SUPER-G

SUSTAINABLE PERMANENT GRASSLAND

Deliverable 4.4

A compilation of SUPER-*G* policy briefs and recommendations

From task 4.4: Developing policy options for ES in relation to PG

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)	

Summary

Project Number: 774124-2

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

Duration: 5 years 9 months

Start date of Project: 1st June 2018

Project management: ADAS

Person in charge: Paul Newell Price

Deliverable: 4.4

Due date of deliverable: September 2022

Actual submission date: February 2024

Work package: WP4

Leader: Lynn Frewer

Person in charge: Lynn Frewer

Author(s): Erik Hunter, Richard Francksen, John Williams, Paul Newell Price, Novieta Sari and Lynn Frewer

Contributor(s): SUPER-*G* Consortium

Communication level: Public

Version: Final (2)

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 do not represent the official position of the European Commission and is entirely the responsibility of the authors.

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	UNIABDN	UK
Mendelova Univerzita V Brne	MENDU	CZ
Magyar Tudomanyos Akademia Okologiai Kutatokozpont	HUN-REN 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	WULS	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
Wageningen University	WU	NL
Forschungsinstitut fur Biologischen Lanbau Stiftung	FiBL	CH

Contact Details	
Name of Contact:	Erik Hunter
Address:	P.O. Box 88. SE-230 53 Alnarp, Sweden
Telephone:	+46 40 41 5075
Email:	erik.hunter@slu.se

Abstract

The purpose of this report is to present a curated set of 12 policy briefs developed in the SUPER-*G* project and to outline the process used to generate them.

Contents

1. INTRODUCTION

1.1 Background

Permanent grassland (PG) encompasses any land predominantly covered by grasses or herbaceous forage, suitable for grazing or mowing, and excluded from crop rotation for at least five years (EU, 2004). Across the EU-27, PG spans nearly 50 million hectares, constituting 34% of the total Utilised Agricultural Area (UAA) (Eurostat, 2021). Despite this widespread presence, substantial variations exist among countries in terms of UAA proportion, spatial distribution, and fragmentation, leading to diverse priorities for the roles played by PG in distinct regions.

PG plays a pivotal role in supporting social infrastructure, fostering high biodiversity levels, and contributing to ecosystem function and societal value (Cardinale et al., 2012). These grasslands also form the basis for valued landscapes, offering recreational opportunities such as hiking, dog walking, skiing, and hunting. The capacity of farmers and land managers to sustainably maintain and manage PG for Ecosystem Services (ES) delivery hinges on various factors, including local conditions, farm type, profitability, regulations, and financial support from rural development programs.

Over time, Europe has witnessed a trend of diminishing PG area, exemplified by a 30% reduction in the EU-6 countries between 1970 and 2010, amounting to a loss of approximately 7 million hectares (Eurostat, 2017). Between 2005 to 2013, both increases and reductions in PG area across different biogeographical regions occurred. Since 2018, the proportion of PG has stabilized due to grasslands under “enhanced conditionality” (GAEC 1), however, the quality of these grasslands and the ecosystem services they provide are threatened by a wide range of factors such as abandonment, poor management, afforestation, deforestation, and climate change.

In 2018, the SUPER-*G* project was financed under the EU Horizon 2020 Programme to address these threats and aimed to 1. enhance understanding of the significance and functioning of PGs, 2. benchmark PG performance across Europe 3., co-develop integrated approaches for profitable and sustainable PG management and 4. to co-create tools and policy mechanisms that consider stakeholder and citizen priorities, fostering the maintenance and sustainable management of PG.

1.2 Purpose of the Report

This report contributes to the fourth aim of the SUPER-*G* project by presenting a curated set of 12 policy briefs and outlining the process used to generate them.

1.3 Scope and Limitations

The policy briefs presented in this document do not provide an exhaustive overview of SUPER-G policy recommendations. They are based on selected project outputs that were completed

(or near-completion) before June 2023, and perceived by the project consortium and stakeholder workshops to have a combination of relevance, rigour, and potential for impact at the EU level. Consequently, the decision to include selected project outputs may reflect inherent biases of the individuals involved in the project consortium, the resources dedicated to investigating certain topics and the stakeholders' present during policy development workshops.

For these reasons, this report was written to outline the process involved in policy brief selection and to acknowledge potential sources of bias. Moreover, results from the SUPER-*G* project are still being developed for publication in research journals, which could result in ideas for additional policy briefs. For the latest information on research output and policy briefs, the reader is directed to the project website: https://www.super-g.eu/.

2. Process of Selecting Project Output to Develop Policy Briefs

2.1 Participants involved in the SUPER-G Consortium and Organization into Work Packages

In total, a transdisciplinary group of over 100 people from 22 partner institutions across Europe (in the UK, CZ, HU, ME, SE, IT, CH, PL, DE, PT, ES, SI, FR, NL), consisting of natural and social scientists, farm advisors and farmers with an interest in permanent grasslands or ecosystem services were involved in the SUPER-*G* consortium. The individuals were organized into six work packages of which, work packages 2 to 5 conducted research and developed the outputs used to produce the policy briefs.

Work Package 2 (WP2) was led by natural scientists and aimed to provide policymakers and stakeholders with information to prioritize ecosystem services (ES) from permanent grasslands (PGs) across Europe. Their objectives included developing a European grassland typology, describing farming systems on PG, providing an overview of ES and associated indicators, conducting transdisciplinary workshops, and detailing PG management approaches. Their planned deliverables included a European Permanent Grassland Atlas, reports on farming systems and ES, outcomes of transdisciplinary workshops, management guidelines for PG types, and a valuation of ecosystem services and trade-offs. WP2 collaborated among various partners to assess and enhance the sustainability of PGs amidst threats like intensification, ploughing, and abandonment.

More information on WP2 and their research output can be found in the interim reports Deliverable 2.2a Ecosystem Services on Permanent Grassland and Deliverable 2.4 Scientist and farmer perceptions of the feasibility of current and emerging permanent grassland management techniques in Europe as well as a current list of all publications here: https://www.super-g.eu/

Work Package 3 (WP3) was multidisciplinary in nature and included a balance of natural and social scientists, farm advisors and farmers. WP3 aimed to benchmark a network of commercial farms across various biogeographic regions in Europe for profitability, sustainability, and ES delivery related to permanent grasslands. Their objectives included establishing farm networks, compiling and synthesizing data on farm performance, co-developing innovative PG management approaches, assessing trade-offs and synergies, testing emerging technologies on pilot farms and road-testing innovative practices on commercial farms.

Tasks involved in WP3 included creating farm networks, gathering and analysing data, conducting co-innovation farm workshops, assessing synergies and trade-offs on pilot farms, experimenting with innovative PG management options on experimental farms, and finally, road-testing the innovations on pilot farms. The tasks and multidisciplinary nature of this WP were designed to enhance collaboration, knowledge exchange, and the practical implementation of sustainable PG management strategies.

More information on WP3 and their research output can be found in the interim report *Deliverable 3.2 Overview of data, key gaps, and trends in PG management in the different biogeographic regions* as well as a current list of all publications here: https://www.super-g.eu/

Work Package 4 (WP4) was led by social scientists with a wide range of backgrounds from food science to policy and innovation research and methodological approaches covering qualitative and quantitative research. The overall objective of WP4 was to develop and validate methods for securing PG performance, with a focus on ES delivery. This included assessing socio-economic facilitators and barriers to the adoption of sustainable PG systems, providing evidence for and developing policy options to support PG management, and maximizing research impacts through knowledge exchange with key stakeholders. WP4 performed several literature reviews including a systematic review of literature on facilitators and barriers to adopting PG management options, economic drivers of farmer adoption, and an assessment of existing policies and their impacts. These reviews were supplemented by interviews, workshops and surveys that involved understanding farmer and citizen priorities and preferences for ES in relation to PG, The final task (4.4 which this report is based on) aimed to develop policy options for ES in relation to PG.

More information on WP4 and their research output can be found in the interim reports: Deliverable 4.1a Review of facilitators of, and barriers to, adoption and choice of PG management options to deliver specific ecosystem services (ES); Deliverable 4.1b Review of economic drivers of PG management options to deliver specific ecosystem services (ES); Deliverable 4.1c The effectiveness of policies promoting sustainable permanent grasslands across five European countries (representing five biogeographic regions): Mapping, understanding, and key stakeholder perceptions; Deliverable 4.3 Citizen priorities and preferences for ecosystem services in relation to permanent grassland as well as a current list of all publications here: https://www.super-g.eu/

Work Package 5 (WP5) was led by natural scientists, environmental modellers and agricultural consultants and focused on developing Decision Support Tools (DSTs) to aid farmers and policymakers in assessing ES provision PG. There were six main objectives in WP5, including reviewing existing tools, conducting workshops to identify necessary farm and policy tools, co-developing and testing farm-level tools, developing tools for assessment of productivity, profitability and ES, co-developing and testing a policy tool, and constructing a policy-level tool for ES provision on grassland farms. WP5 tasks included a comprehensive review of existing DSTs for PG systems, workshops with stakeholders to identify tool requirements, development of a farm-level tool and policy-level tool, and testing and refining these tools through engagement with key stakeholders. Ultimately, WP5 aimed to address gaps in existing tools, ensure user-friendliness, and enable the adoption of DSTs by farmers and policymakers.

More information on WP5 and their research output can be found in the interim report: *Deliverable 5.1 Review of existing tools available for use on permanent grassland* as well as a current list of all publications here: https://www.super-g.eu/

2.2 Materials: Research Output as Primary Source for Developing Policy Briefs

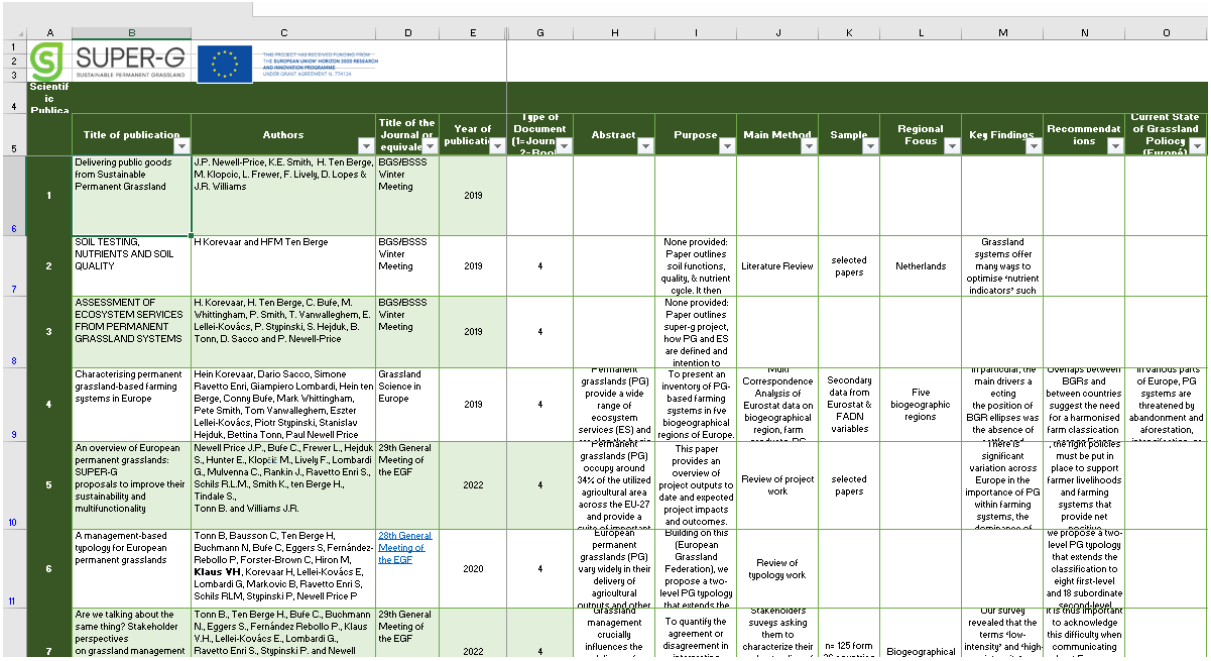
As per the information available at the time of writing this report, the SUPER-*G* consortium produced over 100 unique pieces of research output (i.e. peer reviewed publications, conference proceedings and conference presentations) plus a series of reports across the work packages.

This research output (prior to June, 2023) formed the primary source material for the policy briefs that are presented in the next section. These studies were entered into an excel file and coded for aspects like their purpose, main method and policy recommendations (see Table 1). A full list of research outputs will be available on the SUPER-*G* website: https://www.super-g.eu/

2.3 Procedure for Selecting Policy Briefs

Given the extensive research output in the SUPER-*G* project, there was a need to filter the material available in a way that ensured we included output perceived by the project consortium and stakeholder workshops to have a combination of relevance, rigour, and potential for impact at the EU level.

To accomplish this, four main activities were undertaken. First, SUPER-*G* consortium members were invited to a policy development workshop where initial ideas for selecting policy briefs were discussed. Second, WP leaders (and some task leaders), were interviewed to also identify research output in their group that could be suitable for policy briefs. Third, all of the available research output was read and organized into an excel file in order to take stock of e.g. research output, methods and relevance for generating policy briefs. Fourth, an initial draft of 16 policy briefs were presented to the consortium in order to ensure they were accurate and to solicit policy implications that were often missing in the primary source. Finally, five stakeholder workshops were held in Sweden, the UK, Spain, Czech Republic, Slovenia and Brussels where key results related to the selected policy briefs were presented and input from the stakeholder group on their validity and suggestions for policy recommendations were discussed.



	Scientific Publica	Title of publication	Authors	Title of the Journal or equivale	Year of publicati	Type of Document (1= Journ 2= Rep	Abstract	Purpose	Main Method	Sample	Regional Focus	Key Findings	Recommendations	Current State of Grassland Policies (Europe)
6	1	Delivering public goods from Sustainable Permanent Grassland	J.P. Newell-Price, K.E. Smith, H. Ten Berge, M. Klopcic, L. Frewer, F. Lively, D. Lopes & J.R. Williams	BGS/BSSS Winter Meeting	2019									
7	2	SOIL TESTING, NUTRIENTS AND SOIL QUALITY	H Korevaar and HFM Ten Berge	BGS/BSSS Winter Meeting	2019	4		None provided: Paper outlines soil functions, quality, & nutrient cycle. It then	Literature Review	selected papers	Netherlands	Grassland systems offer many ways to optimise 'nutrient indicators' such		
8	3	ASSESSMENT OF ECOSYSTEM SERVICES FROM PERMANENT GRASSLAND SYSTEMS	H. Korevaar, H. Ten Berge, C. Bufe, M. Whittingham, P. Smith, T. Vanwalleghem, E. Lellei-Kovács, P. Stypinski, S. Hejduk, B. Tonn, D. Sacco and P. Newell-Price	BGS/BSSS Winter Meeting	2019	4		None provided: Paper outlines super-g project, how PG and ES are defined and intention to						
9	4	Characterising permanent grassland-based farming systems in Europe	Hein Korevaar, Dario Sacco, Simone Flavetto Enri, Giampiero Lombardi, Hein ten Berge, Conny Bufe, Mark Whittingham, Pete Smith, Tom Vanwalleghem, Eszter Lellei-Kovács, Piotr Stypinski, Stanislav Hejduk, Bettina Tonn, Paul Newell Price	Grassland Science in Europe	2019	4	Permanent grasslands (PG) provide a wide range of ecosystem services (ES) and	To present an inventory of PG-based farming systems in five biogeographical regions of Europe.	Multi Correspondence Analysis of Eurostat data on biogeographical region, farm	Secondary data from Eurostat & FADN variables	Five biogeographic regions	In particular, the main drivers a ecting the position of BGR ellipses was the absence of	Overlaps between BGRs and between countries suggest the need for a harmonised farm classication	In various parts of Europe, PG systems are threatened by abandonment and aforestation,
10	5	An overview of European permanent grasslands: SUPER-G proposals to improve their sustainability and multifunctionality	Newell Price J.P., Bufe C., Frewer L., Hejduk S., Hunter E., Klopčič M., Lively F., Lombardi G., Mulvenna C., Plankin J., Flavetto Enri S., Schils R.L.M., Smith K., ten Berge H., Tindale S., Tonn B. and Williams J.R.	29th General Meeting of the EGF	2022	4	Permanent grasslands (PG) occupy around 34% of the utilized agricultural area across the EU-27 and provide a	This paper provides an overview of project outputs to date and expected project impacts and outcomes.	Review of project work	selected papers		There is significant variation across Europe in the importance of PG within farming systems, the	the right policies must be put in place to support farmer livelihoods and farming systems that provide net	
11	6	A management-based typology for European permanent grasslands	Tonn B, Bausson C, Ten Berge H, Buchmann N, Bufe C, Eggers S, Fernández-Rebollo P, Forster-Brown C, Hiron M, **Klaus VH**, Korevaar H, Lellei-Kovács E, Lombardi G, Markovic B, Flavetto Enri S, Schils RLM, Stypinski P, Newell Price P	28th General Meeting of the EGF	2020	4	European permanent grasslands (PG) vary widely in their delivery of agricultural outputs and other	Building on this (European Grassland Federation), we propose a two-level PG typology that extends the	Review of typology work				we propose a two-level PG typology that extends the classification to eight first-level and 18 subordinate second-level	
7	7	Are we talking about the same thing? Stakeholder perspectives on grassland management	Tonn B., Ten Berge H., Bufe C., Buchmann N., Eggers S., Fernández Rebollo P., Klaus V.H., Lellei-Kovács E., Lombardi G., Flavetto Enri S., Stypinski P. and Newell	29th General Meeting of the EGF	2022	4	Grassland management crucially influences the	To quantify the agreement or disagreement in	Stakeholders sueys asking them to characterize their	n= 125 form	Biogeographical	Our survey revealed that the terms 'low-intensity' and 'high-	It is not important to acknowledge this difficulty when communicating	

Table 1**.** Sample of SUPER-*G* Research and Coding Published Between January 2019 and February 2024.

The first activity (policy development workshop) took place in June 2022 at the SUPER-*G* (hybrid) annual meeting. In total, *c*. 35 consortium partners participated and were randomly assigned to "break-out groups" that were moderated by one of the persons working in task 4.4. Within the break-out group, participants were given one hour to discuss four key questions inspired by The Theory of Change (Connell and Kubisch, 1998):

- What do you think are the most interesting or important findings from SUPER-*G* to date?
- Why is this finding important/interesting e.g. what problem does this finding address? E.g. How does solving this problem benefit society, environment, providers or users of ES, etc.?
  What would you like to see changed? What needs to change (e.g. behaviour, support, resources, policy, etc.)?
  Which change/outcome should be prioritized?

This workshop resulted in a wide range of topics the consortium participants found interesting, important (to change) and an initial list of ideas they felt should be prioritized as reflected in one of the break-out groups in Table 2.

Idea #	Most interesting/important finding/outcome	Why is this finding/outcome interesting/important?	What change/outcome would you like to see to address the problem?	Votes – most important
1	Management (e.g. liming) to increase productivities and sustainability (finding that liming brings benefits overall)	Optimise the grass yield, support biodiversity, reduce nitrogen requirement of soil, support livestock, control the effects of PG on the environment…and many more!	Liming applied more widely – but farmers should take note of the soil types and grazing situation etc. Low-medium grazing intensity. (Liming was seen as easy to adopt by many farmers in 4.2 - potentially low barriers from farmers)	I
2	Consumer demand perspective.	Policies tend not to focus on demand for ES	Targeting for and values of ES. Explicitly target the interaction between landscape structures and ecosystem services. Link label for regulations. - 4.1.c.	I
6	Citizen values – different in each BGR	Societal value is key for creating sustainable PG systems that meet demand	Market-based approaches (rather than public money) Public money used for those ES that are less valued by public?	I
3	Conflict bw feed production and other ES. Multifuctionality (WP2)	Farmers don't receive income for ES production – new policies for payment for ES are not yet well established or fully functional (Finding from 4.2 that many farmers wanted more financial support to deliver ES)	Policy makers should be clear about the trade-offs between ESs – awareness of the conflict – link to compensation – management options that mitigate the conflict (T2.5)	III
4	Farmers don't plan to make changes to their PG – due to uncertainty? – tend to do what they have been doing (how do we approach those who are less keen to make change)	Farmer behaviour – to define different types of farmers behaviours	Target individual groups – use different policy tools e.g. for people that are open to new ideas (need to focus on combining the scientific findings on MOs with different farmer perspectives)	II
5	Combining evidence from different WPs – linking the scientific findings on the effectiveness of MOs with the opinions of farmers from WP4.2/ 2.4 – could focus on barriers to adoption of effective MOs	Convincing target groups and for improving the implementation – extract scientific findings and convert into practical advice and recommendations	More research needed? Do we need more evidence on the effectiveness of MOs? (we have data previous to SUPER-G on this) – potential change of direction to WP2? Complement opinions already collected in 2.4. – MOs sheets in T2.5 – could the authors do a short literature reviews (for farm consultants/ farmers) – also include how to address the barriers	

Table 2. Results from one break-out session showing a wide range of topics and SUPER-*G* consortium participants found interesting and which ones they wanted to prioritize for change.

Between June and December 2022, interviews were conducted with 17 work package (and task) leaders. These interviews were intended to help identify key research findings suitable for policy briefs and prioritize those under their purview. These interviews were primarily conducted by two researchers working in task 4.4 (one social scientist that interviewed WP/task leaders responsible for social science output and one natural scientist that focused on interviews related to natural science). These interviews were semi-structured and included the following questions:

- In layman's terms, please describe the purpose of your task and the problem it seeks to address.
- What do you think is the most interesting or important findings/result from your task and why?
- Why is this finding/result important/interesting e.g. what problem does this finding address? For example, how does solving this problem benefit society, environment, providers or users of ES? What are the negative/unintended consequences?
- Based on your finding, what would you like to see changed?
- What needs to change (e.g. behaviour, support, resources, policy, etc.)
- Who should be involved in ensuring the change you would like to see?
- What would kind of feedback would you like from stakeholders?
- Is this finding something that could be translated into a policy brief?
- What are the limitations of your important finding?
- Is the task finished? If not, when? Any published results?

Building on the insights gathered during the plenary workshop and interviews, the research output from SUPER-*G* that was available as of June 2023 was read and summarized into an excel file and the objectives, methods, and key results were coded. Of primary interest in each piece of research was the discussion section where, at times, policy implications and recommendations were spelled out.

Based on the initial consortium policy development workshop, interviews with WP/task leaders and available research papers, 16 policy briefs were written and presented to the SUPER-*G* consortium meeting that took place in Budapest, Hungary in June, 2023. The primary interest was to ensure that the written policy briefs were accurate and covered the most important results in the project, and to determine whether more work was needed to formulate policy implications.

Around 40 individuals from the project consortium were randomly divided into groups with each group tasked to discuss two policy briefs, make improvements to the text and provide suggestions. Overall, the groups differed in terms of how effective they felt the policy recommendations would be in solving problems and views varied, depending on the specific policy briefs in question, on the most effective way to communicate information in the briefs. Some researchers thought that in some policy briefs more emphasis should be placed on method, while for other policy briefs the delegates felt there was already too much emphasis. The group tended to agree that the policy briefs chosen were relevant and most of the key findings with policy implications (published as of June 2023) were represented, however, more work was needed on some of the policy briefs regarding policy implications. The discussion led to improvements in what was written in each policy brief, but also the exclusion of four policy briefs that required more input.

Finally, the key results behind the policy recommendations were presented during key stakeholder seminars at the national level in the UK, Sweden, Spain, Czech Republic, and EU level in Brussels between October and December, 2023. The aim of these seminars was to engage key stakeholders representing scientists, environmental groups, farm organizations and policy makers to consider key results in the project and discuss policy options. Insights from these stakeholder workshops were used to supplement the policy implications developed in the consortium and finalize the policy briefs.

3. Policy Briefs

3.1 Results: 12 Policy Briefs and Balance Across WPs

A total of 12 policy briefs were written and selected for inclusion in this report. Five were derived from research conducted in WP2 and WP3 and five from WP4 and WP5.

3.2 Policy Briefs

3.2.1 What role do cultural ecosystem services play in preserving permanent grasslands?

Objective: Cultural ecosystem services are often overlooked in research and seen by many as the least important aspect delivered by European permanent grasslands. This policy brief outlines the role cultural ecosystem services play in promoting (and degrading) European permanent grasslands and provides implications for integrating them into policy.

Methodology: A literature review examined 71 papers addressing threats to cultural ecosystem services (CES) and permanent grasslands, as well as threats originating from CES to grasslands. The underlying causes, direct threats, consequences, and suggested solutions mentioned in the extracted studies were summarised.

Key Findings:

Agritourism is highlighted as a successful tool for farm income diversification and provides educational benefits about agriculture and rural traditions alongside recreational opportunities for tourists. Extensively managed traditional areas support more CES than modernised, homogeneous areas.

Recreational activities may result in environmental damage and differing perceptions between stakeholder groups about aesthetic landscapes and allowed recreational activities contribute to conflicts. Studies comparing the attitudes of residents to tourists or experts reveal differing preferences, with locals often favouring open landscapes like pastures and meadows.

Industrial activities and associated pollution are identified as major threats to CES, impacting human well-being, health, ecosystems, and their services.

Policy Implications:

New agri-environmental programs are needed that support CES, especially in marginal areas, and should be integrated into the new Common Agricultural Policy.

Developing strategies to bring permanent residents back to rural areas are needed while agritourism is advocated to maintain the connection between CES and traditional land use. Knowledge transfer to tourists, inclusion of relevant stakeholders in landscape planning, and educating residents about the value of grassland ecosystems are emphasised.

Improved access to rural regions are proposed to promote responsible recreation in Europe. Improving infrastructure for tourists to access remote areas is (counterintuitively) suggested to minimise potential impacts of unrestrained recreation.

Negative impacts should be anticipated and addressed during the planning phase of new recreational areas, tailored to specific circumstances.

Key Reference: Pellaton, R., Lellei-Kovács, E., & Báldi, A. (2022). Cultural ecosystem services in European grasslands: A systematic review of threats. *Ambio*, *51*(12), 2462-2477.

3.2.2 What policy approaches and levers can be used to improve the capacity of European permanent grasslands to deliver a range of ecosystem services?

Objective: To identify, map, and understand the effectiveness of key policies governing Permanent Grassland (PG) management across five European biogeographic regions. *This policy brief outlines the intervention logics of these policies (i.e. the targets of policy instruments and intended outcomes) using the Cascade Framework and their effectiveness from the perspective of key stakeholders across Europe.*

Methodology: Stakeholders from the SUPER-*G* consortium, together with information derived from desk research, contributed to identifying potentially influential EU and national/biogeographic policies. Delphi policy surveys were sent to key stakeholders in each biogeographic region to validate and rank the most influential policies at both EU and national levels. Publicly available government documents were used to map each policy and their instruments using 50 criteria, capturing e.g. their aims, objectives, targets, monitoring systems, and outcomes. The Cascade Framework was used to analyse each policy's intervention logic. 50 stakeholders across the biogeographic regions provided insights into their perceived effectiveness as reflected by their efficiency, relevance, democracy, and legitimacy.

Key Findings:

EU and national level policies under-utilise available policy instruments. The majority of policy instruments studied use regulations or financial incentives targeted towards land-owners and farmers, while neglecting other potentially effective policy levers such as generating demand for ecosystem services through public information campaigns or directly targeting specific ecosystem services through results-based payments.

Perceived effectiveness of PG policies across Europe is impeded by complexity, decentralised information, and insufficient knowledge and engagement among key stakeholder groups. Lack of clarity in intervention logic and reliance on a limited range of policy mechanisms further hinder policy effectiveness.

Policy Implications:

Create comparable and comprehensive national and/or European repository of information characterising PG management policy by e.g. aims, objectives, targets, monitoring systems, and

outcomes that are easy for the public to access. The new EU CAP dashboard is a step in this direction, however specific information on PG management policy is difficult to access if not unavailable.

Ensure key stakeholders are actively engaged in the policy development cycle and prioritise education to enhance their understanding and participation. Stakeholder support can further be improved by ensuring EU member states are transparent in how they solicit stakeholder input and use it to develop policy.

Promote alternative policy frameworks that extend beyond the conventional focus on land managers and their practices, which often yield anticipated results for landscape features but may not consistently deliver the desired ecosystem services. Consider, for instance, employing policy instruments to stimulate demand for ecosystem services among citizens or direct payments for the ecosystem services delivered on permanent grasslands.

Key Reference: Hunter, E., Quatrini, S., Lieberher, E., Tindale, S., Sanchez, Z., Gallardo, C., ... & Frewer, L. (2020). The effectiveness of policies promoting sustainable permanent grasslands across five European countries (representing five biogeographic regions): Mapping, understanding, and key stakeholder perceptions. *WP4, Deliverable 4.1 c, SUPER-G (Sustainable Permanent Grassland Systems and Policies), EC Project Number 774124-2*.

3.2.3 Impact of land use change from permanent grasslands. How can policy drive land use management to provide multiple benefits to society?

Objective: To identify the impacts of land-use change and management options on the delivery of ecosystem services from permanent grasslands across Europe. The primary focus is on *multi-functionality*, which is defined as the capacity of land use types to provide a spectrum of public and private goods, including food, biodiversity, climate regulation, water purification and cultural values.

Methodology: A systematic literature review of the multi-functionality of permanent grasslands by assessing the effects of land-use change and various management options on 19 indicators of ecosystem services. Evidence was synthesised from relevant studies to identify synergies and trade-offs associated with specific land-use changes or management interventions**.**

Key Findings:

- Conversion of permanent grasslands, particularly to cropland, and intensification of management were found to decrease multi-functionality.
- Reduced management intensity was associated with positive outcomes for biodiversity, climate regulation, and water purification. However, it impacted the provision of animal feed negatively.
- Increasing the number of species in the sward and incorporating more herbs and legumes, enhanced multi-functionality without adversely affecting any of the indicators being considered.

Policy Implications:

- Increased policy support (e.g. greater subsidies; increased scrutiny of existing member state regulations and their implementation) is crucial to prevent the conversion of permanent grasslands to other land uses characterised by decreased multi-functionality and higher rents (e.g. cropland; urbanisation).
- Promoting low to medium-intensity grassland management is essential to optimise the delivery of important ecosystem services.
- Low to medium-intensity management should be context-specific and may involve ecological restoration techniques, such as sowing diverse seed mixes. A multifaceted approach, incorporating knowledge transfer, flexible policy frameworks, and alternative payment schemes for ecosystem service delivery, is necessary.
- Optimal delivery of ecosystem services depends on the local context, requiring a nuanced, region-specific policy strategy. A combined approach of protection and general extensification is proposed to secure multiple benefits from Europe's permanent grasslands.

Key Reference: Schils *et al.* 2022. Permanent grasslands in Europe: Land use change and intensification decrease their multi-functionality. Agriculture, Ecosystems and Environment; 330; 107891

3.2.4 Liming of grasslands is a common agronomic practice but what are the implications of supporting this activity for climate regulation and grassland productivity?

Objective: To evaluate the impacts of liming on soil pH, biomass production, and net greenhouse gas (GHG) emissions in European grasslands.

Methodology: The research focused on the effects of liming on soil pH, grassland biomass production, and net GHG emissions, with specific attention to methane (CH_4), nitrous oxide (NO_2) and net carbon dioxide (CO_2). A total of 12,468 papers were screened, and data from 55 papers were analysed. Data on soil pH and biomass production were analysed using paired tests with random effects. Limited data availability necessitated descriptive summaries for soil organic carbon, N_2O, CH_4, and CO_2 emissions.

Key Findings:

The review supports the positive impacts of liming on soil pH optimisation, enhanced biomass production, and biodiversity in European grasslands.

- Optimisation of Soil pH and Reduction of Acidity—Liming grasslands proved effective in optimising soil pH and significantly reducing soil acidity.
- Enhanced Biomass Production and Biodiversity—Liming contributed to increased grass productivity, improving fertiliser nitrogen use efficiency and promoting plant species richness.
- Mixed Impacts on GHG Emissions—Liming either reduced or had no significant impact on N_2O and CH_4 emissions. However, liming increased net CO_2 emissions.

- Minimal Net GHG Impact—Despite the rise in CO_2 emissions, the overall impact on net GHG emissions was minimal, reflecting reductions in N_2O and CH_4 emissions.

Policy Implications:

- There is a significant knowledge gap regarding the effects of liming on net GHG emissions, necessitating further research.
- The existing evidence strongly supports the regular liming of European grasslands on acid soils within the context of specific soils, climate and management practices.
- Adoption of sustainable liming practices to optimise soil conditions, biomass production and nutrient use efficiency should be encouraged.

Key Reference: Abdalla et al., (2022). Does liming grasslands increase biomass production without causing negative impacts on net greenhouse gas emissions? *Grassland at the heart of circular and sustainable food systems*, 518.

3.2.5 How do innovative PG management options affect grass production and the delivery of non-provisioning ecosystem services?

Objective: To advance our understanding of the trade-offs and synergies inherent in managing permanent grasslands (PG) for Ecosystem Service (ES) delivery, with a particular focus on the interactions between production and other ecosystem services.

Methodology: Drawing from a diverse array of commercial and experimental farms, data from field experimentation and demonstrations, including integrated assessments, were analysed to understand the relationships between productivity, biodiversity and other ecosystem services.

Key Findings:

- Experiments with 'mixed species swards' indicated that there were benefits for various ecosystem services, including greater abundance and diversity of earthworms, invertebrates and pollinators. Importantly, these benefits did not compromise, and in some cases increased, production metrics such as dry matter yield and livestock live weight gain.
- Well-implemented virtual fencing emerged as a facilitator of flexible and tailored conservation management in high nature value grasslands. Trials demonstrated no significant negative impacts on animal welfare or performance compared to traditional fencing, while offering advantages in flexible management and targeted conservation efforts.

Policy Implications:

- Practices with clear synergies and low trade-offs, such as multi-species swards, incorporation of flowering grassland patches, and virtual fencing (where appropriate) should be encouraged in policy.
- Agri-environment payments for these techniques should align with potential environmental benefits, considering both costs and risks involved.

- Farmer training and outreach is needed, with support from initiatives like European Innovation Partnerships to facilitate peer-to-peer learning, enhance land manager confidence, and develop skills for continued management.
- Policy should address barriers to ES delivery, such as capital costs and improved communication about welfare assurance to facilitate wider adoption of these beneficial techniques.
- There is a need for long-term studies on ES delivery of these techniques to monitor synergies and trade-offs comprehensively, as well as how they might be incorporated into Agri-Environment Schemes.

There is potential for enhancing ecosystem service delivery in permanent grasslands through the implementation of management practices. Policy makers should develop strategies to communicate clearly about expected results, synergies, and trade-offs associated with new management techniques, as well as the implications for Agri-Environment payments.

Key Reference: Rankin J., Brown S. and Newell Price P. (eds) (2023). SUPER-*G* Deliverable report 3.6 on Synergies & Trade-offs. EC Project Number 774124-2, 321 pages.

3.2.6 How can policy makers work with farmers to encourage and enable widespread adoption of more sustainable permanent grassland management practices?

Objective: To understand farmers' attitudes, opportunities, and barriers related to adopting sustainable Permanent Grassland (PG) systems, with a focus on ecosystem service provision. Research encompassing different farming intensity types, biogeographic regions, and national contexts across five European countries (UK, Sweden, Switzerland, Spain, and the Czech Republic) was conducted.

Methodology: 373 semi-structured farm interviews were conducted on circa 75 farms in each country. The farms were included to cover diverse livestock, intensity types, and production methods. Qualitative and quantitative data were collected using integrated behavioural models from social psychology and analysed thematically using Nvivo software and through multivariate data analysis.

Key Findings:

- Without policy change, most farmers plan to continue current practices to maintain their current benefits. For those farmers planning changes, both intensification and extensification were being considered. In terms of willingness to adopt new land management practices, farmers who had not changed land practices in the last 5 years were much less likely to consider adopting new practices in the coming years.
- For some farmers, decreased economic support would represent a “tipping point” in their decision making, resulting in land abandonment. Conversely, environmental factors such as promoting biodiversity, ensuring water supply and saving endangered species are factors which motivate some farmers to continue managing their lands. Across all countries, learning new skills was seen as the biggest challenge associated with implementing changes needed to improve and maintain PG and ES.

Policy Implications:

- National and regional policies should reflect priorities for PG management to deliver improved ES delivery appropriate for each geographical, economic and cultural context.
- Policies could consider that adopting new technology and innovations can provide opportunities for the agri-food sector to become more resilient and sustainable with fewer negative environmental impacts.
- Policy support can be linked to the transformation from direct subsidies to implementation of a new approach focusing on land capability and 'working with nature' to reduce negative environmental impacts and increase the overall sustainability and viability of the agri-food sector.
- Demonstration of effectiveness, advice and subsidies may be needed to facilitate the change.

Key References:

Tindale et al (submitted). Tipping points and farmer decision-making in European permanent grassland (PG) agricultural systems.

Jin, S. et al (submitted) Farmer Identities and Permanent Grassland Management: Evidence from Five European Biogeographic Zones.

3.2.7 Understanding farmer dependence on different income streams and how this influences behaviour and the delivery of ecosystem services associated with permanent grasslands.

Objective: Permanent grasslands (PG) are at risk of loss or degradation due to agricultural land use and land management changes. Assessing which policies optimise PG conditions across different climatic and sociocultural regions in Europe is challenging. Policy development requires an assessment of the main economic influences on farmers in relation to maintaining and managing PG systems, across different contexts, as well as their impact on risks and opportunities for delivery of Ecosystem Services (ES).

Methodology: A systematic literature review of European, peer reviewed studies on farmer responses to CAP from 1962-2019 was conducted. The review was supplemented by data from the Farm Accountancy Data Network (FADN) to provide an economic context in which farmer land use and management decisions are made, as well as CAP subsidies to farm income in selected European countries (i.e. Czech Republic, Sweden, Spain and UK).

Key Findings:

- Many European farmers were dependent economically on Basic Payments and Rural Development Funding. While subsidies (direct payments) can offset low profitability and limit change, they are often not sufficient to prevent significant increases in intensification or abandonment.
- Protection of PG through regulation (CAP Cross Compliance and Greening) is also unreliable in protecting PG, from degradation or loss. This is particularly true in the case

of environmentally sensitive PG (ESPG). Agri-environment schemes (AES) can support market premiums, for example for organic and niche products.

- Land abandonment is most prevalent in less favoured areas (LFAs), which experience challenging geographical and climate conditions leading to higher production costs and an inability to adapt the land management to social and economic pressures. The characteristics that make these areas valuable for biodiversity, are often the same that threaten the economic viability of farms.
- Policy can be ineffective at targeting how the land is managed to optimise Ecosystem Service provision. Land use policy which can take account of land capability and carrying capacity could enable more targeted and effective policy.

Policy Implications:

- More targeted support through Agri Environment Schemes can encourage a balance between food production and other Ecosystem Services but uptake is voluntary and farmers may adopt the most economic options, which may not deliver desired environmental outcomes. Locally-focused, or flexible, policy approaches are needed to maintain and improve the provision of ecosystem services from permanent grasslands.
- Payment by Results agri-environment schemes may improve Ecosystem delivery associated with PG.
- Many PGs are associated with valued landscapes and opportunities for diversified income streams e.g. via tourism, food processing, and environmental management, supported by market premiums (e.g., for organic, and pasture-based products).

Key Reference: Elliott et al., (2024). European Permanent Grasslands: A Systematic Review of Economic Drivers of Change, Including a Detailed Analysis of the Czech Republic, Spain, Sweden, and UK. *Land*, *13*(1), 116.

3.2.8 How to improve communication between policy makers and stakeholders about the different types of permanent grassland in Europe and their capacity to deliver a range of ecosystem services for society?

Objective: This policy brief outlines the development of a new permanent grassland (PG) typology that aims to enhance the understanding of European PG and considers management intensity, frequency of renewal and productivity potential across Europe. The primary goal is to improve communication between policymakers and stakeholders, providing detailed insights into ecosystem service delivery and management considerations.

Methodology: A two-level grassland typology has been developed, focusing on eight primary indicators of permanent grassland management, including defoliation, fertilisation, and renewal. 19 secondary indicators were identified based on factors such as management intensity, productivity potential, the presence of woody plants, and grassland renewal intervals. These indicators were established through multi-national stakeholder surveys, ensuring a comprehensive and inclusive approach.

Key Features of the Typology:

- The typology offers a unique input-based management intensity classification, distinguishing between productive and marginal regions.
- It encompasses diverse habitats, including grasslands with shrubs or trees, those not under agricultural management, and frequently renewed grasslands.
- It is applicable at both field and regional scales, facilitating a versatile and comprehensive assessment.
- It is cross-referenced with existing classification schemes like European Nature Information System and Natura 2000 habitats, ensuring compatibility and integration with established frameworks.
- It is complemented by additional attributes needed for management and ecosystem service delivery, providing a holistic understanding.
- It Encompasses the full spectrum of grassland uses within European farming systems.
- It offers a valuable knowledge base for understanding conditions, challenges, and opportunities related to permanent grassland management across Europe.
- It provides a tool for facilitating communication between policymakers and stakeholders in discussions about the sustainable management of permanent grasslands for public benefit.

Key Results and Policy Implications:

There is a need for improved permanent grassland typologies that account for complexity in different systems and management practices. The typology outlined here could help facilitate dialogue between policy makers and stakeholders that address the complex challenges associated with PG management and lead to improved delivery of ecosystem services through a common language and informed decision-making. EU policy makers could support the adoption of this typology by encouraging EU member states to use it during policy planning, monitoring and development.

Key Reference: Tonn, B., Bausson, C., Ten Berge, H., Buchmann, N., Bufe, C., Eggers, S., ... & Newell, P. P. (2020). A management-based typology for European permanent grasslands. In *Grassland Science in Europe* (Vol. 25, pp. 412-414). P. Virkajärvi K. Hakala M. Hakojärvi J. Helin I. Herzon V. Jokela S. Peltonen M. Rinne M. Seppänen J. Uusi-Kämppä.

3.2.9 How can communication around farming systems based on permanent grasslands across Europe be improved?

Objective: Prevailing farming system classifications, centred on production types such as cattle, dairy, and sheep, are limited in their relevance for permanent grassland farming systems in Europe. This policy brief outlines an effort to redefine, classify, and summarise European farming systems based on permanent grassland. The ultimate goal is to develop a conceptual model of s 'typical' farming systems that are largely reliant on permanent grassland, and their potential to deliver a range of ecosystem services across Europe.

Methodology: To achieve these objectives, four primary activities were undertaken: 1. A questionnaire was circulated among the SUPER-G consortium to gather descriptions of main farming systems. 2. Assessment of the most relevant variables characterising the different

farming systems. 3. Using these variables to interrogate two farm-based European datasets.4. Using the data to produce farming system distribution maps and statistics for the main PG-based farming systems across Europe.

Key Results:

A multi-level classification system was proposed that defines each farming system by a combination of criteria. The key levels include livestock type, stocking rate, share of permanent grassland, and exploitation regime (e.g., grazing, cutting, non-feed, or NA). Using this classification, 315 types of farming systems were identified, offering a nuanced perspective on the diversity within permanent grassland farming.

An important insight from this research emphasises the biogeographic context dependence of specific farming systems. For example, the prevalence of sheep and goat systems in the Mediterranean region underscore the necessity for customised policies that take into account the unique context and regionally significant characteristics of permanent grassland farming systems in Europe.

Policy Implications:

Developing effective permanent grassland policy is difficult without a way to understand and account for differences across farming systems. The multi-level classification system outlined here provides the means for understanding and accounting for differences across “typical” farm systems.

The classification system can be used as a foundation for policy development that recognizes the importance and varied nature of ecosystem service delivery. For example, it can be used to establish a ranking system for farms based on their potential contribution to ecosystem services, allowing support to be directed towards systems that offer the greatest public benefit.

The classification system may also be used to create awareness among farmer associations and the general public regarding the broad spectrum of ecosystem services provided by permanent grassland farming systems that extend beyond traditional production metrics. Such efforts are needed to legitimise policy and leverage their support.

Key Reference: Korevaar, H., Sacco, D., Ravetto Enri, S., Lombardi, G., Ten Berge, H., Bufe, C., ... & Newell Price, P. (2019). Characterising permanent grassland-based farming systems in Europe. *Proceedings of the Improving Sown Grasslands through Breeding and Management, Zurich, Switzerland*, 24-27.

3.2.10 How feasible is it for farmers to implement various innovative permanent grassland management options in different parts of Europe?

Objective: This policy brief presents the findings of an assessment aiming to evaluate the feasibility of eleven different permanent grassland (PG) management options and innovations. The study focused on ease of implementation, likely uptake, and potential to deliver ecosystem

services under diverse climatic, agronomic, and socio-economic conditions. Perspectives from scientific experts and farmers across five biogeographic regions in Europe were gathered using a modified Delphi technique.

Methodology: Utilising interviews and online questionnaires, data were collected from sixty-two scientific experts and fifty farmers. Expert opinions were sought to evaluate each management option based on the underlying rationale, mechanism of action, outcomes, potential for ecosystem service delivery, applicability, and support requirements in terms of land manager implementation. Farmer interviews focused on familiarity, experience, ease of adoption, likelihood of adoption, and preference ranking of the management options.

Key Findings:

- Opinions varied across biogeographic zones.

- Rotational grazing emerged as the most feasible option in the Mediterranean region, with positive impacts on ecosystem service delivery.

- Sward renewal and virtual fencing were perceived as the least feasible options, with sward renewal perceived to have the greatest negative impact on ecosystem service delivery, particularly in the Alpine region.

- Adoption of current/new technologies by farmers is hindered by a lack of evidence, and awareness.

- Both scientific experts and farmers highlighted the need to compensate farmers who reduce productivity to enhance ecosystem services.

Policy Recommendations:

- Provide independent and periodic reviews of technology efficacy to build farmer confidence in adopting new technologies (for example, through extension specialists).

- Support research into field trials of all technologies to establish on-farm benefits.

- Fund training programs for farmers to enhance their proficiency in using technologies.

- Ensure adequate ICT connectivity in rural areas for the seamless use of applications and other technological tools.

- Make upfront capital grants available for the purchase of virtual fencing, GPS collars, improved farm infrastructure, and potentially satellite/drone technology, where appropriate.

This assessment provides valuable insights into the prioritisation of permanent grassland management options, offering a starting point for supporting farmers in adopting technologies that contribute to multiple ecosystem service deliveries. The policy recommendations underscore the importance of empowering farmers through knowledge, awareness, training, and financial support to enhance sustainable grassland management practices across Europe.

Key Reference: Tindale, S., Raley, M., Vicario Modroño, V., Hunter, E., Bufe, C., Dekker, C., … Frewer, L. (2018). Scientist and farmer perceptions of the feasibility of current and emerging permanent grassland management techniques in Europe. *WP2 Deliverable 2.4, SUPER-G (Sustainable Permanent Grassland Systems and Policies), EC Project Number 774124-2*.

3.2.11 What are citizens' attitudes towards management of the countryside and grasslands in particular, and how can this inform policy?

Objective: To explore citizen priorities and preferences for ecosystems services (ES) in relation to PG and policies associated with the preservation and management of PG.

Methodology: A total of 15 focus groups (including 104 individuals from urban and rural areas) were conducted in 5 EU countries (UK, Spain, Sweden, Czech Republic, Switzerland) representing 5 biogeographic regions. Thematic analysis and Nvivo were used to analyse the focus group transcripts.

Key Results: Participants' opinions on the benefits of grassland could most often be categorised as ES associated with providing habitats for wild plants and animals, followed by cultural ES of sport, recreation and leisure. However, those living in the rural areas perceived more varied bundles of benefits from grassland than those living in urban areas.

Citizens articulated three types of problems: i) conversion of grassland to urban land use or cropland, or reduction of access to grassland; ii) degradation of grassland; and iii) abandonment of grassland (lack of management. In all five case study areas, threats to biodiversity was mentioned as a consequence and a need for grassland to be present and well managed to provide valuable biodiversity.

In terms of how citizens would like to improve grassland landscapes, five themes were identified (education, rules, farming ideals, economics, social pressure), the most common being education. Participants assumed that more information provision through education would lead to decisions that favoured buying local products that were sustainably produced.

Policy Implications: The implications of this research are that as agricultural landscapes are continually contested, a better understanding of citizen perspectives may lead to better conceptualisation of how and when mismatches in (perceptions of) ES supply and demand (including relational values) occur. It may allow better communication between stakeholder groups, including citizens, farmers and policy makers, particularly if shared ideals or (social-ecological) systems understandings can be incorporated into deliberations or decision-making processes.

Changing policy would also need to address people's interconnected identities as citizens and consumers, facilitating regionally-specific connection and attachment to grasslands through education, shared ideals, and discourses, emphasising the multiple values of grassland at a local and landscape scale, which may help improve pro-environmental behaviour, in order to facilitate transition to sustainable grassland systems.

The scale and quality of ES provided by PG in Europe continues to decline and better evidence on effective responses is needed urgently.

Key Reference: Tindale, S., Vicario-Modroño, V., Gallardo-Cobos, R., Hunter, E., Miškolci, S., Price, P. N., ... & Frewer, L. J. (2023). Citizen perceptions and values associated with ecosystem services from European grassland landscapes. *Land Use Policy*, *127*, 106574.

3.2.12 How can grassland farmers be empowered to clearly demonstrate how they deliver a range of ecosystem services for society?

Objective: This policy brief outlines the development of a cutting-edge farm-level Decision Support Tool (DST) designed to assist farmers in making informed decisions by providing a comprehensive overview of ecosystem service delivery from permanent grasslands on their farms. Additionally, it explores farmer perceptions of existing tools and evaluates the demand for the newly developed DST.

Methodology: Farmers, landowners, advisors, NGOs, and researchers were engaged in a collaborative effort to develop the DST. The DST assesses six ecosystem services: food production, climate regulation, biodiversity, aesthetics and recreation, flood and erosion control, and water quality. Farmer perceptions of existing tools were gathered through working groups in Hungary and Northern Ireland. The new DST was introduced to farmers, and their feedback was collected.

Key Results:

- Farmer feedback highlighted that existing tools fail to meet their requirements for assessing and quantifying ecosystem service delivery from permanent grasslands on their farms.
- Farmers expressed a strong desire for a new DST that provides user-friendly, intuitive, and evidence-based information on ecosystem service delivery.
- The newly developed DST calculates values for different ecosystem services based on user responses to a series of questions.
- Scores for six ecosystem services are generated, benchmarked against expected values, and presented using a 'traffic light' system followed by recommendations for improvement.
- Demonstrations to farmer working groups revealed that the new DST offers useful, intuitive feedback on farm ecosystem services.

Policy Recommendations:

- Policy support is crucial for the further development, communication, and dissemination of the DST beyond the SUPER-*G* consortium and network.
- Recognise the clear desire among farmers for useful, intuitive, and evidence-based information on ecosystem service delivery at the farm level.
- Encourage policies that promote farmer engagement with the DST, ensuring its effective utilisation.

The development of the DST represents a significant step toward empowering farmers with practical, user-friendly tools for evaluating ecosystem services on their farms. Policy support is essential to ensure the widespread adoption and continuous improvement of this innovative decision support system.

Key Reference: https://www.super-g.eu/deliverables/

4. References

Abdalla et al., (2022). Does liming grasslands increase biomass production without causing negative impacts on net greenhouse gas emissions? *Grassland at the heart of circular and sustainable food systems*, 518.

Cardinale, B., Duffy, J., Gonzalez, A., Hooper, D., Perrings, C., Venail, P. … Naeem, S. 20212) Biodiversity loss and its impact on humanity. Nature 486, 59–67. https://doi.org/10.1038/nature11148

Connell, J. P., & Kubisch, A. C. (1998). Applying a theory of change approach to the evaluation of comprehensive community initiatives: progress, prospects, and problems. New approaches to evaluating community initiatives, 2(15-44), 1-16.

Elliott et al., (2024). European Permanent Grasslands: A Systematic Review of Economic Drivers of Change, Including a Detailed Analysis of the Czech Republic, Spain, Sweden, and UK. *Land*, *13*(1), 116.

EU, 2004. Commission Regulation (EC) No 796/2004 of 21 April 2004 laying down detailed rules for the implementation of cross-compliance, modulation and the integrated administration and control system provided for in of Council Regulation (EC) No 1782/2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers.

Eurostat (2017) Permanent grassland: number of farms and areas by agricultural size of farm (UAA) and size of permanent grassland area. Online data code EF_POGRASS. Accessed on 18 February 2021. https://ec.europa.eu/eurostat/databrowser/view/EF_POGRASS/default/table?lang=en

Eurostat (2021) The share of the utilised agricultural area (UAA) occupied by the main agricultural land uses (arable land, permanent grassland and land under permanent crops); based on Farm Structure Survey data. Online data code TAI05. Accessed March 2022.

Hunter, E., Quatrini, S., Lieberher, E., Tindale, S., Sanchez, Z., Gallardo, C., ... & Frewer, L. (2020). The effectiveness of policies promoting sustainable permanent grasslands across five European countries (representing five biogeographic regions): Mapping, understanding, and key stakeholder perceptions. *WP4, Deliverable 4.1 c, SUPER-G (Sustainable Permanent Grassland Systems and Policies), EC Project Number 774124-2*.

Newell Price, J. P., Bufe, C., Frewer, L., Hejduk, S., Hunter, E., Klopčič, L. F., ... & Williams, J. R. (2022). An overview of European permanent grasslands: SUPER-G proposals to improve their sustainability and multifunctionality. *Grassland at the heart of circular and sustainable food systems*, 781-790.

Pellaton, R., Lellei-Kovács, E., & Báldi, A. (2022). Cultural ecosystem services in European grasslands: A systematic review of threats. *Ambio*, *51*(12), 2462-2477.

Jin, S. et al (submitted) Farmer Identities and Permanent Grassland Management: Evidence from Five European Biogeographic Zones.

Korevaar, H., Sacco, D., Ravetto Enri, S., Lombardi, G., Ten Berge, H., Bufe, C., ... & Newell Price, P. (2019). Characterising permanent grassland-based farming systems in Europe. *Proceedings of the Improving Sown Grasslands through Breeding and Management, Zurich, Switzerland*, 24-27.

Rankin J., Brown S. and Newell Price P. (eds) (2023). SUPER-*G* Deliverable report 3.6 on Synergies & Trade-offs. EC Project Number 774124-2, 321 pages.

Tindale, S., Raley, M., Vicario Modroño, V., Hunter, E., Bufe, C., Dekker, C., … Frewer, L. (2018). Scientist and farmer perceptions of the feasibility of current and emerging permanent grassland management techniques in Europe. *WP2 Deliverable 2.4, SUPER-G (Sustainable Permanent Grassland Systems and Policies), EC Project Number 774124-2*.

Tindale, S., Vicario-Modroño, V., Gallardo-Cobos, R., Hunter, E., Miškolci, S., Price, P. N., ... & Frewer, L. J. (2023). Citizen perceptions and values associated with ecosystem services from European grassland landscapes. *Land Use Policy*, *127*, 106574.

Tindale et al (submitted). Tipping points and farmer decision-making in European permanent grassland (PG) agricultural systems.

Tonn, B., Bausson, C., Ten Berge, H., Buchmann, N., Bufe, C., Eggers, S., ... & Newell, P. P. (2020). A management-based typology for European permanent grasslands. In *Grassland Science in Europe* (Vol. 25, pp. 412-414). P. Virkajärvi K. Hakala M. Hakojärvi J. Helin I. Herzon V. Jokela S. Peltonen M. Rinne M. Seppänen J. Uusi-Kämppä.

Schils *et al.* 2022. Permanent grasslands in Europe: Land use change and intensification decrease their multi-functionality. Agriculture, Ecosystems and Environment; 330; 107891