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ORCID
ST: 0000-0002-2154-546X
VM: 0000-0002-9607-8528
MR: 0000-0001-6960-1099
AP: 0000-0002-6936-5118
AJV: 0000-0002-1384-8372
KH: 0000-0001-6413-4540
MK: 0000-0001-5290-4771
NL: 0000-0001-8778-1126
MC: 0000-0002-0789-0910
DN: 0000-0002-4030-4645
DV: 0000-0001-9503-2977

Provision of public goods and bads by agriculture and forestry. An analysis of stakeholders' perception of factors, issues and mechanisms

Stefano Targetti[1,*], Valentina Marconi[1], Meri Raggi[2], Annette Piorr[3], Anastasio José Villanueva[4], Kati Häfner[3], Mikko Kurttila[5], Natalia Letki[6], Mihai Costica[7], Dimitre Nikolov[8], Davide Viaggi[1]

[1] *Department of Agricultural and Food Sciences, University of Bologna, viale Fanin, 50 - 40127 Bologna, Italy*
[2] *Department of Statistical Sciences, University of Bologna, via Belle Arti 41 - 40126 Bologna, Italy*
[3] *Leibniz Centre for Agricultural Landscape Research (ZALF), Institute of Socio-Economics, Eberswalder Str. 84,15374 Muencheberg, Germany*
[4] *IFAPA-Institute of Agricultural and Fisheries Research and Training, Camino de Purchil PO Box 2027, Granada, Spain*
[5] *Natural Resources Institute Finland (Luke), Bio-based Business and Industry, FI-80101 Joensuu, Finland*
[6] *Institute of Sociology, University of Warsaw, 00-927 Warszawa, ul. Karowa 18, Poland*
[7] *Department of Economics and International Relations, "Alexandru Ioan Cuza" University of Iași, Carol I Boulevard 22, Iași RO – 700505, Romania*
[8] *Institute of Agricultural Economics, Zarigradsko shose 125, Bl.1, 1113 Sofia, Bulgaria*
*Corresponding author. E-mail: stefano.targetti@unibo.it.

Abstract. The provision of public goods by agriculture and forestry has been a major topic of the agricultural policy debate in the EU. The objective of this paper is to investigate local stakeholder perceptions regarding the cause-effect relations between agriculture and forestry activities and a broad set of public goods and bads, and hence to contribute to the identification of improved policy options for a more efficient delivery of public goods from rural areas. The study presents an assessment based on 71 stakeholder questionnaires collected from seven case study regions in different EU countries. The survey was based on a list of the most relevant public goods and bads developed with the local stakeholders, and aimed to collect stakeholder perception of positive and negative impacts of agriculture and forestry on a range of environmental assets and their relationship with local drivers, socio-economic and cultural features, and policy mechanisms. The analysis shows that the role of agriculture and forestry in the provision of public goods is perceived as generally positive across the selected case study regions. Stakeholder opinions concerning the negative impacts on the environment were more divergent. In particular, differences regarding the impact of different socio-economic and cultural features, and policy mechanisms are evidenced. The results outline the importance of regulations. Also, payments for environmental services are considered relevant in particular for biodiversity, landscape, and water quality. Beside that, aspects such as expectations of society and the attitude of farmers towards the environment resulted noteworthy.

Keywords: Common Agricultural Policy, Ecosystem services, public goods, stakeholders, transdisciplinary approach.
JEL codes: Q18, Q20.

HIGHLIGHTS

- The paper presents an analysis based on 71 stakeholder questionnaires collected from seven case study regions in the EU
- The study concerns the relation between public goods and factors, issues and policy mechanisms
- Results outline that in particular issues and mechanisms are influenced by the perception of public goods
- Regulations, payments for environmental services and environmental attitude of farmers and society result as the most relevant mechanism.

1. INTRODUCTION

Agriculture and forestry are the dominant forms of land-use, respectively covering 38% and 31% of the world's land surface (FAO, 2021). Beside the provision of raw materials such as food and timber, the society is increasingly demanding environmental and cultural services, most of which displaying public goods characteristics, from agriculture and forestry (Muradian & Rival, 2012; OECD, 2015). Also, 'disservices' (public bads) that are defined as ecosystem functions or attributes that generate negative impacts on human wellbeing, affect the wider society (Shackleton *et al*., 2016). These negative impacts can result from agricultural and forestry activities (and in that case they overlap with the concept of negative externality) or might be related to natural processes (e.g. shrub encroachment, crop pests, pollen allergens cfr. Shackleton *et al*., 2016 for a comprehensive definition of ecosystem disservices).

A wide range of policy tools (including incentives, regulations, information and training, etc.) can be used to induce farmers to adopt practices able to enhance the provision of services and reduce the generation of disservices from agri-ecosystems (Kuehne *et al*., 2017). Nonetheless, the identification of efficient mechanisms in the context of the complex range of relationships between policy, institutions and actors, requires taking into account different factors that are often related to local-scale socio-economic and cultural features (Zasada *et al*., 2012). Indeed, a consistent body of literature reports that the complex cause-effect relationships between the management of agri-ecosystems and the generation of benefits linked to public goods are connected to local-scale contexts (Hart *et al*., 2011; Schaller *et al*., 2018).

The provision of public goods by agriculture and forestry has been one of the main topics in the debate concerning the agricultural policy in the recent decades. The new programming period of the Common Agricultural Policy (CAP 2023-2027) of the European Union (EU) has confirmed the growing attention towards the environment: The CAP new "Green Architecture" aims to improve the effectiveness of EU agriculture in delivering public goods from rural areas through different tools such as enhanced conditionality, Agri-Environment-Climate Measures (AECM) and the Eco-schemes. The latter is a relevant novelty of the reformed CAP, introducing a set of measures that the Member States should include in Pillar I and that would work on a voluntary basis for farmers. The Eco-schemes, together with the enhanced conditionality, substitute the so-called 'greening' of the previous programming period and are aimed at harmonizing the mechanisms and the objectives of the Pillars I and II and -to some extent- should facilitate the uptake of agri-environment-climate practices by farmers (Runge *et al*., 2022).

One relevant principle strongly underlined in the new CAP programming period is that a more effective design of AECM requires an adaptation fitting to the local contexts (EC 2021). Therefore, the role of national and sub-national institutions in the design and implementation of Eco-schemes and AECMs has been boosted in the CAP reform to facilitate a better targeting of agri-environmental policies based on the physical and ecological features of different areas. Nevertheless, the inclusion of the different socio-institutional structures (i.e. actors, networks, authorities, policy, etc.), their boundaries and interplay would allow a more comprehensive account of local needs and opportunities (Zasada *et al*., 2017). Consequently, aspects related to the stakeholder perception of factors and issues affecting the generation of public goods in rural areas would potentially allow to increase the efficiency of the policy design by integrating the local-scale biophysical context with the complex socio-ecological processes affecting the provision of public goods (Lebel & Bennett, 2008; Schaller *et al*., 2018).

The assessment of socio-ecological processes, that on one hand influence the supply of ecosystem services

and on the other hand determine their demand (van Zanten *et al.*, 2014; Wolff *et al.*, 2015), can follow different analytical approaches. Biophysical approaches aim to assess public goods and bads through physical measures that can be spatially explicit. The results of such analyses are often characterized by a combination of very specific information that is difficult to scale-up on the aggregate (Marconi *et al.*, 2015). That hampers the policy design and reduces considerably its efficiency in particular when multiple public goods and bads are considered (Armsworth *et al.*, 2012). Despite there are methods and approaches of combining multiple public goods in the same area, examples of implementation are scarce and limited to case studies (e.g. Ungaro *et al.*, 2021). Other approaches try to attach values to public goods provision to support related decision-making, using either monetary (Tienhara *et al.*, 2021; Tyllianakis & Martín-Ortega, 2021) or non-monetary techniques (Targetti *et al.*, 2018). However, generalizations about value-generation processes and the identification of societal and stakeholder demands for multiple public goods and ecosystem services in a spatial explicit manner are very often complicate (Schwartz *et al.*, 2021). In addition, value assessments should include demand and supply that are difficult to observe separately one from each other (Wolff *et al.*, 2015). In practice, the relevance of public goods tends to mix up with the discrepancy between the desired level of public goods and the actual supply, but the quantitative assessment is challenging due to their cognitive and subjective nature[1] (Faccioli *et al.*, 2020), to the different types of use and non-use values perceived by people (Targetti *et al.*, 2021a) and to their variation at different spatial scales (Granado-Díaz *et al.*, 2020). In this sense, the sociocultural evaluation is an approach that is getting momentum (Martin-Lopez *et al.*, 2012). This approach is hinged on assessing how different people perceive and value the environment and the cognitions of wellbeing stemming from landscape. It therefore targets the relationship between society, public goods generation, and environment (Targetti *et al.*, 2021b). By embracing the complexity of human-nature relations, the sociocultural evaluation is less prone to incur in a mechanistic simplification of processes and institutions existing between society and nature and therefore is able to provide a more comprehensive assessment in comparison to other approaches (Muradian & Baggethum, 2021; Norgaard, 2010). Nonetheless, the heterogeneity of public goods perceptions involves the need of analyses able to identify typologies of such perceptions for supporting the design of policies (Soini *et al.*, 2012).

The objective of the study is to investigate local stakeholder perceptions regarding the cause-effect relations between agriculture and forestry activities and a broad set of public goods and bads (PGBs) relevant to society in seven case study regions (CSR). We do so by providing a cross country comparison of perception from a sample of stakeholders based on a common analytical framework. In this paper, the concept of public bads is introduced to consider both positive and negative impacts of agricultural activities on a range of environmental assets such as landscape, water quality, biodiversity, etc. The analysis is based on the identification of groups of stakeholders featuring different PGB perceptions and the characterization of the group dissimilarities in terms of: i) drivers and/or forces that impact PGB provision (hereafter 'factors'), ii) local socio-economic and cultural features (hereafter 'issues') and iii) policy and governance mechanisms (hereafter 'mechanisms'). More specifically, the paper aims to: a) finding relations between PGB perceptions and stakeholder opinions regarding issues, factors and mechanisms that are considered able to foster public goods and/or reduce public bads; b) finding groups of stakeholders with convergent perception of PGBs; and c) discuss the potential of that information for the identification of improved governance options for rural areas.

The paper is structured as follows: the methodology and the description of the CSRs are reported in section 2. Section 3 illustrates the results and section 4 presents the discussion including the study implications for the design of agri-environmental policies. Section 5 concludes.

2. CASE STUDY REGIONS AND METHODS

2.1. Description of the case study regions

The CSRs were located in seven Member States (Finland, Spain, Italy, Germany, Romania, Bulgaria and Poland) to cover different geographical areas of the EU (North, South, West and East EU). Based on information collected from local stakeholders, one CSR was identified in each country to investigate areas featuring a relevant supply of public goods (cfr. § 2.2).

The Finnish CSR was North Ostrobothnia, in Northern Finland, featuring 88% of the land covered by forests. Typical elements of landscape are hills in the northeastern side, rivers and valleys in the western side, and flat peatland areas in the center of the region.

[1] Public goods perception is typically heterogeneous and depends on individual attitudes, experience and values. Also, cognitive processes such as beliefs and knowledge of ecological processes have a relevant influence on the perception and are therefore important aspects to be considered when assessing public goods (Adams, *et al.*, 2003).

The Spanish CSR was Andalusia, in southern Spain, which hosts a wide variety of agroforestry landscapes, especially including olive groves (with more than 1.5 million ha), 'dehesas' agroforestry and livestock systems (around 1 million ha), winter rainfed cereal systems and different types of irrigated agricultural systems. While there are several hotspots related to PGs (e.g. biodiversity in dehesas) and bads (e.g. soil erosion in certain olive grove areas), there is a significant potential for improving PGB provision by agroforestry systems.

The Italian CSR was Emilia-Romagna, located in the north-eastern side of Italy. Agricultural areas cover around 60% of the region, which is mainly cultivated with intensive arable crops (42% of the utilized agricultural area). Agricultural systems in Emilia-Romagna are mostly oriented towards high-quality traditional and intensive production systems and have been characterized by a process of farm concentration (abandonment of small and marginal farms and increase in average farm size). Given the heterogeneity of the region, a wide range of PGB (e.g. biodiversity, amenities, water quality etc.) are relevant in relation to the different agricultural systems and practices.

The German CSR was located in the County of Märkisch-Oderland, Federal State of Brandenburg. The CSR is a natural park where forested areas are under nature conservation measures and are surrounded by agricultural areas. Relevant environmental aspects concern water scarcity, soil functionality (water retention and wind erosion), loss of habitats and biodiversity, and soil carbon stock linked to water management.

The Romanian CSR is the North-East Region, which is characterized by low productivity due to fragmentation of farmland ownership, aging workforce, migration of young people to urban areas and a high degree of poverty for small farmers. The main environmental problems are linked to deforestation, with implications on landslides and soil erosion issues.

The Bulgarian CSR is the South Central Region, where 48% of the land is represented by agricultural areas (mainly arable and grasslands) and 45% by forest areas. The region features a developed livestock sector and agriculture delivers many public goods which are highly valued in the region: agricultural landscapes, farmland biodiversity, water quality and availability. However, also public bads such as soil erosion affects 80% of agricultural areas.

The Poland CSR is the Podlasie region, where agricultural areas constitute 53% of the area and forests cover 31% of the territory. The region is predominantly rural and a significant number of municipalities include Natura 2000 sites. The number of farms recently declined by a rate of 14%. The farms are, on average, small and oriented towards high quality production. Environmental issues that are important include water quality pollution and biodiversity losses due to the recent intensification of agriculture and urban expansion.

2.2. Stakeholder survey and analysis

The survey was carried out to collect information regarding the perception of PGB provision from local agriculture and forestry systems across Europe, and identify the most relevant factors, issues, and the most useful policy mechanisms from the point of view of local stakeholders. The selection of stakeholders was made in all the CSRs following the same procedure. First, a list of relevant stakeholder types was defined, involving farmers and/or foresters, consultants and technicians assisting agricultural and forestry farms, public officers and decision-makers, NGO technicians, and researchers, with all of them focusing their working expertise on PGBs provided by agriculture and forestry. Second, according to the stakeholder types, a list of relevant stakeholders was identified.

The list of public goods and bads linked to agriculture and forestry was selected and refined through stakeholder workshops carried out in the seven selected Member States and in one EU-level workshop organized in Brussels. The workshops were aimed at gathering the views of regional and EU-level stakeholders regarding the notion and the ranking of public goods and bads from agriculture and forestry systems, and issues affecting their provision and demand. A list of 29 different public goods and bads was developed in the workshops. Public bads were, in general, not considered as something conceptually different from public goods and were referred to low or inadequate supply levels of public goods (e.g. for instance, the public bad related to biodiversity was 'biodiversity loss'). In other cases, public bads referred to aspects which could be understood as activities or actions generating public bads, such as pollution. The list of 29 PGBs was afterwards refined taking also into account the typology of most relevant public goods linked to the agricultural sector in the EU as proposed by Cooper and colleagues (2009; cfr. also ENRD, 2010). Accordingly, eight PGB types related to ecosystem capital (Rural landscape, farmland biodiversity, water quality and availability, soil functionality, climate stability, air quality, resilience to flooding and fire) and two related to social capital (rural vitality, and animal health) were selected among the 29 PGBs (Table 1; cfr. Annex A; Novo *et al.*, 2016).

A further objective of the country-level workshops was to map and delimit the CSRs in which to carry out

Table 1. List of public goods and bads considered in the survey (cfr. Annex A).

Public goods	Public bads
Landscape and scenery	Landscape degradation
Farmland biodiversity (animal and vegetal)	Biodiversity losses
Water quality and availability	Water resources pollution and depletion
Air quality	Air pollution
Soil functionality	Soil erosion
Climate stability	Climate degradation
Resilience to flooding, landslides and fire	Increase of flood and wildfire risk
Rural viability and vitality	Degradation of abandoned land
Production quality and security (food, timber, energy)	Poor productions quality and distribution
Farm animal health and welfare	Degradation of animal health and welfare

the subsequent stakeholder survey focusing on PGBs and outline a list of issues, factors and mechanisms affecting the public good delivery. To this end, areas featuring relevant supply of public goods were mapped during the workshops to identify 'hotspots' areas and the main issues in terms of public goods supply and demand, and the potential related criticalities (Tindale *et al*., 2018).

A questionnaire was developed to be submitted to local stakeholders in the 7 selected CSRs. In the questionnaire, the stakeholders were asked to score the relevance of the ten selected PGBs in their CSR. First of all, the relevance of the public goods delivered by agriculture and forestry systems was assessed on a 0-9 scale, then they were asked to score on the same scale the public bads. Thus, each stakeholder provided an overall 20 scores for the relevance of PGBs. For each PGB, the stakeholders were then asked to indicate whether the different factors, issues, and mechanisms were relevant or not in their CSR (Table 2).

One-hundred-one local stakeholders were invited in the 7 CSRs to participate to the survey with a request to fill-in a multiple-choice questionnaire. The survey was filled-in by a total number of 71 respondents in the seven CSRs 68% out of which indicated 'agriculture' as their area of expertise, whereas 32% indicated 'forestry'. The composition of the sample according to the professional categories represented by the respondents is synthetized in Table 3, showing that stakeholders are mostly researchers working in the field of agriculture and forestry or related (38% of the total sample) or public officers from regional or national agencies (30%) (Table 3).

Concerning the composition of the sample, the Italian CSR, Emilia-Romagna region, was the most represented region (23% of the total sample), followed by the Romanian (21%), Bulgarian and Spanish (14% each), Polish and German (10% each) and Finnish CSRs (8%).

2.3. Statistical analysis

The identification of a typology of stakeholder perception towards PGBs was carried out performing a hierarchical cluster analysis based on the scores attributed by the stakeholders to the 20 PGBs. The cluster analysis was preceded by a principal component analysis (PCA). The output of the PCA (scores on the PCA axes) was employed for the cluster analysis (Ward agglomeration method, Manhattan distance metric). This analysis is often employed to explore heterogeneous opinions of respondents (e.g. Soini *et al*., 2012). Previous applications of such an approach have also shown its useful application in studies focusing on agri-environmental policy (e.g. Maton *et al*., 2005; Gómez-Limón *et al*., 2013)[2]. The identification of the clusters was supported by the analysis of the dendrogram structure (Appendix B) to identify how the cases (i.e. the stakeholders) grouped together. An inertia analysis was employed to support the visual identification of the optimal number of clusters. That analysis is based on the within-cluster sum-of-squares calculated for each partition and indicates the partitioning of the dendrogram with the higher relative loss of inertia (inertia of cluster n+1/ inertia of cluster n). According to that, the inertia analysis identifies the

[2] Analyses combining PCA with a hierarchical clustering is often used in social sciences to identify the main variables 'explaining' a database variability and describe groups of cases accordingly. In particular, the PCA outlines the variables able to explain the major part of the variance on the different axes, the cluster analysis is then performed on the scores attributed to these variables. The approach is therefore able to reduce considerably the 'noise' that is usually present in database concerning individuals' perceptions. Regarding the use of such approaches in perception-related surveys, some examples are reported in Husson *et al*., 2010; Soini *et al*., 2012; Targetti *et al*., 2020 and 2021a. The objective is reducing the 'noise' which generally affects database regarding opinions or cognitive-related processes and outline trends or tendencies in the dataset. That procedure is usually at the base of the interpretation of the information conveyed or formulation of policy recommendations.

Table 2. List of factors, issues and mechanisms devised in the local and EU-level stakeholder workshops and considered in the survey.

Factors	Issues	Mechanisms
Public goods are a direct results of land management by farmers and foresters complying with the environmental regulations	Public goods and bads are still theoretical concepts, society has no perception of the role of farmers and foresters as land managers	Increase financial support to farmers and foresters
Public goods are direct result of agriculture and forestry fostered by CAP funding	Inadequate funding for compensation of farmers and foresters adopting sustainable practices	Implement payments for environmental services
Public goods are direct result of the increasing pressure and control exerted by society on farmers and foresters	Conflicts of interest and uses between different stakeholders	Implement new market-based incentives
Public goods are direct result of market demand for healthier, more sustainable agricultural and forestry products	Development and trade-offs between different land uses	Promote farmers' and foresters' education to sustainability
Public goods are direct result of technological advancement and innovation in agriculture and forestry	Problems related to the urban sprawling, rural land abandonment	Adapt compensation schemes and regulations to the global market
Public bads are mostly unintended by-products from agricultural and forestry activities, (direct result only in absence of compliance with the law)	Public access to public goods; land tenure and property issues	Adopt more efficient land use plans
Public bads s are never a direct result of agriculture and forestry, which do not pollute the environment or to damage the society intentionally		Pioneer/foster cross-compliance in all public subsidies
Public bads are a direct result of land management choices exerted by farmers and foresters (e.g. practicing intensive agriculture)		
Public bads are a consequence of the absence of adequate compensation schemes to farmers and foresters		
Public bads are caused by the rising land-abandonment in rural areas		
Public bads emerge from the competition between regions/ countries forcing farmers and foresters to lower the sustainability of productions		

Table 3. Composition of the sample of stakeholders and shares of job categories.

	N.	%
Research/ academics	27	38%
Public officers	21	30%
NGOs	9	13%
Consultant/ agronomists	8	11%
Farmers/foresters (incl. agri-food firms and representatives of producers associations)	6	8%

classification where a further cluster formation does not provide an advantage in terms of data description.

The information regarding the relevance of factors, issues and mechanisms was analyzed with the Shannon-Weaver indicator (H index) as following:

$$H=-\Sigma p_i \times \ln p_i \quad (1)$$

Where p_i indicates the frequency with which a variable (factor, issue or mechanism) was rated as relevant for a specific PGB in that cluster. The H index is a measure of the information entropy and was employed to indicate if specific factors, issues or mechanisms were considered relevant for specific PGBs (i.e. highlighting a low entropy) or otherwise there was not specific indications emerging from the stakeholders (i.e. high entropy: all factors, issues or mechanisms considered relevant).

3. RESULTS

3.1. Relevance of public goods and bads

In general, public goods linked to agricultural and forestry systems were perceived as relevant in the CSRs (Figure 1). Indeed, the average score ranged between

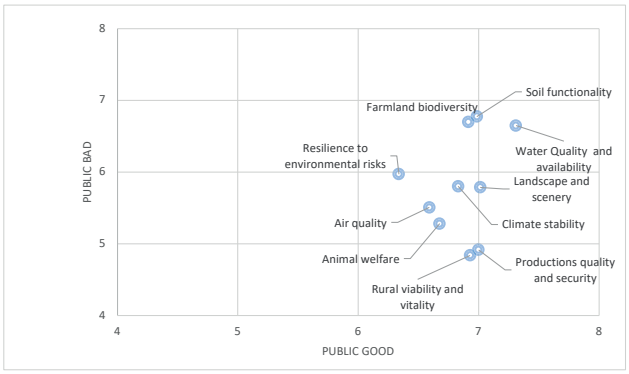

Figure 1. Stakeholders' perception of public goods and public bads provided by agricultural and forestry systems in the 7 CSRs. The rating is reported on a 9 point scale and related to the ten environmental categories included in the study.

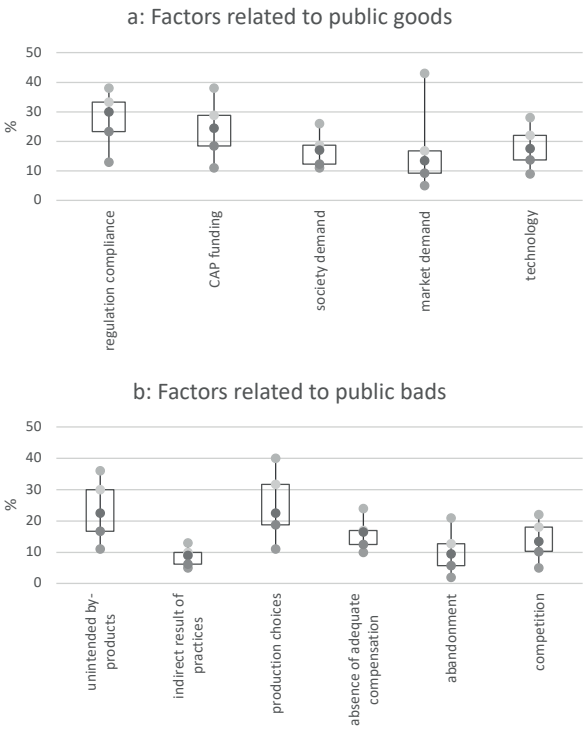

Figure 2. Perception of the stakeholders concerning the relevance of the factors linked to PGBs across the 7 CSRs and for the 10 PGBs: Boxplot of factors related to public goods (a) and public bads (b) provision from agricultural and forestry systems. Grey points in each plot represent 10th, 25th, 50th, 75th, and 90th percentiles, bottom to top.

6.34 for 'Resilience to Flooding, Landslides and Fire' and 7.31 for 'Water Quality and availability' (out of a maximum of 9). Perception of public bads was lower in comparison to public goods. In particular, public bads related to 'Rural viability and vitality' and 'Productions quality and security' were considered the least important (range 4.8-4.9). On the contrary, the relevance of public bads linked to the reduction of 'Farmland biodiversity', 'Soil functionality' and 'Resilience to environmental risks' was significant. As evidenced in Figure 1, a greater variability characterized the scores attributed to public bads. That is also outlined by higher standard deviations for public bads (range 2.15-2.83) in comparison to public goods (range 1.67-2.37) (Appendix C). Public goods perceptions across the CSRs did not result significantly different. On the other hand, public bads perception were significantly different across the CSRs (with $p<0.05$) for all the PGBs considered in the study except for 'Degradation of rural viability and vitality', 'Reduction of climate stability' and 'Reduction of resilience to environmental risks'.

3.2. Factors, issues, and mechanisms linked to public goods and bads

The results about the most important factors considered as relevant for the different PGBs across the seven CSRs are shown in Figure 2. The results show that the most important factors relate to the complying of farmers and foresters to the environmental regulations for public goods and the land management decisions taken by farmers and foresters for public bads (with an across-CSRs average of 30% and 25% of all PGBs impacted by these factors respectively). Specific PGBs that were considered particularly related to regulations were farmland biodiversity and water quality (54% of stakeholders indicated regulation as a relevant factor for these PGBs; Appendix D). Similarly, the CAP funding was considered a significant and positive factor for biodiversity protection and maintenance of rural viability and vitality by 54% of stakeholders. On the other hand, production choices were indicated as a factor specifically related to farmland biodiversity depletion by 56% of stakeholders. The stakeholders' opinions concerning the factors were not significantly different across the CSRs. Two notable exceptions were 'Public goods are direct result of market demand for healthier, more sustainable agricultural and forestry products' that was significantly different with $p<0.01$ and the factor 'Public bads emerge from the competition between regions/countries forcing farmers and foresters to reduce the sustainability of productions' with $p<0.05$.

The relevance of the issues for the ten PGBs was rated between an average of 18% and 33% (Figure 3). In particular, the perception of the role of farmers and foresters as land managers was considered the most rel-

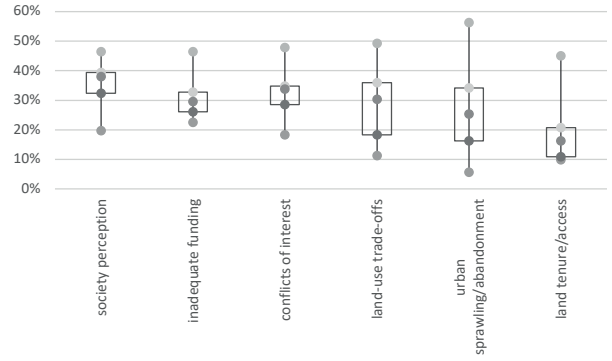

Figure 3. Boxplot of issues related to PGB provision from agricultural and forestry systems: Average stakeholder perception concerning the relevance of the issues across the seven CSRs and for the ten PGBs. Grey points in each plot represent 10th, 25th, 50th, 75th, and 90th percentiles, bottom to top.

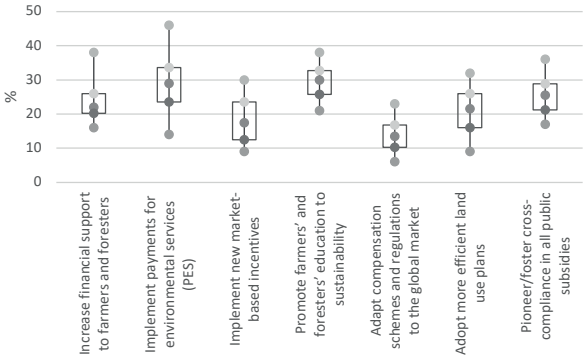

Figure 4. boxplot of mechanisms related to PGBs provision from agricultural and forestry systems . Average perception of the stakeholders concerning the relevance of the mechanisms across the seven CSRs and for the ten PGBs. Grey points in each plot represent 10th, 25th, 50th, 75th, and 90th percentiles, bottom to top.

evant issue, whereas issues linked to land tenure and access were considered on average the least important. Even though urban sprawling and land abandonment was not considered among the most relevant issues for PGBs, that issue was the most important affecting 'Landscape and scenery' (Appendix E). In the case of public bads, 'Inadequate funding' was perceived as the most important issue and in particular 45% of stakeholders considered that as relevant for biodiversity degradation[3]. Likewise for factors, stakeholders' opinions over the issues considered were quite homogeneous across CSRs, except for 'Urban sprawling and abandonment' and 'Development and trade-offs between different land uses' for which statistical significant differences were found between the CSRs (at 0.05 and 0.01 levels, respectively).

According to the stakeholders, the most relevant mechanisms to improve public goods and reduce public bads were the implementation of payments for environmental services (PES) and the promotion of farmers' and foresters' awareness of sustainability (education). These mechanisms were considered effective for a range of different PGBs, but PES were rated as particularly effective for biodiversity and landscape (62% and 53% of stakeholders on average rated PES as relevant for biodiversity and landscape; Appendix F). Interestingly, the mechanism 'Adapt compensation schemes and regulations to the global market' was considered as the least effective mechanism to foster public goods and reduce public bads. Concerning the difference between regions, PES and 'Adopt more efficient land use plans' were significantly different across the seven CSRs considered ($p<0.05$; Appendix G).

3.3. Cluster analysis. Finding groups of stakeholders with convergent perception of PGBs

The cluster analysis performed on the PCA scores outlined four clusters (Appendix B). The largest cluster (Cluster 2) included 37% of stakeholders characterized by stating high scores for all PGBs (with overall average scores of around 8 out of 9 for both public goods and public bads; Table 4). Noteworthy, public bads were relevant and higher than in the other clusters. The second largest cluster (Cluster 3) grouped 25% of stakeholders was characterized by the perception of landscape as the most relevant public good (average score of 7.7) and biodiversity depletion as the most important public bad (scoring 6.9) connected to agricultural and forestry systems. Also, PGBs linked to resilience to flooding, landslides and fire and air quality were considered the least relevant, with scores within the range of 3.6-4.6. The third largest cluster (Cluster 4; 24% of stakeholders) was composed by stakeholders who stated the overall lowest scores for PGBs (5.5 for public goods and 4.2 fo public bads), considering rural viability as the most relevant public good and soil erosion as the most critical public bad (scoring 6.7 and 6.2, respectively). In this cluster, water and production quality were considered the least relevant public good and public bad respectively (scoring 4.3 and 5.1). Finally, Cluster 1 included 18% of stakeholders. In that cluster, the stakeholders perceived a high relevance of public goods (7.2) compared to bads (4.5), indicating soil functionality as the most relevant public

[3] More details concerning the differences between the stakeholder perception have been reported in the discussion section.

Table 4. Average scores of PGBs in the four identified clusters. The PGBs that in each cluster were reported more frequently as relevant in the stakeholder opinion are in bold.

Variable	Cluster 1-"Positivists"		Cluster 2-"Holistics"		Cluster 3-"Naturalists"		Cluster 4-"Agrarians"	
% of stakeholders	18		37		24		21	
	PGs	PBs	PGs	PBs	PGs	PBs	PGs	PBs
Landscape and scenery	6.6	3.3	7.6	8.0	7.7	5.4	5.8	4.3
Farmland biodiversity	7.8	4.8	7.7	8.2	7.4	6.9	4.6	5.4
Water quality and availability	8.1	4.2	8.7	8.3	7.4	6.6	4.3	5.1
Air quality	6.8	5.7	8.5	8.2	4.6	3.9	5.4	3.5
Soil functionality	8.2	3.8	8.7	8.0	5.8	5.9	4.5	6.2
Climate stability	7.5	6.4	8.3	7.9	5.5	5.1	5.5	4.5
Resilience to flooding landslides and fire (%)	7.8	4.8	7.9	8.2	3.6	3.8	5.6	4.1
Rural viability and vitality	6.1	4.5	8.0	7.3	6.4	2.8	6.7	3.7
Quality and security of products (food. timber. energy)	6.8	3.3	8.1	7.3	6.1	3.5	6.5	2.6
Farm animal health and welfare	6.6	4.2	7.9	7.6	5.9	4.4	5.6	3.0
Overall average score	7.2	4.5	8.1	7.9	6.0	4.8	5.5	4.2

good (scoring 8.2) and the deterioration of climate stability as the most relevant public bad (scoring 6.4) produced by agriculture and forestry systems. In cluster 1 on the contrary, public bads related to landscape and production quality were perceived as the least important (both scoring 3.3). Considering the results, we propose the following cluster labelling: *C1-Positivists, C2-Holistics*, *C3-Naturalists* and *C4-Agrarians*.

The four clusters outlined a relation with some of the CSRs as presented in Appendix G. In particular, cases from the German and Spanish CSRs were more often classified in C3-Naturalists and C4-Agrarians, respectively. C1-Positivists and C2-Holistics, on the contrary, showed a less clear relation with a specific CSR, though stakeholders from the Italian CSR were more likely C1-Positivists and Romanian CSRs were more likely C2-Holistics.

Figure 5 shows the Shannon-Weaver index of information entropy for factors, issues, and mechanisms for the different clusters. The classification provided by the cluster analysis allowed to reduce the information entropy and therefore provided indications about the relevance of specific issues and mechanisms for the different PGBs: As shown in figure 5, the uncertainty conveyed by the stakeholders concerning issues and mechanisms in connection with the different PGBs was significantly decreased. On the contrary, the information entropy regarding the factors linked to PGBs was not affected significantly with the cluster analysis. According to the Shannon-Weaver index, C2-Holistics showed the highest entropy for issues and mechanisms, indicating a lower capacity to discriminate between these for the improvement of PGB provision from agriculture and forestry. The cluster analysis enhanced the information quality in particular for C1-Positivists and, to a lesser extent, C3-Naturalists and C4-Agrarians, which recorded a significant lower entropy of the information across issues and mechanisms in comparison to C2.

4. DISCUSSION

In general, the average scoring of public goods linked to agricultural and forestry systems in the 7 CSRs was higher than the perception of public bads. That points to an overall positive perception of the role of agriculture and forestry activities in providing environmental services, but that was also linked to the selection of CSRs with relevant levels of public goods supply. In particular in the selected CSRs, public goods such as production quality and quantity, and rural vitality clearly prevail compared to the public bad one. This may reflect a general perceived efficiency of agriculture and forestry in providing those public goods (Villanueva *et al.*, 2014; Novo *et al.*, 2016). The results also indicate that the rating of public goods such as biodiversity, soil functionality, and resilience to environmental hazards, was very close to the rating of public bads. That denotes contrasting impacts for these environmental categories that are likely linked to different agricultural practices or systems and therefore highlights aspects where agri-environmental policies may play a more relevant role.

Even though public bads perception was generally low, its variability across the CSRs was more promi-

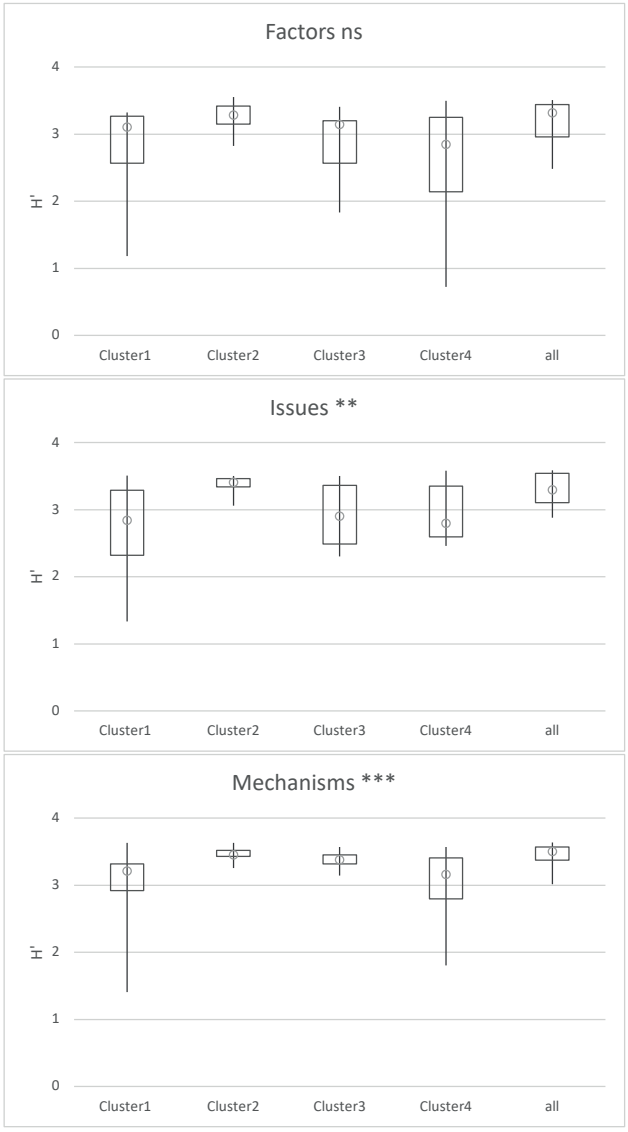

Figure 5. Shannon-Weaver index of information entropy. Boxplot of the clusters and ANOVA: Boxplots with different letters indicate significant differences of H' between the clusters with p<0.05 (Tukey HSD test for significant difference between clusters with**=p<0.01; *** p=<0.001; ns= not significant; i.e. cluster indicated with 'a' is different from 'b', cluster indicated with 'ab' are not different from 'a' and 'b').

nent in comparison to public goods. In other words, the analysis indicates that agriculture and forestry systems are perceived as relevant "providers" of a wide range of public goods, whereas differences across the CSRs are more evident when considering the negative impacts. That points to an appropriate consideration of public bads and supports the stream of literature highlighting the usefulness of ecosystem disservice analyses for disentangling the dynamics taking place in different rural regions (Blanco *et al.*, 2019; Targetti *et al.*, 2021b; Zabala *et al.*, 2021). Nonetheless, the inclusion of CSRs featuring agricultural systems that provide significant public bads would be necessary to bring clearer insights in that respect.

The selectd CSRs were characterized by different agricultural and forestry systems, but that did not implicate siginificant differences related to PGBs. In that respect, the classification based on the cluster analysis allowed to increase the informative value conveyed by the stakeholders and highlighted significant differences across the clusters concerning issues and mechanisms. On the contrary, the perception of factors linked to PGBs was rather homogenous between the clusters. That evidence highlights how issues and mechanisms may have a different relevance even though the factors linked to PGBs are rather similar. For instance, the important role of factors such as regulations and the CAP in promoting public goods was a clear outcome of the analysis. In contrast, the implementation of mechanisms such as payments for environmental services was rated as particularly effective for public goods such as biodiversity and landscape. Similarly, inadequate funding was considered as an issue with negative consequences for specific public goods such as farmland biodiversity, rural viability, and production. That confirms that the design of large scale policies for PGBs is complicate because of the different local-scale and socioeconomic features as supported by a range of studies (e.g. Armsworth *et al.*, 2012; Schaller *et al.*, 2018). Our results show that the consideration of mechanisms and issues would help to target the PGBs that are at stake in the different regions and improve the implementation of agri-environmental policies. Indeed, some general trends regarding mechanisms can be highlighted. For instance, the promotion of farmers' and foresters' awareness of sustainability issues resulted as a very effective mechanism for a range of different PGBs. If on one hand the stakeholders underlined aspects related to human and social capital like education, on the other hand they highlighted a scarce belief in market-related mechanisms such as adapting PGB schemes and regulations to the global market and market-based incentives. The latter, though, was rated as a relevant mechanism for improving production quality. In a nutshell, market-related mechanisms link better to specific PGBs that are considered more relevant for consumers (e.g. food production and animal welfare), other PGBs relating for instance to water, soil, landscape etc. require more refined mechanisms such as PES and cross-compliance of public subsidies. Contrarily, the scope of mechanisms designed to enhance education to

sustainability of farmers and foresters is rated as effective on a more general level.

Concerning the issues connected to PGBs, tools targeting human capital were confirmed as important. For instance, societal perception of the role of farmers and foresters was considered the most relevant issue. That reiterates the opportunity to consider "soft" aspects like education ,social benefits and the acknowledgment of the role of land managers in environmental protection. Other issues that reached a high ratings in connection to specific PGBs was urban sprawling and land abandonment for their impacts on landscape and rural viability. On the contrary, the issue 'Public access to public goods, land tenure and property' was usually included among the least relevant issues.

Concerning the perception of factors, regulations were acknowledged as the most important for the delivery of public goods. CAP funding was also perceived as very relevant in particular for specific PGBs such as biodiversity and rural viability. On the other hand, the role of farmers' decisions and the unintended effects of those decisions were perceived as the most important factors. Those results outline a very traditional view of agri-ecosystems where farming activities generate externalities that policies need to tackle through classical stick-and-carrot tools. Technology, on the contrary, was not perceived as a factor able to improve the provision of PGB from rural areas. Exceptions concerned water and production quality. That is likely linked to the availability of technologies like for instance drip irrigation that are well-known for their potential positive effects, whereas for other public goods like biodiversity the potential of technology in helping the transition towards agro-ecological solutions is still less palpable (Bellon-Maurel & Huyghe, 2017).

In terms of policy implications, the limited number of stakeholders and regions that were included in the survey (71 stakeholders in 7 CSRs) makes difficult to generalise the results. Though, the work was carried out in a good range of different agricultural and forestry areas, located in North, East and Southern parts of the EU. Even though with limitations, the study can therefore highlight some trends and interesting aspects on the connection between agriculture and forestry, and the supply of PGBs in EU. The results support the usefulness of mixing different tools taking into consideration their different capacity to deal with different PGBs. On one hand regulations seem to guarantee high levels of efficiency, on the other hand a mix with tools targeting information and education are also necessary. Beside the importance of policy mix, that result also confirms that the configuration and design of the different tools together is important (Fraser and Campbell, 2019). Nevertheless, this work cannot provide insights on aspets related to the design of different policy mixes as the study focused on the relevance of the mechanisms for the different PGBs and not on the configuration of different mechanisms together. A further interesting aspect regards the reflection on the temporal dimension. Even though the survey did not explicitly consider the time range, the results outline a dicrepancy between issues, factors and mechanims that accrue in the long term (e.g. human capital related) and others that denote a more immediate impact (such as regulations and payments for environmental services). However, that observation would need confirmation through an ad-hoc study focused on these aspects.

From a governance perspective, several considerations can be raised. First of all with specific reference to sectorial policies like the CAP, the relevance of incentives to support (reduce) the supply of public goods (bads) results as paramount. Indeed, a general skepticism emerges concerning the possibility to improve public goods such as biodiversity or other environmental services relying on market-related mechanisms only. Likely, the importance of supporting (e.g. biodiversity) and regulating services are considered too complex to fit easily to society awareness. That involves the perceived necessity to intervene with subsidies to complement the rationale of the market demand-supply mechanism. In that regard, the new CAP architecture (REG 2021/2115)[4] could tackle that aspect. For instance, the higher rate of funding earmarked for environmental objectives (e.g. the eco-schemes) and the enhanced conditionality requirement could match with increasing the CAP targeting towards environmental objectives. Beside incentives, the role of regulations as necessary tools to ensure an adequate level of public goods supply is also reported. However, it seems obvious in the stakeholder perception that the availability of budget for incentives and regulations for PGBs is not enough without a more 'horizontal' approach of the policy design (Hodge, 2001). Fostering cross-compliance of public subsidies was for instance a mechanism that was rated as very important for several PGBs. In other words, the adequacy of a policy framework focusing on environmental objectives is necessary but not sufficient if a local-scale dialogue with other land-use-planning institutions and a wider range of local economic sectors is not established.

[4] Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans); https://eur-lex.europa.eu/eli/reg/2021/2115/oj - access in all EU languages

The study also highlights that a more efficient governance of PGBs is forcedly related to human capital. Knowledge, perception, ability, are for instance some of the farmers' and foresters' education objectives that need to be considered and promoted in consideration of long-term goals (Knowler and Bradshaw, 2007). The difficulty is clearly related to the necessity to focus short-term targets taking also into account the long-term objectives (Janssen and Anderies, 2007). For instance, the development of new PES schemes was considered relevant. But the implementation of innovative payment types also needs to take into account the socioeconomic context. In other words, if innovative solutions will be more and more necessary their success also depends on the capacity, interest and motivation of farmers to uptake such solutions (Raina *et al.*, 2021). Tools fitting to the improvement of human capital are therefore relevant, but the time range needed is usually long and a constant adaptation and coordination with regulations and incentives is needed.

5. CONCLUSIONS

The work presents the results of a survey carried-out in 7 CSRs and collecting opnions from 71 stakeholders. The work covered a range of different agricultural/forestry systems located in North, East and Southern parts of the EU that were selected for their particular supply of public goods. Even though with limitations, the study can therefore highlights some trends and interesting aspects on the connections between agriculture and forestry, and PGBs in EU.

Overall, the perceived impacts on PGBs linked to agriculture and forestry were positive: this is consistent across regions and stakeholders, whereas more remarkable differences between the stakeholders were evident for public bads. On one hand, that outcome confirms that the selected CSRs were 'hotspots' of public goods. On the other hand, assessing aspects related to public bads is a potential pathway of research to shed light on differences and opportunities for the design of local-scale agri-environmental policies (Blanco *et al.*, 2019; Targetti *et al.*, 2021a). In that regard, the selection of CSRs denoting a significant supply of public goods is however a limitation of the study. The inclusion of CSRs featuring a wider set of PGB supply would therefore be necesssary to deepen the aspects related to public bads.

The results clearly point to regulation compliance and subsidies as relevant factors for the maintenance and improvement of a range of public goods. The CAP in particular is confirmed among the most relevant factors but the opinion of the stakeholders is rather differentiated according to the different PGBs. This can be related to a less clear perception of effectiveness of voluntary schemes, but in part it is also very likely associated to the higher complexity of that policy approach and the consequent difficulty in assigning clear impacts on specific PGBs. That is consistent with current debates that concerns for instance the role and design of subsidies for the conservation and promotion of farmland biodiversity (Pe'er *et al.*, 2022).

A general convergence regards the impact of factors on PGBs. Conversely, a different consideration of mechanisms and issues was evidenced and related to the different perception of stakeholders towards PGBs. The classification provided by the clusters analysis allowed to understand the configuration of issues and mechanisms that were considered relevant in connection with the different PGBs. For instance, market processes and society demand were more relevant for specific public goods such as production quality and security, and animal welfare, whereas to a lesser extent to climate stability. This in part explains the relevance attributed to market-related mechanisms for those PGBs. Instead, more articulated tools such as payments for environmental services were considered necessary for public goods such as landscape, biodiversity, water quality, etc. The disconnection between society demand and supply of environmental services is fundamentally an issue that involves awareness of processes underpinning such services, the adequacy of markets to stimulate specific services, and the trade-offs that inevitably incur between levels of ecosystem services supply (Adams, 2014). In this study, we have evidenced that different stakeholders have different views and opinions but further evidence would be necessary to understand whether such differences might be related to CSR features or agricultural systems.

Beside regulation and subsidies, soft aspects leveraging on the environmental attitude of farmers and society are considered important across the different CSRs and for the different public goods. Surely, these aspects accrue on longer time ranges but likely their perceived relevance denotes a scarce attention or inefficiencies of the current agrienvironmental policy framework towards those topics. Even though the study did not evaluate different policy mixes, a message emerging from the analysis supports the need of considering instruments addressing different temporal and spatial scales. On the one hand regulations are considered effective for a wide set of public goods and across the different CSRs. On the other hand, the effectiveness of incentives depends on the type of public goods and local scale

issues. The role of knowledge, awareness and education in general is considered relevant for enhancing the adaptation capacity of a socio-ecological system (Janssen and Anderies, 2007). Therefore, tools targeting social and human capital should also be taken into account even though their impact will likely span in the long-term.

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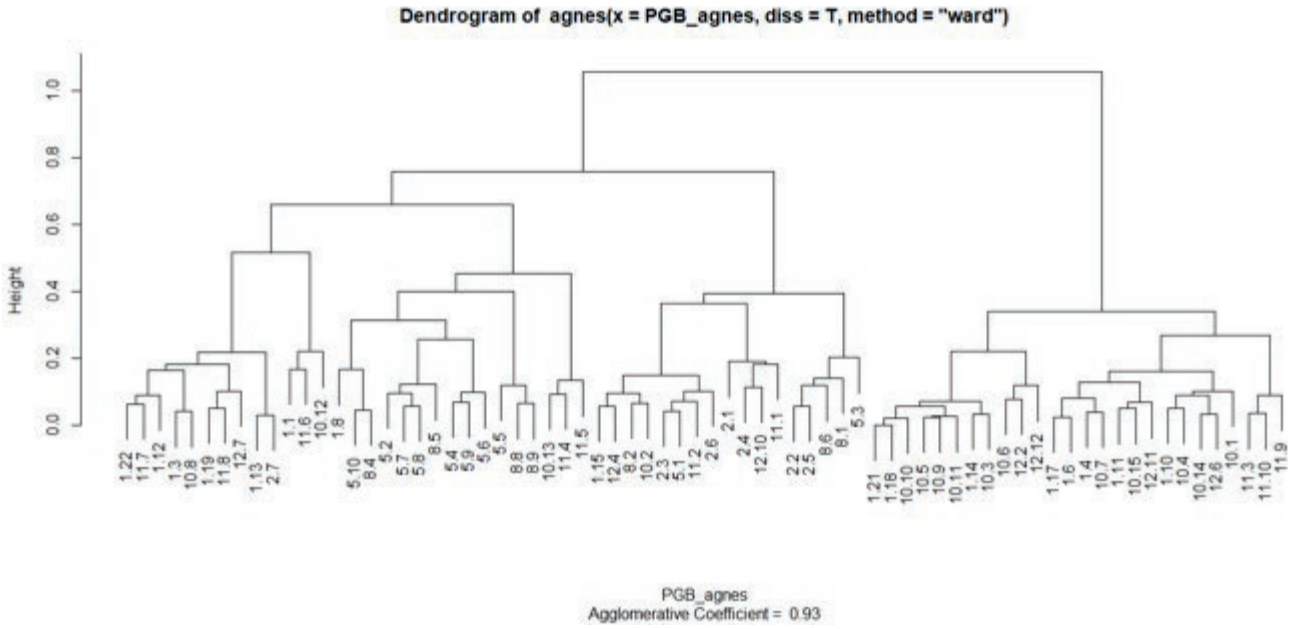
APPENDIX A

List and description of PGBs as developed with the stakeholders.

	Category	Related Public Goods	Related Public Bads
1	Rural Landscape	Beauty access Naturalness (sounds & scents) Health & wellbeing Tranquility Tourism Educational & recreational values Connectedness & spiritual values	Landscape degradation Land fragmentation Barriers to recreation Clear-cut forest areas
2	Farmland Biodiversity	Pollination Habitats Wild berries and mushrooms Games Local varieties of plants and animals Protection against pests Picking fruits	Pest & diseases Increase of dangerous wild animals Pollination reduction
3	Water availability	Sustainable land management Resilience to drought	Intensification Natural resources consumption
	Water quality	Sustainable land management	Intensification Water Pollution Intensification Health problems
4	Air quality	Health, & wellbeing Sustainable land management	Intensification Air pollution Health problems
5	Soil functionality	Sustainable land management Carbon storage Water retention Geodiversity Climate change adaptation and mitigation	Soil erosion Soil pollution Intensification
6	Climate stability	Carbon storage GHG emissions Carbon Sink	Intensification
7	Resilience to flooding, landslide and wildfire	Sustainable land management Water flows regulation Climate change adaptation	Flooding
	Resilience to fire	Sustainable land management Climate change adaptation	Wild fire
8	Rural viability/vitality	Cultural heritage Local identity Land & Infrastructure maintenance Creation of rural jobs Land stewardship Connectedness & spiritual values	Land abandonment Culture loss Poverty Poor land management Safety / vandalism
9	Food, energy and timber security and quality (local supply)	Energy supply Food security & quality Sustainable land management Employment Forest quality	Poor food quality & distribution Outsourcing production Deforestation Natural resources exploitation
10	Farm Animal health/welfare	Foraging & hunting Pasture and grasslands Sustainable land management	Intensification Health problems

APPENDIX B



Cluster dendrogram.

APPENDIX C

Average perception of PGBs relevance and standard deviation. Public goods perception Public bads perception were significantly different across the CSRs (with $p<0.05$) for all the PGBs considered in the study except for 'Degradation of rural viability and vitality', 'Reduction of climate stability' and 'Reduction of resilience to environmental risks'.

	Public goods perception*		Public bads perception**	
	Average score	St. dev.	Average score	St. dev.
Landscape and scenery	7.01	1.67	5.79	2.68
Farmland biodiversity (animal and vegetal)	6.92	1.97	6.70	2.25
Water quality and availability	7.31	2.21	6.65	2.33
Air quality	6.59	2.33	5.51	2.83
Soil functionality	6.99	2.29	6.77	2.15
Climate stability	6.83	2.15	5.80	2.56
Resilience to flooding, landslides and fire	6.34	2.37	5.97	2.79
Rural viability and vitality	6.93	1.89	4.84	2.76
Productions quality and security (food, timber, energy)	7.00	2.00	4.92	2.73
Farm animal health and welfare	6.68	1.98	5.28	2.55

*Difference between case study regions not significant
** difference between case study regions significant with $p<0.05$ except for 'Degradation of rural viability and vitality', 'Reduction of climate stability' and 'Reduction of resilience to environmental risks'.

APPENDIX D

Heathmap of the perception of relevant factors for the different PGBs.

	Relevant for public goods				
	Regulation compliance	CAP funding	Technology	Society demand	Market demand
Productions quality and security (food, timber, energy)	42%	41%	39%	34%	61%
Farmland biodiversity (animal and vegetal)	54%	54%	23%	24%	24%
Farm animal health and welfare	44%	35%	25%	37%	46%
Resilience to Flooding, Landslides and Fire	42%	25%	18%	17%	8%
Water Quality and availability	54%	28%	38%	27%	17%
Landscape and scenery	32%	39%	15%	24%	21%
Soil functionality	48%	34%	31%	15%	14%
Rural viability and vitality	18%	54%	24%	17%	23%
Climate stability	28%	23%	13%	18%	7%
Air quality	34%	15%	31%	25%	13%

	Relevant for public bads					
	Production choices	Nnintended by-products	Absence of adequate compensation	Competition	Abandonment	Indirect result of practices
Productions quality and security (food, timber, energy)	31%	15%	24%	31%	14%	14%
Farmland biodiversity (animal and vegetal)	56%	48%	34%	25%	13%	15%
Farm animal health and welfare	30%	21%	23%	23%	7%	13%
Resilience to Flooding, Landslides and Fire	32%	31%	14%	7%	18%	8%
Water Quality and availability	45%	31%	20%	30%	3%	7%
Landscape and scenery	44%	51%	24%	15%	23%	14%
Soil functionality	48%	44%	24%	25%	17%	7%
Rural viability and vitality	15%	15%	17%	10%	30%	10%
Climate stability	25%	38%	27%	15%	11%	18%
Air quality	25%	32%	14%	14%	7%	13%

APPENDIX E

Heathmap of the perception of issues related to the different PGBs.

	PGs relevance						PBs relevance					
	society perception	inadequate funding	conflicts of interest	land-use trade-offs	urban sprawling/ abandonment	land tenure/ access	society perception	inadequate funding	conflicts of interest	land-use trade-offs	urban sprawling/ abandonment	land tenure/ access
Productions quality and security (food, timber, energy)	42%	42%	35%	46%	46%	45%	42%	39%	38%	37%	42%	25%
Farmland biodiversity (animal and vegetal)	37%	46%	48%	49%	31%	21%	37%	45%	38%	32%	35%	18%
Resilience to Flooding, Landslides and Fire	39%	25%	46%	32%	23%	27%	28%	30%	28%	32%	18%	20%
Water Quality and availability	38%	23%	18%	11%	18%	10%	25%	23%	13%	10%	15%	13%
Air quality	38%	34%	30%	34%	35%	14%	31%	35%	30%	32%	18%	10%
Soil functionality	46%	30%	25%	28%	14%	10%	37%	30%	15%	20%	14%	14%
Climate stability	39%	28%	34%	37%	28%	20%	25%	20%	23%	20%	18%	14%
Landscape and scenery	31%	30%	28%	17%	56%	18%	24%	31%	27%	18%	41%	30%
Rural viability and vitality	25%	30%	34%	23%	15%	14%	20%	30%	14%	13%	15%	15%
Farm animal health and welfare	20%	23%	34%	13%	6%	10%	23%	27%	20%	8%	8%	8%

APPENDIX F

Heathmap of the perception of mechanisms able to foster PGs and reduce PBs.

	Fostering public goods						
	Increase financial support to farmers and foresters	Implement payments for environmental services (PES)	Implement new market-based incentives	Promote farmers' and foresters' education to sustainability	Adapt compensation schemes and regulations to the global market	Adopt more efficient land use plans	Pioneer/foster cross-compliance in all public subsidies
Production quality and security (food, timber, energy)	34%	23%	42%	38%	32%	23%	28%
Farmland biodiversity (animal and vegetal)	48%	59%	32%	42%	20%	37%	39%
Resilience to Flooding, Landslides and Fire	31%	35%	13%	45%	8%	28%	32%
Water Quality and availability	30%	49%	25%	42%	21%	37%	39%
Air quality	23%	30%	15%	35%	13%	23%	35%
Soil functionality	28%	48%	17%	46%	14%	45%	39%
Climate stability	28%	45%	17%	39%	25%	24%	34%
Landscape and scenery	38%	59%	24%	44%	10%	37%	41%
Rural viability and vitality	42%	24%	30%	30%	28%	31%	27%
Farm animal health and welfare	31%	31%	37%	38%	20%	20%	31%

	Reducing public bads						
	Increase financial support to farmers and foresters	Implement payments for environmental services (PES)	Implement new market-based incentives	Promote farmers' and foresters' education to sustainability	Adapt compensation schemes and regulations to the global market	Adopt more efficient land use plans	Pioneer cross-compliance in all public subsidies
Production quality and security (food, timber, energy)	32%	20%	38%	35%	28%	21%	24%
Farmland biodiversity (animal and vegetal)	46%	65%	37%	52%	20%	44%	51%
Resilience to Flooding, Landslides and Fire	23%	35%	15%	35%	14%	27%	28%
Water Quality and availability	35%	46%	28%	49%	15%	37%	46%
Air quality	24%	38%	15%	46%	14%	20%	37%
Soil functionality	31%	44%	17%	54%	13%	37%	42%
Climate stability	28%	44%	24%	48%	24%	30%	35%
Landscape and scenery	54%	46%	27%	46%	18%	42%	41%
Rural viability and vitality	37%	27%	20%	34%	18%	35%	24%
Farm animal health and welfare	30%	32%	42%	39%	27%	13%	37%

APPENDIX G

Correlogram outlining the relation between clusters and CSRs. The intensity of the blue colour is related to a positive relation, whereas red color indicates negative relations. The dimension of the bubble is proportional to the rate of the relation.