SUPER-G

SUSTAINABLE PERMANENT GRASSLAND

Deliverable 4.1a

Review of facilitators of, and barriers to, adoption and choice of PG management options to deliver specific ecosystem services (ES)

Project funded under the Horizon 2020 Research and Innovation Programme

Dissemination Level

PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Contact Details

Name of Contact:	Sophie Tindale
Address:	Centre for Rural Economy, School of Natural and Environmental Sciences, Agriculture Building, NewcastleUniversity, Newcastle upon Tyne, NE1 7RU
Email:	sophie.tindale@newcastle.ac.uk

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Contents

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Summary

Project Number: 774124-2

Project: SUPER-G – Developing SUstainable PERmanent Grassland systems and policies

Duration: 5 years

Start date of Project: 1st June 2018

Project management: RSK ADAS LIMITED

Person in charge: Paul Newell-Price

Deliverable: 4.1c

Due date of deliverable: Sept 2019

Actual submission date: Sept 2019

Work package: WP4

Leader: Lynn Frewer

Person in charge: Lynn Frewer

Author(s): Sophie Tindale (UNEW), Lynn Frewer (UNEW), Erik Hunter (SLU), Pedro Sánchez Zamora (UCO), Rosa Gallardo (UCO), Belén Caño Vergara (UCO), Paul Newell-Price (ADAS), Marjolein Elings (WR), John Elliot (ADAS), Simona Miškolci (MENDELU).

Contributor(s): Hannah Schleuter (UNEW)

Communication level: XXX

Version: XXX

The SUPER-*G* project (Grant Agreement No.: 774124) has received funding from the European Union Horizon 2020 Research and Innovation Programme. The views and opinions expressed in this report does not represent the official position of the European Commission and is entirely the responsibility of the authors.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Partners in the *SUPER-G* project are:

Organisation	Acronym	Country
University of Newcastle upon Tyne	UNEW	UK
RSK ADAS Limited	ADAS	UK
The University Court of The University of Aberdeen	UABDN	UK
Mendelova Univerzita V Brne	MENDU	CZ
Magyar Tudomanyos Akademia Okologiai Kutatokozpont	MTA ÖK	HU
Javna Ustanova Univerzitet Crne Gore Podgorica	UOM	ME
Sveriges lantbruksuniversitet	SLU	SE
Universita Degli Studi Di Torino	UNITO	IT
Stichting Wageningen Research	WR	NL
Eidgenoessische Technische Hochschule Zuerich	ETHZ	CH
Szkola Glowna Gospodarstwa Wiejskiego	UWA	PL
Georg-August-Universitat Gottingenstiftung Offentlichen Rechts	UGOE	DE
Agri-food & Biosciences Institute	AFBI	UK
Consulai, Consultoria Agroindustrial, Lda	CONSULAI	PT
Universidad De Cordoba	UCO	ES
Univerza V Ljubljani	UL	SI
Chambre Regionale d'Agriculture De Normandie	CRAN	FR
Association Normande de la ferme expérimentale de La Blanche Maison	LBM	FR
The Northern Ireland Agricultural Research and Development Council	AgriSearch	UK
CRA GRAND EST	CRAGE	FR

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Executive summary

Context and aim

This report details the findings of task 4.1a of the Horizon 2020 SUPER-*G* project, which supports the maintenance and sustainable management of PG, and sets out to (i) increase understanding of the importance and functioning of permanent grassland (PG); (ii) benchmark PG performance across Europe; (iii) develop integrated approaches for sustainable PG management; and (iv) develop tools and policy mechanisms inclusive of stakeholder and citizen priorities. Task 4.1a aims to produce a *review of facilitators of, and barriers to, adoption and choice of permanent grassland (PG) management options to deliver specific ecosystem services (ES*). The review aims to better understand what motivates and constrains managers to adopt a variety of PG management options that may target a variety of ES.

The key questions addressed by the review include:

1) What are the attitudes of different stakeholder groups to grasslands and to ES delivery?
2) Where might there be conflicts between different groups regarding ES priorities?
3) What factors influence the choice and adoption of PG management options?

Task 4.1a sits alongside tasks 4.1b: *Economic drivers of farmer adoption* and 4.1c: *Review of existing policies and impacts*. The results of each of the three tasks will combine to help assess the socio-economic facilities of, and barriers to, adoption of sustainable PG systems in different biogeographic regions across Europe. The knowledge presented in this review will form the basis of further direct empirical exploration, which will underpin development of discussions around policy recommendations for more sustainable PG management.

Methodology

A systematic literature review approach was used as an explicit, rigorous and transparent methodology for exploring the research questions (Greenhalgh, *et al*., 2004; Greenhalgh *et al*., 2005). The strengths of a systematic review process, including its ability to efficiently make sense of large bodies of literature, and as a method of mapping out uncertainties, providing evidence and maintaining a balanced and less biased sample of research from which to draw answers to particular questions (Petticrew and Roberts, 2006) were advantageous in the context of this research. The review process included the creation of a set of search terms that were inputted into both Google Scholar and Scopus databases. The results were screened for relevance by assessing the abstracts using a predefined set of exclusion criteria (including, for example, studies that were peer-reviewed, based in European countries, reported in English, conducted after 1962 and including primary empirical socio-economic data). The resulting set of 136 papers were then read in full, and if data was of sufficient quality, the relevant information and themes were recorded and analysed using Nvivo12.

Findings

Studies included in the review covered data collected between 1988 and 2019, in 24 European countries, with the majority in central and northern Europe. Popular topics for research included adoption of agro-environmental management practices, different perceptions of ES, landscape preferences, conservation of landscapes, and farmers' landscape decision-making. Studies targeted predominantly farmers and citizens/the public/residents/ visitors through interviews and surveys, but also included other stakeholders and a variety of methods.

In relation to attitudes and perceptions of stakeholders, grassland and grassland management were covered in some studies, and a number focused their case studies on specialist grassland systems such as meadows, species-rich environments, pastures and alpine grassland areas. However, most mention of grassland was

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

incorporated into studies of broadly defined landscapes and farming systems. This highlighted a potential lack of research specifically targeting grassland in this area.

In relation to ES, farmers and non-farming stakeholders tended to prefer or value different aspects more predominantly than others. Citizens were more likely to describe valuing cultural services including food, tourism, cultural heritage and landscape over supporting or regulating services. Farmers were more likely to give importance to regulating and provisioning services, such as erosion control, water regulation and production from the land. Conflicts over attitudes were seen to occur in areas where land was becoming newly protected or in national parks.

In relation to landscape preferences, aesthetics was a popular way to assess opinion, particularly of non-farmer populations, where general preferences for diversity and open landscapes are dominant, but highly dependent on context and cultural background. In some studies farmers were found to hold opposing views to non-farming populations, particularly in relation to the mix of landscape use and 'tidiness' of the land, which could cause conflict with conservation priorities.

In relation to facilitators and barriers for decision-making, a variety of factors were covered by the papers. Financial considerations were the most studied aspect relating to cost of implementation of management measures, farm income and profit. Policy characteristics were also an important focus, often related to agri-environment schemes and subsidies, and were often seen to be problematic in relation to bureaucracy and uncertainty issues. Biophysical factors were important in research studies, relating to the influence of landscape, climate and biodiversity on decision-making. The way in which decision-making was facilitated was fairly well studied, with research highlighting issues around social learning, communication and knowledge sharing as important enablers. The role of farm advisors and extension services was seen to be important, but was less well studied. Social norms were less well studied, but were seen as an important influence, particularly around family values, historical and cultural influence, and opinion and action of other farmers. Factors missing from the study that may offer opportunities for future research in relation to PG management include consumer preferences, land ownership and tenancy, risk perception, and technology adaption.

Conclusions

The review has found that there is an opportunity to add to the literature on socio-economic factors affecting grassland management decision-making and attitudes to grassland, as there are currently few studies taking an explicit focus on PG. Studies in this review have highlighted that ggrasslands are perceived in relation to their benefits, including ES, but may be perceived as part of the wider landscape and perceived differently by farming and non-farming stakeholders. There is a complex interaction of factors affecting decision-making in each case that constitute enablers or barriers. Extrinsic factors such as biophysical factors, political context and social norms form the context of decision-making. Interim factors such as policy characteristics, agri-environment schemes, management issues, farm structure, bridge the scope between influence of context and influence of local, intrinsic factors, such as perceptions and values and attitudes. Such factors are fluid and open to change through time and between scales and groups. Processional factors such as collaboration, knowledge–sharing, participation and advice and guidance affect the mode by which decisions are facilitated. Financial considerations are the most studied factor affecting decisions. Based on the results of this review, there may be opportunity to contribute to under studied factors that may also have importance.

Recommendations

- Despite limitation of the method, this review offers a tool box of factors to discuss decision-making around PG management.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

- Further research will be able to assess the relative importance of factors in specific grassland decision-making contexts and in relation to attitudes.
- Further research is also needed to address potential gaps in the understanding of factors and interconnections between factors (such as the influence of public attitudes on farmer decision-making).
- Further research will also explore the attitudes of citizens and consumers to ES in relation to PG.

THIS PROJECT HAS RECEIVED FUNDING FROM
THE EUROPEAN UNION' HORIZON 2020 RESEARCH
AND INNOVATION PROGRAMME
UNDER GRANT AGREEMENT N. 774124

1. Introduction

This report details the findings of task 4.1a of the Horizon 2020 SUPER-*G* project. The SUPER-*G* project supports the maintenance and sustainable management of PG, and sets out to (i) increase understanding of the importance and functioning of permanent grassland (PG); (ii) benchmark PG performance across Europe; (iii) develop integrated approaches for sustainable PG management; and (iv) develop tools and policy mechanisms inclusive of stakeholder and citizen priorities. Task 4.1a aims to produce a *review of facilitators of, and barriers to, adoption and choice of permanent grassland (PG) management options to deliver specific ecosystem services (ES*). The review aims to better understand what motivates and constrains managers to adopt a variety of PG management options that may target a variety of ES. The purpose of the review is to assess the common and conflicting interest of societal actors, as well as the attitudes of farmers towards ES delivery in Europe, and aims to take into account the biophysical factors affecting decision-making, amongst other factors.

The key questions addressed by the review include:

4) What are the attitudes of different stakeholder groups to grasslands and to ES delivery?
5) Where might there be conflicts between different groups regarding ES priorities?
6) What factors influence the choice and adoption of PG management options?

We have interpreted the task to be focused on understanding the variety of attitudes, opinions, perceptions and values of different groups to grassland, ES, landscape, landscape change as well as landscape and grassland management. We have understood that PG is not always referred to as such and have broadened our study to incorporate grassland and other wider landscape systems that include PG. We have also interpreted the 'choice and adoption of management options as, broadly, 'decision-making'. We understand the primary decision-makers about PG management are farmers and will target our understanding of decision-making to farmers (and land managers).

Task 4.1a sits alongside tasks 4.1b: *Economic drivers of farmer adoption* and 4.1c: *Review of existing policies and impacts*. The results of each of the three tasks will combine to help assess the socio-economic facilities of, and barriers to, adoption of sustainable PG systems in different biogeographic regions across Europe.

2. Background

The existence and management of permanent grasslands (PG) is key to the delivery of multiple ecosystem services (ES) across Europe (e.g. Le Clec'h *et al*., 2019; Allan *et al*., 2015; Baldocchi *et al*., 2017; Harrison *et al*., 2010). However, PG maintenance and functions are under threat from sub-optimal management of inputs, cultivation in higher output farming systems and abandonment in remote and marginal areas (Korevaar *et al*., 2019). Such threats are manifested in the decisions made by land managers and farmers in relation to changing management options, or choices to convert or abandon PG (e.g. Jeanneret *et al*., 2007). Their decisions are affected by multiple incentives and barriers, including underlying attitudes and perceptions of the decision-makers (Blackwell *et al*., 2013; Kohler *et al*., 2014; Lončarić *et al*. 2016; Plieninger *et al*., 2004; Power *et al*., 2013). Priorities for PG management are also arguably affected by the attitudes and perceptions of non-farmers, who, although do not directly make landscape decisions, may influence the barriers or opportunities for change in existence, through their willingness to use the landscape for recreation,

their role in policy creation, biodiversity protection, or local business, or their changing demand for products from grassland landscape and livestock. This review recognizes that there are two areas of focus that are important to explore: the first being the attitude and perceptions of both farmers and non-farmers in relation to grassland and the landscapes in which grassland sit, and in particular towards different ES; and the second being the factors (including attitudes) that affect farmer decision-making around grassland and related environments.

In relation to the study of perceptions and attitudes to ecosystem services (ES) and to associated landscapes, attempting to understand the socio-cultural valuation of ES can enable the quantification of the relevance of ES to people (Bernues *et al.*, 2014). It also allows an understanding of the similarities and differences between stakeholders with diverse values, interests, experiences and knowledge (Bernues *et al.*, 2014). Part of developing this understanding is to try and better understand the services from the point of view of those who might be beneficiaries. This could have consequences for the use of different stakeholders' knowledge and their societal demands in assessing the development and production of ES in grassland environments (Cowling *et al.*, 2008; Koschke *et al.*, 2012; Cebrián-Piqueras *et al.*, 2017). Where attitudes about ES are not considered, it may lead to sub-optimal management alternatives (Hein *et al.*, 2006).

Studies have shown that an increasing number of assessments of land management decision-making and priority setting are based on stakeholder perceptions, either for the understanding of the ES that are most relevant for the system and problem at hand, or the evaluation of suitable management options (Seppelt *et al.*, 2011). However, ecosystem services have different meanings for different stakeholder groups (Cebrián-Piqueras *et al.*, 2017), depending on their knowledge, access to networks, professional experience, cultural context and socio-economic situations (Lamarque *et al.*, 2011; Martín-López *et al.*, 2012; Orenstein and Groner, 2014;). For example, conservationists might have good knowledge of the value of habitats for species protection (Barrera-Bassols and Zinck, 2003; Desbiez *et al.*, 2004; Anadón *et al.*, 2009), whereas farmers might have a knowledge of ecosystem properties and processes that contribute to an understanding of the way that agricultural yield is determined and an understanding of the value of production, although such knowledge would vary greatly (Cebrián-Piqueras *et al.*, 2017). However, Cebrián-Piqueras *et al.*, (2017) argues that services such as water retention or carbon sequestration are hard to assess even by experts (Fang *et al.*, 2007; Eigenbrod *et al.*, 2010). Equally, stakeholders may ascribe different values to ES at different local, regional or institutional levels (Martín-López *et al.*, 2009) based on their cultural background as well as the impact that any particular ES might have on their health and well-being (Hein *et al.*, 2006). Difference in conceptions offer insights on spatio-temporal trade-offs between ES (Bennett *et al.*, 2009). Agricultural trade-offs are important in relation to sustainability issues (Kanter *et al.*, 2017), and it is therefore important to understand the variety of views and trade-offs in relation to ES, and specifically in relation to PG environments.

Cebrian-Piqueras *et al.*, (2017) have stated that, in relation to understanding farmers attitudes to ES and their consideration in land management behaviour, there is no established body of literature, and only a small number of empirical based studies exist to better understand farmers´ behaviour and decision making around land management. For example, Lamarque *et al.* (2011), have investigated farmers' perception and values related to ES in the Central French Alps with the focus on mountain grasslands management. Lewan and Söderqvist (2002) analyzed how farmers in a Swedish river valley identify and value different ES. Switek and Sawinska (2016); Schulz *et al.* (2014) and van Herzele *et al.* (2013) have conducted surveys looking at the importance of greening activities and how perceptions around the related ES might affect agricultural management

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

practices. Similarly, Sattler and Nagel (2010) have investigated the level at which farmers will accept conservation measures and the influences on their opinions. These studies afford valuable insight into the opinion and values of farmers and demonstrate the type of knowledge this review will attempt to collate and analyse.

Bartkowski and Bartke (2018) provide a review that is very similar to the second element of this study as they provide a systematic review of empirical studies investigating determinants of farmer´s decision making in the European context. Their focus is specifically on soil management and they aim to utilise the determinants of farmers' behaviour and decision-making regarding soil management to develop an understanding of the leverage points for soil governance. For example, they argue that the results of their review help to identify easy interventions that can result in potential significant changes (Abson *et al*., 2017; Meadows, 1999). This points out the value of better understanding the factors affecting decision-making for future policy making. They themselves identify that there are few synthesizing studies around farmer decision-making. They identify the importance of the seminal study by Wilson and Hart (2000), which tries to understand the complexity of economic and non-economic factors that influence participation in agri-environmental schemes (AESs) in the European Union (EU). They also identify the review study by Siebert *et al*. (2006), who synthesised a wide variety of empirical literature (including grey literature) that focused on European farmers' participation in biodiversity policies. They found that financial incentives were important but not the only relevant factor influencing the participation of farmers. Lastra-Bravo *et al*. (2015) is also seen as an important study in which they conducted a meta-analysis of discrete choice experiment studies that were investigating drivers of farmers' participation in EU AESs. They found that both economic and demographic factors were important influences in this context.

Bartkowski and Bartke (2018) identify the most important factors affecting farmer decision-making by assessing those most frequently studied, alongside a measure of significance (Figure 2.1). Figure 2.1 demonstrates the balance of factors seen to be important in Bartowski and Bartke's review for farmer decision-making. They find that economic considerations are a very significant factor, supplemented by pro-environmental attitudes, goodness of fit of management option, and past experience. The review acknowledges that there are missing elements from the review, including technology adoption, role of advisory services, bureaucracy, social capital and social norms, and risk aversion. These observations provide a baseline for the potential results of this SUPER-*G* review and in contrast to the context of soil governance, this SUPER-*G* review aims to supplement the work of this previous review by focusing on decision-making in the context of grassland management, which although offers a similar context, may provide different insight into the factors that are important for specific grassland management decisions.

Overall the review aims to build on previous explorations of attitudes and factors affecting decision-making to describe current knowledge on what motivates and constrains managers to adopt a variety of PG management options that may target a variety of ES. This knowledge will form the basis of further direct empirical exploration of the way in which famers and land managers decide to manage PG areas and as such the balance of ES, as well as further exploration of the perceptions of non-farmers to grassland landscape and the variety of ES that they can support and deliver. This empirical work will underpin development of discussions around policy recommendations for more sustainable PG management.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

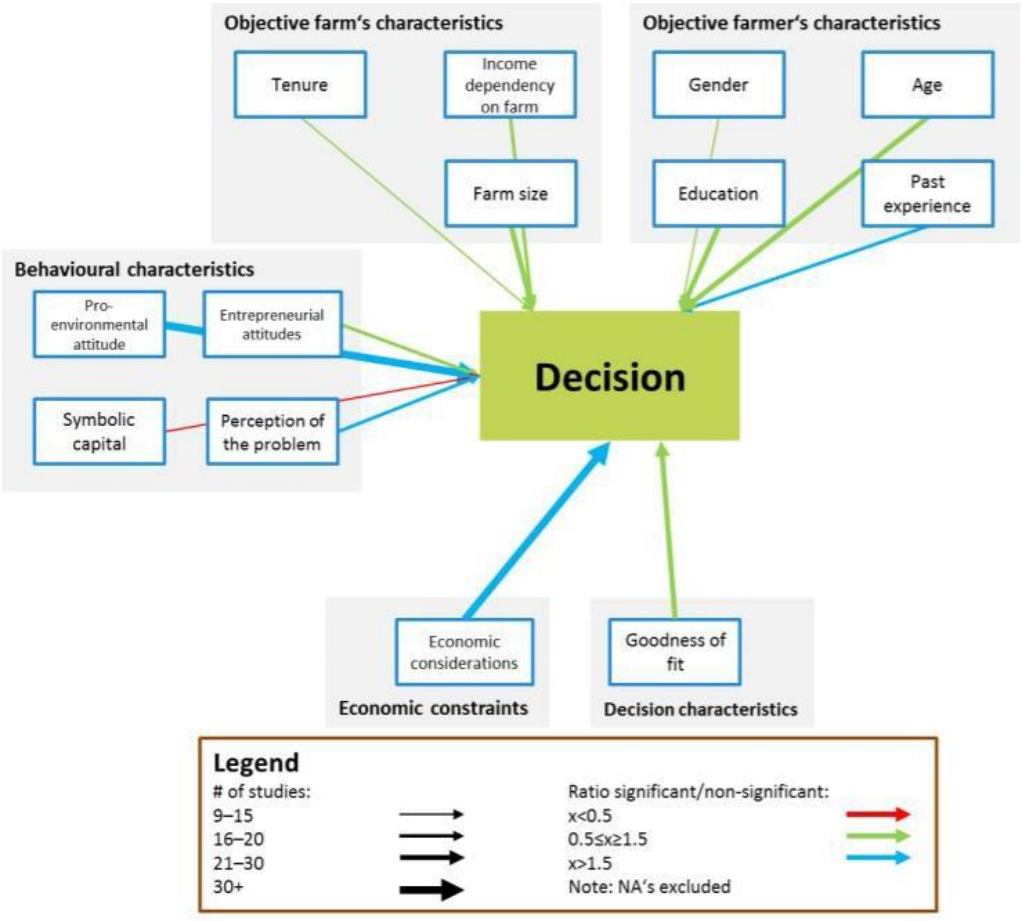

Figure 2.1 *Most frequent factors sorted by conceptual framework categories for decision-making in the context of soil management. Source: Bartkowski and Bartke (2019).*

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

3. Methodology

3.1. The systematic review process

Undertaking a systematic review is an explicit, rigorous and transparent methodology for exploring a particular research question (Greenhalgh, *et al.*, 2004; Greenhalgh *et al.*, 2005). Rigour and transparency are ensured in the process through a series of standardized steps (Sargant, *et al.*, 2006). Well-conducted systematic reviews often provide a synthesis of current knowledge that serves as an evidence base for (policy) decision making, and by highlighting important knowledge gaps that inform needs for future research (Cook *et al.*, 1997). The strengths of a systematic review process are its ability to efficiently make sense of large bodies of literature, and as a method of mapping out uncertainties, providing evidence and maintaining a balanced and less biased sample of research from which to draw answers to particular questions (Petticrew and Roberts, 2006). Such qualities offer a suitable method to tackle a broad research area such as attitudes to PG management and decision-making around ES, and allows the identification of future gaps in order to inform the next stages of empirical research.

In this review the steps that were taken began with the development of a protocol that lays out the approach to the review. The review process included the creation of a set of search terms that were inputted into relevant databases. The results that were returned were screened for relevance by assessing the abstracts using a predefined set of exclusion criteria. The resulting set of papers was then read in full, and if data was of sufficient quality, the relevant information and themes were recorded and analysed. Meta-analysis can be performed as part of the systematic review process if the data is appropriate, however in this study the qualitative data was not suitable for meta-analysis and only thematic analysis was undertaken.

Reporting of the review followed the Preferred Reporting Items for Systematic Reviews (PRISMA (Moher *et al.*, 2009). Figure 3.1 details the process of the systematic review through a PRIMSA flow diagram, and shows that 136 papers were eventually included in the review, after a screening process. Figure 3.1 also details the exclusion criteria used for screening (explained further in the next section).

Search terms were derived from the initial research questions using associated key words. Search strings were trialed and refined in a multistep process, with the face validity of each search addressed by assessing the appropriateness of the papers returned, and by checking some search results for key authors identified through an initial search. A wide variety of search terms was used in order to cover the multiple contexts in which PG could be perceived and in which decisions could be made. All strings included phrases aimed to find opinions, values, preferences and choices, and 1-3 additional specific topic words or phrases. Two examples of search strings are shown below (see Appendix A for full list of terms):

> *"permanent grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)*

> *"rural landscape" AND "grassland" AND "citizen" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)*

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Overall 11 search strings were used. Each string was inputted into the topic section of the database and in most cases the full text of the articles was searched. The exceptions to this, where only the keywords, title and abstract of the article were searched, were strings that included a key term (plus the choice and opinion qualifiers) that was a more generic words such as grassland, permanent grassland or nature, in which full text searches gave less relevant results.

The search was conducted on the 5th and 6th of February 2019, with some additional searches added on 11th and 14th April once results had been viewed. To increase the likelihood of discovery and reduce bias in the algorithms used in different search engines, all searches were repeated in Scopus and Google Scholar (Harzing and Alakangas, 2016). The searches in Google Scholar were performed on whole documents, whereas the searches in Scopus could be restricted to title, abstract and key words. The default search for this study was 'all fields' which constituted the whole document, however where the initial results were judged to be less relevant, the search was narrowed to title, abstract and keywords, which then returned a more relevant list of results. This dynamic meant that Scopus and Google Scholar could perform complementary searches. Initially the search returned 96,877 records. With such a large number, due to the extensiveness of Google databases, it was concluded that, due to time and resources, where there were more than 100 results, only the first ~100 records would be downloaded and included in the review (or equivalent of 10 pages of Google Scholar results). Although there are limitations of this choice, 100 results were chosen in order to capture the most relevant hits while still being a feasible amount to screen. Such a justification has also been used in previous systematic reviews using Google Scholar, in other disciplines e.g. Godin *et al.*, 2015). The results were therefore representative of existing studies but were not fully inclusive of all relevant papers, due to the constraints of the methodology. The searches resulted in 2392 documents included for screening after the removal of duplicates.

EXCLUSION CRITERIA
- Irrelevance to the topic and questions
- Language other than English
- Before 1962
- Non-peer reviewed
- A non-European focus (includes Europe but not just EU member states)
- No inclusion of empirical data
- Lack of focus on socio-economic primary data

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

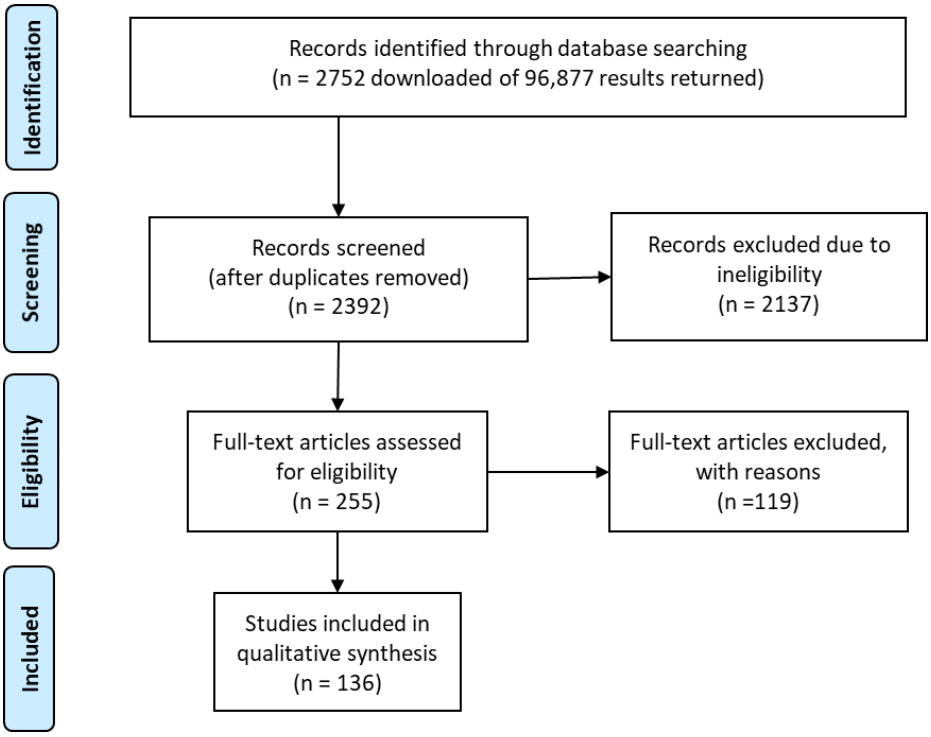

Figure 3.1 *PRISMA flow diagram of systematic review process and exclusion criteria used.*

3.2. Selection and screening of relevant studies

Studies were screened based on a pre-defined set of exclusion criteria (see Figure 3.1). Only papers that were deemed to be relevant to the topic and research questions were included. Moreover, only papers referring to studies conducted in European countries were included. We acknowledge that there is much learning that can be gained from reviewing perceptions and decision-making in non-European countries, however the purpose of this review was to collate and analyze the studies already conducted in Europe. For pragmatic reasons these were also papers written in English as this was the primary language of the research team. In making this choice there is a trade-off between efficiency and resources used to conduct the review, and full and equal opportunity to learn from studies in all European languages. On balance, it was decided that the international applicability of the English language would mean that only a small number of relevant studies would be missing from the review. Papers before 1962 were excluded as this was before the advent of the Common Agricultural Policy (CAP) in the EU, and the CAP is seen as having a very significant influence on farmer decision-making in relation to the logic of farming and the economic context. Only peer-reviewed documents were included in the review, which meant the documents included were only academic journal papers. Books, dissertations and conference proceedings were excluded. Papers included were those that focused on empirical data collection (therefore excluding literature reviews and theoretical pieces) and the empirical data was required to be socio-economic primary data, although hybrid studies of physical science data (e.g. climate data) and social data were included.

Returned studies were exported to a Mendeley library, and duplicates were removed as far as possible. Any unidentified duplicates were removed at later stages of the review. Studies were then excluded, using the above criteria, in a two-stage process using a traffic light system derived and

THIS PROJECT HAS RECEIVED FUNDING FROM
THE EUROPEAN UNION' HORIZON 2020 RESEARCH
AND INNOVATION PROGRAMME
UNDER GRANT AGREEMENT N. 774124

verified amongst the research team (green = included, amber = uncertain, need another team member to review, and red = excluded). First the titles and abstracts were screened for relevance. Then the resultant (255) article were read in full. This process allowed the relevant articles to be analysed for relevant themes and information as well as being able to further screen for irrelevant studies. 136 articles were eventually included in the thematic analysis.

It is usual to conduct a critical appraisal processes within a systematic review, where the content of the documents are judged against pre-set criteria (e.g. those derived from the Critical Appraisal Skills Programme checklist (CASP, 2018)). The purpose of such appraisal is to assess the validity of the results and check for bias or inconsistency in the data. Checks are normally conducted when there are non-peer reviewed studies included in reviews. In the case of this review, as all the studies included had been verified by the process of peer-review it was not anticipated that there would be any issues with validity or bias of studies. Therefore a full critical appraisal process was not undertaken, however the criteria considered important were held as a standard by which all the papers were read and any issues were flagged up informally. As it was, no papers in the review triggered the need for further investigation in relation to validity or bias.

3.3. Thematic Analysis

A process of coding was undertaken when reading through the full text articles, and papers were categorised and analysed using QSR Nvivo 12. Certain codes and categories were set prior to the coding process. Some were based on recording the basic information from each article in order that the spread and scope of studies could be compared and analysed. For each article basic information was recorded including:

1) Location of the study (country),
2) Research problem or premise (as a broad category of focus)
3) Target group (e.g. livestock farmers),
4) Aims and objectives (the core purpose of the study)
5) Date or timespan of the study (date when the data were collected)
6) Methods used (e.g. survey)
7) Any critical appraisal issues

Other codes that were created prior to reading full text articles were three broad themes relating to the aims of the systematic review. These were:

- Attitudes and perceptions
- Factors affecting attitudes
- Factors affecting decision-making

Beyond these three codes, plus the category codes listed above, open coding was used to derive the sub-themes within each. In order to do this each paper was read through and core, cross-cutting themes were identified (Strauss, 1987; Flick, 1998). To account for the nuances in the themes, focused coding was conducted, which involves a breaking down of themes further in sub-categories to aid explanation and exemplification of the intricacies of the original codes (Coffey and Atkinson, 1996).

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Due to the broad nature of the study and of the papers, many initial thematic sub-categories were derived within the three themed codes listed above. For example, in relation to attitudes and perceptions, eight sub-themes were identified, including, for example, '*attitudes to the environment and farmland*', which itself contained 19 sub-categories, one of which ('*ecosystem services*') contained up to 15 sub-sub-categories. This was a similar pattern for factors affecting attitudes, where 47 sub-categories were identified (again, some with sub-nodes themselves), and factors affecting decision-making numbered 58 sub-categories (plus sub-categories of their own). These codes were the initial, in-depth, diverse coding, which aimed to capture the depth and breadth of information within the studies. Codes were gradually assimilated into more coherent themes through a process of analysis. This resulted in the thematic structure described in Chapter 4 of this report.

Due to the depth of the codes identified, one of the outputs of this review is the creation of this database of papers within the Nvivo file. This can be used for future reference by the research team and others within or beyond the SUPER-*G* project to identify papers on key themes relating to perceptions and decision-making around PG.

THIS PROJECT HAS RECEIVED FUNDING FROM
THE EUROPEAN UNION' HORIZON 2020 RESEARCH
AND INNOVATION PROGRAMME
UNDER GRANT AGREEMENT N. 774124

4. Results

This chapter covers the presentations of results from the review. The first section summaries the range of studies resulting from the literature search, including the topics, geographical coverage and methods used in the studies. The rest of the chapter focuses on the thematic analysis of the content of the studies. Section 4.2 focuses on the attitudes and perceptions of different stakeholder groups to grassland, ES and landscape and landscape management. Section 4.3 focuses on the facilitators and barriers to decision-making, including biophysical and management issues, policy and political context, financial considerations, processes and practices, and social, cultural and personal factors. The final section focuses on trade-offs, conflicts and complexities associated with decision-making.

4.1. Summary of studies

In relation to spatial coverage of studies, 24 European countries were represented. The UK was the most commonly studied country, with 26 papers. This bias may be related to the criteria for articles relevant to this review to be written in English. Studies were also numerous from Germany (20) and Italy (20) and studies focusing on multiple countries (20). Other countries covered by the papers included France (19), Austria (12), Spain (11), Denmark (9), Ireland (9), Switzerland (8), Slovenia (5), Sweden (5), Netherlands (5), Belgium (4), Slovakia, Norway, Hungary, Bulgaria, Greece (all 2), and Lithuania, Estonia, Finland, Poland and Croatia (all 1). Most studies are focused on central and northern Europe with fewer studies in Eastern Europe.

There was a wide variety of **topics** covered by the papers with the most numerous focusing on adoption of agro-environmental management practices (26), followed by papers focusing on different perceptions of ES (21) and those focusing on landscape preferences (13). Other common themes included attitudes to conservation of landscapes (8), farmers' landscape decision-making (8), engagement in climate change related issues or mitigation (6), public opinion of (future and past) rural landscape (change) (5).

The most targeted **group** included 'farmers' (either unspecified types or all types of farmers) (46 papers). Many studies targeted particular groups of farmers based on the focus of the farm activities or the location of the farmer, including livestock farmers (10), dairy farmers (8), arable farmers (5), organic farmers (4), conventional farmers (3), peri-urban farmers (1) and upland farmers (2). Some studies gave specific criteria such as farmers with more than 2ha of land (2), farmers undertaking landscape changes (1), farmers eligible for LSA schemes (1), farmers implementing specific agri-environment schemes (2). Other types of farmers were labelled based on their lifestyle, age or life stage including family farmers (3), hobby farmers (1), retired farmers (2) and young farmers (1). The second most targeted group for studies was that covering locals, residents, citizens, public and non-experts (36). There were many different terms used for this group of people, which is representative of their diversity. Studies often made a distinction between local populations and tourists/ visitors (who were included in 13 studies). Some studies also distinguished local populations from general or regional populations (5). 18 studies simply focused on other relevant stakeholders without specifying the exact mix of stakeholders. Some studies named such stakeholders as government (agencies) or public officials (local and national) (15), NGOs (11) and scientists and researchers (9). Other stakeholders targeted included private businesses (5), agricultural extension or farm advisors (6), conservationists (3), land managers (3), decision-makers (3), farming organisations (2), agricultural companies (1), landscape professionals (1), hunters and hunting associations (1), engineers (1), professionals (1). Many studies targeted a mix of groups.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

There were many types of **systems and environments** targeted within the studies. Some of the systems were labelled using similar language across the studies. For example the most commonly focused environment for the studies (where there was a specific focus highlighted) included mountain or alpine agro-ecosystems (15). This is perhaps because there are particularly challenging issues for agriculture in these areas. Others were less commonly focused within the studies but included, special protected areas or national parks (6), semi-natural grassland (3), high nature value farms (3), Environmentally Sensitive Areas (2), transhumance systems (2), lowlands (2). Other single studies highlighted the types of environments they were uniquely focusing on including species-rich grassland (1), oak-wood pasture land (1), peri-urban landscape (1), marginal areas (1), high latitudes (1), dehesas (1) and wetland (1).

The studies range between **data collected** in 1988 and 2017, with many studies spanning one or two years. The most numerous period for studies appears to be between 2009 and 2013. Many studies (32) do not name the date of data collection, which means that the only basis for understanding the temporal context of the work is the publication date.

In relation to the **methods used**, the most common method was the survey (or questionnaire) (73) this appeared in many iterations, including addressing perceptions, behaviours and attitudes. The second most popular method was interviews (47). Many studies used a combination of methods, applied in multiple stages, with interviews and surveys often being combined. Modelling was also a method applied to studies (13) in number of ways, including for example estimating aesthetic landscape values (Schirpke, 2016 - Austria[1]), structural equation modelling to explore the relationships between stakeholders' perception and ecosystem properties (Cebrián-Piqueras *et al.*, 2017 - Germany), multinominal models used to explore farmers' decision-making processes (Defranceso *et al.*, 2008 - Italy), among others. Participatory workshops were also used (13). Choice experiments were popular, particularly when trying to better understand the perceptions of participants in relation to visual landscape features (e.g. Hafner, 2018 - Germany), as well as payment for ecosystem services and willingness to pay (e.g. Bernues *et al.*, 2014 - Spain).

4.2. Attitudes and perceptions

4.2.1. Attitudes to grassland and grassland management

Attitudes to grassland and grassland management were covered in some studies, and a number focused their case studies on specialist grassland systems such as meadows, species-rich environments, pastures and alpine grassland areas. However, it was more likely that mention of grassland was incorporated into studies of broadly defined landscapes and farming systems. In relation to grassland, some obvious ideas are confirmed (e.g. by Klopčič and Kuipers, 2015 – Slovenia), for example that dairy farmers in particular give a high priority to the management of grassland.

Species-rich grasslands were mentioned in a few studies and were seen to be an important focus of conservation efforts in many regions. This appears to be justified also for aesthetic reasons (Lindemann-Matthies *et al.*, 2010 – Germany). In relation to conservation, Wilson and Hart (2001 -

[1] References included in the systematic review study are listed in this document with the location of their data collection, in order to communicate the geographical context of the information presented.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

UK) found that when entering into a scheme to conserve small areas of specialist culm grassland the conservation value of the farmers' small patch of land was appreciated, but is seen as an area outside the farming system, not integrated within it. This could mean that where species-rich grassland is managed in a farming environment there may be conflicts of interest.

Arnberger *et al.*, (2018 – Austria) have studied the opinions of participants on managed and unmanaged grassland in relation to cultural and social benefits, namely meadow land. Participants perceived that both the managed and unmanaged meadows were restorative environments and had strong health benefits. The study showed that the more participants were convinced that there was a positive health effect, the more additional health benefits were assumed. Thus, they perceived meadows as multifunctional, affecting them positively on many health-related levels. Both meadow environments were seen as having high biodiversity and contributing to the creation of beautiful surroundings. Whilst the managed meadows were appreciated, the unmanaged meadow was seen as more interesting and offered people more to explore and discover. However, in contrast, participants also perceived the abandoned meadow as more chaotic and confusing than the managed one, with a higher level of distraction. This study shows that there are varying attitudes to managed and unmanaged grassland, but that there are equal benefits in relation to health and well-being.

Lindemann-Matthies *et al.* (2010 - Germany) also interpreted attitudes to grassland and found that while people's aesthetic appreciation increased with grassland species richness, this was modified by the presence of particular species. Aesthetic appreciation was also found to be associated with presence or lack of grazing livestock on grasslands, depending on social factors. In a study in Germany (Hafner *et al.*, 2018 - Germany), it was found that there were preferences for low numbers of grazing livestock in the landscape, in contrast to the findings in other contexts. This was attributed to the familiarity of people with the local landscape where livestock are increasingly kept in stables and are therefore less evident than in the past. The way that people see grassland is therefore linked to their experience. Quetier *et al* (2010 - France) report that the notions used to describe local grasslands demonstrate knowledge of and interest for various benefits provided by these grasslands. Cultural ecosystem services (e.g. aesthetics and testimonies to past use of the land) dominated the description of grasslands. Such recognition of benefits from grassland appears to be more prevalent in European countries than non-European countries (Leroy *et al.*, 2018 – multiple).

Other benefits provided by grassland include the prevention of wild forest fires. In a study in Spain (Bernues *et al.*, 2016 – Spain), the prevention of forest fires was discussed in connection with five different practices related to forest and shrub clearing and to appropriate grazing management (winter use of pastures to force animals to graze marginal areas and fencing, among others). This was an important aspect of discussion for beef farmers. They also identified that there were trade-offs associated with grazing, e.g. the optimal grazing pressure also affected other regulating services, such as "soil fertility" (natural fertilization with manure), "waste management" (prevention of water pollution), and "erosion prevention" (avoidance of excessive trampling and maintenance of slopes). Bernues *et al.* (2016 - Spain) show that the farmers also associate the intensity of the system of grazing with the delivery of ecosystem services.

Each study demonstrates the different ways that attitudes to grassland can be understood. One study demonstrated where attitudes can differ around grassland between stakeholder groups. Cebrián-Piqueras, *et al.*, (2017 – Germany) reported a difference in preference between farmers and

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

conservationists: Conservationists preferred wet, extensively used grasslands, salt marshes and reeds over intensively used grasslands and appreciated the conservation value, carbon sequestration, soil fertility over forage production. Conversely, farmers preferred intensively used grasslands, salt marshes and reeds over wet, extensively used grasslands and forage production, soil fertility and conservation value over carbon sequestration. Another study into attitudes to grassland landscape found that locals and visitors to an area around Villar d'Are`ne in the central French Alps had different ways of describing grassland (Quetier *et al.*, 2010 – France). They found that a richer vernacular representation focusing on the grassland resource (and associated with a long-term interaction with the local ecosystems) was understood by locals and shared little with an aesthetic appreciation of the landscape mostly found among short-term visitors.

In relation to change in grassland areas, a study in the French Alps showed that institutional constraints meant that farmers perceived an increase in grassland to be an administrative burden, and where grassland abandonment is happening there are concerns about the impact on wild flora and fauna (Hinojosa *et al.*, 2018 – France). This demonstrates the way that attitudes to grassland change dependent on the factors affecting the land use decision-making.

In the rest of the results section grassland will be understood as part of the wider system of agriculture and landscape. Many studies did not focus only on grassland and therefore direct consequences for PG management cannot be easily made. However, by understanding the wider attitudes, and influences on decision-making, a better understanding of PG management as part of the agricultural and landscape system can be gained.

4.2.2. Attitudes to ecosystem services (ES)

4.2.2.1. Citizens and residents, non-farming stakeholders perceptions

The concept of ES is not always clear to populations, however, Plieninger *et al.*, (2013 – Germany) found that when stressing "landscapes" rather than "ecosystems," and "values" rather than "services," the ecosystem-services approach proved useful as a unifying framework for stakeholder interaction.

Within the studies, the priorities of local people (sometimes referred to as residents, citizens, public and non-experts) were discussed. Often it was identified that this group gave more importance to cultural ES, in particular opportunities for recreation, spiritual and cultural experiences and to the provision of food, mainly relating to quality and safety issues (Bernues *et al.*, 2014 – Spain; Bernues *et al.*, 2016 - Spain). Most studies focused on positive services, whereas one study from Germany (Plieninger *et al.*, 2013a – Germany) asked participants to comment on disservices. Less than 30% of respondents attributed disservices to sites within their communities, and most of those referred to noise and waste in the landscape, which is a consequence of human use of ecosystems, not a disservice from the ecosystem itself. In one study (Bernues *et al.*, 2016 – Spain) most of the ecosystem services in question were perceived as declining. Only three ecosystem services were perceived as increasing: nature recreation activities, rural tourism and environmental education.

Biodiversity and supporting services

In some studies biodiversity was seen as one of the most important services (Matin-Lopez *et al.*, 2012 - Spain; Lupp *et al.*, 2014 - Germany), and some showed that biodiversity loss was an

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

important issue (Bernues *et al.*, 2014 - Spain). Other studies have shown, however that supporting services such as soil fertility and biodiversity ranked low in the opinion of the public (Bernues *et al.*, 2015 - Norway). This could be because their consequences on human well-being are not immediate or not easily perceived. Bernues *et al.*, (2014 - Spain) state that people tend to value more ES that have direct effects and satisfy more tangible needs.

Regulating services

A number of studies have shown that populations value regulating aspects of ecosystems (Martin-Lopez *et al.*, 2012 - Spain), including the prevention of forest fires (Bernues *et al.*, 2014 - Spain) and air purification (Matin-Lopez *et al.* – Spain; Oteros-Rozas, 2014 – Spain). In an Italian study, populations assigned high importance to water quality (Faccioni *et al.*, 2019). This initially could be seen as a regulating service, however the population in the study explained the importance as associated with the recreational functions of the rivers and lakes in the province, as well as the function to supply water to the surrounding non-mountainous provinces. These are links to both cultural and provisioning services. This group therefore values the multiple ecosystem services provided, stemming from the supporting service of water quality.

Provisioning services

Some populations valued the maintenance of availability of quality products from the region under study (Bernues *et al.*, 2014 - Spain). In one study locals assigned more importance to food quality than soil and biodiversity (Bernues *et al.*, 2015 – Norway). In addition to (quality) food production laypersons think that drinking water is one of the most important ecosystem services of agricultural landscapes. (Lupp *et al.*, 2014 – Germany). However, some aspects of provisioning are not seen as important. For example providing biomass for renewable energy production is considered less important as an ecosystem service, and people generally perceive forests as providing a wider range of ecosystem services than croplands (Lupp *et al.*, 2014 – Germany).

Cultural services

Cultural services were often the focus of studies of non-expert populations. For example, citizens clearly recognized the importance of cultural ES related to the aesthetic and recreational value of landscapes (Bernues *et al.*, 2014 - Spain), and often assigned more importance to landscape than other aspects (Bernues *et al.*, 2015 - Norway). Some populations rated cultural ESs (food, tourism, cultural heritage and landscape) as more important than regulating ESs (avalanches, soil erosion and soil fertility) and supporting ESs (habitats and biodiversity) (Faccioni *et al.*, 2019 - Italy; Lopez-Santiago, 2014 - Spain). Cultural, spiritual and educational dimensions were also clearly identified (e.g., traditional food and gastronomy, popular architecture, ''old ways of living'', etc.) (Bernues *et al.*, 2014 - Spain). These were often attached to particular landscapes, such as wood pastures and grasslands (Oteros-Rozas, 2018 - Spain); and in relation to recreation within mountain areas (terrestrial recreation) and on water bodies (aquatic recreation). (Oteros-Rozas, 2018 - Spain). Services and benefits like aesthetic values, social relations and educational values were also associated with local-level sites and individual well-being (Plieninger *et al.*, 2013a - Germany). This can also translate into finding various cultural values in the everyday surroundings, not only in landscapes of outstanding biodiversity, heritage, or scenery. (Plieninger *et al.*, 2013a - Germany). In a Romanian study this idea related to the presence of a traditional village system with land covers of historical continuity, identity of community and agro-silvo-pastoral activities (Pătru-Stupariu *et al.*, 2016 - Romania).

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Some studies allude to ideas of distinct hotspots and coldspots of cultural services (compare van Berkel and Verburg, 2012; Willemen *et al.*, 2008) (Plieninger *et al.*, 2013a - Germany). This may be associated with spatial areas, but should also extend to temporal understandings of ES associated with landscape change, and social understanding of cultural ES at the everyday scale.

4.2.2.2. Farmers perceptions

A number of studies focused on farmers perceptions of ES. The term ES was not always understood, similarly to local populations. Often ES are inherently known and applied by farmers, whether this be through awareness of the term through being part of a research project, or guessing its meaning from the word 'ecosystem', or via an understanding of soil function (Dietze *et al.*, 2019 - Germany). However their relevance to implementation through management is judged differently compared to societal goals (Dietze *et al.*, 2019 - Germany). In one study, although farmers did not demonstrate spontaneous knowledge of the ecosystem service concept, they showed an understanding of multiple ecosystem services and the agricultural practices that influenced their delivery. Burnues *et al.* (2016 - Spain) state that farmers often hold rich mental concepts of ecosystem services, even if they are not familiar with the formal terminology (Fischer and Young, 2007). The farmers also established various interactions among these concepts, which indicated a large capacity to recognize the complexity of ecological processes in agroecosystems (Martín-López *et al.*, 2012 - Spain).

Supporting services
When referring to supporting services farmers in one study placed more importance on functions that were connected directly to their farming activity, specifically maintaining soil fertility, maintaining rural life and rural activity, and controlling forest growth or encroachment. (Buernes *et al.*, 2015 - Norway). Other farmers from the UK considered pollination, soil stability, water quantity, habitat for fauna as important (Lamarque *et al.*, 2011 - multiple).

Regulating services
Farmers gave more importance (mentioned more times) to regulating ES, such as disturbance prevention (forest fires) and soil fertility/erosion prevention (Buernes *et al.*, 2014 - Spain). Erosion control was also important in a Germany study where it was seen as very important for preventing and maintaining soil as a basis for food production. Water regulation was also very important for plant growth, and water purification because it ensures the maintenance of clean drinking water. In the same study climate regulation, although not seen as unimportant, was not seen to play a big role in agricultural farming practices. Five farmers said that climate is not relevant for their agricultural farming practices and agricultural production cannot influence climate (Dietze *et al.*, 2019 - Germany).

Provisioning services
Raw materials was considered as an important provisioning service and was associated in one study with self- sufficiency practices to obtain fodder, nuts and fruits from trees located near the farm (Bernues *et al.*, 2016 - Spain). Clean water was also considered an essential provisioning service but was not connected to any particular practice; instead, clean water was always linked to pollution problems arising from intensive farming (Bernues *et al.*, 2016 - Spain). Food was seen as the most important ES for farmers, because it is the basis of farmers' income. This is supported by the study of Lamarque *et al.* (2014 - France). They conclude that farmers ranked provisioning ES such as forage quality and quantity as very high, while regulating ES were valued lower.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Perceptions of being a farmer (cultural services)

There are a number of studies that alluded to the perception of farmers and their attitudes to the environment. Although not always labelled as cultural services, this can be interpreted as the cultural value that farmers may gain from environments, which may include grassland environments. Farmers often believe that they are good stewards of the countryside or the land that they manage (Plieninger *et al*., 2004 - Germany; Quetier, 2010 - France). Kohler *et al* (2014 - France) argued that farmers feel closer to nature because they believe themselves to be the producers of nature, in the sense that they shape the landscape and make it productive. This relates to understanding of place and potentially the spiritual aspects that farmers feel in relation to nature. In Croatia, although the farmers believe they are nature-loving and hardworking, they are also disappointed and feel underestimated because of long running problems in agriculture, including demand and production mismatch, lack of adequate use of funds, low wages and high unemployment (Lončarić *et al*., 2016 – Croatia). Across multiple countries a sense of place and artistic value were seen as important for farmers (Lamarque *et al*., 2011 – multiple), which are significant in relation to the cultural experience of farmers in the landscape. Therefore the review reveals that although farmers are more likely to value provisioning and regulating services, cultural services are not unimportant, but may be explained and studied in different ways, or less frequently.

4.2.2.3. Conflicts

Often conflicts can appear between different perceptions of ES. However not many studies covered conflicts of interest, as most focused on understanding certain populations' views in isolation. Where there were studies of conflicts (Kovács *et al*., 2015 – Hungary), these were found to arise between multiple groups. Firstly, farmers found that their perceptions of the aesthetic landscape were different from conservation groups. For example, where reconstructed habitats (in a national park context) had been created, the positive effects of increasing biodiversity were questioned by farmers many times. This is because when they observed the disappearance of cultivated plots and saw reconstructed habitats in their transitional state, the landscape looked messy to them, especially when weed or invasive species appeared (Kovács *et al*., 2015 – Hungary). Therefore the key trade-off was between cultural services (in a national park) and the decreased provisioning services. Kovács *et al*., (2015 – Hungary) state that the national park service, the local inhabitants, visitors, scientists and students who pursue recreation, cultural and supporting/ regulating services were the winners of the changing situation, while the losers were the local farmers who had a more production oriented opinion and who value ecosystem services such as food from agriculture over regulating or cultural services..

Lamarque *et al*., (2014 – France) identified that visions of ES differed between farmers and scientists. Farmers in the study area explained that for them, ''ES are neither numbers nor upward or downward trends'', but are part of a more complex system of decision-making. Pietrzyk-Kaszyńska *et al*. (2012 – Poland) identify that conflict can be internal to a stakeholders group. For example the opinions of landowners or farmers can be contradictory in the context of opposition to protected areas, while some can declare their love for nature they at the same time support activities that cause its degradation (Visser *et al*. 2007), this is particularly where local factors are identified as influencing the level of awareness and support for protected areas.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

4.2.3. Attitudes to landscape and landscape change

Attitudes to landscape and landscape change were an important section of the papers studied. 17 papers focused on the aesthetic quality of the landscape, often asking non-farmer populations about preferences for certain landscape types, sometimes using visual cues, scenarios and photographs to understand choice and preference, sometimes using field trips or field studies to gauge opinion. Many studies focused on whole landscape scale and often included grassland as part of the landscape. Some studies aimed to better understand farmers' views about aesthetics of agricultural landscapes. However, as Soy Massoni *et al.*, (2016 – Spain) have found, there is an immense variability in visual landscape preferences among groups. This will also include variability within groups and between regions and contexts.

In relation to whole landscapes aesthetics, Schirpke (2016 – Austria) found that, amongst non-farming populations, viewpoints with high aesthetic values were mainly located at high altitude, allowing long vistas, and included views of lakes or glaciers, and the lowest values were for viewpoints close to streets and in narrow valleys with little view. Water related features are often seen as a dominant attribute in terms of visual amenity (Howley, 2011 – Ireland). In relation to a specifically agricultural context, Bernues *et al.*, (2016 – Spain) showed that aesthetics was seen to be one of the most important ES. According to the non- farmers, this service was affected by avoiding the overexploitation of pastures (to prevent desertification); grazing in the mountains (to create and maintain meadows); maintaining traditional buildings (to provide shelters, water points, and popular architecture); and freely grazing animals (to enhance the quality of the landscape, to make it more beautiful, and to offer spiritual experience to those who value contact with animals (see also Junge *et al.*, 2015 - Switzerland).

Some studies focused on understanding the characteristics of highly valued landscapes. Häfner (2018 - Germany) found that about 70% of (non-farmer) respondents preferred diverse and highly structured landscapes, which is a common finding amongst other studies, and included clear preference for crop diversity, point elements and linear elements. Point elements, such as the vegetation around kettle holes or the single tree within the fields out-value other attributes. Linear elements are seen to be landscape elements such as high-stem fruit trees, hedgerows and low-intensity pastures with trees and bushes (Junge *et al.*, 2015 - Switzerland). Lopez-Santiago (2014 – Spain) also showed that the linear element of a 'drove road' (traditional path through the landscape for transhumance populations to move livestock) to be highly valued, partly due to its cultural associations, but which also then influence a preference for the road visually. A third of the population in Hafner's study seemed to prefer 'cleared-out' landscapes with very low degrees of complexity. Although Hafner's study does not explore why people hold these views it does explore influential factors, for example political opinion, preferred outdoor activity and means of transport were found to be significantly influential. Howley (2011; 2012 – Ireland) demonstrate that their respondents prefer mixed farming landscape, and extensive farming landscape over the more modern intensive farming landscapes (also see Willis, 1994 – UK) due mainly to the homogeneity of this type of landscape (Arriaza *et al.*, 2004). Landscape preferences were also affected by factors such as seasonal stage (e.g. flowering stages are valued highest). Equally, naturalness and diversity were important to non-farming populations (Junge *et al.*, 2015 - Switzerland), particularly in terms of species richness in grassland (Lindemann-Matthies *et al.*, 2010 – Germany).

Farmers were found to sometimes hold opposing views to non-farming populations. For example, Junge *et al.* (2011 – Switzerland) found that whilst non-farming populations preferred a mixed

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

landscape with 30% of the land used for ecological compensation areas (ECAs), farmers preferred cropland with 10% ECAs. This study not only demonstrated the differences between the populations in terms of attitude, but also that the agro-environment schemes affect the visual attractiveness of the landscape because they change the land use patterns. Andersson *et al.* (2015 – Sweden) found that there were differences in expectation between farmers around visual preferences following different intensity regimes. For example, high-intensity farmers saw the importance of having well-tended farms, where the land, buildings and infrastructure should be in good condition. They were interested in the land looking and being economically valuable. Equally, Junge *et al* (2011 – Switzerland) and Kohler *et al.*, (2014 – France) found that some farmers showed a strong preference for neat, clean and ordered landscapes. Junge *et al.* (2010) report that this might have been due to these farmers having a strong internalized sense of 'stewardship and care' and/ or believing that production is the only function of agriculture, over and above ecological function. Such views of aesthetics can cause conflict when conservation often creates environments that may be viewed as untidy or messy (Kovacs *et al.*, 2015 – Hungary). Tidiness, however can also be perceived as positive by non-farmers, for example regional experts in an alpine environment perceived a tidy landscape to be aesthetically pleasing, partly due to associations with avalanche regulation (Lamarque *et al.*, 2011 – multiple).

Quetier *et al.* (2010 – France) suggest that although aesthetics is an important element of landscape management it often favours postcard or heritage social representations. In addition Willis (1994 – UK) showed that people prefer the status quo landscape, which has consequences for any need or drive for landscape change. Konkoly-Gyuró (2018 – France and Germany) highlights that landscape can be seen in very different ways: as a photo, a snapshot of reality, and/or as a film, or a dynamic entity. As such it has links to the past and the future, to images of stability and change, where conflict and degradation are associated with change. In an earlier study, Marcel *et al.* (2008 - Switzerland) suggest that it is not landscape change that is assessed as good or bad, but the (related) change in the meaning of the landscape elements that leads to positive or negative assessments. In an Italian study, major driving forces of landscape change are perceived to be planning policies, technological innovation, agricultural policies and demographic trends (Larcher *et al.*, 2013 – Italy). In a Romanian study Pătru-Stupariu *et al* (2016 – Romania) found that causes of landscape changes are also: 'increasing tourism', 'land tenure and social changes', 'land-use intensification', 'post-communist transition', and 'foreign investments'. In Germany concerns were given in relation to a lack of regeneration, oak decline, and conversion to urban areas (Plieninger *et al.*, 2004 – Germany).

4.3. Facilitators and barriers to decision-making

This review has revealed many different factors that are likely to be part of the complex mix of factors affecting decision-making. Not all factors emergent from papers can be presented in detail in this review. The factors that are not reported here relate to characteristics of the farmer, such as age, education and gender. These are not reported as the studies including such factors were relatively few and contextual factors affect the results too heavily to be able to make useful conclusions from this review. The management issues encountered in the particular decision-making context are also not included in this review, as well as the characteristics of management options. This is because these factors offer such as wide array of considerations and are significantly affected by the management context and the specific technical details of the management options. This is not to say that these considerations are not important for farmers, but that each situation may be

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

judged individually. The rest of the section covers factors that were most mentioned within studies and where it was important to elaborate on the detail of findings. Sections focus on biophysical factors, policy and political context, financial consideration, processes and practices and social, cultural and person factors. The section also includes a summary of studies highlighting the complexity and trade-offs involved in decision-making.

4.3.1. Biophysical and management context

4.3.1.1. Biophysical factors

Biophysical factors are mentioned in many studies as one of the most important contextual factors when making decisions and changes to land management. For example (Feliciano *et al.*, - UK) state that physical-environmental constraints were one of the most commonly mentioned barriers for farmers, and were important for the adoption of several mitigation practices. Outcomes and control factors of particular practices are related to biophysical characteristics, such as soil conditions (e.g. clay soils, nutrients and type (Kristensen *et al* 2004 – Denmark; Peltonen-Sainio *et al.*, 2018 – Finland), climate (slow soil heating, frost, rainfall) and the presence of erodible land (Bijttebier *et al.*, 2018 – multiple), as well as parcel characteristics (e.g. topography, location, size, land-locked position, proximity of water supply), landscape types (e.g. presence of specialist habitats, semi-natural ecosystems or geological features (Schultz *et al.*, 2014 – Germany; Wilson, 1997 – UK)), and pest outbreaks (e.g. voles, grasshoppers) (Lamarque *et al.*, 2014 – France). Kristensen *et al.*, (2001 – Denmark) claim that differences in decisions are caused by unique cultural and biophysical environment, which influence and modify the relationship between farm characteristics and landscape activities in a distinct manner. As such, aspects such as geographical differences, biodiversity, climate change, soil fertility, natural hazards and types of grassland are important to consider.

In relation to geographical differences, which can encompass climate, geology, topography, but also national and regional differences, several authors (Busck, 2002 – Denmark Kristensen *et al.*, 2001 – Denmark) claim that the 'location factor' is more significant in explaining heterogeneity in landscape practices and understanding landscape activity than socioeconomic factors such as farmers' age, or farm characteristics such as livestock and acreage. For example, the same farm types might engage in different patterns of landscape activities from one area to the next. For example Marcel *et al.* (2008 – Switzerland) found that in relation to landscape development there were major differences in opinion (and action) between groups living inside and outside the Alps. On a smaller scale, transhumance farmers in France make their decisions based on the geographical characteristics of the areas they choose to inhabit, for example by exploiting the short winter season where grazing remains possible, and holding strategies for dealing with drought (Nettier *et al.*, 2011 – France).

Geographical differences can also be based on social differences across geographies. Pavlis *et al.* (2016 – multiple) show that decisions around agri-environment schemes are place specific across Europe, for example "respondents of peri-urban Northern European landscapes—featuring a variety of economic sectors and opportunities and more developed diversification of agricultural production–seemed to be more motivated in AES participation. On the other hand, less motivation was reported by respondents living in Central and Southern European landscapes, with marginal potential for agriculture–no longer the dominant economic sector–in less competition with other economic sectors and less diversified farm production". Wilson and Hart (2000 – UK) discuss the differences across Europe in participation in AES and claim that farmers in `northern' EU member

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

states were more likely to state environmental reasons as a motivation for participation in AESs than farmers in Mediterranean countries. They claim that this suggests a possible north / south divide with regard to both how schemes are sold to farmers and the type of farmer recruited into schemes. Such findings demonstrate the importance of considering the geographical context as a combination of factors, including, but not limited to the biophysical.

Biodiversity is often a factor affecting decision-making. This could be through the presence of biodiversity on farmland, the need to improve biodiversity, the decline of biodiversity, the assignment of conservation status etc. For example Andersson *et al.* (2015 – Sweden) found that managing land to maintain high biodiversity was important, particularly for low intensity farms, and where there were specific threatened species. Often, however there appears to be a trade-off that affects decision-making between production and biodiversity (Dumont *et al.*, 2018 - multiple). It is this trade-off that affects decisions to manage grassland, for example through grazing management (ibid).

The role of climate change was not a specific focus of this literature review, however, several studies mentioned the issues of climate change and climate change mitigation. For example Pröbstl-Haider *et al.* (2016 – Austria) discuss implications surrounding the idea that warming climate will offer new opportunities to increase income, either through expansion of cash crop cultivation or new land use options such as short-term rotation forestry. They note that these opportunities will almost always be seized, for example only 43 % of farmers would prefer the existing grassland cultivation. This may impact upon farmers' decisions to maintain, convert or abandon grassland.

4.3.1.2. Farm structure, size and intensity

Farm structure and characteristics (e.g. farm type, farm size, farm economy) were seen as an important factors for decision-making. 20 studies mentioned related aspects. 15 studies also mentioned the importance of labour and resources for decision-making, affecting aspects such as physical capacity on the farm, to the gain and transfer of knowledge.

In relation to farm characteristics, the studies covered many topics and context but alluded to the importance of the following aspects for decision-making:

- Plot configuration and distance from the farm affecting production activities (Alavoine-Morans and Girard, 2017 – France) and land allocation (Peltonen-Sainio *et al.*, 2018 - Finland)
- Hedge and tree positioning affecting livestock care (Alavoine-Morans *et al.*, 2017 – France)
- Farm size linked to cost-efficiency (Austin *et al.*, 2015 – UK)
- Farm structure affecting perception of positive and negative aspects of grazing (Becker, 2018 – Germany)
- Herd size affecting adoption of new measures (Hyland *et al.*, 2018 – Ireland)
- Farm size affecting participation in AES (Pavlis *et al.*, 2016 - multiple) e.g. AESs tend to be more suitable for relatively large farms (compared with regional averages) across the EU (Wilson and Hart, 2000 – UK).
- Farm types affecting participation in greening e.g. arable farms on highly productive land and intensive dairy farms are most likely to opt out of greening (Schultz *et al.*, 2014 – Germany)

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

- Farm size affecting risk-taking e.g. larger farms showing a higher risk avoidance behaviour than the smaller enterprises and traditional farms (Pröbstl-Haider, *et al.*, 2016 – Austria).
- Farm type affecting measures uptake e.g. mixed farms wanting new measures to be compatible with the whole farming system (Sattler and Nagel, 2010 – Germany) and extensive grassland farms more likely to participate in schemes than intensive livestock and arable farms (Wilson and Hart, 2000 – UK; Wilson, 1997 - UK).
- Multiple characteristics affecting diversification, e.g. larger farm sizes, high-value production, organic farming, and livestock production encouraging deepening strategies for diversification, and smaller farms and on farms with horses and higher grassland encouraging broadening strategies for diversification (Pölling and Mergenthaler, 2017 – Germany).

4.3.2. Policy and political context

4.3.2.1. Political context

The political context creates the conditions within the systems that farmers make decisions. The broader mode of governance in each country and within international governing bodies such as the EU play an important role in setting boundaries, norms and values, encouragements, support and conditions for change. Although not many studies specifically focused on political issues (perhaps because of the nature of the search criteria), some did mention issues of governance, regulation, institutions, integration, globalisation and power. Agricultural governance instruments are important in relation to the implementation of measure, for example cross-compliance standards and funding in the Common Agricultural Policy, market, brand and trade regulations at the EU and international level have the largest influence on the implementation of soil conservation measures (Nguyen-the *et al.*, 2016). Darnhofer *et al.*, (2017 – Austria, France, Norway) show that governance arrangement are important and propose that a reflective learning process is vital for the uptake of AES measures, but that the process requires a transformation of the broader governance arrangements and the structural context, i.e. the norms and values used to assess what is effective and efficient. Darnhofer *et al.* explain that it is important that institutional arrangements enable and encourage more critical, inclusive, and reflexive practice (Buizer *et al.*, 2011; McLoughlin and Thoms, 2015; Wyborn, 2015). This transformation requires a change in boundaries and power structures, which makes it likely that individual changes are resisted (Pahl-Wostl, 2009). Lončarić *et al.*, 2016 – Croatia) mention the importance farmers place on governmental action to ameliorate unfavourable situations in agriculture. Such observations highlight the importance of the political context for facilitating productive change in uptake of AES.

Hinojosa *et al.* (2018 - France) suggest that constraints on farming can be associated with the institutional framework of agriculture (i.e., regulation and administrative burdens). For example institutions can influence the maintenance of nature-friendly farming practices in mountain areas. Such influence might be delivered through integrated planning as part of a governance strategy. For example Gullino *et al.* (2018 - Italy) highlight the need for planning and management in peri-urban areas to be more integrated with urban areas due to the proximity of peri-urban farms to urban areas, linked to demand for multiple functions and services. For example, quality food, natural elements, rural network, didactic and recreation spaces represent important incentives to peri-urban farmers to carry out new activities beyond commodity production. The lack of integration within the

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

policy context has acted as a barrier in this particular context.

4.3.2.2. Policy characteristics

The existence of policy is a fundamental factor affecting the decisions made by farmers, and where policy influence can be positive, (perceived) problems with policy act as barriers. Factors such as trust in governments and change in policy affect the way in which policy is influential.

Positive characteristics and influence

One of the positive influences of policy (e.g. direct payments) is the contribution to viable food production by improving agricultural competitiveness (Ciliberti, 2015 –Italy). However, this is not a straightforward mechanism and is disputed and often complicated by other factors. In a German study farmers mentioned that financial incentives would be a good initiative for implementing sustainable agricultural practices for considering more ES in their farming management (Dietze *et al.*, 2019 – Germany). Financial measures therefore play an important role.

Particular characteristics of policies mean that they may be more likely to be successful. For example Streck *et al.* (2011) believe that a mix of instruments and governance arrangements, including positive incentives, regulations and sanctions is needed to achieve multiple objectives, for example in relation to issues of food security and effective GHG mitigation (Feliciano *et al.*, 2014 – UK). In addition to the mix of instruments Aslam *et al.*, (2017 – UK) demonstrate that most farmers would prefer to participate in schemes with flexible and less restrictive measures. Flexibility might mean treating each farm individually with less recourse to blanket prescriptions (Wilson and Hart, 2000 - UK). Less restrictive measures are important because Aslam *et al.*, (2017), show that measures that restrict practices such as grazing and ploughing are far less popular with farmers (and require higher levels of compensation to encourage action). Characteristics of the policy process are also seen as important where management and planning agencies should take into account the differences between expert views and the views of the general public. Marcel *et al.* (2008) argue for public involvement strategies in policy and management. Problems may occur, however, where there are some strong political barriers between local perceptions of landscape changes and the policy drivers of those changes, meaning social representations of grassland areas (e.g. in the central French Alps) can be unequally represented in existing socio-political discourses identified at the European level (Quetier, 2010).

Problems with policy

There are often issues of scale and context within policy. For example in a German study (Dietze *et al.*, 2019 - Germany) farmers criticized that the existing policy instruments are not adapted to regional contexts and specific farm conditions. This may sometimes lead to policies being seen as inflexible, which makes it difficult to encompass or cope with environmental problems (Baur *et al.*, 2015). In relation to the Nitrates Directive in particular, farmers criticised the restrictive nature of the requirements and would prefer to be encouraged into actions (such as intercropping). This shows that where policy is restrictive it may be less appealing or easy for farmers to engage with. This may affect the decisions that they make on their land.

Bureaucracy can be an issue within policy, and Brotherton in an early study in 1990, identified that a requirement in the Cambrian Mountains (UK) to survey holdings to establish stocking rates caused a significant backlog of applications, which resulted in problems for the delivery of benefits from the survey. More recently, Darnhofer *et al.* (2017 - multiple) also reported that systemic issues linked to

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

the policy design and implementation process around permanent mountain grasslands were not (sufficiently) addressed. Such bureaucratic issues are prevalent in many policy contexts. (See 4.1c report).

Uncertainty can be a barrier to decision-making. Uncertainty in legislative issues is important for the pioneers and those farmers considering implementation of a new policy in the near future (Borremans *et al.*, 2016 – Belgium). Uncertainty may stem from a lack of clear focus, for example agri-environmental policy (in Denmark, for example) that does not have one particular target. This causes some uncertainty in situations where the owner and the producer are two different people, which is often the case in countries like Denmark. The lack of certainty around responsibility for grassland agreements in particular is difficult as a result and means that action might be uncoordinated (Primdahl, 1999 - Denmark).

Although lack of uptake is often seen as one of the major issues in agri-environmental policy, Leventon *et al.* (2017 - Germany) argued that limited effectiveness of the CAP in delivering meaningful biodiversity benefits, may be because it entrenches actor fragmentation, thereby reinforcing fragmentation in biodiversity management. The authors suggest that a more systemic change in the governance of farmland biodiversity is needed in order to address the problem of actor fragmentation.

Trust in government

Burbi *et al.* (2016 - UK) show that factors most negatively affecting farmers are represented by financial limitations and the lack of trust in government action. This might stem from a lack of trust in all authorities including scientific as well as government sources. In relation to grassland management, Mante and Gerowitt (2007 - Germany) describe the importance of defined contact persons within the subsidising institution, who have a very strong influence on the probability of adopting grassland measures. Where trust with the subsidising institution is good it has been found to be crucial in enhancing adoption rates. This trust is built on the face-to-face relationship between a farmer and the contact person. Although it is acknowledged that underlying patterns of interaction might influence the willingness of the farmer to engage in a good relationship (and therefore show trust for governing authorities), the personal relationship may be able to overcome some entrenched ideas.

4.3.2.3. Subsidies and schemes (including Agri-Environment Schemes (AES))

The existence of subsidies is a clear financial and cultural influence on farmers. For example Bijttebier *et al.* (2018 – multiple) describe the existence of subsidies as influential on the adoption behaviour of farmers, and Franzén *et al* (2016 - Sweden) show that in a choice experiment, an increase in financial support through subsidies was the most important factor to increase the willingness of farmers to create wetlands. Subsidies are seen as important because they are connected to the quality of life of the farmer, and the family. Bernues *et al.* (2016 - Spain) show that this is because subsidies improve the profitability of farming and contribute to the welfare of the household. Kaler and Green (2013 - UK) show that farms can become reliant on such payments, for example sheep farmers in the UK were found to be overly reliant on single farm payment, and were relying on the conditions set by such payment to influence their management. Equally in Tyrol,

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Austria, on average >80% of farmers' income comes from public transfer payments (Schermer *et al.* 2016) and in France, a study reports that farmers are heavily reliant on public support via the CAP (Quetier, 2010).

Reliance on subsidies is sometimes seen as negative. For example when the EU subsidies are judged to disregard the unique character of the landscape (Konkoly-Gyuro, 2018 – France and Germany). In the same vain, when the priority for subsidies is set at the local level, then it is more likely that there is uptake and application of the desired activities. Conversely, the existence of and participation in voluntary AES (perhaps in addition to receiving basic payments) can often have little effect on the practices of farmers (which is one of the significant critiques of the CAP Pillar II). For example, Wilson as early as 1997, noted that most of the participants in an Environmentally Sensitive Area scheme (62%) did not have to change their management practices through the scheme. This has the implication that the scheme was, at the time, making little difference to the management of ESAs and would likely have little impact on future management. However, in Wilson's study, 16% of participants admitted that the ESA 'had made them think about the environment', with most saying that they would avoid overgrazing of vulnerable habitats even without ESA payments (the remaining 4% were 'unsure'). It may be that those that witnessed the positive benefits of the scheme had been influenced to change their management practices in the long-term.

4.3.2.4. Advice, guidance and farm outreach

A factor that affects farmer decision-making is the support that they receive. This can be part of a suite of factors that might enable or provide a barrier to change in behaviour. For example, Grüneis *et al.* (2018 – Austria) claimed that diverse climate change adaption practices in the Tyrolean mountain landscape were motivated in part by support for farmers, but also by awareness raising, environmental improvement, productivity gain, resilience raising and heritage conservation. Henjowicz *et al.* (2016 – UK) focus on the role of advisors in agri-environment scheme delivery in which the majority of advisors (92%) indicated that clients demonstrated a high degree of openness towards their advice. This shows that the farmers were ready to be informed and potentially open to being persuaded on a range of possible recommendations concerning the type and composition of the agreements they enter. Advisors can, therefore, have an important role in guiding farmer-decision making processes (Henjowicz *et al.*, 2016 - UK).

Moreover, Henjowicz *et al.* (2016 - UK) claim that advisors, potentially occupy an influential 'soft power' position. The direction of this power can be varied and the authors claim that advisors can either encourage farmers to undertake environmentally strong agreements that build on intrinsic 'green' motivations or, draw on farmers' extrinsic motivations in order to produce agreements requiring few changes to on-farm practices, which would benefit existing farm business arrangements. This power to influence the type of agreements that farmers enter into is important and they are a potentially influential group to engage in discussions about future direction of farming. Linking to findings in 4.1c (see report) many stakeholders feel that there are too few farm advisors currently (2019) and that improved support could be advantageous.

Discussion groups and farm extension services are also seen to be influential. For example farm extension meetings of dairy farmers organised by a dairy advisor were observed by Hyland *et al.* (2018 – Ireland) in Ireland. These groups met regularly at a host farmers' farm and aimed to discuss a specific topic (e.g. grazing management, artificial insemination, production costs, or animal health). These groups were seen to be important (in the Irish context) because membership had a

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

positive impact on technology adoption. Equally, for dairy farmers in Slovenia the national extension service was seen to fulfil a major role in know-how transfer (Klopčič and Kuipers, 2015 – Slovenia). However amongst Spanish land managers, the majority saw the local extension service as nothing more than a source of information and that only one third had come into contact with the service in the three years previous to the study (Pleininger *et al*., 2004 - Spain). Wilson and Hart (2000 – UK) recognise that the nature of farm-extension work (frequency and intensity of contacts with farmers) is a key factor in participation rates in AESs. They claim that it particularly underlines the importance of officials (including local and regional officials and meetings) in the provision of advice to farmers. They argue that regional officers provide a key `intermediary' role at the interface between policy formulation and implementation on the ground.

4.3.3. Financial considerations

It is not unsurprising that financial considerations are one of the most commonly mentioned factors affecting farmer decision-making. Within the review many different aspects of finance and economy were mentioned. Table 4.1 give a sample of the considerations that were most mentioned within the review. Other considerations included productivity, Payment for Ecosystem Service (PES), utility, efficiency, diversification, property prices, long term planning, financial viability, and land tenure and ownership.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Financial consideration	No. of studies	Selected examples
Cost of implementation	12	"it is likely that individual farmers make their implementation decisions based on their own assessment of the likely costs of implementation, including maintenance." (Austin *et al.*, 2015: 160 – UK) Farmers tend to choose mitigation options that are relatively simple and either cost effective or with only relatively small additional costs (Vellinga *et al.*, 2011: 185 – Netherlands) The economic aspects are considered thoroughly beforehand, including the returns and the cost of land (Busck, 2002 - Denmark) Our findings indicate that grassland farmers clearly prefer simple and cost-effective adaptation measures such as the introduction of new plant species and varieties. (Eggers, 2015: 614 – Germany) Low-Adopters were characterised by their high sense of resource constraint despite feeling that they were capable of implementing the grazing system. (Hyland *et al.*, 2018 – Ireland) As a note → The findings show that, despite of the general assumption that farmers' decisions are mostly driven by economic rationality, costs were not the most important factor. (Sattler and Nagel, 2010: 70 – Germany)
Farm income	11	The results highlight that labour-intensive farming, investment oriented managerial behaviour, as well as a strong dependence of household income on farming activities, act as constraints against participation in any AEM (Defrancesco *et al.*, 2006: 128 – Italy) On the basis of responses given by 789 participants in the ten (European) countries under investigation, economic considerations have been the primary driving force for farmers to participate in AESs (79% gave financial reasons; 64% a secure source of income) (Wilson and Hart, 2000: 2166) Income risk is an important factor affecting implementation of extensification (Dorschner *et al.*, 2012 – Germany) For farmers, scheme payments present a real issue, particularly because management interventions can have a considerable impact on overall farm income and; furthermore, may not adequately account for all the costs farmers incur and appropriately reflect regional socio-economic differences. (Henjowicz *et al.*, 2016: 253 – UK)

		Farmers who felt that their farm income was sufficient for them to live on required a payment of 4.7 times their annual single farm payment more to switch (to a one-off lump sum) than farmers who felt that their farm did not provide them with a sufficient income to live on. (Howley, 2016: 188 – Ireland)
Profit and business successes	9	Profitability" was the most important item regarding farm economics and was discussed relative to the "self-sufficiency" of a farm (low dependence on external factors), "mechanization" (facilitated and optimized labour), "fencing" (easier and more profitable management), and "grazing in mountains" (low feeding costs). (Bernues *et al.*, 2016: 135 - Spain) Simultaneously, low agricultural income affected "farm diversification" because low profitability promoted off-farm activities and eventual farm abandonment. (Bernues *et al.*, 2016: 137 - Spain) Certain farmers' strategy is to use all available land for production in an efficient manner in order to ensure a profitable production. (Busck, 2002: 244 - Denmark) Such management practices (grazing in oak-wood pastures) are currently of marginal profitability, which endangers the overall land-use system and the provision of those ES important for people. (Garrido *et al.*, 2017: 102 – Sweden). Profitability is viewed as an important factor for staying in livestock farming. By definition, less profitable farms experience market difficulties. Yet, our results confirm that profitability is not the only factor that influences the permanence of farmers in mountain areas (Hinojosa *et al.*, 2016; Dumont *et al.*, 2016). (Hinojosa *et al.*, 2018: 731 – France)
Market prices and market structure	7	We also know that major changes in market prices, for instance a rise in cereal prices, will motivate full-time farmers to expand and intensify arable farming and thus give production-oriented decision a key role in landscape change. (Primdahl, 1999: 149 – Denmark) The milk price is low when compared to the old EU member states; this stimulates the sale and transport of raw milk from Slovenia to Italy. (Klopcic and Kuiper, 2015: 49 – Slovenia) According to the farmers, the main problem in Croatian agriculture are high input prices, slow administration and low market food price (Lončarić et *al.*, 2016: 335 – Croatia).

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Compensation (within schemes)	7	Therefore, promoters of agri-environmental schemes must be able to demonstrate to the farming community that compensation levels are compatible with production revenues forgone and additional costs (Ducros and Watson, 2002: 418 – UK). As a reason for not participating, 30% of the farmers referred to too small compensation payments. (Hammes *et al.*, 2016: 530 – Germany). The reasons for not taking part in the programme (farm beautification) include those who stated that the compensation offered was too low (Vanslembroek *et al.*, 2002: 500 – Belgium). Financial reasons also ranked highly, with many farmers (25%) of the opinion that compensation was far too low for entry to be feasible. (Wilson and Hart, 2000: 2169 – multiple).
Risk	5	Some risks can be connected to climate change (e.g., extreme weather events), and reducing these risks contributes to better adapted (farming) systems. (Grüneis *et al.*, 2018: 390 – Austria) The overall reaction (of farmers) to economic risks, such as changes of global market prices, is stronger than reactions to climate change phenomena, such as flooding, […] and risks of the world market and high price fluctuations play a greater role in the decision-making of all farmers than the environmental premium (Pronstl-Haider *et al.*, 2016:461 – Austria) Reducing inputs was reflected in changing substantive norms towards balancing risks and potential returns against investment, rather than optimising production (Sutherland, 2011: 815 – UK) It could be argued that farmers, being by nature risk averse, are unlikely to implement all or nothing behaviours; therefore, the behaviour or lack of a specific behaviour is unlikely to completely inform the study (Willock *et al.*, 1999: 12 – UK)

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

4.3.4. Processes and practices

The way in which processes and practices are enacted form an important enabler to decision-making for farmers. This might be through providing a support network, collaborating with other farmers, receiving the right information, participating fairly and openly, communicating well with policy officials, facilitating a constructive learning process or co-creating management options.

4.3.4.1. Collaboration, leadership, networks and co-management

Dialogue is important if schemes are to appeal to the farming community. Ducros and Watson (2002 – UK) advocate that dialogue between scheme organizers, the farming community and conservation groups must be established earlier in the policy process. Gullino *et al*. (2018 – Italy) also advocate dialogue, where increased dialogue between farmers and municipal officials results in the possibility to increase multifuctionality of the territory in Italy. In the same study better communication strategies, improvements to farm networks and cooperation were seen to be the best sustainability criteria for addressing problems of farm income (Gullino *et al*., 2018 - Italy). This was achieved through new institutional programmes that involved cooperation. Cooperation can also be seen as intersectoral thinking and partnerships, as well as an increased rate of information exchange and transparent decision-making processes (Prager and Freese, 2009 – UK). This can promote sustainable landscape management, e.g. using landscape as a platform for harmonising development and protection strategies (Konkoly-Gyuro, 2018 – France and Germany).

Consequently a lack of communication and knowledge transfer is argued to lead to prioritising economic interests (Konkoly-Gyuro, 2018 – France and Germany). Equally, such a lack of communication could lead to fragmentation of actors, which, Leventon *et al*, (2017 - Germany) argue has happened within the CAP by not addressing drivers that provide a disincentive to collaborate, such as land tenure arrangements. Actor fragmentation can mean that farmers are not given reasons to collaborate and are not compelled to; they lack information, advice and someone with the overview to coordinate collaboration; or no actions are taken to reduce disincentives to collaborate (ibid). Despite these difficulties in collaboration, Leventon *et al* (2017) found that farmers are willing (in principle) to collaborate if facilitated to do so in easy, non-bureaucratic ways.

Where collaborative approaches are taken, they are seen to be facilitators. For example, a collaborative approach was preferred by farmers as well as business owners in a Danish National Park project related to promoting and enhancing food producing aspects of the park (Hjalager *et al* – Denmark). Farmers typically worked with other farmers, tourism enterprises and collaborated in tourism boards and associations, but on the whole an attitude with a significant collaboration across sectors was altogether not prevalent among the respondents. This is because collaborative relationships were largely determined by tradition, and only some respondents described efforts to include other groups. Therefore although there was the recognition of the need to collaborate, and some action, some barriers existed to breaking out of traditional relationships. In relation to this, a study in Ireland found that although adoption of measures was dependent on social networks, people were often unaware of the influence of others and may even deny it (Hyland *et al*., 2018 - Ireland). Therefore even when social networks are perceived as unimportant the influence may be hidden.

Collaboration amongst farmer groups is seen to be an enabler of action, particularly when action is seen as co-management. Co-management schemes might refer to agri-environment schemes that include dialogue between scheme organizers, the farming community and conservation groups

early in the policy process, are often a preferred option for farmers, for example Ducros and Watson (2002 - UK) show that 58% of farmers (in a UK survey) preferred co-management arrangements above government or locally led schemes. Co-management is argued to encourage a sense of scheme ownership within the farming community, where the benefits could be better compliance. In a Slovenian study of dairy farmers, cooperation among farmers was seen as an important development pathway besides specialisation in dairying (Klopčič and Kuipers, 2015 – Slovenia).

4.3.4.2. Knowledge, data and information

The transfer of data, knowledge and information is key for developing collaborative approaches, and where communication, trust and learning are strong, schemes have more chance of success.

There are multiple ways of knowing the landscape and acknowledgement of different ways of knowing within management schemes could be an enabling factors for farmers and land managers. For example, Garcia-Nieto *et al.*, (2015 - Spain) explore the spatial representation of ecosystem services, with participants, finding that some base an understanding of ES on the continuous reading of signs and signals of the landscape. The authors argue that this cultural understanding of the landscape can give rise to sustainable management practices (Pilgrim *et al.*, 2007, 2008), and can inspire knowledge for designing multifunctional landscapes that ensure the delivery of ecosystem services (García-Llorente *et al.*, 2012).

Understanding the knowledge sources of different groups is a key point in understanding why farmers choose a given management practice (Dietze *et al.*, 2019 - Germany). This has consequences for existing and new policy instruments, which might support alternative agricultural management practices. Dietze *et al.* (2019 – Germany) found that long-term experience was one of the most important knowledge source for selecting management options and methods. Such experience could be personal or learned through exchanges and discussions between farmers. Funding programs were also identified as a source of knowledge. Franzén *et al.*, (2016 – UK) found that knowledge communicated within an AES complemented knowledge already known by farmers about the Water Framework Directive. There was a threefold willingness to participate in the AES, which was perhaps due in part to the reinforcing effect of the knowledge within the scheme. Despite the recognition of the need for information to reach owners and land managers about new schemes, it is not always clear how to reach them. For example Hejnowicz *et al.* (2016) found that the majority of farmers did not read the handbook about an AECS (agri-environment climate schemes) scheme in the UK, which could explain their lack of knowledge. Such a lack of knowledge can be seen as reasons why non-participants in AES are less likely to join in the future (Wilson and Hart, 2000). These insights might be helpful for identifying alternative routes of knowledge communication.

The way in which knowledge and information is communicated is also important. For example, in a study of UK land and water management, Ducros and Watson (2002 - UK) found that farmers had little in trust in the government agency to fairly set the compensation levels in an AES. Therefore it was suggested that an intermediary group of evaluators should set the compensation levels in order that the levels be more transparent and therefore more attractive. This alternative route to communicating may have increased the trust levels and influenced the farmers' decision-making. In the UK the role of farm advisors as intermediaries was seen to facilitate knowledge exchange

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

about AES (Environmental Stewardship schemes) (Henjowicz *et al.*, 2016 - UK). The authors show that the 'knowledge-exchange encounter' occurring between the advisors, the farmers and Natural England (government representatives) was fundamental to the environmental effectiveness of the schemes as well as the farm business compatibility. The role of advisors is potentially also important as they may help to facilitate the spread of knowledge and the development of innovation. Kristensen *et al.* (2001 - Denmark) show that the pace of spread of innovation and whether a 'follow the leader' mentality prevails were important factors in determining the rate of adoption of agro-environmental measures. It is not surprising that to facilitate this, different sources of information about AES opportunities should be adapted to the characteristics of different landowner groups (Pavlis *et al.*, 2016 – multiple).

4.3.4.3. Participation and learning processes

Organised collective group learning can be an effective method of fostering behaviour among farmers. Social learning as a useful concept for facilitating such change in behaviour has deep roots in participation and integration of knowledge from different perspectives. It involves critical thinking, interactions, dialogue, and questioning assumptions that underline individual concepts (Leeuwis *et al.*, 2002). This approach is advocated in management (Hyland *et al.*, 2018 - Ireland) as it would allow individuals to discuss their perceptions on grassland management with each other and experts. Partnerships are often seen as a mode to facilitate social learning and provide supportive networks of sharing and learning around land management issues. The existence of partnerships can allow multiple stakeholders to participate in policy-making, the design of management tools as well as conflict resolution. They can also help improve the acceptance of agr-environment schemes (Prager and Freese, 2009 – Germany). Such participation in partnership structures might help farmers make better informed decisions through processes of social learning and co-creation.

In order to engage in management and policy processes and thus make better decisions, Darnhofer *et al.*, (2017 - multiple) argued that a process of double-loop learning is required, i.e. the questioning of underlying assumptions. They describe that 'best practice' examples of design and implementation identified by experts build on a radical move away from the dominant assumptions about the role of both farmers and researchers, meaning that there should be new ways of administering the process that break away from entrenched understandings, via a deep learning process. If the farmers are involved in such processes of reflection and learning they can be more engaged with the design and implementation of policy, and help to create policy that is more effective for all involved. These often come from academic research projects, which offer chances to reflect and learn collaboratively (e.g. Lamarque *et al.*, 2014 - France; Martin *et al.*, 2011 – France; Oliver, 2012 - UK). A number of studies reflect on the opportunity offered by participatory research projects (modelling, mapping, participatory panels) to learn and co-create better solutions and management options. This might include the co-development of decision support tools (Oliver *et al.*, 2012 - UK). This trend involves a shift in farmer-scientist relationships from one of knowledge transfer to one of knowledge exchange (and development), learning and two-way communication of information and advice (Oliver *et al.*, 2012 - UK).

The concept of double-loop learning was also assessed as being important within management

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

tools themselves. For example Duru *et al.*, (2012 - France) showed that in a process of developing new tools to help farmers create adaption options to climate change, a tool (forage sticks) that incorporated elements of double-loop learning allowed participants to analyse the consequences of climate change critically, and to question the underlying assumptions in order that they could make better choices.

Participation of farmers and other stakeholder in events and processes relevant to grassland management can help to inform decision-making and also help to inform the context in which they are to make decisions. For example, Garcia-Nieto *et al.* (2015 - Spain) stated that the involvement of local stakeholders with different levels of influence in the decision-making process (about land management) can empower stakeholders (Fagerholm *et al.*, 2012) and generate a collective vision for landscape planning (Swetnam *et al.*, 2011). Events such as workshops can provide the setting for learning and participation. However Duru *et al.* (2012 - France) noted that although farmers attending a workshop claimed they would rethink their own system after the workshop, there was no guarantee that they would.

The creation of connections between farmers, researchers and policy makers was seen as advantageous for the successful implementation of agricultural management (Burbi *et al.*, 2016 – UK). Such connections are seen to help the development of linking social capital, which aids the interconnection of people across heterogeneous groups.

4.3.5. Social, cultural and personal context

4.3.5.1. Social norms and social values

Borremans *et al.*, (2016 – Belgium) demonstrate that norms (subjective norms, group norms and moral norms) have an important influence on farming communities. In relation to agro-forestry, for example, they found that farmers in Belgium felt little or no obligation to practice agroforestry in relation to group and subjective norms, but that they demonstrated the importance of social pressure, therefore intimating that there was little current social pressure to enter agroforestry (whilst also taking into account other influences). Busck (2003- Denmark) highlighted the importance of understanding the influence of network relationships on farmers' practice, and Burbi *et al.* (2016 – UK) showed that networks of influence also play an important role in promoting innovation among farmers as they encourage farmer-to-farmer knowledge sharing. Equally important for the uptake of new management or technology are the farmers' normative beliefs, which are seen to be influenced by the opinions of society as a whole, and those of neighbouring farmers (Defranceso *et al.*, 2006 – Italy). These are seen to be relevant for active adopters of new management or technology, but negligible for passive participants. Therefore different groups are affected in different ways by the same networks and interactions. Networks can also be created as an influence and stregthener for social and human capital. For example, Grüneis *et al.*, 2018 – Austria) showed that the existence of a farm women's network provided education, consultation and network activities among farmers and between farmers and consumers.

Lifestyle and family values are an important social influence on decision-making. For example some farmers may make decisions about their land management in order to create a pleasant environment; one in which they can allow their children to be safe and one that meets with their own understandings of a beautiful environment (Busck, 2002 - Denmark). Some farmers are sensitive generational succession and want to aim towards maintaining an intact farming

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

background for future generations and preservation of the current cultural landscape (Eggers, 2015- UK). Farmers' families have been found to be the social group that most influences the intention of a farmer (Schroeder *et al*., 2015 – UK).

The influence of social norms may also come through **historic and cultural influence** on behaviour (Eggers, 2015- UK). For example Cebrian-Piqueras *et al*., (2017 - Germany) highlight that for certain farmers in a German study, their practices were influenced by the consideration of the practices and legacy of their Fresian ancestors, and they saw themselves as proud and responsible for establishing a particular pattern of land management (drainage and reclamation of land). Other farmers might be influenced by their understanding of the cultural importance of the land, for example, a farmers from Breckland decided to preserve the foundations of a church because he considered it special and a link to the history of the farm (Fish *et al*., 2003 – UK). There can sometimes be an understanding that the farmer and their ancestors 'made the countryside' and therefore there is an inherent historical link (ibid).

Perceptions of others can be a significant influence on decision-making, including attitudes of neighbouring farmers (Ducros and Watson, 2002 - UK). This can also be linked to substantive norms (understanding of others' expectations). In a study of conversion to organic agriculture Sutherland (2011 - UK) found substantive norms consistently demonstrated that farmers believed that other farmers particularly approved of maintaining viable farm businesses, and often made considerations to try and represent themselves as rational businesses people. This was how they believe they could become accepted by their fellow farmers. Despite this influence, there are some studies that counter the influence of others by showing that the opinion of other farming colleagues and reputation amongst fellow farmers were deemed to be unimportant in relation to participation in AESs and acceptance of conservation measures (Schroeder *et al*., 2015 - UK; Sattler and Nagal, 2010 - Germany). Where influence of neighbours is low in the latter case, it could be that the scheme was well established and well known prior to the study, therefore colleagues no longer matter in the decision-making process (Sattler and Nagal, 2010 - Germany). Therefore the opinion of others may matter at particular times in a decision-making process or process of adopting a new practice.

The **image of a 'good' farmer** sometimes plays a role in influencing behaviour. For example, Alavoine-Mornas *et al*., (2017 – France) finds that farmers sometimes resist biodiversity policies because they represent a potential disruption of their identity that they associate with being "good" farmers, which means that they are focused on productivity. In another study (Busck, 2002 - Denmark) a converse example is found where farmers can be concerned about the image of farmers, but related to the resistance of being perceived as a 'destroyer of nature', because farmers can feel responsible for creating habitats and supporting wildlife. It is therefore clear that a 'good farmer' is perceived as different across contexts and farmer groups (Sutherland, 2011). It may be related to cultural identify and skills of the farmer (Franzén *et al*., 2016 - Sweden) or economic outcomes (Willock *et al*., 1999 – UK). The process of social learning can be seen to play a role in shifting the image of a 'good farmer', sometime away from a purely production standard towards one with more environmental tendencies (Hyland *et al*., 2016 –UK)

4.3.5.2. Perceptions and values around environment and farming

Whilst some studies discussed in this review reveal information about the attitudes and perceptions of different groups, few link perception to decision-making. The studies described in

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

this section made some conceptual link between the values and perceptions of farmers and the land management decisions they make.

Kristensen *et al.* (2004 – Denmark) describes that there is a new kind of environmental interest among modern farmers that means that they are motivated to include features on the farm such as trees, hedgerows and ponds that go beyond any policy requirement and that have no agricultural purpose. Farmers also have an understanding, knowledge and value system around ES. For example Lamarque *et al.* (2014 - France) describes that farmers often adapt their behaviour so that they can opt for the most highly valued ES, although often farmers valued multiple ES. Their results suggest that knowledge and/or values were necessary but not always decisive in farmers' decisions. Equally, farmers' attitudes can mix with their motives to affect behaviour. For example, when farmers in a study by Power *et al.* (2013 - Ireland) shared positive attitudes to the environment and wildlife, there were significant differences between farmer attitude and actual reported behaviour. The difference could potentially be explained by a difference in motive. Profit motives are suggested to be stronger than environmental motives, even when an awareness of and a sympathetic attitude to environmental problems exist. However, Power *et al.* (2013 - Ireland) show that this may not always be the case. What Power *et al.* (2013 - Ireland) do report is a link between farmland biodiversity and farmers' attitudes, behaviours and knowledge, thus a link between farmer environmental attitudes and knowledge and the effectiveness of AES for biodiversity. However, another study demonstrated that environmental values are not significant predictors of participation in AECS (Špur *et al.*, 2018 - Slovenia). Therefore, they advocate that the protection of grassland in the interest of biodiversity protection must be addressed with measures targeting cognitive levels. This refers to a cognitive level 'fix' in relation to changing management measures that refers to a network of values, attitudes and opinions, as opposed to 'fixes' that are technical or structural (Šorgo *et al.*, 2016).

Aesthetic factors might also affect the decisions of farmers. For example they may be motivated to have nice looking fields (Bijttebier *et al.*, 2018 - multiple) or an orderly farm that is a display of work properly done (Alavoine-Mornas *et al.*, 2017 – France). Therefore some farmers think that maintaining 'tidy' grasslands shows the quality of their work. This perception is important for tenant farmers who are trying to display their work to landowners in order to find new plots to rent if necessary (ibid). Where farmers integrated the natural environment most fully into their farms they were not motivated by aesthetic but were confident that they were appreciated in their role as preservers of the land and landscape from urbanisation (ibid). In a study in the UK, Fish *et al.* (2003) find that farmers often rationalise land-management practices using words such as ``beautiful'', ``picturesque'', ``attractive'', ``grand'', ``lovely'', ``gorgeous'', ``majestic'', demonstrating the importance of aesthetic appeal. Fish *et al.* (2003) also found that if a farmer owned the farm they would more readily describe its aesthetic appeal. Many of these attitudes can be linked to the relationship of the farmer to the land, to nature or to environmental issues, as well as the extent to which they integrate the environment into the farming practice each of which affects their decision-making. These variations in values and attitudes and their effect on behaviour have been linked to particular farmer styles or types (e.g. Busck, 2002; Eggers, 2015; Hammes *et al.*, 2016; Hyland *et al.*, 2016; Pavlis *et al.*, 2016).

4.3.6. Trade-offs, conflicts and complexity

Trade-offs inevitably occur when decisions have to be made. In a study of farmers in Sweden

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Andersson *et al.*, (2015 - Sweden) found that farmers of high-intensity farms felt they constantly had to make trade-offs between production of provisioning ecosystem services, and environmental consequences derived from this pressure, especially through nutrient input. Trade-offs equally have to be made between effectiveness and efficiency, for example in relation to interventions to enhance pollinators (Austin *et al.*, 2015 – UK). Some farmers will try and avoid trade-offs altogether by rejecting 'greening' policies (Schulz *et al.*, 2014 - Germany). In relation to mitigation measures and policies, some may be less effective due to trade-offs (Vellinga *et al.*, 2011 - Netherlands), others may be designed to reduce or compensate trade-offs in order to encourage uptake.

Although farmers have the ability to discuss highly interrelated issues and to associate them with management practices, mixing agricultural practices, environmental effects and diverse socio-economic issues at various spatial scales (Bernues *et al.*, 2016 – Spain), **complexity** can arise when multiple factors come together to influence decision-making. For example Becker (2018 – Germany) discusses that when considering concepts to promote grazing, there is a need to reflect on the interactions between the differing attitudes and perceptions of dairy farmers and their interactions with farm structures and management. Equally, farmers highlighted the complexity of land allocation and the interactive nature of the drivers (Peltonen-Sainio *et al.*, 2018- Finland). Adaption to climate change in relation to livestock-grassland was seen to be complex. This is because of the strong interdependence of system components and decisions made at different times of the year (Duru *et al.*, 2012 – France). Some grassland farmers preferred to reduce complexity when thinking about adaption to climate change by choosing simple solutions such as introduction of new plant species and varieties (Eggers *et al.*, 2015 – UK), which may be seen to pass on some of the complexity to the plant breeders (ibid).

From another angle, complexity can also arise in relation to AES. Often the complicated nature of schemes is confusing and a barrier to decision-making, also affecting farmers' participation in the schemes (Henjowicz *et al.*, 2016 - UK). Whilst Schroeder *et al.* (2015 - UK) is in agreement with regards to complexity and the need for it to be managed in order to accommodate farmers, they argue that to some extent high complexity of AES (like Higher Level Stewardship) leads to greater success in meeting environmental goals and is therefore often needed. This also relates back to the issues of need for farm advisors to help navigate the complexity. Complexity therefore may need to be reduced in relation to the process of AES delivery, if not in their motives to achieve multiple benefits.

Tensions can arise when there are multiple interests involved in an issue. For example, tensions appeared to arise in relation to AES implementation, due to the competing agendas and objectives of the different actors involved (Henjowicz *et al.*, 2016- UK). This can affect the content of AES agreements. For instance, farmer selection of management options versus Natural England's (national government) target environmental objectives. Henjowicz *et al.* (2016 - UK) show that it is farm advisors that negotiate the balance and mediate between the needs of the farmers and the requirements of the AES. Hinojosa *et al.* (2018 - France) argue that tensions need to be more strategically addressed by both agricultural and environmental policies.

Uncertainty is a factor that limits decision-making. For example in a study of UK farmers (Ducros and Watson, 2002), they were found to be cautious when faced with uncertainties about changing market prices. This, combined with policy reforms had made them less likely to adopt conservation schemes.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

5. Discussion

The aim of this review was to highlight the facilitators of, and barriers to, adoption and choice of PG management options to deliver specific ES. This was approached by first understanding the differing attitudes of stakeholder groups to grassland management and related issues, followed by an understanding of the factors affecting (farmer) decision-making. The study has been able to achieve these aims, however although the breadth of papers was an advantage to better understanding a broad range of issues, there were a significantly relatively few papers solely focused on grassland environments. There were a number of studies that had an explicit focus on grassland, however the majority included grassland as part of the broader landscape. This review therefore, has identified a potential opportunity to add more studies of socio-economic factors affecting decisions in and attitudes to grassland environments, and even more specifically in PG environments. It therefore justifies our further study in the *SUPER-G* project to take that opportunity.

In order to answer the research questions associated with this review therefore we have considered that grassland is part of a broader landscape, and where studies have not specifically mentioned grassland, their findings are relevant for an understanding of agricultural and farming systems as a whole. The study indicates that there are a range of factors that influence decision-making, as well as a range of attitudes to ES. It is clear that there are significant interconnections between the factors, and that the variance within each category as well as interaction amongst the categories means every element can act as both a barrier and a facilitator of decision-making depending on the context of that decision. Figure 5.1 is a conceptual map of the potential interconnections between the factors affecting decision-making. Factors are broadly categorized by scale and scope of influence: political context, biophysical factors and social norms are likely the most extrinsic factors affecting decision-making, and could be seen to be beyond the (immediate) control of farmers (if not other stakeholders, and if not considering feedback loops). Factors such as policy characteristics, agri-environment schemes, advice and guidance, farm structure and management issues may be strongly linked to the contextual factors, but also affected by the preferences and values of farmers, or resultant from the interaction of farmer values and circumstance with contextual factors. Financial considerations are of a similar scope and may represent a crossing of scale and contexts. The factors associated with process, including collaboration, knowledge sharing and participation, have a medium scope as they are set by factors such as policy characteristics and advice and guidance, but are also affected strongly by the values and attitudes of farmers and other participants in the process, particularly when sharing and learning require enabling behaviours from multiple scales and groups. Other factors such as attitudes, and perceptions and values are closely linked with people and groups in a personal and intrinsic sense, however the interconnections highlighted on the figure recognize that these, and other factors, do not exist in isolation and can be affected, changed and manipulated by changes in other factors.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

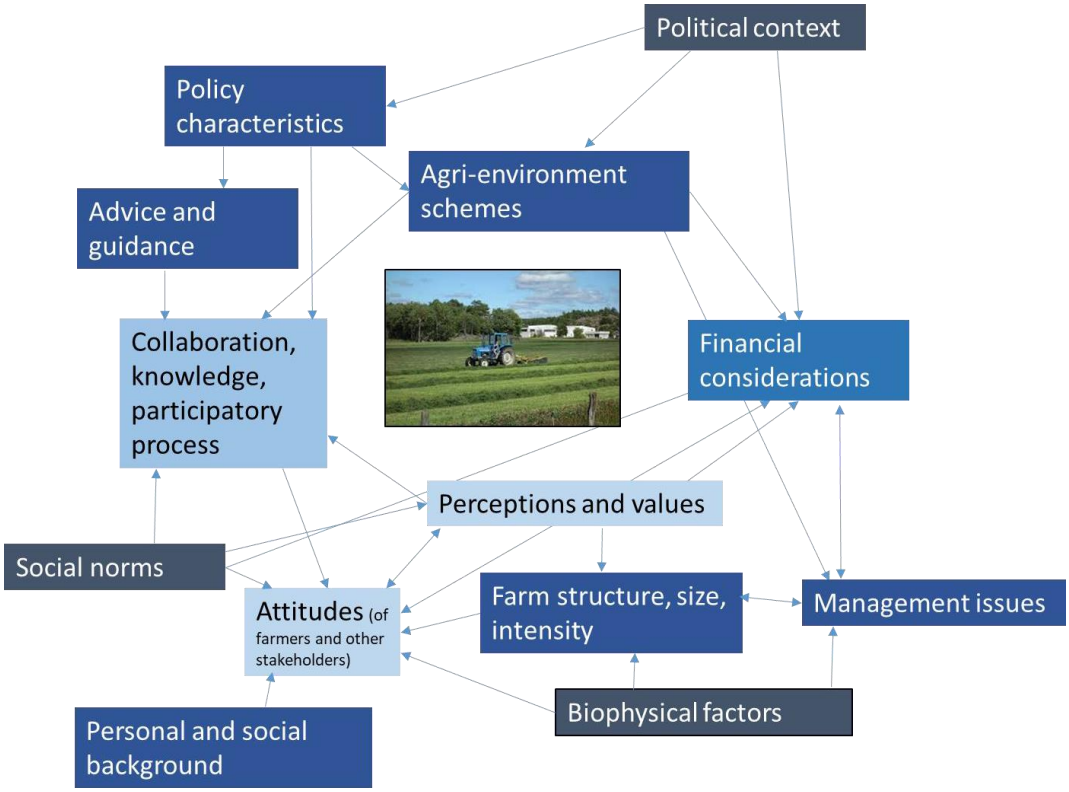

Figure 5.1 *Conceptual map of relationships between factors affecting farmer decision-making.*

Figure 5.2 shows the categories of factors affecting decision-making in relation to the number of studies in the review that gave some level of focus to each aspect. The categories are the same as those shown in Figure 5.1, but also detail the three most common sub-themes in each category. The number of studies range from 8 – 50, with a large number of categories only separated by a small number of studies. This indicates that there are many factors that have been given equal interest in research. The diagram shows that financial considerations are by far the most studied aspect (50 studies). This is a broad category and encompasses many aspects of finance and income, which may be the key to its size. This correlates with the results of the systematic review by Bartkowski and Bartke (2018) investigating factors affecting farmer decision-making (in a soil management context). They also report that this is not a surprising finding, given the significance that previous studies have given to the economic factors affecting farmers (e.g. Wilson and Hart, 2000). It emphasises the nature of farming as a business activity and the need for any decision to consider the financial capacity of the farm as an enterprise, although it is also important to acknowledge that financial factors are not always the most significant factor in a decision-making context. The second most studied aspect was policy characteristics (37 studies). The three most numerous sub-categories within this category were bureaucracy, uncertainty and lack of policy adaption to local context. The negative nature of these categories may indicate that studies are showing that policy is often discussed as a barrier to decision-making. However, some studies did emphasise the positive aspects of policy, such as Dietze *et al.* (2019), whose participants discussed the positive aspects of incentive policies for implementing sustainable agricultural practices and considering more ES in their farming. However, the majority of studies were focused on the

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

negatives. This could be due to the nature of academic studies, which tend to pick up on critiques rather than successes. In which case, the emphasis may not reveal the true scale of opportunity that policies offer for developing sustainable management choices, equally perhaps because participants in surveys, for example, are less likely to mention when things are working well, and more likely to emphasis their current struggles. The popularity of this theme may also indicate the reliance of farmers on the policy context when making decisions.

The third most numerous categories are biophysical factors, and processional characteristics (knowledge, collaboration, participation). The emphasis on biophysical factors indicates that studies are focused on the context in which decisions are made. This is, again, not a surprising result as the context will always be both a constraint and an opportunity for decisions. The three relevant sub-categories are climate, geology and topography; landscape type; and biodiversity. These factors represent both aspects that may stay relatively constant (topography, geology), as well as those that are changing (e.g. climate and biodiversity). The category referring to collaboration and knowledge sharing practices is interestingly mentioned a similar number of times to biophysical factors, which does not necessarily indicate an equivalence to biophysical factors when making decisions, but does show the emphasis on the need to explore the way in which decision-making is facilitated, alongside the constraints of context. The three categories refer to knowledge sharing and trust, social learning and communication. These are positive aspects and demonstrate that studies featuring discussion of these factors highlight the opportunities and enablers of decision-making. Perhaps interestingly, this category does not appear in many other similar reviews. For example Bartkowski and Bartke (2018) do not refer to any such studies as being a focus of their review on farmer decision-making. Perhaps the most closely related factor to which they refer is advisory services and their role in knowledge transfer, reporting that there are few studies that take this focus, but that there should perhaps be more, given the potentially significant role. In this review the role of advisors has represented a separate category, despite their association with processes and practices of knowledge sharing. This is because they appear to take a very specific role in knowledge sharing. However, similarly to Bartkowski and Bartke (2018), in this review they have been found to be mentioned in fewer studies than many other factors (8), perhaps because it is a narrow issues (compared to financial concerns, for example). However, they appear to show importance for influencing farmer behaviour in some areas, particularly technology adoption (e.g. Hyland *et al.*, 2018). However, in others, the lack of advisors or lack of engagement with the extension service may mean they have less of a role. However, their importance where engagement is high is significant, and the potential to harness their 'soft power' (Henjowicz *et al.*, 2016), may be a significant way to influence change.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

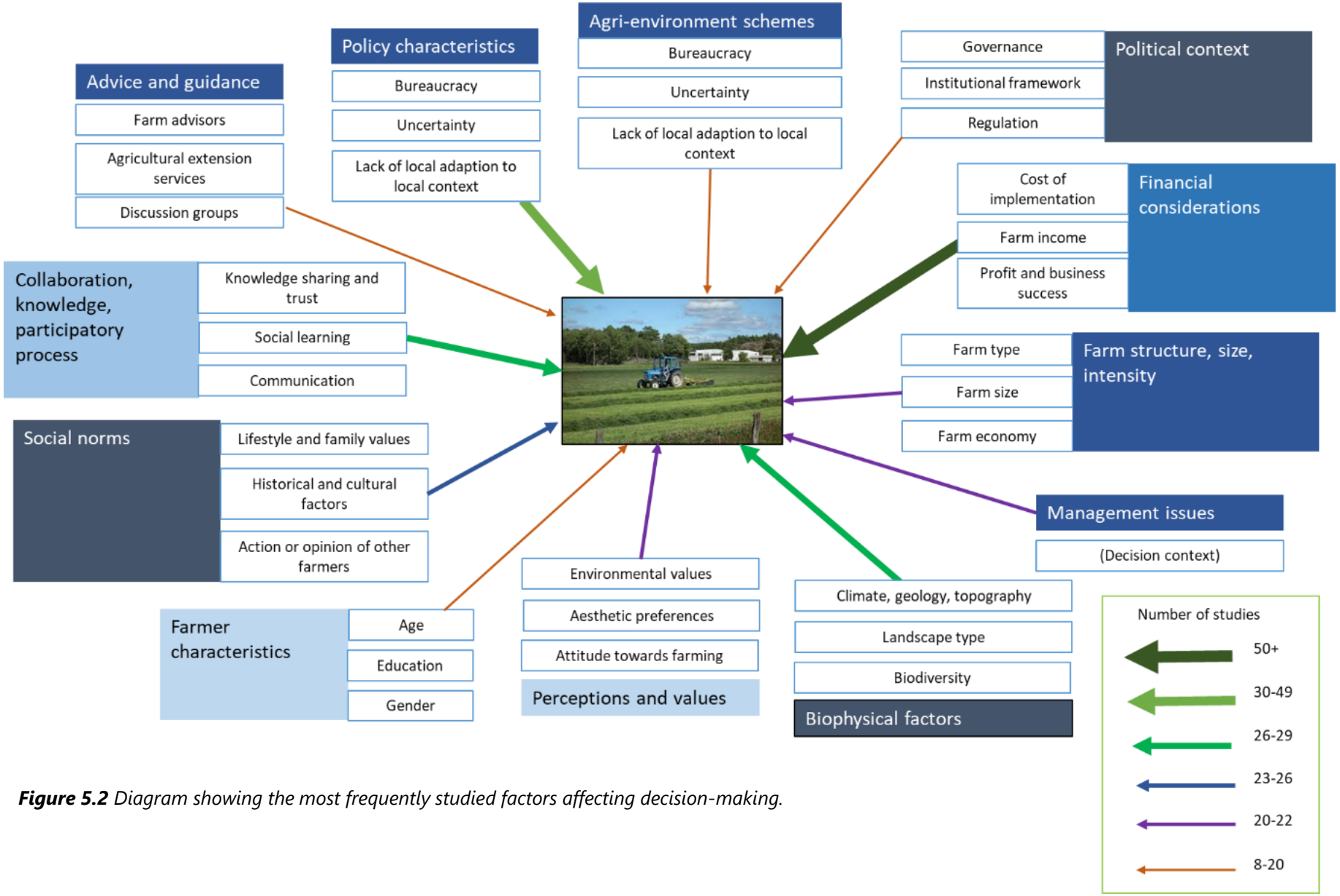

Figure 5.2 *Diagram showing the most frequently studied factors affecting decision-making.*

Social norms are the next most numerous category highlighted on Figure 5.2. These relate to lifestyle and family values, historical and cultural factors and action or opinion of other farmers. Again, Bartkowski and Bartke (2018), identify that this is an understudied area, but one that is potentially impactful. This review identifies 24 studies that focus on these aspects, which shows that in relation to studies that also mention grassland environments, there is an interest in better understanding social networks and the role of the opinion of others. This may be more the case than for farmers making decisions about soils as there may be more established networks of sharing amongst groups of farmers that understand grassland issues (which also includes soil management), either through their specific farming focus (e.g. dairy) or through a particular type of land management (e.g. upland hay meadow management). Bartkowski and Bartke (2018) particularly highlight a potentially important link to understanding the influence of consumers on farmer decision-making, principally in relation to ideas such as community-supported agriculture (e.g. Opitz *et al.*, 2019), which show the increasing reliance of some farmers on consumer opinion and feedback. This link between farmers and consumers, and the influence of consumer attitudes and opinions, is an area that we have identified as missing from this review and an area that could be pursued in further research.

Figure 5.2 identifies that studies focusing on farm structure, size and intensity; on perceptions and values; and on management issues were slightly less numerous than others (20-22 studies). The farm structure and size are fundamental aspects of decision-making and it may be more relevant to study other aspects that align alongside these foundational factors. Perceptions and values are fundamental aspects of a farmer as an individual and are perhaps more difficult to understand and interpret. Management issues were also seen as foundational and incredibly varied depending on the type and area of agriculture and the particular problem in hand. Some studies have tried to combine an understanding of farm characteristics with studies on perspectives and management issues as well as social norms, and describe certain types or styles of farmers as a typology (e.g. Busck, 2002; Eggers, 2015; Hammes *et al.*, 2016; Hyland *et al.*, 2016). For example Hammes *et al.*, (2016) focused on the development of farmer styles in relation to grassland farmers and their action and attitudes to nature conservation and agri-environment measure. They classified farmers into four groups: Traditionalist, Idealist, Modernist, and Yield Optimizer, which were defined by farm management practices, general attitudes towards agricultural issues, farming objectives and economic success. These farmer styles affected attitudes towards nature conservation and the reasons for not taking part in AES. Hammes *et al* (2016) argued that this concept of farmer styles or types can improve understanding and communication between governmental or environmental stakeholders and the farming community. This is because communication can be adapted and targeted to the varying requirements of different groups of farmers. Although these studies of farmer styles were few in this review, it may be a helpful modes for pulling together the influence of multiple factors in decision-making contexts, if taken with the understanding that there will always be exceptions to farmer categories and that farmers themselves may not agree with categorisations that they have not also been involved in creating.

The two least numerous categories in Figure 5.2 (in addition to advice and guidance) are political context and farmer characteristics. The latter may be due to the fact that farmer characteristics are often seen as a contextual factor in many of the more complex studies, and studies have identified no clear pattern of influence of such characteristics on behaviour (e.g. Burton *et al.*, 2014). Categories such as gender might have been less studied due to the typical imbalance of female farmers to male farmers in existence across Europe. However where female farmers may be more active, it may provide an opportunity to identify whether differences exist. This therefore could be

an interesting focus for future SUPER-G research. For example Yang *et al.*, (2018) identify that there are gendered aspects to perceptions of ES, which may have implications for better understanding the decision influence of different groups of stakeholders in environments such as PG.

Overall Figure 5.2 demonstrates that studies are mainly focused on economic aspects of farmer decision-making, but that other important aspects play a role, in particular that the policy environment and the options available to farmers can be a barrier to decision-making; that strong processes of decision facilitation can be an enabler; and that aspects such as social norms, including where perceptions, farm characteristics and management issues combine, can help to better understand the specific contexts in which different groups of farmers are making decisions. This in turn could facilitate an understanding of farmers' capacity to make better decisions in relation to the existing capital (social, physical, resource and human).

Bartkowski and Bartke (2018) identify the link between such factors and trigger points for action as they link the significance of effects achieved within particular decision contexts in relation to particular factors in the papers they review. In this review we have not been able to identify which factors produce the most significant results (because it is very difficult to identify the results that should be the focus). However this is something that should be taken into consideration in the next stage of research in order to answer questions around the probability and possibility of change in behaviour in the future. Although it was not a focus of the review, a number of studies have utilised an underlying concept or theory of behavioural change including the Theory of Planned Behaviour (Bijttebier *et al.*, 2018; Borremans *et al.*, 2016; Gorton *et al.*, 2003; Hyland *et al.*, 2016; Menozzi *et al.*, 2015; Shreoder *et al.*, 2015; Sutherland, 2011), which was the most often used, alongside diffusion of innovation theory, theory of reasoned action and others including Actor Network Theory (Busck, 2003). However, the relatively few studies that mention theories of behaviour change show that it has not been the focus to utilise an understanding of decision-making to produce or develop theories. It could be that there is opportunity to combine practical understanding with the wealth of theoretical explorations of decision-theory in other disciplines, to help facilitate a better understanding of decision-making in the specific context of grassland management.

Where While Figure 5.2 shows the categories that were most studied, it does not identify those that were less well studied, but that and yet could have potential for influencing the management of PG environments. For example consumer preferences in relation to product quality, although consumer preferences (in relation to product quality) were a feature of discussions around ES, they were not explicitly linked to decision-making in many studies (with the exception of studies that linked consumer demand to the development of organic farming, e.g. Grüneis *et al*, 2018). As discussed, this may be an area that can be explored further. Land ownership in relation to tenancy, land rights and community land were not frequently a focus. However the studies that did pick up on such issues showed that they were hugely influential. For example in a study of greenbelt areas in France, Alavoine-Mornas *et al.* (2018) showed that the tenant farmers of tenanted farms often had to comply with their landowners' preferences in relation to land management decisions, which were not always in line with their own judgement or preference. In addition there were also occasions when the need to impress a landowner influenced decisions in order that the farmers might present a 'good image' of their farming skills so that they may compete to win the right to rent land in the future. In relation to grassland in particular, in High Nature Value farms, Bernues *et al.* (2016), show that mismanagement of communal grasslands in Spain could lead to lack of maintenance of grazing infrastructures and thus force land management change. The length of the

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

leasehold was also seen to affect the decisions farmers make about AES and landscape change (e.g. Kristensen *et al*., 2004). Such concerns and effects may be underlying in all studies of decision-making but may not have been explored in depth. This may call for further exploration within the literature, as it was not a specific part of this review, and also in further study. It seems that land rights are significantly different in different parts of Europe and for different areas of grassland. This may be a significantly understudied factor for decision-making.

Equally, a potentially understudied area in relation to grassland is risk perception. Again it may have been the nature of the search that delivered few papers focused on risk, however it was a factor that appeared in relation to attitudes to landscapes (e.g. Hummel *et al*., 2017; Willock *et al*., 1999), and it is a well-known factor affecting decision-making in farming, particularly in relation to technology adoption. It is therefore worth noting that its absence as a large area of focus in relation to grassland, through this particular search of the literature, may suggest that more work is needed to understand risk perceptions and decision-making more generally though further empirical research relating to PG. Relatedly, few studies also focused on technology and the adoption of new technology. This may suggest a lack of focus on exploration of grassland related technology in a socio-economic context. There are many studies of farmer technology adoption that could be harnessed in relation to gaining a better understanding, but may be an area that needs further exploration in relation to PG.

In relation to attitudes to ES there are differences between different stakeholder groups: citizens and the public appear to be more concerned and engaged with issues around cultural ES and farmers more engaged with regulating and provisioning services. This is not surprising, however the review has revealed that there are nuances associated with these preferences and a link to broader attitudes to landscape and landscape change. The concept of aesthetic appeal of landscape was popular within the review and reveals the interest the academic community, at least, has with investigating differences in understandings of visual preference. Few studies focus on the experiential preference of stakeholder groups (perhaps as a function of the search criteria). This better understanding of attitudes can reveal the position of different stakeholder groups to landscape and give insight into their priorities for landscape management. There are often few links made, however between the presence of particular attitudes, and consequences for landscape change via decision-making (with some exceptions). It is therefore an implied link between these attitudes and the facilitators and barriers to adoption and choice. Presumably it is seen that the attitudes of the decision-makers themselves (farmers) are more influential than the attitudes of those groups who are not involved in decision-making (e.g. the public). However links could be further explored between the two.

In relation to the factors that affect farmer decision-making, they are shown in this review to be broad and varied. In relation to motivations and barriers, although Figure 5.2 demonstrates that there are biases in the way that some studies are discussing the factors (e.g. policy may be acting as a barrier more often than an enabler) clarity as to the balance of importance will only be found in specific contexts where a specific set of conditions and trade-offs are present. However, based on the tone of the studies in this review, it may be possible to suggest that motivations and enablers may arise when personal values and attitudes align within a relevant policy context through conditions (e.g. of an AES scheme) that match the biophysical features and context, and where the process is facilitated through open, communication with clear knowledge-sharing practices and focused support, where trade-offs are made clear the unnecessary complexity in the process has been reduced, and the necessary complexity clearly communicated. Such conditions

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

and contexts may offer the best route to decision-making for a farmer or land manager. However, the variety of contexts and conditions both geographically and socially across Europe mean that the enablers of (good) decision-making are likely to look very different in each country and context. Equally, the aims of the decision in relation to ES would look very different for different types of farmers and in different PG environments, perhaps dependent on attitudes to ES of different groups in the area, as well as the particular ES mix promoted by policy.

The results of this review, therefore, give a broad tool box of factors to use to discuss and explain decision-making for farmers and land managers. At this point it may only be able to roughly associate such factors with specific decisions about PG. This is because a relatively few number of studies explicitly focus on only PG management decisions, because they are seen as part of decision-making at the farm system and landscape scale. However, the wider scope of the factors means they are likely to be applicable to (and have sometimes been directly identified in) such a PG context. Further research within the SUPER-G project will help to identify a more specific decision context for PG, particularly in relation to the preference for ES delivery, and the relative importance of some of the factors.

Limitations

The systematic review process, on the whole, has been appropriate for answering questions around attitudes and decision-making. The study has been broad, which has meant that the results were numerous and the conclusions therefore also broad. In addition, because of the wide remit there may have been studies that have not been picked up that are relevant to understand specific factors in more detail. For example, we have identified that by not incorporating the key words "dehesa" and "montado" in the bibliographic search, perhaps some specific considerations on permanent grassland in the Mediterranean region could have been left out (e.g. Gaspar *et al.*, 2016; Pinto-Correia and Azeda, 2017; Surová *et al.*, 2018). However, the study as a whole has begun to identify the context in which PG is managed across Europe and is representative of the type and balance of studies that exist, and also helps in identifying where more targeted searching could reveal more in depth information and research. In focusing on papers written in English, the review has potentially excluded some studies from countries not often publishing in English, therefore can give only a restricted picture of factors across European countries.

The review was not able to reveal variations across geographies. This was because it was not easy to compare results from studies focusing on different aspects across different contexts. There were too few studies focusing on similar enough issues in different countries to be able to compare definitively. However, the review has represented all 5 biogeographic zones identified in the SUPER-G project. Countries missing in representation were those at the extremes of the continent, such as Latvia, and Portugal. This may be because the publications were not easily accessible in English.

Most of the expected populations and interest groups were included in the review, but what might be missing from the map of influential factors is a better understanding of the view and actions of consumers, and the influence of markets and supply chains (which was not a distinct enough target in search criteria for this review). However, some of this information has been found and reviewed by the corresponding Task 4.1b, systematic review of economic drivers of farmer adoption. What may still be missing is a link to the understanding of consumer attitudes as a driver for farmer decision-making. This will be further investigated in SUPER-G tasks 4.2 and 4.3 on citizen and farmer priorities and preferences for ES in relation to PG management.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

5.1. Implications for future research

Due to the nature of the review, a broad range of papers have emerged, and their reference to PG environments is not always present, but considered as part of the wider farming system. Even so, the review has revealed a framework of factors that might be important for adoption and choice of management options in relation to ES delivery. Further research, in particular in Task 4.2 (farmer priorities and preferences for ES in relation to PG), can endeavour to investigate the model further. It would be particularly interesting to try and judge the relative importance of particular influences on PG management in particular. Equally, task 4.3 (citizen priorities and preferences for ES in relation to PG) can follow up on the factors identified in this review relating to attitudes of citizens and the public in relation to ES. Further research should aim to identify the drivers of such views and the depths and breadth of preferences across the different groups of stakeholders. This is also where there may be potential to better understand the perspective of consumers in relation to PG products.

6. Conclusions

This task aimed to provide a review of facilitators and barriers to adoption and choice of PG management options to deliver specific ES. This was achieved through a systematic review of 136 peer-reviewed papers covering studies from 24 countries across Europe. It has revealed a complex picture of factors affecting decision-making against a backdrop of a variety of attitudes to grassland and to ES delivered from environments including grassland systems. The research sits within a wider task (4.1) in which two related reviews are published: 4.1b *Economic drivers of farmer adoption* and 4.1c *Review of existing policies and impacts*. The results of this review are contextualized by the results of the review of policy, where the complex patterns and logics of the policy mixes affecting PG management form the policy context and influence policy characteristics, including agri-environment schemes and financial considerations that are seen to affect decision-making. The review of economic drivers gives extras detail and further layers to the financial considerations seen to affect decision-making in this review. In consequence, the picture for better understanding the work that has already been conducted across Europe around exploring the factors affecting farmers when making land management decisions is rich. The results of the review will help to inform further research in the SUPER-*G* project by helping to understanding the management context and process. The tool box of factors revealed in the review, alongside the further research will help to identify the most sustainable modes of facilitating and designing sustainable PG systems and policies.

Key points:

- There is an opportunity to add to the literature on socio-economic factors affecting grassland management decision-making and attitudes to grassland, as there are currently few studies taking an explicit focus on PG.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

- Grasslands are perceived in relation to their benefits, including ES delivered by species-rich grassland, through managed and unmanaged environments, and the aesthetic value of grassland.
- Citizens, residents, the public and non-farming stakeholders show a preference for understanding and expressing the importance of cultural ES.
- Farmers express the importance of provisioning ES as well as regulating and supporting, more frequently than cultural services.
- Conflicts may arise between the differing priorities of stakeholder groups.
- Aesthetic value is a popular characteristic used to explore landscape attitudes.
- Stakeholder groups usually value aesthetics at the landscape scale and there are patterns of landscape elements that are assessed as pleasing, including linear elements and diversity.
- Farmers may hold different understandings of aesthetic value based on their experience an expectations of the function of agriculture and farmers in the landscape.
- It is likely that there is a complex interaction of factors affecting decision-making in each case and no set of factors can be identified as distinct enablers or barriers.
- Extrinsic factors such as biophysical factors, political context and social norms are likely to form the context of decision-making.
- Interim factors such as policy characteristics, agri-environment schemes, management issues, farm structure, advice and guidance bridge the scope between influence of context and influence of local, intrinsic factors. These factors provide a framework that provides specific conditions for decision-making.
- Intrinsic or more personal factors, such as perceptions and values and attitudes, drive decisions from an individual scale. Such factors are fluid and open to change through time and between scales and groups.
- Financial considerations sit between scales, merging personal ideals with contextual constraints and enablers.
- Processional factors such as collaboration, knowledge –sharing and participation affect the mode by which decisions are facilitated and also bridge the gap between conditions set by context and personal values and characteristics of decision-makers.
- This review offers a tool box of factors to discuss decision-making around PG management.
- Further research will be able to assess the relative importance of factors in specific grassland decision-making contexts and in relation to attitudes.
- Further research is also needed to address potential gaps in the understanding of factors and interconnections between factors (such as the influence of public attitudes on farmer decision-making).
- Further research will also explore the attitudes of citizens and consumers to ES in relation to PG.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

7. References

Abson, D.J.; Fischer, J.; Leventon, J.; Newig, J.; Schomerus, T.; Vilsmaier, U.; von Wehrden, H.; Abernethy, P.; Ives, C.D.; Jager, N.W.; *et al.* Leverage points for sustainability transformation. *Ambio* 2017, 46, 30–39.

Alavoine-Mornas, Françoise & Girard, Sabine. (2014). Green belts in the hands and minds of farmers: A socio-agronomic approach to farmers' practices. *Journal of Rural Studies.* 56. 10.1016/j.jrurstud.2017.09.005.

Allan, E., Manning, P., Alt, F., Binkenstein, J., Blaser, S., Blüthgen, N., Böhm, S., Grassein, F., Hölzel, N., Klaus Valentin, H., Kleinebecker, T., Morris, E.K., Oelmann, Y., Prati, D., Renner Swen, C., Rillig Matthias, C., Schaefer, M., Schloter, M., Schmitt, B., Schöning, I., Schrumpf, M., Solly, E., Sorkau, E., Steckel, J., Steffen-Dewenter, I., Stempfhuber, B., Tschapka, M., Weiner Christiane, N., Weisser Wolfgang, W., Werner, M., Westphal, C., Wilcke, W., Fischer, M., Knops, J., (2015) Land use intensification alters ecosystem multifunctionality via loss of biodiversity and changes to functional composition. *Ecol. Lett.* 18: 834–843.

Anadón, J.D., Giménez, A., Ballestar, R., Pérez, I., (2009) Evaluation of local ecological knowledge as a method for collecting extensive data on animal abundance. *Conserv. Biol.* 23, 617–625.

Andersson, Erik & Nykvist, Björn & Henriksson Malinga, Rebecka & Jaramillo, Fernando & Lindborg, Regina. (2015). A social-ecological analysis of ecosystem services in two different farming systems. *AMBIO A Journal of the Human Environment.* 44(Suppl. 1). S102-112. 10.1007/s13280-014-0603-y.

Arnberger, Arne & Eder, Renate & Allex, Brigitte & Hutter, Hans-Peter & Wallner, Peter & Bauer, Nicole & Zaller, Johann & Frank, Thomas. (2018). Perceived health benefits of managed and unmanaged meadows in a mountain biosphere reserve - An experimental study in the Austrian Alps. *eco. mont (Journal on Protected Mountain Areas Research).* 1. 5-14. 10.1553/eco.mont-10-1s5.

Arriaza M., J.F. Canas-Ortega, J.A. Canas-Madueno, P. Ruiz-Aviles (2004) Assessing the visual quality of rural landscapes. *Landscape and Urban Planning*, 69 (1): 115-125.

Aslam, Uzma & Termansen, M. & Fleskens, Luuk. (2017). Investigating farmers' preferences for alternative PES schemes for carbon sequestration in UK agroecosystems. *Ecosystem Services*. 27. 103-112. 10.1016/j.ecoser.2017.08.004.

Austin, Zoe & Penic, Maja & Raffaelli, David & White, Piran. (2015). Stakeholder perceptions of the effectiveness and efficiency of agri-environment schemes in enhancing pollinators on farmland. *Land Use Policy*. 47. 10.1016/j.landusepol.2015.04.003.

Baldocchi, D., Chu, H., Reichstein, M., (2017). Inter-annual Variability of Net and Gross Ecosystem Carbon Fluxes: A Review. Agricultural and Forest Meteorology. *Agricultural and Forest Meteorology*, 249: 520-533

Barrera-Bassols, N., Zinck, J.A., (2003). Ethnopedology: a worldwide view on the soil knowledge of local people. *Geoderma* 111, 171–195.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Baur, I., Dobricki, M., Lips, M., (2015). The basic motivational drivers of northern and central European farmers. *J. Rural Stud.* 46, 93–101.

Becker, Talea & Kayser, Manfred & Tonn, Bettina & Isselstein, Johannes. (2018). How German dairy farmers perceive advantages and disadvantages of grazing and how it relates to their milk production systems. *Livestock Science*. 214. 10.1016/j.livsci.2018.05.018.

Bernués A, Rodríguez-Ortega T, Ripoll-Bosch R, Alfnes F (2014) Socio-Cultural and Economic Valuation of Ecosystem Services Provided by Mediterranean Mountain Agroecosystems. *PLoS ONE* 9(7): e102479. https://doi.org/10.1371/journal.pone.0102479

Bernués, Alberto; Tamara Rodríguez-Ortega, Frode Alfnes, Morten Clemetsen, Lars Olav Eik, (2015) Quantifying the multifunctionality of fjord and mountain agriculture by means of sociocultural and economic valuation of ecosystem services. *Land Use Policy,* 48: 170-178.

Bernués, Alberto; Elena Tello-García, Tamara Rodríguez-Ortega, Raimon Ripoll-Bosch, Isabel Casasús (2016) Agricultural practices, ecosystem services and sustainability in High Nature Value farmland: Unraveling the perceptions of farmers and non-farmers, *Land Use Policy*, 59: 130-142. `

Bennett, E. M., G. D. Peterson, and L. J. Gordon. 2009. Understanding relationships among multiple ecosystem services. *Ecology Letters* 12(12):1394-1404. http://dx.doi.org/10.1111/j.1461-0248.2009.01387.x

Bijttebier, jo & Ruysschaert, G. & Hijbeek, Renske & Werner, M. & Pronk, A.A. & Zavattaro, Laura & Bechini, Luca & Grignani, Carlo & Berge, H. & Marchand, Fleur & Wauters, Erwin. (2018). Adoption of non-inversion tillage across Europe: Use of a behavioural approach in understanding decision making of farmers. *Land Use Policy*. 78. 460-471. 10.1016/j.landusepol.2018.05.044.

Blackwell, Bradley F.; Seamans, Thomas W.; Schmidt, Paige M.; Devault, Travis L.; Belant, Jerrold L.; Whittingham, Mark J.; Martin, James A.; and Fernández-Juricic, Esteban, (2013). "A framework for managing airport grasslands and birds amidst conflicting priorities" *USDA National Wildlife Research Center - Staff Publications*. 1105.

Borremans, Lieve; Bert Reubens, Bert Van Gils, Dorien Baeyens, Céline Vandevelde & Erwin Wauters (2016). A sociopsychological analysis of agroforestry adoption in Flanders: understanding the discrepancy between conceptual opportunities and actual implementation, *Agroecology and Sustainable Food Systems*, 40:9,

Brotherton (1990). Initial participation in UK set-aside and ESA schemes, *Planning Outlook*, 33:1, 46-61

Buizer, M., Arts, B., Kok, K., (2011). Governance, scale, and the environment: the importance of recognizing knowledge claims in transdisciplinary arenas. *Ecol. Soc.* 16 (1), 21. (online:). http://www.ecologyandsociety.org/vol16/iss1/art21/.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Burbi, Sara; R.N. Baines & J. S. Conway (2016) Achieving successful farmer engagement on greenhouse gas emission mitigation, *International Journal of Agricultural Sustainability*, 14:4, 466-483

Burton, R.J.F. (2014). The influence of farmer demographic characteristics on environmental behaviour: A review. *J. Environ. Manag*. 135, 19–26.

Busck, Anne. (2002). Farmers' Landscape Decisions: Relationships between Farmers' Values and Landscape Practices. *Sociologia Ruralis*. 42. 233 - 249. 10.1111/1467-9523.00213.

Busck, Anne. (2003). Hedgerow planting analysed as a social system - Interaction between farmers and other actors in Denmark. *Journal of environmental management.* 68. 161-71. 10.1016/S0301-4797(03)00064-1.

CASP (Critical Appraisal Skills Programme) (2018) Checklists. https://casp-uk.net/casp-tools-checklists/ [accessed August 2019]

Cebrián-Piqueras, M.A., L. Karrasch, M. Kleyer (2017) Coupling stakeholder assessments of ecosystem services with biophysical ecosystem properties reveals importance of social contexts, *Ecosystem Services*, 23:108-115.

Ciliberti, Stefano & Frascarelli, Angelo. (2016). A critical assessment of the implementation of CAP 2014- 2020 direct payments in Italy. *Bio-based and Applied Economics.* 4. 261-277. 10.13128/BAE-16377.

Clec'h, L., Finger, R., Buchmann, N., Gosal, A., Hörtnagl, L., Huguenin-Elie, O., Jeanneret, P., Lüscher, A., Schneider, M.K., Huber, R. (2019). Assessment of spatial variability of multiple ecosystem services in grasslands of different intensities. *Journal of Environmental Management* 251, 109372.

Coffey, A. and P. Atkinson (1996*) Making sense of qualitative data: Complementary research strategies*. Thousand Oaks, California: Sage.

Cook, D. J., Mulrow, C. D., & Haynes, R. B. (1997). Systematic reviews: synthesis of best evidence for clinical decisions. *Annals of internal medicine*, *126*(5), 376-380.

Cowling, R.M., Egoh, B., Knight, A.T., O'Farrell, P.J., Reyers, B., Rouget, M., Roux, D.J., Welz, A., Wilhelm-Rechman, A., 2008. An operational model for mainstreaming ecosystem services for implementation. *Proc. Natl. Acad. Sci. USA* 105, 9483–9488.

Darnhofer, Ika & Schermer, Markus & Steinbacher, Melanie & Gabillet, Marine & Daugstad, Karoline. (2017). Preserving permanent mountain grasslands in Western Europe: Why are promising approaches not implemented more widely? *Land Use Policy.* 68. 306-315. 10.1016/j.landusepol.2017.08.005.

Defrancesco Edi, Paola Gatto, Ford Runge, Samuele Trestini (2008) Factors Affecting Farmers' Participation in Agri-environmental Measures: A Northern Italian Perspective. *Journal of Agricultural Economics*, 59 (1), 2008, 114–131

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Desbiez, A., Matthews, R., Tripathi, B., Ellis-Jones, J., (2004). Perceptions and assessment of soil fertility by farmers in the mid-hills of Nepal. Agric. *Ecosyst. Environ.* 103, 191–206.

Dietze, Victoria; Nina Hagemann, Nataly Jürges, Stephan Bartke, Christine Fürst (2019). Farmers' consideration of soil ecosystem services in agricultural management - A case study from Saxony, Germany. *Land Use Policy*, 81: 813-824.

Ducros Caroline & Nigel M. Watson (2002) Integrated Land and Water Management in the United Kingdom: Narrowing the Implementation Gap, *Journal of Environmental Planning and Management*, 45:3, 403-423

Dumont, Bertrand & Ryschawy, Julie & Duru, Michel & Benoit, Marc & Chatellier, Vincent & Delaby, Luc & Donnars, Catherine & Dupraz, Pierre & Lemauviel-Lavenant, S. & Méda, Bertrand & Vollet, Dominique & Sabatier, Rodolphe. (2019). Review: Associations among goods, impacts and ecosystem services provided by livestock farming. *Animal.* 13. 1773-1784. 10.1017/S1751731118002586.

Dumont, B., Dupraz, P., Aubin, J., *et al.*, 2016. Review: Associations among goods, impacts and ecosystem services provided by livestock farming. INRA (France), pp. 1032.

Duru, Michel & Felten, Benoît & Theau, Jean & Martin, Guillaume. (2012). A modelling and participatory approach for enhancing learning about adaptation of grassland-based livestock systems to climate change. *Regional Environmental Change.* 12. 739-750. 10.1007/s10113-012-0288-3.

Eigenbrod, F., Armsworth, P.R., Anderson, B.J., Heinemeyer, A., Gillings, S., Roy, D.B., Thomas, C.D., Gaston, K.J., (2010). The impact of proxy-based methods on mapping the distribution of ecosystem services. *J. Appl. Ecol.* 47, 377–385.

Eggers, Markus & Kayser, Manfred & Isselstein, Johannes. (2014). Grassland farmers' attitudes toward climate change in the North German Plain. *Regional Environmental Change*. 15. 607-617. 10.1007/s10113-014-0672-2.

Faccioni, G.; E. Sturaro, M. Ramanzin, A. Bernués, (2019) Socio-economic valuation of abandonment and intensification of Alpine agroecosystems and associated ecosystem services, *Land Use Policy,* 81: 453-462.

Fagerholm, N., Käyhkö, N., Ndumbaro, F., Khamis, M., (2012). Community stakeholders' knowledge in landscape assessments – mapping indicators for landscape services. *Ecol. Indic.* 18, 421–433.

Fang, J., Guo, Z., Piao, S., Chen, A., (2007). Terrestrial vegetation carbon sinks in China, 1981–2000. Sci. China Ser. *D: Earth Sci.* 50, 1341–1350.

Feliciano, Diana; Colin Hunter, Bill Slee, Pete Smith, (2014) Climate change mitigation options in the rural land use sector: Stakeholders' perspectives on barriers, enablers and the role of policy in North East Scotland, *Environmental Science & Policy*, 44: 26-38,

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Fischer, A., Young, J.C., 2007. Understanding mental constructs of biodiversity: implications for biodiversity management and conservation. Biol. Conserv. 136, 271–282.

Fish, Rob & Seymour, Susanne & Watkins, Charles. (2003). Conserving English landscapes: Land managers and agri-environmental policy. Environment and Planning A. 35. 19-41. 10.1068/a3531.

Flick, U. (1998). An Introduction to Qualitative Research. London: Sage

Franzén, Frida & Dinnetz, Patrik & Hammer, Monica. (2016). Factors affecting farmers' willingness to participate in eutrophication mitigation — A case study of preferences for wetland creation in Sweden. *Ecological Economics*. 130. 8-15. 10.1016/j.ecolecon.2016.05.019.

García-Llorente, M., Martín-López, B., Iniesta-Arandia, I., López-Santiago, C.A., Aguilera, P.A., Montes, C., (2012). The role of multi-functionality in social preferences toward semi-arid rural landscapes: an ecosystem service approach. *Environ. Sci. Policy* 19 (20), 136–146.

García-Nieto, Ana & Quintas-Soriano, Cristina & Garcia Llorente, Marina & Palomo, Ignacio & Martín-López, Berta. (2015). Collaborative mapping of ecosystem services: The role of stakeholders' profiles. *Ecosystem Services*. 13. 141-152. 10.1016/j.ecoser.2014.11.006.

Garrido, Pablo & Elbakidze, Marine & Angelstam, Per. (2017). Stakeholders' perceptions on ecosystem services in Östergötland's (Sweden) threatened oak wood-pasture landscapes. *Landscape and Urban Planning*. 158. 96-104. 10.1016/j.landurbplan.2016.08.018.

Gaspar, P., Escribano, M., and Mesias, F.J. (2016). A qualitative approach to study social perceptions and public policies in dehesa agroforestry systems (2016). *Land Use Policy*, 58, 427-436.

Greenhalgh, T., Robert, G., McFarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: systematic review and recommendations. *The Milbank Quarterly*, 82(4), 581e630.

Greenhalgh, T., Robert, G., McFarlane, F., Bate, P., & Kyriakidou, O. (2005). *Diffusion of innovations in service organizations: A systematic review*. Massachusetts: Blackwell Publishing.

Grüneis, Heidelinde & Penker, Marianne & Höferl, Karl-Michael & Schermer, Markus & Scherhaufer, Patrick. (2018). Why do we not pick the low-hanging fruit? Governing adaptation to climate change and resilience in Tyrolean mountain agriculture. *Land Use Policy*. 79. 386-396. 10.1016/j.landusepol.2018.08.025.

Godin, K., Stapleton, J., Kirkpatrick, S. I., Hanning, R. M., & Leatherdale, S. T. (2015). Applying systematic review search methods to the grey literature: a case study examining guidelines for school-based breakfast programs in Canada. *Systematic reviews*, *4*, 138. doi: 10.1186/s13643-015-0125-0

Gorton, Matthew & Douarin, Elodie & Davidova, Sophia & Latruffe, Laure. (2008). Attitudes to agricultural policy and farming futures in the context of the 2003 CAP reform: A comparison of

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

farmers in selected established and new Member States. *Journal of Rural Studies*. 24. 322-336. 10.1016/j.jrurstud.2007.10.001.

Gullino, Paola & Battisti, Luca & Larcher, Federica. (2018). Linking Multifunctionality and Sustainability for Valuing Peri-Urban Farming: A Case Study in the Turin Metropolitan Area (Italy). *Sustainability*. 10. 10.3390/su10051625.

Häfner, Kati; Ingo Zasada, Boris T. van Zanten, Fabrizio Ungaro, Mark Koetse & Annette Piorr (2018) Assessing landscape preferences: a visual choice experiment in the agricultural region of Märkische Schweiz, Germany, *Landscape Research*, 43:6, 846-861,

Hammes, Verena & Eggers, Markus & Isselstein, Johannes & Kayser, Manfred. (2016). The attitude of grassland farmers towards nature conservation and agri-environment measures. A survey-based analysis. *Land Use Policy*. 59. 10.1016/j.landusepol.2016.09.023.

Harrison, P.A., Vandewalle, M., Sykes, M.T., Berry, P.M., Bugter, R., de Bello, F., Feld, C.K., Grandin, U., Harrington, R., Haslett, J.R., Jongman, R.H.G., Luck, G.W., da Silva, P.M., Moora, M., Settele, J., Sousa, J.P., Zobel, M., 2010. Identifying and prioritising services in European terrestrial and freshwater ecosystems. *Biodivers. Conserv.* 19, 2791–2821.

Harzing, A. W., & Alakangas, S. (2016). Google Scholar, Scopus and the Web of Science: a longitudinal and cross-disciplinary comparison. *Scientometrics*, *106*(2), 787-804.

Hein, Lars & Van Koppen, Christianus & Groot, Rudolf & van Ierland, Ekko. (2006). Spatial Scales, Stakeholders and the Valuation of Ecosystem Services. *Ecological Economics*. 57. 209-228. 10.1016/j.ecolecon.2005.04.005.

Hejnowicz, Adam & Rudd, Murray & White, Piran. (2016). A survey exploring private farm advisor perspectives of agri-environment schemes: The case of England's Environmental Stewardship programme. *Land Use Policy*. 55. 240-256. 10.1016/j.landusepol.2016.04.005.

Herzele, Ann & Gobin, Anne & Van Gossum, Peter & Acosta, Lilibeth & Waas, Tom & Dendoncker, N. & Frahan, Bruno. (2013). Effort for money? Farmers' rationale for participation in agri-environment measures with different implementation complexity. *Journal of environmental management*. 131C. 110-120. 10.1016/j.jenvman.2013.09.030.

Hinojosa, Leonith; Eric F. Lambin, Naoufel Mzoughi, Claude Napoléone, (2018) Constraints to farming in the Mediterranean Alps: Reconciling environmental and agricultural policies, *Land Use Policy*, 75: 726-733.

Hinojosa, L., Lambin, E.F., Mzoughi, N., Napoléone, C., (2016). Place attachment as a factor of mountain farming permanence: a survey in the French Southern Alps. *Ecol. Econ.* 130, 308–315

Howley, Peter. (2011). Landscape aesthetics: Assessing the general publics' preferences towards rural landscapes. Ecological Economics - ECOL ECON. 72. 10.1016/j.ecolecon.2011.09.026.
Howley, Peter; Cathal O. Donoghue, Stephen Hynes, (2012) Exploring public preferences for traditional farming landscapes, *Landscape and Urban Planning*,104 (1): 66-74,

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Hummel C, Provenzale A, van der Meer J, Wijnhoven S, Nolte A, Poursanidis D, *et al*. (2017) Ecosystem services in European protected areas: Ambiguity in the views of scientists and managers? *PLoS ONE* 12(11):

Hyland, John & Heanue, Kevin & McKillop, Jessica & Micha, Evgenia. (2018). Factors influencing dairy farmers' adoption of best management grazing practices. *Land Use Policy*. 78. 562-571. 10.1016/j.landusepol.2018.07.006.

Hyland, John & Jones, Davey & Parkhill, Karen & Barnes, Andrew & Williams, A. Prysor. (2016). Farmers' perceptions of climate change: identifying types. *Agriculture and Human Values*. 33. 10.1007/s10460-015-9608-9.

Jeanneret, P., Huguenin-Elie, O., Baumgartner, D., Freiermuth Knuchel, R., Gaillard, G., Nemecek, T., Weibel, P., 2007. Analysis of spatial and temporal variations of High Nature Value farmland and links with changes in bird populations: a study on France. *Grassland Science in Europe* 12, 382–385.

Junge, Xenia & Schüpbach, B. & Walter, Thomas & Schmid, Bernhard & Lindemann-Matthies, Petra. (2015). Aesthetic quality of agricultural landscape elements in different seasonal stages in Switzerland. *Landscape and Urban Planning*. 133. 67-77. 10.1016/j.landurbplan.2014.09.010.

Junge, Xenia & Lindemann-Matthies, Petra & Hunziker, Marcel & Schüpbach, B. (2011). Aesthetic preferences of non-farmers and farmers for different land-use types and proportions of ecological compensation areas in the Swiss lowlands. *Biological Conservation*. 144. 1430-1440. 10.1016/j.biocon.2011.01.012.

Kaler J, Green LE. (2013) Sheep farmer opinions on the current and future role of veterinarians in flock health management on sheep farms: A qualitative study. *Prev Vet Med*. 112(3-4):370-7.

Kanter DR, Musumba M, Wood SLR, Palm C, Antle J, Balvanera P, Dale VH, Havlik P, Kline KL, Scholes RJ, Thornton P, Tittonell P, Andelman S. (2017). Evaluating agricultural trade-offs in the age of sustainable development. *Agricultural Systems*.

Klopčič M. and Kuipers A. (2015) Dairy farming systems and development paths in Slovenia, *Grassland Science in Europe*, Vol. 20

Kohler, F., Thierry, C. & Marchand, G. Multifunctional Agriculture and Farmers' Attitudes: Two Case Studies in Rural France. *Hum Ecol* (2014) 42: 929.

Konkoly-Gyuró, Éva. (2018). Conceptualisation and perception of the landscape and its changes in a transboundary area. A case study of the Southern German-French borderland. *Land Use Policy*. 79 (2018). 556-574. 10.1016/j.landusepol.2018.08.019.

Korevaar, H., Sacco, D., Ravetto Enri, S., Lombardi, G., Ten Berge, H., Bufe, C., Whittingham, M., Smith, P., Vanwalleghem, T., Lellei-Kovacs, E., Stypinski, P., Hejduk, S., Tonn, B. and Newell Price, P. (2019). Characterising permanent grassland-based farming systems in Europe. *Grassland Science in Europe* 24, 164-166.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Koschke, L., Fuerst, C., Frank, S., Makeschin, F., 2012. A multi-criteria approach for an integrated land-cover-based assessment of ecosystem services provision to support landscape planning. *Ecol. Indic.* 21, 54–66.

Kovács, Eszter; Eszter Kelemen, Ágnes Kalóczkai, Katalin Margóczi, György Pataki, Judit Gébert, György Málovics, Bálint Balázs, Ágnes Roboz, Eszter Krasznai Kovács, Barbara Mihók, (2015) Understanding the links between ecosystem service trade-offs and conflicts in protected areas, *Ecosystem Services*,12: 117-127.

Kristensen, Soren & Thenail, Claudine & Kristensen, Lone. (2001). Farmers' involvement in landscape activities: An analysis of the relationship between farm location, farm characteristics and landscape changes in two study areas in Jutland, Denmark. *Journal of environmental management*. 61. 301-18. 10.1006/jema.2000.0409.

Kristensen, Lone & Thenail, Claudine & Kristensen, Soren. (2004). Landscape changes in agrarian landscapes in the 1990s: The interaction between farmers and the farmed landscape. A case study from Jutland, Denmark. *Journal of environmental management*. 71. 231-44. 10.1016/j.jenvman.2004.03.003.

Lamarque P, Tappeiner U, Turner C, Steinbacher M, Bardgett RD, Szukics U, Schermer M, Lavorel S (2011) Stakeholder perceptions of grassland ecosystem services in relation to knowledge on soil fertility and biodiversity. *Reg Environ Change* 11(4):791–804

Lamarque P, Meyfroidt P, Nettier B, Lavorel S (2014) How Ecosystem Services Knowledge and Values Influence Farmers' Decision-Making. *PLoS ONE* 9(9).

Larcher F.; S. Novelli; P. Gullino; M. Devecchi. (2013) Planning rural landscapes: a participatory approach to analyse future scenarios in Monferrato Astigiano, Piedmont, Italy. *Landscape Research*. 38(6): 707-728

Lastra-Bravo, X.B.; Hubbard, C.; Garrod, G.; Tolón-Becerra, A. What drives farmers' participation in EU agri-environmental schemes? Results from a qualitative meta-analysis. *Environ. Sci. Policy* 2015, 54, 1–9

Leeuwis, C., Pyburn, R., Röling, N., 2002. Wheelbarrows Full of Frogs: Social Learning in Rural Resource Management: International Research and Reflections. *Koninklijke Van Gorcum.*

Leroy G, Hoffmann I, From T, Hiemstra SJ, Gandini G. (2018) Perception of livestock ecosystem services in grazing areas. *Animal,* 2(12): 2627–2638.

Leventon, Julia & Schaal, Tamara & Velten, Sarah & Dänhardt, Juliana & Fischer, Joern & Abson, David & Newig, Jens. (2017). Collaboration or fragmentation? Biodiversity management through the common agricultural policy. *Land Use Policy.* 64. 1-12. 10.1016/j.landusepol.2017.02.009.

Lewan L, Soderqvist T (2002) Knowledge and recognition of ecosystem services among the general public in a drainage basin in Scania, Southern Sweden. *Ecol Econ* 42:459–467

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Lindemann-Matthies, Petra; Xenia Junge, Diethart Matthies, (2010). The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation, *Biological Conservation* 143: 195–202

Lončarić, Ružica, Zdenko Lončarić, Zrinka Tolušić (2016) What Croatian farmers think about situation in agriculture? *European Scientific Journal* August 2016 /SPECIAL/ edition ISSN: 1857 – 7881

López-Santiago, C. A., E. Oteros-Rozas, B. Martín-López, T. Plieninger, E. González Martín, and J. A. González. 2014. Using visual stimuli to explore the social perceptions of ecosystem services in cultural landscapes: the case of transhumance in Mediterranean Spain. *Ecology and Society* 19(2): 27.

Lupp, Gerd; Olaf Bastian, Reimund Steinhäußer, Ralf-Uwe Syrbe (2014) Perceptions of energy crop production by lay people and farmers using the ecosystem services approach, *Moravian Geographical Reports*, 22 (2).

Mante, Juliane & Gerowitt, Baerbel. (2007). A survey of on-farm acceptance of low-input measures in intensive agriculture. *Agronomy for Sustainable Development.* 27. 399-406. 10.1051/agro: 2007038.

Marcel Hunziker, Patricia Felber, Katrin Gehring, Matthias Buchecker, Nicole Bauer, Felix Kienast (2008) Evaluation of Landscape Change by Different Social Groups. *Mountain Research and Development,* 28(2): 140-147.

Martin, Guillaume & Felten, B. & Duru, Michel. (2011). Forage rummy: A game to support the participatory design of adapted livestock systems. *Environmental Modelling and Software* - ENVSOFT. 26. 1442-1453. 10.1016/j.envsoft.2011.08.013.

Martín-López, B., E. Gómez-Baggethun, P.L. Lomas, C. Montes (2009) Effects of spatial and temporal scales on cultural services valuation. *Journal of Environmental Management*, 90 (2):1050-1059.

Martín-López, B., Iniesta-Arandia, I., García-Llorente, M., Palomo, I., Casado-Arzuaga, I., Del Amo, D.G., Gómez-Baggethun, E., Oteros-Rozas, E., Palacios-Agundez, I., Willaarts, B., (2012). Uncovering ecosystem service bundles through social preferences. *PloS One* 7, e38970.

Meadows, D.H. Leverage Points: Places to Intervene in a System; The Sustainability Institute: Hartland, VT, USA, 1999

Menozzi, Davide & Fioravanzi, Martina & Donati, Michele. (2014). Farmer's motivation to adopt sustainable agricultural practices. *Bio-based and Applied Economics.* 4. 125-147. 10.13128/BAE-14776.

McLoughlin, C., Thoms, M., (2015). Integrative learning for practicing adaptive resource management. *Ecol. Soc.* 20 (1). http://dx.doi.org/10.5751/es-07303-200134. Art. 34 (online)

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Moher D, Liberati A, Tetzlaff J, Altman DG, The Prisma Group (2009) Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. *PLoS Med* 6:e1000097. doi:10.1371/journal.pmed.1000097

Nettier, Baptiste; Laurent Dobremez, Jean-Luc Coussy and Thomas Romagny (2011) Attitudes of livestock farmers and sensitivity of livestock farming systems to drought conditions in the French Alps », *Revue de Géographie Alpine | Journal of Alpine* Research [Online], 98-4.

Nguyen-the, C., Bardin, M., Berard, A., Berge, O., Brillard, J., Broussolle, V., Carlin, F., Renault, P., Tchamitchian, M., Morris, C.E., 2016. Agrifood systems and the microbial safety of fresh produce: trade-offs in the wake of increased sustainability. *Sci. Total Environ.* 562, 751–759.

Oliver, David & Fish, Rob & Winter, Michael & Hodgson, Chris & Heathwaite, Ann & Chadwick, Dave. (2012). Valuing local knowledge as a source of expert data: Farmer engagement and the design of decision support systems. *Environmental Modelling & Software*. 36. 76-85. 10.1016/j.envsoft.2011.09.013.

Opitz, Ina; Felix Zoll, Ingo Zasada, Alexandra Doernberg, Rosemarie Siebert, Annette Piorr, Consumer-producer interactions in community-supported agriculture and their relevance for economic stability of the farm – An empirical study using an Analytic Hierarchy Process*, Journal of Rural Studies*, 68: 22-32.

Orenstein, D.E., Groner, E., 2014. In the eye of the stakeholder: changes in perceptions of ecosystem services across an international border. Ecosyst. Serv. 8, 185–196.

Oteros-Rozas, Elisa & Martín-López, Berta & Fagerholm, Nora & Bieling, Claudia & Plieninger, Tobias. (2017). Using social media photos to explore the relation between cultural ecosystem services and landscape features across five European sites. *Ecological Indicators*. 10.1016/j.ecolind.2017.02.009.

Pahl-Wostl, C., 2009. A conceptual framework for analyzing adaptive capacity and multilevel learning processes in resource governance regimes. *Global Environ. Change* 19, 354–365.

Pătru-Stupariu, Ileana; Constantina Alina Tudor, Mihai Sorin Stupariu, Alexandre Buttler, Alexander Peringer (2015). Landscape persistence and stakeholder perspectives: The case of Romania's Carpathians. *Applied Geography*. 69.

Pavlis, Evangelos & Terkenli, Theano & Kristensen, Soren & Busck, Anne & Georgia, Cosor. (2016). Patterns of agri-environmental scheme participation in Europe: Indicative trends from selected case studies. *Land Use Policy*. 57. 800-812. 10.1016/j.landusepol.2015.09.024.

Peltonen-Sainio, Pirjo & Jauhiainen, Lauri & Sorvali, Jaana & Laurila, Heikki & Rajala, Ari. (2018). Field characteristics driving farm-scale decision-making on land allocation to primary crops in high latitude conditions. *Land Use Policy*. 71. 49-59. 10.1016/j.landusepol.2017.11.040.

Petticrew and H. Roberts. (2006) *Systematic Reviews in the Social Sciences: A Practical Guide*. Oxford: Blackwell.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Pietrzyk-Kaszyńska, Agata; Cent, Joanna; Grodzińska-Jurczak Małgorzata; Szymańska Magdalena. (2012). Factors influencing perception of protected areas-The case of Natura 2000 in Polish Carpathian communities. *Journal for Nature Conservation*. 20. 284-292. 10.1016/j.jnc.2012.05.005.

Pilgrim, S., Smith, D.J., Pretty, J., (2007). A cross-regional assessment of the factors affecting ecoliteracy: implications for policy and practice. *Ecol. Appl.* 17, 1742–1751.

Pilgrim, S., Cullen, L., Smith, D.J., Pretty, J., (2008). Ecological knowledge is lost in wealthier communities and countries. *Environ. Sci. Technol.* 42, 1004–1009.

Pinto-Correia, T. and Azeda, C. (2017). Public policies creating tensions in Montado management models: Insights from farmers' representations. Land Use Policy, 64, 76-82.

Plieninger T., J. Modolell y Mainou, W. Konold,(2004) Land manager attitudes toward management, regeneration, and conservation of Spanish holm oak savannas (dehesas), *Landscape and Urban Planning*, 66(3): 185-198.

Plieninger, Tobias; Sebastian Dijksb, Elisa Oteros-Rozasc, Claudia Bielingd (2013a) Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land Use Policy* 33: 118–129.

Plieninger, T., C. Bieling, B. Ohnesorge, H. Schaich, C. Schleyer, and F. Wolff. (2013b). Exploring futures of ecosystem services in cultural landscapes through participatory scenario development in the Swabian Alb, Germany. *Ecology and Society* 18(3): 39

Power, Eileen & Kelly, Daniel & Stout, Jane. (2013). Impacts of organic and conventional dairy farmer attitude, behaviour and knowledge on farm biodiversity in Ireland. *Journal for Nature Conservation.* 21. 272–278. 10.1016/j.jnc.2013.02.002.

Prager, Katrin & Freese, Jan. (2009). Stakeholder involvement in agri-environmental policy making - Learning from a local- and a state-level approach in Germany. *Journal of environmental management.* 90. 1154-67. 10.1016/j.jenvman.2008.05.005.

Primdahl J. (1999), "Agricultural landscapes as places of production and for living in owner's versus producer's decision-making and the implications for planning", *Landscape and urban Planning, 46,* 1-3, pp. 143-150.

Pröbstl-Haider, Ulrike & Mostegl, Nina & Kelemen-Finan, Julia & Haider, Wolfgang & Formayer, Herbert & Kantelhardt, Jochen & Moser, Tobias & Kapfer, Martin & Trenholm, Ryan. (2016). Farmers' Preferences for Future Agricultural Land Use Under the Consideration of Climate Change. *Environmental Management*. 58. 10.1007/s00267-016-0720-4.

Pölling, Bernd & Mergenthaler, Marcus. (2017). The Location Matters: Determinants for "Deepening" and "Broadening" Diversification Strategies in Ruhr Metropolis' Urban Farming. Sustainability (Switzerland). 9. 10.3390/su9071168.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Quétier, Fabien & Rivoal, Florian & Marty, Pascal & Chazal, Jacqueline & Thuiller, Wilfried & Lavorel, Sandra. (2010). Social representations of an alpine grassland landscape and socio-political discourses on rural development. *Regional Environmental Change*. 10. 119-130. 10.1007/s10113-009-0099-3.

Sargant, J. M., Rajic, A., Read, S., & Ohlsson, A. (2006). The process of systematic review and its application in agri-food public-health. *Preventive Veterinary Medicine*, 75, 141e151.

Sattler, Claudia Uwe Jens Nagel (2010) Factors affecting farmers' acceptance of conservation measure. A case study from north-eastern Germany, *Land Use Policy,* 27(1): 70-77.

Schermer M, Darnhofer I, Daugstad K, Gabillet M, Lavorel S, Steinbacher M (2016) Institutional impacts on the resilience of mountain grasslands: an analysis based on three European case studies. *Land Use Policy*. 52:382–391

Schirpke, Uta, Florian Timmermann, Ulrike Tappeiner, Erich Tasser, (2016) Cultural ecosystem services of mountain regions: Modelling the aesthetic value, *Ecological Indicators*, 69: 78-90.

Schroeder, L.A. & Chaplin, Stephen & Isselstein, Johannes. (2015). What influences farmers 'acceptance of agri-environment schemes? An ex-post application of the Theory of Planned Behaviour'. 65. 15-28. 10.3220/LBF1440149868000.

Schulz, Norbert & Breustedt, Gunnar & Latacz-Lohmann, Uwe. (2014). Assessing Farmers' Willingness to Accept "Greening": Insights from a Discrete Choice Experiment in Germany. *Journal of Agricultural Economics*. 65. 10.1111/1477-9552.12044.

Seppelt, R., Dormann, C.F., Eppink, F.V., Lautenbach, S., Schmidt, S., 2011. A quantitative review of ecosystem service studies: approaches, shortcomings and the road ahead. *Journal of Applied Ecology* 48, 630–636

Siebert, R.; Toogood, M.; Knierim, A. (2006) Factors Affecting European Farmers' Participation in Biodiversity Policies. *Sociol. Rural.* 46, 318–340.

Šorgo, A. Špur, N. Škornik S (2016) Public attitudes and opinions as dimensions of efficient management with extensive meadows in Natura 2000 area. J. *Environ. Manage*, 183 (2016): 637-646,

Soy Massoni Emma; Varga, Diego; Saez, Marc; Pintó, Josep. (2016). Exploring Aesthetic Preferences in Rural Landscapes and the Relationship with Spatial Pattern Indices. *Journal of Landscape Ecology*. 9. 10.1515/jlecol-2016-0001.

Špur, Natalija & Sorgo, Andrej & Skornik, Sonja. (2018). Predictive model for meadow owners' participation in agri-environmental climate schemes in Natura 2000 areas. *Land Use Policy*. 73. 115-124. 10.1016/j.landusepol.2018.01.014.

Strauss, A. L. (1987) *Qualitative analysis for social scientists*. Cambridge University Press.

Streck, C., Campbell, B., Mann, W., Melendez-Ortiz, R., Tennigkeit, T. 2011. Agriculture and Climate Scoping Report. Available from: https://www.climate-agriculture.org/en/Scoping_Report.aspx

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Surová, D., Ravera, F., Guiomar, N., Martínez-Sastre, R. and Pinto-Correia, T. (2018). Contributions of Iberian Silvo-Pastoral Landscapes to the Well-Being of Contemporary Society. Rangeland, *Ecology & Management*, 71(5), 560-57.

Sutherland, Lee-Ann. (2011). "Effectively organic": Environmental gains on conventional farms through the market? *Land Use Policy*. 28. 815-824. 10.1016/j.landusepol.2011.01.009.

Swetnam, R.D., Fisher, B., Mbilinyi, B.P., Munishi, P.K.T., Willcock, S., Ricketts, T., Mwakalila, S., *et al.*, 2011. Mapping socio-economic scenarios of land cover change: a GIS method to enable ecosystem service modelling. *J. Environ. Manag.* 92 (3), 563–574.

ŚWITEK, Stanisław and SAWINSKA, Zuzanna. (2017) Farmer rationality and the adoption of greening practices in Poland. Sci. agric. (*Piracicaba, Braz*), vol.74, n.4, pp.275-284

van Berkel, D.B., Verburg, P.H. (2012). Spatial quantification and valuation of cultural ecosystem services in an agricultural landscape. *Ecological Indicators,* http://dx.doi.org/10.1016/j.ecolind.2012.06.025.

Vanslembrouck, Isabel & Van Huylenbroeck, Guido & Verbeke, Wim. (2002). Determinants of the Willingness of Belgian Farmers to Participate in Agri-environmental Measures. *Journal of Agricultural Economics.* 53. 489-511. 10.1111/j.1477-9552.2002.tb00034.x.

Vellinga, Th.V. & de Haan, M. & Schils, R. & Evers, A. (2011). Implementation of GHG mitigation on intensive dairy farms: Farmers' preferences and variation in cost effectiveness. *Livestock Science* - LIVEST SCI. 137. 185-195. 10.1016/j.livsci.2010.11.005.

Visser, M., Morana, J., Regana, E., Gormallya, M., & Skeffington, M. S. (2007). The Irish agri-environment: How turlough users and non-users view converging EU agendas of Natura 2000 and CAP. *Land Use Policy,* 24(2), 362–373.

Willemen, L., Verburg, P.H., Hein, L., van Mensvoort, M.E.F., 2008. Spatial characterization of landscape functions. *Landscape and Urban Planning 88*, 34–43.

Willis, Ken (1994) Contingent valuation in a policy context, *Landscape Research*, 19:1, 17-20

Willock, Joyce; Ian J. Deary, Murray M. McGregor, Alister Sutherland, Gareth Edwards-Jones, Oliver Morgan, Barry Dent, Robert Grieve, Gavin Gibson, Elizabeth Austin, (1999) Farmers' Attitudes, Objectives, Behaviors, and Personality Traits: The Edinburgh Study of Decision Making on Farms, *Journal of Vocational Behavior*, 54(1): 5-36.

Wilson, G.A. (1997) Assessing the environmental impact of the environmentally sensitive areas scheme: a case for using farmers' environmental knowledge? *Landscape Research,* 22:3, 303-326

Wilson, G.A. and Hart, K. (2000) Financial Imperative or Conservation Concern? EU Farmers' Motivations for Participation in Voluntary Agri-Environmental Schemes. *Environ. Plan. A,* 32, 2161–2185

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Wilson, G.A.; Hart, K. (2001) Farmer Participation in Agri-Environmental Schemes: Towards Conservation-Oriented Thinking? *Sociologia Ruralis*, 41, Number 2, April

Wyborn, C., 2015. Co-productive governance: a relational framework for adaptive governance. *Glob. Environ. Change* 30, 56–67

Yang, Yi-Chen & Passarelli, Simone & Lovell, Robin & Ringler, Claudia. (2018). Gendered perspectives of ecosystem services: A systematic review. *Ecosystem Services.* 31. 10.1016/j.ecoser.2018.03.015.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

Appendix A – Search terms

Search terms	Database	Download date	Results (download 100 or 10 pages)	Full text search or restricted to title, abstract and keywords (Scopus)
"permanent grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	6th Feb 2019	1520	n/a
"permanent grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	242	Title, abstract, keywords
"grassland" AND "farmer" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	6th Feb 2019	19,400	n/a
"grassland" AND "farmer" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	481	Title, abstract, keywords
"grassland" AND "stakeholder" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	6th Feb 2019	7370	n/a
"grassland" AND "stakeholder" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	117	Title, abstract, keywords
"rural landscape" AND "grassland" AND "citizen" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	6th Feb 2019	441	n/a
"rural landscape" AND "grassland" AND "citizen" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	87	All fields

"rural landscape" AND "grassland" AND "resident" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	6th Feb 2019	557	n/a
"rural landscape" AND "grassland" AND "resident" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	158	All fields
"traditional food" AND "grassland" AND "consumer" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	34	All fields
"traditional food" AND "grassland" AND "consumer" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	14th April 2019	360 results	n/a
"grassland conservation" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	80	Title, abstract, keywords
"grassland conservation" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	6th Feb 2019	432	n/a
"landscape value" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb 2019	205	All fields
"landscape value" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	14th April	525	n/a
"nature" AND "grassland" AND (attitude* OR opinio* OR willingness	Scopus	5th Feb	1046	Title, abstract, keywords

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124

OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)				
"nature" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	6th Feb	37,500	n/a
"recreation" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb	82	Title, abstract, keywords
"recreation" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	14th April	14,000	n/a
"leisure" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	5th Feb	485	All fields
"leisure" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	14th April	7720	n/a
"Ecosystem service*" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Scopus	11th April (replacement search)	650	Title, abstract, keywords
"Ecosystem service*" AND "grassland" AND (attitude* OR opinio* OR willingness OR accept* OR prefer* OR percept* OR belief OR trust OR valu*)	Google	11th April	2750	n/a

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 774124