - organic permitted - no fertilisation allowed	- This paper demonstrates: 1. how 2-stage analysis of discrete–continuous supply, based on CE, can be used to inform the design of conservation contracts 2. to investigate how the information provided by this analysis affects policy performance. - The results of 2-stage analysis showed that it is possible to determine 1. the probability of whether farmer participates in an agri-environmental scheme 2. land area he would be willing to enrol in such a scheme.
		2. First mowing not before	1 June, 22 June	
		3. Maximum grazing with (animals per hectare)	2, 3, 4 animals per hectare (1 animal = 1 cattle or 3 sheeps)	
		4. Contract period	1, 5, 10 years	
		5. Annual compensation	250, 350, 450 € per hectare per year	

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				- Stricter prescriptions led to a fall in the probability of choosing a contract, while a higher compensation payment per hectare increased it. The greatest effects were on fertilisation, grazing and mowing prescriptions. - Farm-specific variables also had a significant influence on contract choice. Farmers who already participated in agri-environmental schemes (dummy variable 'scheme participant') were more likely to opt for a contract and requested less compensation.
16.	(Hasler et al., 2019)	1. Area: The area enrolled in the contract (%) 2. Length of contract 3. Termination: Flexibility to terminate the contracts	1, 5, 7, 10, 15, 25, 100 (%) 1, 3, 5, 7, 10, 20 (years) Not possible, Possible with refund, Possible without refund	- WTA differs substantially between countries - subsidy is negatively correlated to the 'Area enrolled' attribute. - Similarly, lengthier contracts would require higher subsidies

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		4. Advisory: Advice offered 5. Payment levels: EUR/ha dependent on the country (in the choice cards the subsidy levels were presented in national currencies)	Charged, free DK 9 levels: from 70 to 940 EUR/ha (500–7000 DKK/ha) EE 10 levels: from 50 to 1000 EUR/ha FI 10 levels: from 50 to 500 EUR/ha PL 10 levels: from 23 to 345 EUR/ha (100–2000 PLN/ha) SE 10 levels: from 25 to 570 EUR/ha (250–6000 SEK/ha)	- Results also show that the effect of the option for the farmer to terminate a contract varies across the countries. - Finally, contracts containing the possibility of free agricultural advice were valued at 131 EUR per ha in Estonia, 33 EUR in Sweden, 28 EUR in Denmark and 18 EUR in Poland. This also depends on whether the countries have pre-existing advisory services or not.
17.	(Roussel, 2019)	1. Specifications: Levels of specifications required by the compensatory measurement	- Level I: 30 UN, June 20, no refuge area	- Farmers prefer to keep their current practices and, if they commit, prefer contracts with

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contract with regard to: the quantity of nitrogen for fertilization (UN), the mowing delay and the presence of a refuge area	- Level II: 0 UN, June 20, no refuge area - Level III: 0 UN, July 20, no refuge area - Level IV: 0 UN, July 20, refuge area	limited management constraints, of short duration, with a conditional monetary bonus and well remunerated, which seems quite intuitive. - Two interactions between attributes and socioeconomic variables have significant effects: 1. having larger areas increases the probability of adopting more restrictive measures 2. being the owner of his land, whether partially or completely, increases the probability of signing a contract, and this, for a longer period.
2. Duration of engagement: Total commitment period of the compensatory measure contract	9, 18, 25, 40 (years)	
3. Conditional monetary bonus: Additional remuneration (200 €/ha/year) for additional ecological measures when the bonus is proposed in the scenario	Bonus available (200 €/ha/y), No bonus in compensatory measure, No bonus because it was the opt-out option that was chosen	- Among the farmers with larger holdings and more often owners, there are two profiles represented by classes 2 and 3.
4. Remuneration of the measure: Remuneration received each year by the farmer per hectare hired (€ / ha / year)	800, 1100, 1500, 2000 (€ / ha / year)	- Members of class 2 are not against the idea of engaging in MC.

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		5. Non- participation: Farmer prefers to keep current practices	Non-participation, Choice of compensatory measure A or B	- Class 3 farmers are the only ones with a strong preference to keep their current practices. If they had to accept MCs, which 64% find realistic, these should include limited constraints, of short duration, contain a monetary bonus and be well remunerated (ie results similar to the mixed Logit model). - Finally, class 2 and 3 farmers based their choices essentially on the *duration of engagement* attribute (91% and 70% respectively), which translates into a stronger reluctance to long-term MC.
17.	(Le Coent, Préget, and Thoyer, 2017)	1. Purpose: Aim of the contract	Compensation of biodiversity loss, Conservation of biodiversity Yes, No	- On an average farmers are more likely to choose a conservation contract than a compensation contract.

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2. Threshold: Existence of a minimum threshold of participation of 20% of farmers of the area		- Farmers prefer contracts which are not conditional to a minimum participation level. They would require 59€ more to enroll in a contract that includes a 20% threshold of participation rather than in a contract that does not include a threshold. This difference might be linked to anticipated costs of transaction. - Farmers are reluctant to engage into a contract procedure (which can be costly in terms of paperwork, compulsory meetings with extension workers etc.) which may not be finalized. Revealing the existence of such threshold might therefore be counterproductive for the developer because it will discourage some farmers to participate in the contracts. - There is also a significant preference for the opt-out option,
3. Payment: Payment level per ha and year	170, 200, 230, 260 (€/ha)	
4. Opt-out: Neither of the 2 contracts	Opt-out, Contract 1 or Contract 2	

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				i.e. the non-participation in any of the contracts
18.	(Rocchi, Paolotti, and Fagioli, 2017)	1. Nature: conversion of agricultural areas to pasture, using particular species with a high natural value 2. Biodiversity improvement: growing of hedges with species suitable for insect development. 3. Landscape improvement: building of fences for animals at pasture. 4. Seeds: use of native seeds. 5. Lisciviation: additional decrease of 5% in nitrates consumption with regard to Nitrate Vulnerable Zone limits.	No surface, 1/3 surface, 1/2 surface Do not make it, Creation of hedges Do not make it, Creation of fences No surface, 1/2 surface, All the surface No surface, 1/2 surface, All the surface	- results indicate three different groups of farmers, each with specific preferences regarding the environmental measures to be applied - Farmers in Class I (the largest) are interested only in intensification of the reduction of nitrates and not in AES. It seems that farmers in Class I are willing to accept payment for increasing a current mandatory environmental measure. Furthermore, they are not interested or are unfavourable to more innovative actions, such as the growing of hedges and naturalization - Class II farmers, the smallest (15.76%), showed opposite results compared to Class I

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	6. Money: additional annual payment per hectare (€/hectares per year)	50, 100, 150, 200 (€/hectares/year)	- Class II is that of the youngest farmers and have higher willingness to participate in AES - The majority of farmers would prefer to practice traditional agricultural methods that are already in use with a low intensity in the area (e.g. actions aimed at decreasing lisciviation)
19. (Chang et al., 2017)	1. Land to be enrolled in the CFRS (%)	25% eligible area, 50% eligible area, 100% eligible area	- results suggest that to encourage full enrolment (100%) of their farmland, offered compensation must perhaps lie over NTD$ 698 per hectare (for farmers estimated to be willing to participate) - the option of extending the contract length to 5 years requires additional compensation (approximately NTD$ 404 per hectare)
	2. Payment for entry to the scheme (reference level): Fixed payment for joining the CFRS scheme (NT$/ha/year)	2000, 2500, 3500 (NT$/ha/year)	
	3. Additional chemical fertilizer reduction with corresponding reward payments (NT$/ha/year)	4 levels: - only comply with reference level (no payment)	

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	- apply 15% less than reference level (NT$ 1000) - apply 30% less than reference level (NT$ 2000) - give up the use of chemical fertilizer (NT$ 5000)	- However, when the eco-label is provided to the farmers in exchange for participating in the CFRS, they are willing to accept a significantly lower compensation level (about NTD$ 717 less)
4. Contract length: Duration of the contract	2, 5 (years)	- Model analysis separates the farmers into 2 classes
5. Eco-Label: An eco-label for farmers who successfully comply with the standard	Yes, No	- Class 1 is the group of respondents having less education and not having a history of actively practicing rational fertilization. It is very unlikely that this group can be motivated to participate in the scheme. - Class 2 group has higher education and has already obtained at least one of the certifications for their products. This group also follows an extension agent's advice while decreasing the amount of fertilizer use gradually. They currently use 100%

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				chemical fertilizer on the farm. This group appreciates having an eco-label and has a positive attitude towards additional payment. However, they are not willing to practice further fertilizer reduction. This may show that the farmers' attitude of aversion to further chemical fertilizer reduction means that they fear yield losses.
20.	(Anastasio J. Villanueva, Gómez-Limón, and Rodríguez-Entrena, 2017)	1. Green roof surface: Percentage of the surface of mountain olive grove under cover vegetable (%)	10% (reference level), 30%, 50%, 100%	- results show that at a higher level of demand the DAA of farmers increases, positively correlating attribute value increase.
		2. Plant cover management	Free (reference level), Limited, Brushcutter and/or tooth, No driving	- Beyond a certain point of demand, majority of the farmers are not willing to accept the adoption of associated practices.
		3. Insecticide treatment: made in the plots of mountain olive grove	Free (reference level), Limited, Ecological, No treatment	- there are programs with low requirements (e.g., related to integrated production) for which farmers would require modest compensation (< 80 €/ha), other
		4. Premium for results: single payment at the end from the agri-environment program to condition	Non-inclusion of premium (reference	

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	that they be at provision levels of biodiversity and functionality of expected ground 5. Annual payment: per hectare to receive during the 5 years of the agri-environment scheme (€/ha/year)	level), Inclusion of premium for €400/ha to be received in the 5th year of the program 50, 150, 250, 350	programs with demanding requirements (ecological) for which they require moderate compensation (125-175 €/ha), while for programs with very high levels of demand (which greatly limit the management of farm) significant compensation is required (>300 €/ha)
21.	(Pröbstl-Haider et al., 2016)		- Almost all farmers participated in AES (99.3%) - About 2/3rd of the respondents (65.5%) had already signed conservation-related contracts in past, and 22% of them contributed to the conservation of wet meadows in the March–Thaya floodplains - About half of all respondents (48 %) indicated that they would be willing to participate in AES contracts again upon expiry of their current contracts

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1. Type of management
2. Gross margin (€/ha/year)
3. Environment premium per ha per year (AES)
4. Duration (years)
5. Potential price fluctuation
6. Likelihood of complete crop failure

Alternative A	Alternative B	Alternative C
Cash crop cultivation	Short-rotation cultivation	Grassland cultivation
300, 450, 750, 1200, 1650	150, 375, 550, 725	75, 150, 250
None, Greening premium: € 50, 150	None, Climate premium: € 50, 100, 150	None, Australian AES funding € 300, 600, 900, 1200
1 year	15, 20, 25 years	7 years
Low, medium, high, very high	Low, Medium, High	Low
Every 2 years, every 3 years	Every 10 years, every 25 years	Every 5 years, every 10 years, every 15 years

- Another 30 % of all farmers were undecided and 22 % would not sign new contracts.

- Their main reasons for opposing these contracts were
  - inadequate compensation (10%)
  - excessive administrative effort (8.8%)
  - lengthy contract periods (8.1%)

- Regarding farmers' perception of climate change
  - Overall, the majority of farmers (64.2 %) already "recognize the first effects of human induced climate change,"
  - 7.5 % expect to see "significant effects in the near future."
  - Another 25 % are "undecided if climate change will occur,"
  - 2 % "do not believe in climate change

- Regarding farmers' perception of future farm development, the majority of respondents planned to

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				expand their farm, intensify farming or specialize in a particular crop. Options like reducing the amount of acreage, changing to a different management model (i.e., conventional vs. organic farming), or terminating the business were the least likely options envisaged.
22.	(Hope, Borgoyary, and Agarwal, 2008)	1. Land commitment to organic farming (acres) (%)	25%, 50%, 75%, 100%	- Results from choice experiment estimates farmer preferences with regard to a range of scenarios, and reveals two groups of farmers with differing choice profiles and sociodemographic characteristics from a latent class analysis. - Class 2 farmers express a positive preference for adopting organic farming subject to price incentives and labour constraints - In Class 1, the attributes for labour effort and compost price are not significant. This indicates a higher
		2. organic crop price increase (per 100 Rupees)	5, 7, 9, 11, 13, 15	
		3. cost of certification per acre (Rupees)	R1,000 as a group, R3,000 as a group, R3,000 as an individual	
		4. compost price per trolley (Rupees)	R600, R900, R1200, R1500	
		5. labour days to compost one trolley	4, 8, 12, 16	

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price preference for Class 2 farmers.

- While Class 2 farmers are more willing to convert land to organic production, this is balanced by a higher price preference and a lower labour investment.

- Class 1 farmers record high positive utility estimates for certifying land across the three scenarios, price per acre has little impact on utility levels. In contrast, Class 2 farmers record an almost identical utility estimate to the aggregate score for group certification at R1000 per acre, but they reveal a far larger utility improvement from this option in comparison with the higher-cost certification options.

- Class 1 farmers have no experience of organic farming, are over 50, and live in the upper

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				watershed, compared with Class 2 farmers, who do have organic experience, are illiterate, are non-income poor, and live in the lower watershed. - Finally, land commitment attribute suggests that Class 1 farmers are literate and live in non-poor homes. In contrast, Class 2 farmers are illiterate and live in the lower watershed.
23.	(Rodríguez-Entrena, Villanueva, and Gómez-Limón, 2019)	1. Cover crops area: percentage of the olive grove area covered by cover crops 2. Cover crops management: farmer's management of the cover crops	25%, 50% Free management, Restrictive management *former implies no restrictions other than those that are part of cross-compliance,	- Payment is the attribute with the lowest level of nonattendance; thus, showing it is most important for farmers - Monitoring is the attribute with the highest level of nonattendance. - Thus, it received the least attention from the farmers, indicating that monitoring played a minor role in farmers choices - The attributes for collective participation and ecological focus

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	while the latter restricts the use of both tillage and herbicide in cover crops management	area can generate a higher degree of uncertainty among the farmers -
3. Ecological focus areas (EFA): percentage of the olive grove plots covered by ecological focus areas	0%, 2% *considering green payments and CAP regulations	
4. Collective participation: participation of a group of farmers (at least 5) with farms located in the same municipality	Individual participation, Collective Participation *Collective contracts can help in reducing transaction costs (mainly public) while increasing the environmental effectiveness of policy instruments	

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5. Monitoring: percentage of farms monitored each year	5%, 20% *studies have shown that level of monitoring influences farmers' preferences towards AES
6. Payment: yearly payment per ha for a 5-year AES contract	100€, 200€, 300€ and 400€ per ha per year

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