Agricultural landscapes, ecosystem services and regional competitiveness-Assessing drivers and mechanisms in nine european case study areas

Lena Schaller, Stefano Targetti, Anastasio J. Villanueva, Ingo Zasada, Jochen Kantelhardt, Manuel Arriaza, Tufan Bal, Valerie Bossi Fedrigotti, F. Handan Giray, Kati Haefner, et al.

Land Use Policy 76 (2018) 735–745

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Agricultural landscapes, ecosystem services and regional competitiveness—Assessing drivers and mechanisms in nine European case study areas

Lena Schaller[a,*], Stefano Targetti[b,c], Anastasio J. Villanueva[d], Ingo Zasada[e], Jochen Kantelhardt[a], Manuel Arriaza[f], Tufan Bal[g], Valérie Bossi Fedrigotti[h], F. Handan Giray[i], Kati Häfner[e], Edward Majewski[j], Agata Malak-Rawlikowska[j], Dimitre Nikolov[k], Jean-Christophe Paoli[l], Annette Piorr[e], Macario Rodríguez-Entrena[d], Fabrizio Ungaro[m], Peter H. Verburg[n,o], Boris van Zanten[n], Davide Viaggi[b]

[a] Institute of Agricultural and Forestry Economics, University of Natural Resources and Life Sciences, Vienna, Austria
[b] Department of Agricultural Sciences, University of Bologna, Bologna, Italy
[c] Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Prague, Czech Republic
[d] Department of Agricultural Economics, Sociology, and Policy, University of Córdoba, Córdoba, Spain
[e] Leibniz Centre for Agricultural Landscape Research, Müncheberg, Germany
[f] Department of Agricultural Economics, Institute of Agricultural Research and Training (IFAPA), Córdoba, Spain
[g] Antalya, Turkey
[h] Faculty of Science and Technology, Free University of Bozen-Bolzano, Bolzano, Italy
[i] Suleyman Demirel University, Faculty of Agriculture, Department of Agricultural Economics, Isparta, Turkey
[j] Faculty of Economic Sciences, Warsaw University of Life Sciences, Warsaw, Poland
[k] Institute of Agricultural Economics, Sofia, Bulgaria
[l] Institut national de la recherche agronomique, Laboratoire de Recherches sur le Développement de l'Elevage, Corse, France
[m] National Research Council, Institute for Biometeorology, Sesto Fiorentino, Italy
[n] Faculty of Earth and Life Sciences, VU University Amsterdam, The Netherlands
[o] Swiss Federal Institute WSL, Birmensdorf, Switzerland

ARTICLE INFO

Keywords:
Analytic Network Process
Rural competitiveness
Stakeholders
Participatory approach
Landscape valorisation
Common Agricultural Policy

ABSTRACT

Agricultural landscapes affect regional development and competitiveness in a way far beyond the production of agricultural commodities. However, comprehensive assessments of the relevant cause-effects between agricultural landscape and regional competitiveness are complex and they require a range of ecological, economic and social aspects to be considered. This study proposes an stakeholder-based 'Analytic Network Process' applied in nine European case-study areas in order to assess the role of economic actors, ecosystem services, socio-economic benefits and regional competitiveness in the agricultural landscape system. The results reveal that agricultural food production is still perceived as a major element for creating value from landscapes. However in some case studies, the importance of non-marketable, socio-cultural and environmental public good-type ecosystem services outweighs the importance of agricultural production. Region-specific variations of cause-effect relationships are discussed and a range of drivers, related to biophysical conditions, land-use patterns, agricultural management and remoteness are identified. Our study reveals the perception of non-monetary services and their impact on regional competitiveness and provides considerations on entry points for rural policies promoting landscape valorisation.

1. Introduction

There is consensus that sustainable growth in Europe cannot be achieved without the contribution of its rural regions. These regions have been coping with substantial challenges over the last decades. Profound changes in the agricultural sector such as changing policies (Jongman, 2002), institutional modifications, technical progress and mechanisation (van Vliet et al., 2015), and the focus on production

* Corresponding author.
E-mail address: lena.schaller@boku.ac.at (L. Schaller).

https://doi.org/10.1016/j.landusepol.2018.03.001
Received 13 September 2017; Received in revised form 28 February 2018; Accepted 1 March 2018
Available online 13 March 2018

efficiency have all led to a reduction in agricultural employment, a price decrease for agriculture commodities and a general increase in the socio-economic disparities among regions (Pedroli et al., 2016). The transformation of the agricultural sector, together with the comparatively slower development of other sectors of the rural economy, in several regions has led to a reduction in investments, the depletion of rural infrastructures and to outmigration (Wilson, 2010). Against this background, in recent years there has been growing interest in how the competitiveness of European rural regions can be strengthened and to what extent agriculture still contributes to this process. In particular, the concepts of multifunctionality and ecosystem services (ESS) are discussed, indicating that agricultural landscapes do not provide private good-type commodities only, but also a broad range of public good-type services, which constitute important socio-economic assets for the rural economy (Costanza et al., 1997; Huang et al., 2015; Huylenbroeck et al., 2007).

The ESS concept, in particular, has gained much attention and numerous frameworks have refined the classification of services (Haines-Young and Potschin, 2010; LaNotte et al., 2017). Moreover, a large number of studies has investigated social and economic effects related to the supply of private and public good-type ESS in agricultural landscapes. The main effects which have been identified are enhanced recreational opportunities (Sharpley and Vass, 2006; Rodríguez-Entrena et al., 2017), the creation of niche-market opportunities for local and quality products (Tempesta et al., 2010), enhanced quality of life and the viability of rural crafts and traditional skills (Sharpley and Vass, 2006). Furthermore, upstream and downstream effects have been reported in branches connected to agricultural production, eventually opening up opportunities for added value creation and rural employment (Dissart and Vollet, 2011). The aforementioned studies acknowledge that, depending on the regional context and the given territorial potentials, agricultural landscapes affect regional development in a way far beyond the production of agricultural commodities. However, it is also acknowledged that the complexity of the cause-effect chains, and the multitude of direct and indirect, multi-staged and multi-faceted effects, as well as the variety of feedbacks and loops characterising the pathways between agricultural landscape and local economy, are a substantial challenge for a comprehensive assessment. This is particularly true if benefits stemming from the use of public good-type ESS are included (Dissart and Vollet, 2011; Manrique et al., 2015).

In this paper, drivers and mechanisms linking agricultural landscape, ESS provision and the local economy are assessed, by means of the multi-criteria technique 'Analytic Network Process' (ANP). The focus is on different sectors of the rural economy, their impact on the provision of landscape services, the most important socio-economic benefits resulting from the use of these services, and the factors of regional competitiveness affected by such benefits. Based on the framework proposed by van Zanten et al. (2014), an analytic network has been developed, involving an intensive multi-step stakeholder co-construction and validation process. Data from 9 European rural case study areas (CSAs) have been collected and analysed. The paper presents supra-regional and region-specific results, which are interpreted and validated against the background of CSA specificities. The findings are discussed, and conclusions are drawn with the aim of outlining opportunities for environmental and agricultural policy design.

2. Materials and method

2.1. Analysing ESS from agricultural landscapes with the ANP

The most common approaches for assessing the impact of landscape services on the generation of socio-economic benefits and regional competitiveness include environmental economic valuation (Hein et al., 2006; Turner et al., 2003; Vandermeulen et al., 2011), dynamic input-output modelling, including multiplier effect analysis (Dissart and Vollet, 2011; Heringa et al., 2013), spatial econometrics combined with regional growth models (Ferguson et al., 2007; Kim and Johnson, 2002), or regression analysis (Partridge et al., 2008; Zasada and Piorr, 2015). In addition, multi-criteria analysis (MCA) approaches are considered appropriate for analysing ESS provision in rural landscapes (Parks and Gowdy, 2013). The main advantages of MCA approaches are their potential to overcome the limits of economic valuation of non-tangible goods and benefits (Parks and Gowdy, 2013; Spangenberg and Settele, 2010) and their capacity to assess multiple dimensions and complex pathways within a specific system (Finn et al., 2009; Gasparatos and Scolobig, 2012). The ANP is a MCA technique specifically designed to cope with systems characterised by loop effects and the presence of feedbacks and trade-offs between a system's constituent parts (Saaty, 2005). Taking advantage of these features, the ANP has been used for a wide range of assessments in environmental and landscape evaluation. There are, for example, studies on solid waste management (Aragonés-Beltrán et al., 2010), sustainable tourism (García-Melón et al., 2010), sustainable urban development (Gómez-Navarro et al., 2009), farmland appraisals (García-Melón et al., 2008), soil erosion risks (Nekhay et al., 2009), landslide hazard (Neaupane and Piantanakulchai, 2006), alternative fuels (Erdoğmuş et al., 2006), landowners' adaptation to socio-environmental changes (Eakin et al., 2011), and sustainable forest management (Wolfslehner et al., 2005). ANP studies specifically focusing on the provision of public goods and ESS by farming systems are found in Villanueva et al. (2014), Parra-López et al. (2008) and Carmona-Torres et al. (2016). The methodological advantages of the ANP, to integrate comprehensively a broad set of factors and as a tool able to provide a comparative analysis of the impacts of different economic sectors on landscape services, have been recently discussed by Zasada et al. (2017) and Villanueva et al. (2015) respectively, representing direct precedents for the study at hand.

2.2. Using the ANP for the assessment of pathways between agricultural landscape, ecosystem services and regional competitiveness

The ANP consists of several methodological steps, namely (1) network design, including the identification of the observed system's main elements and relationships; (2) comparative assessment of the relative importance of the elements by means of expert judgments; (3) calculation of so-called 'priority vectors', summarising the elements' overall importance in the system; and (4) validation of the results through an expert-panel evaluation (Saaty, 2013).[1]

2.2.1. Design of the ANP network

The ANP network builds upon the framework developed by van Zanten et al. (2014). This framework suggests that the provision of goods and services in a landscape is affected not only by 'landscape providers' (e.g. agriculture or forestry), but also by a variety of other actors demanding ESS from landscapes to derive personal and societal benefits. On this theoretical basis, multi-staged cause-effects between agricultural landscapes and the competitiveness of rural regions are addressed. The elements and pathways of van Zanten et al.s' (2014) framework were synthesised in the ANP network by involving a participative co-construction process based on local stakeholder workshops. The workshops were held in nine CSAs between November 2012 and March 2013. The evaluation of the relationships between the single ANP elements was centred on the potential of landscapes to create benefits and value for society, which was paraphrased as 'Landscape valorisation'.[2] (Fig. 1).

The final network consists of 16 elements, which were identified in

[1] A more detailed description of the ANP methodology is provided in Appendix A.

[2] The term 'landscape valorisation', defined as the potential of landscapes to create benefits and values for society, was used as the control criterion (in ANP jargon) of the assessment. Landscape valorisation should not be confused with the 'valuation' of ESS.

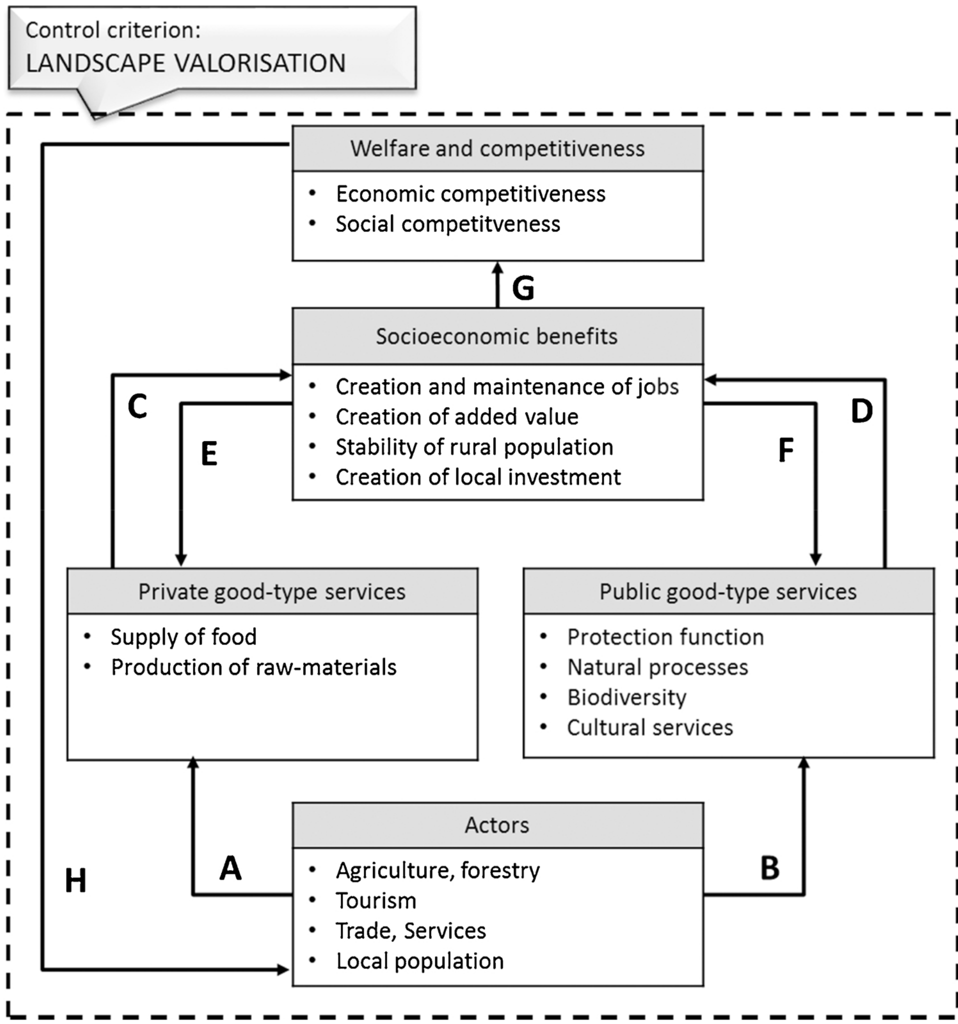

Fig. 1. The analytic network.

the stakeholder workshops as accounting for the most relevant impacts on landscape valorisation in the CSAs. The elements are arranged in five clusters: The first cluster 'Actors' represents four actor groups which account for the most relevant impact on local supply and demand of landscape services in the CSAs. The actor groups are 'Agriculture and forestry', 'Local population', 'Tourism' and 'Trade and services'. The second and third cluster represent the major ESS provided in agricultural landscapes and basically follow the ESS classification of TEEB (2010). Here, the main adaptation is the distinction between 'Private good-type services', representing the two most relevant provisioning services throughout the CSAs, and 'Public good-type services', representing TEEB's (2010) regulating, cultural and supporting ESS. Further adaptations integrate suggestions by the local stakeholders to make ESS terminology easier to understand. Table 1 shows the adaptations in comparison with the corresponding ESS of the TEEB's classification.

The fourth cluster 'Socio-economic benefits' includes the elements 'Creation and maintenance of jobs', 'Creation of added value', 'Stability of the rural population' and 'Creation of local investments'. The fifth cluster 'Welfare and competitiveness' addresses the economic and social competitiveness stemming from the socio-economic benefits generated by the agricultural landscape. 'Economic competitiveness' refers to productivity and profitability (i.e. GDP, GVA, wage levels, etc.), while 'Social competitiveness' refers to the wellbeing of the local population in a broader sense, such as quality of life and the development of human capital.

The five clusters are incorporated in a network of relationships and feedbacks, altogether investigating eight causal connections (depicted as arrows 'A'–'H' in Fig. 1). The first two relations characterise the contribution of 'Actors' to the provision of both 'Private good-type services' ('A') and 'Public good-type services' ('B'). Two further relations characterise the contribution of 'Private good-type services' and 'Public good-type services' to 'Socio-economic benefits' ('C' and 'D'). As it is assumed that the interrelationship between services and benefits is not unidirectional (van Zanten et al., 2014), the two relations 'E' and 'F' express feedbacks and trade-offs between benefits and services. For example, the provision of the private good-type service 'Production of raw materials' could impact on the 'Creation of local investment', which could have trade-off effects on 'Cultural services'. Relation 'G' reflects that socio-economic benefits from the use of ESS contribute to social and economic welfare and competitiveness (van Zanten et al., 2014). Finally, connection 'H' suggests that regional welfare and competitiveness have effects on local actors.

2.2.2. Comparative assessment

For the comparative assessment of the relative importance of the elements, weights were elicited by pairwise comparison of the single elements of the same cluster (e.g. 'Tourism' and 'Local population' in the 'Actors' cluster) with the control element of another connected cluster (e.g. 'Cultural services' in the 'Public good-type services' cluster). For the given example, the pairwise comparison was formulated in the question: *"Which Actor has a more positive influence on the*

Table 1
Interpretation of TEEB (2010)'s classification of ESS for the ANP network (based on the results of the local stakeholder workshops).

TEEB (2010) classification and terminology	ANP classification and terminology
Provisioning Services	**Private good-type services**
Food Raw materials Fresh water Medical resources	Supply of food Production of raw materials
Regulating Services	**Public good-type services**
Local climate and air-quality regulation Carbon sequestration and storage Waste-water treatment Erosion prevention and maintenance of soil fertility Pollination Biological control	Natural processes
Moderation of extreme events	Protection function
Habitat/supporting Services	
Habitats for species Maintenance of genetic diversity	Biodiversity
Cultural services	
Recreation and mental and physical health Aesthetic landscape appreciation and inspiration for culture, art and design Spiritual experience and sense of place	Cultural services

Table 2
Number of interviewees in the CSAs by type of expert.

	CSAs									
Type of expert	AT	BG	DE	ES	FR	IT	NL	PL	TR	Total
Agriculture	2	7	1	3	2	1	1	2	3	22
Economy	2	–	–	3	–	–	–	–	2	7
Environment/landscape	1	–	2	1	2	3	2	4	–	15
Policy/rural development	2	4	3	3	1	1	5	1	1	21
Research	2	–	2	–		1	–	1	3	9
Tourism	1	–	2	–	1	2	2	–	–	8
Others	–	–	–	–	1	–	–	2	–	2
Total	**10**	**11**	**10**	**10**	**7**	**8**	**10**	**10**	**9**	**85**

*AT: Austria; BG: Bulgaria; DE: Germany; ES: Spain; FR: France IT: Italy; NL: Netherlands; PL: Poland; TR: Turkey.

provision of Cultural services and to what extent—Tourism or Local population?". For operationalisation, a common questionnaire translated into the language of the respective CSA was designed. To ensure that the questions were readily understood, an introduction to the questionnaire explained the terminology. Seven to eleven selected experts per CSA, involving policy makers, agriculture-related experts and qualified farmers, environmentalist, and other interest groups (e.g. the tourism sector), filled in the questionnaires by means of individual interviews which were carried out between October and December 2013. Due to institutional arrangements in the different regions, the composition and affiliation of the expert panel slightly differed throughout the CSAs (see Table 2).

2.2.3. Calculation of priority vectors

The results of the pairwise comparisons were used for the calculation of a priority vector for each element in the network. The priority vector summarises the elements' overall importance in the network in relation to the control criterion. The calculation followed the Eigenvector Method proposed by Saaty (2005). The method is based on a matrix algebra procedure, which derives a value for each element of the network from the pairwise comparison matrices obtained from the experts' judgements. This value accounts for all possible interactions inside the network (Harker and Vargas, 1987). For detailed information on the matrix calculation process, refer to Appendix A.

2.2.4. Validation of results

Discussion, validation and interpretation of local results took place in a second stakeholder round organised between November 2013 and March 2014 in the nine CSAs. In these workshops, the specific CSA results were presented to the stakeholders involved in the ANP assessment and to additional stakeholders familiar with the topic.

2.3. Description of the CSAs

The selection of the CSAs aimed to cover a wide range of agricultural landscapes and socio-economic conditions throughout Europe (Table 3). The chosen CSAs are characterised by different though typical European climate and topography and by contrasting conditions of remoteness from urban centres. Moreover, the CSAs differ in prevailing farming systems (farm structure and specialisation, level of intensity) and the relevance of agricultural production, as well as in overall regional competitiveness (especially economic performance).

3. Results

3.1. Results across the CSAs

The average priority vectors for the single elements across all CSAs show that each element in the network is considered as relevant (Table 4). However, the score range outlined by the priority vectors

Table 3
Main features of the nine European case study areas.

Name	Country	km^2	Persons/km^2	Agricultural intensity	Topography
Mittleres Ennstal (AT)	Austria	250	23	low-high	mountainous
Description	Dairy farming in richly structured mountainous scenery. Alpine valley and high alpine locations; grassland and alpine pastures.				
Pazardzhik Region (BG)	Bulgaria	4500	65	low-medium	hilly
Description	Mix of landscape features including lakes and hills, prominence of forests, sheep, cattle and dairy farming, vineyards.				
Märkische Schweiz (DE)	Germany	580	82	low-high	plain
Description	Gradient from intensively managed, large-scale farming area to low-intensively managed area inside nature park; cash crops, grazing livestock, pigs.				
Montoro (ES)	Spain	590	17	low-medium	hilly-mount.
Description	Rain-fed olive groves; Agro-forestry system 'Dehesa' (part of it in natural park); herbaceous crop systems.				
North Corsica (FR)	France	420	16	low	mountainous
Description	Mediterranean region managed with low intensity by small cow, pig, goat and ewe breeders and by chestnut farmers.				
Po Delta Lowlands (IT)	Italy	900	74	medium-high	plain
Description	Flat landscape on reclaimed wetlands; cash crops, vegetables, quality products.				
Winterswijk region (NL)	Netherlands	140	209	medium	plain
Description	Hedgerow mosaic landscape with high agro-biodiversity. Agricultural focus on dairy farming.				
Chlapowski Lscp.Park (PL)	Poland	172	109	medium-high	plain
Description	Typical agricultural lowland landscape, rich in small-structured landscape elements like shelterbelts, field ponds and water catchments. Mainly cash crops, dairy farming, cattle/pig fattening.				
Isparta (TR)	Turkey	9000	16	low-high	hilly-mountainous
Description	Mix of landscape features including lakes, hills and mountains; intensive rose oil production; cherries and apples.				

Table 4
Overall element weights (priority vector), standard deviations (σ) and coefficients of variation of the experts' estimations (C_v) (9 CSAs, n = 85 questionnaires).

Cluster	Element	Priority	σ	C_v
Actors	Agriculture, forestry	0.082	0.036	0.431
	Tourism	0.024	0.012	0.510
	Trade, services	0.032	0.021	0.652
	Local population	0.034	0.020	0.578
Private good-type services	Supply of food	0.119	0.075	0.628
	Production of raw materials	0.062	0.047	0.757
Public good-type services	Protection function	0.032	0.026	0.828
	Natural processes	0.022	0.021	0.940
	Biodiversity	0.033	0.025	0.758
	Cultural services	0.059	0.045	0.763
Socio-economic benefits	Creation and maintenance of jobs	0.085	0.037	0.431
	Creation of added value	0.082	0.041	0.497
	Stability of rural populations	0.065	0.033	0.503
	Creation of local investment	0.096	0.041	0.424
Welfare and competitiveness	Economic competitiveness	0.107	0.047	0.436
	Social competitiveness	0.066	0.036	0.550

reveals differences between single elements' importance in each cluster. For more details, Appendix B shows the results for each CSA, descriptive statistics, and significant differences between the average weights of elements.

Within the cluster 'Actors', an outstanding role is attributed to 'Agriculture and forestry'. The weights of 'Local population', 'Trade and services', and 'Tourism' are significantly lower (see Table B3 in Appendix B) and, when taken together, just equal the weight of 'Agriculture and forestry' alone. As regards ESS provision, the importance addressed to the cluster 'Private good-type services' exceeds the importance addressed to 'Public good-type services'. Much weight in the former cluster originates from 'Supply of food', which has a significantly higher weight as compared to all other services. In the 'Public good-type services' cluster, 'Cultural services' reach the highest average weight, while this weight is only significantly higher as compared to the weight of 'Natural processes'.

It seems that the role of service provision in the system is difficult to evaluate or that there is a lack of knowledge in this field amongst the experts: The average C_v of the weights in the services clusters are remarkably higher than the average C_v in the clusters 'Actors', 'Socio-economic benefits' and 'Welfare and competitiveness'.

For the elements included in the cluster 'Socio-economic benefits' similar weights are obtained. Some statistically significant difference is only found between 'Creation of local investments' and 'Stability of the rural populations'. Finally, with regard to 'Welfare and competitiveness', 'Economic competitiveness' shows a significantly higher weight than 'Social competitiveness'.

3.2. Region-specific results

Fig. 2 shows the CSA-specific relative weights of the different elements by cluster, where the two clusters of private and public good-type services are grouped together.

The differences in the weights of the elements indicate specific features of the 9 CSAs. In particular, these differences occur in the private and public good-type services clusters. Here, the stakeholder validation provided keys for the interpretation of the specific distributions of weights, considering the specific contexts and peculiarities of the CSAs.

In the CSAs AT, DE, BG and TR, a broad distribution of the elements in the services clusters and a high overall importance of 'Public good-type services' become obvious. In all four CSAs, the agricultural landscape shows a clear gradient of intensity and is shaped by diverse typical landscape elements and heterogeneous landscape structures. The pronounced landscape diversity directly raises the perception towards services like 'Biodiversity' and 'Cultural services' (landscape aesthetics, agricultural traditions) and the related benefits. Concerning the 'Actors' cluster, the role of 'Agriculture and forestry' in AT, DE and TR is perceived as important and evaluated with similar weights. Only for BG there is a low relative importance of 'Agriculture and forestry', which was explained by the stakeholders by the poor vertical integration of the agricultural sector, whose activities are mainly limited to primary production. Opportunities of valorisation lie instead in the presence of mineral water sources (e.g. spa) or agro-forestry services, and are realised by 'Tourism' and the 'Trade and services' sector. Also in DE, 'Trade and services' was given high weighting. Here, the forestry sector, with related trade, processing and services plays a comparably strong role. Additionally, landscape-valorisation activities (e.g. tourism, branding and marketing) in the 'Märkische Schweiz Nature Park' have a high potential. In AT, a high importance of 'Social competitiveness', featuring aspects of well-being of the population, becomes apparent: The landscape in AT is widely valorised through the recreational behaviour of the local population and reportedly plays an important role in

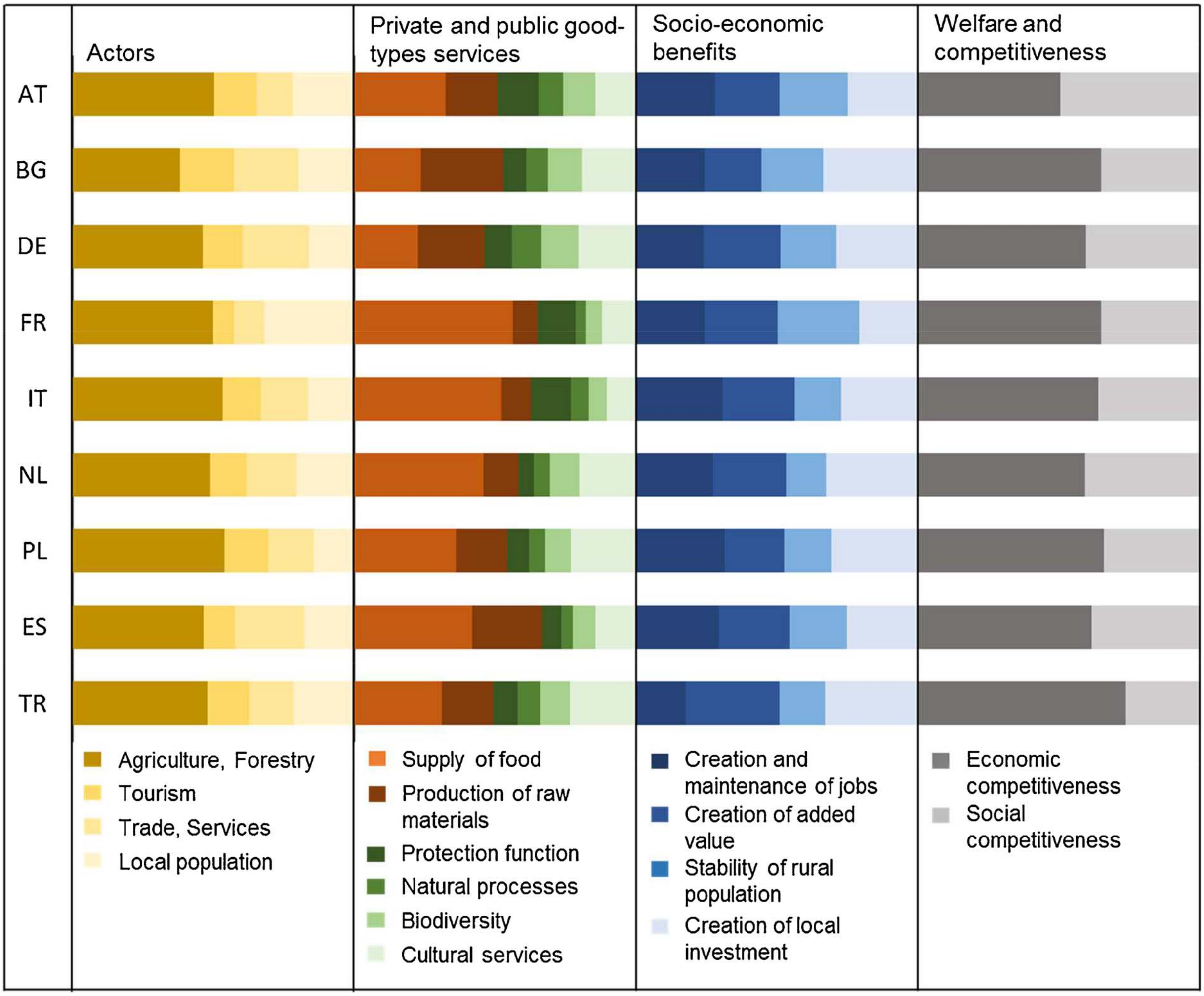

Fig. 2. Relative importance (in%) of different elements within the clusters in nine European case-study areas. Acronyms of the case-study areas are referred to in Table 2.

enhancing the quality of life of the local inhabitants. In TR, the strong performance of 'Economic competitiveness' and the important role of economic processes like 'Creation of local investment' and 'Creation of added value' stand out. This result is interpreted by the local stakeholders as linked to the prominent role of the rose sector. Its well-developed commercialisation channels, driving investments and enhancing added value in the area, and the associated economic benefits results in a paramount economic role of the landscape in this area.

For the CSAs IT, PL and NL, the results reveal a high importance of agriculture and private good-type services, as well as a stronger role of economic competitiveness over social competitiveness. This result mirrors the intensive agricultural sector, which is strongly committed to its productive role in the agri-food supply chain: All the three CSAs are characterised by intensive agricultural systems in plain lowland landscapes. In IT and PL, the main agricultural activity is cash-crop production; in NL it is dairy farming. Noticeably, 'Cultural services' represent the most important element in the public good-type services cluster in NL and PL, whereas the 'Protection function' is more relevant in IT. In IT, this result is linked with the perception of hydrogeological fragility of the reclaimed lands of the Po Delta. In NL and PL, the appreciation of the cultural function of the landscape is linked to the prominent role of landscape aesthetics and cultural heritage related to dairy farming, and to the specific agricultural landscape characterised by the shelterbelts of the 'Chlapowski Landscape Park' respectively.

In the two remaining CSAs ES and FR, the high relative importance of 'Agriculture and forestry' and the particularly stronger role of private good-type services over public good-type services contradict the intensity of production and the high quality of the landscape: Both CSAs represent relatively remote, sparsely populated, hilly-to-mountainous landscapes. Agricultural intensity is moderately low, mainly due to the climatic and geographic conditions. In FR, the low-intensive agricultural system is based on chestnut farmers and small cow, pig, goat and ewe breeders. In ES, rain-fed olive groves with a low-to-medium degree of intensity and extensive specific mixed agro-forestry-and-livestock systems (i.e. Dehesa) dominate the landscape. In both CSAs, farmland is widely surrounded by Mediterranean forest. In ES and FR, the priority of private goods over public goods and the important role of agriculture and forestry is linked to the scarcity in other viable economic activities. This brings the economic activity of agriculture and forestry to the fore, while limiting the competitiveness of these areas in creating value from public good-type services. In ES, the high contribution of private services (including raw-material production) is also related to the high importance of the "Trade and services" sector. This sector is driven by the production and marketing of olive oil with quality cues such as the 'Montoro-Adamuz' Protected Designation of Origin, which represents an asset for local economy. In FR, the relatively high importance given to 'Local population' indicates that a stable demographic development of the population is considered an important socio-economic driver in the CSA.

4. Discussion

The results of our ANP confirm the findings of other works (e.g. Bürgi et al., 2015), namely that the effects of agricultural landscapes on regional competitiveness strongly depend on natural, historical, social, economic and, of course, agricultural conditions. They also show that the broad diversity of these conditions makes it difficult to generalise on how agricultural landscapes contribute to rural competitiveness. However, some common points concerning the role of agriculture and agricultural production in landscape valorisation can be emphasised.

In traditional 'market-based' terms, such as gross value added, employment and income generated, several studies report that in many EU regions the socio-economic role of agriculture is in decline (e.g. SEGIRA, 2010). Nonetheless, taking a more comprehensive perspective on welfare and competitiveness and including the indirect benefits particularly from non-marketable, socio-cultural and environmental public good-type services, our study paints a different picture. Despite the diversity of regions and their individual potential to create alternative value chains from landscape and ecosystem services, we can evidence a common fundamental understanding of joint private- and public-good provision in agricultural landscapes across different experts as well as across different case-study contexts. On the one hand, our findings suggest that the pathway of agricultural food production is still perceived as a very important valorisation chain, often outweighing the influence of public good-type services on welfare and competitiveness. This implies that the classic narrative of farming persists, despite the marginalisation of agriculture as an economic actor. On the other hand, the study indicates that there is considerable awareness that agriculture and forestry affect rural competitiveness through a range of valorisation pathways, involving social and cultural aspects such as place identity or rural vitality, and a wider range of actors and services. As highlighted in other works (e.g. van Vliet et al., 2015; Debolini et al., 2018), these pathways are paramount to an understanding of rural-area dynamics.

Our study also shows that the recognition of the socio-economic benefits connected to public good-type services lags behind, when compared to private good-type services. The difficulties, which our study reveals in perceiving the various ways in which public good-type services impact on landscape valorisation, support studies by other authors (e.g. McVittie et al., 2009); these underpin the complexity of evaluating less visible public good-type services, such as biodiversity or regulating services. In contrast, our work confirms studies which suggest that the impact of more visible public good-type services like landscape aesthetics and recreation potentials (cultural services) and their valorisation via tourism and local population are often more easily acknowledged (Rodríguez-Entrena et al., 2017).

Our study also evidences that the relevance of public good-type services is very much connected to the specific context characterising the area under study. For instance, in the Austrian, Italian and French CSAs, 'Protection function' is rated as the most important element among the 'Public good-type services' cluster, while it plays nearly no role in all other CSAs. This result is clearly linked to the awareness of specific regional vulnerabilities, such as the high risk of avalanches and landslides in AT, floods in the IT reclaimed wetlands and wild fires in FR. In these contexts of risks, the knowledge of how agriculture and forestry enhances the landscape's protection function is very evident; for example, grazing reduces shrub encroachment and fire risk in FR, shelter woods reduce avalanches on alpine slopes in AT and agricultural water management guarantees stable water levels in IT.

Overall, our results highlight the need for greater efforts and more novel approaches to improving the awareness and comprehension of the role of agriculture in providing not only private goods, but also public good-types services with a socio-economic benefit dimension. In addition, new public and/or private mechanisms, able to generate benefits from these services for the rural communities, are necessary. Some examples could be new businesses or nature-based solutions for climate-change adaptation, natural-resource provision or risk reduction for natural disasters (Maes and Jacobs, 2017).

In terms of policy implication, our study supports the necessity to improve communication between civil society, scientists, decision makers and local administrations, in order to reduce the gap in knowledge and to raise awareness of the landscape potential. Besides generic information about values, it is also important to focus on the potential benefits connected to private and public goods which residents or tourists use and have experience of. At the same time, our results encourage the consideration of multiple entry points for rural policies. This corroborates attempts by the recent Common Agricultural Policy (CAP) reform to enlarge the scope for instruments focusing on multiactor collective actions within the Rural Development Programmes, as well as to coordinate these instruments with more common agri-environmental and quality-related practices (EU Regulation No 1307/2013). This also raises the issue of policy consistency and coordination, not only between agriculture and environmental policy, but also with local industrial, commercial and planning policy. In addition, the weight of different valorisation pathways can hint at a wide range of alternatives for the design of local policies, especially when strong links offer unexplored opportunities for generating added value. In particular, this relates to cases in which landscape values are (or can be) linked to private goods, offering an opportunity for valorisation through marketing measures rather than public payments. However, several ecosystem services are connected to each other, especially if considered at the level of landscape. This also suggests the need for the explicit consideration of the synergies and coordination requirements between market-driven forces (on which the described system connections are largely based) and policy-based incentives in landscape valorisation more focused on 'soft' aspects and including built-in participatory instruments for policy design and targeted public-private partnerships.

With regard to the method, the ANP approach has proved useful in dealing with the complex system of agricultural landscapes and its interrelations between a large number of relevant elements. However, we have found some limitations which should be considered in future assessments. First of all, reducing a complex system to an affordable number of relations for a questionnaire-based elicitation of judgements might represent a significant simplification (Meade and Sarkis, 1999; Nekhay et al., 2009). As shown in our study, the use of participatory approaches (e.g. in network design and adaptation) can help greatly in ensuring that the system under study incorporates its most relevant elements. Secondly, scorings can be affected by the context, as respondents might focus too much on local specificities. Here, apart from a careful selection of case studies (e.g. sharing similar contexts) and surveyed individuals (e.g. selecting those with wider knowledge of not only the case study but also the surrounding areas), we recommend providing some key information which helps to contextualise the case study in the respondent's eyes. Thirdly, potential bias exists with regard to the perceived importance of certain elements, in particular, the evaluation of tangibles and intangibles and the potential risk of upward bias for scorings of private goods compared to public goods. However, we find that, compared to other approaches (mostly monetary-based), the approach proposed is useful when dealing with both types of elements at the same time. Additionally, triangulation of results and the discussion of both the scorings obtained and comparable results of other relevant assessments with the local experts represent an opportunity partly to overcome this bias.

5. Conclusions

This study has investigated the pathways between private and public good-type services from agricultural landscapes and rural competitiveness. It provides an evaluation of the importance of relevant elements in this system, using the multi-criteria technique ANP. The analysis is based on the knowledge of experts and represents a mix of quantitative and qualitative insights into nine European case-study areas, accounting for a large variety of socio-economic contexts. The analysis evidences specific drivers and relations in the landscape-valorisation system, uncovering some hidden aspects (e.g. the valorisation of intangibles). In particular, the results have shown that the cause-effect chains connecting landscape management and competitiveness are complex and very much connected to local-scale contexts. On the one hand, it has become obvious that agricultural activity is perceived as an important driver of competitiveness in many rural regions. This is shown not only in pronounced agricultural regions with intensive production systems under favourable agricultural conditions, but also in more remote regions, which face problems in stimulating valorisation from public good-type services by other economic actors than agriculture. On the other hand, the results support the high potential to valorise agricultural landscapes by taking advantage of the added value related to the provision of public good-type services, such as biodiversity, natural processes, protection function and cultural services. In this regard, public good-type services are especially acknowledged as drivers for rural competitiveness in regions where agricultural landscape is highly diverse and 'multifunctional', and where the landscape potentials provided are realised by a wider range of economic actors. It becomes clear, that landscape valorisation depends not only on horizontal actions at the level of actors driving landscape change, but also on vertical actions aimed at the valorisation processes from ecosystems to society. In the latter dimension, a major role is played by food-value chains and their ability to bring forward landscape-related values.

The approach adopted by the paper highlights the point that landscape should be seen in the context of whole rural systems. This also has implications for policy making, which should consider a consistent set of complementary instruments ranging from communication to direct incentive payments and involving all key actors in each area, from farmers to consumers and citizens. The role of food-value chains also highlights the need to coordinate public-goods components and private ones, in order to strengthen synergies and minimise conflicts. Finally, the paper emphasises a number of knowledge gaps and potential qualifications, especially in translating this broad view into a more detailed understanding of processes, which open the way for future research in this field.

Acknowledgements

The work has been supported by the EU-FP7 CLAIM Project, grant number-289578. This work does not necessarily reflect the view of the EU and in no way anticipates the Commission's future policy. The authors would like to thank the reviewers of the paper and the stakeholder panels in the nine CSAs for their valuable contribution to the study. *L. Schaller, S. Targetti and A.J. Villanueva have contributed in equal part to leading this paper.*

Appendix A. Description of the Analytic Network Process (ANP) method

The Analytic Network Process (ANP) is a multi-criteria technique that was developed to enhance the applicability range of the well-known Analytic Hierarchy Process (AHP). Similarly to the AHP, the ANP breaks down a problem into its constituent parts and requires simple pairwise comparison judgments. The objective of the method is to model a complex system with a formal mathematical system connected to an explicit network (Saaty 2005).[3] Hence, while the AHP fits into hierarchical structures, the ANP and its network structure allow analysing systems characterised by loops and feedbacks between elements.

Basically, the ANP consists of identifying the main elements in a system, building a network of relationships among these elements and assessing the relative importance of the elements by way of expert judgments. The following steps are normally followed in ANP applications (Saaty 2005):

(1) *Network design:* Network design includes the identification of the relevant elements—and clusters of elements—constituting a specific system, as well as the determination of the relationships among them (Saaty, 1996). To ensure correctness, completeness and logicality of elements, clusters and relationships, in this phase the use of external expert knowledge is strongly recommended (Saaty and Shih, 2009).
(2) *Pairwise comparisons:* Once the network is designed, relationships among its elements are assessed by means of pairwise comparisons, performed by relevant experts and/or stakeholders. In these comparisons, the relative importance among the elements of the same cluster is evaluated with regard to the control element of a connected cluster. All pairwise comparisons of the elements of one cluster with regard to one control element of another cluster form a group of pairwise comparisons. For the evaluation, a fixed 1–9 evaluation scale of absolute numbers is used. In this scale 1 means equal influence of the two compared elements on the control element and 9 means an extremely higher influence of one element over the other (see Saaty 2005). The use of this ratio scale is based on the empirical work of Saaty (1980) showing its effectiveness in capturing an individual's intensity of preference (Saaty, 2005, 2008; Saaty, 2013).
(3) *Calculation of the eigenvector.* With the calculation of the eigenvector, the single elements overall importance in the network is quantified (Duke and Aull-Hyde, 2002).

First, the pairwise comparisons judged by the interviewee (ratios $a_{ij,}$) are entered into a pairwise comparison matrix, while the reciprocal ratios ($a_{ji} = 1/a_{ij}$) are automatically assigned to the reverse comparison within the matrix. Ideally, a judgement matrix would be consistent if $a_{ij} = a_{ik}/a_{jk}$ for all i, j, k. In that case, the weights w_i, w_j, w_k from an arbitrary column of the matrix would be the vector of weights of the elements i, j, k. As inconsistent judgements are usual in particular in the analysis of complex systems, Saaty (2005) proposes the right eigenvector method and a related consistency index for the calculation of the priority vector of "near" consistent judgment matrices.

$$AW = \lambda\_max\ W$$

where λ_{max} is the largest eigenvalue of matrix A, and W is the eigenvector (Meade and Sarkis, 1999; Saaty, 2008; Saaty, 2013).

The most commonly used procedure to approximate such a unique solution is to raise and then normalizing the judgment matrix to an arbitrary large power k so that the (normalized) column vectors converge to the principal right eigenvector of the matrix (Harker and Vargas, 1987; Saaty, 1980, 2008; Saaty, 2013). The eigenvector represents the influence weights of the single elements within each group of pairwise comparisons (Duke and Aull-Hyde, 2002).

(4) *Building the matrices of influences and the unweighted matrix.* Eigenvectors are grouped together forming *matrices of influences*. Each matrix of influences condenses the influences of the elements of one cluster on the elements of another cluster. All of the matrices of influences of a network form the so-called "unweighted supermatrix", which summarises the elicited relationships between the elements.
(5) *Obtaining the priority vector.* To consider the different dominance of the clusters on the system, the unweighted supermatrix is weighted by

[3] The details of the references are available upon request.

multiplying it by the "cluster weights matrix" to obtain the "weighted supermatrix". The cluster weights matrix is calculated from pairwise comparisons among clusters, in a similar way to that described for the element comparisons. Then, the weighted supermatrix is multiplied itself *n* times until it is stabilised ("brought to the limit"). The resulting matrix is called the "limit supermatrix" and all of its columns are equal to one another. These columns represent the *priority vector* that is the main output of the ANP method and summarises the average coefficient or weight of each element in the network. The priority vector calculated through the eigenvector method accounts for all the possible direct and indirect interactions inside the network (Harker and Vargas, 1987; Saaty, 2005). That property of the right eigenvector method is commonly employed for the analysis of transition probabilities applied to ergodic systems and is thoroughly explained in (Harker and Vargas, 1987) and (Saaty, 2013) concerning ANP applications.

(6) *Validation of results*: The final recommended step of the ANP regards the validation of results through an expert panel evaluation. This step aims at verifying the extent to which the results obtained represent and are consistent with the studied system (Saaty, 2005).

Appendix B. Data analysis

See Tables B1 and B2.

Table B1
Average Priority vectors (Elements Priority [EP]) of the landscape valorisation analytical network (9 CSAs, n = 84 questionnaires).

		Study regions*									
Cluster	Factor	AT EP	BG EP	DE EP	ES EP	FR EP	IT EP	NE EP	PL EP	TK EP	Avg. **EP**
Actors	Agriculture	0.083	0.061	0.084	0.092	0.096	0.089	0.091	0.086	0.065	0.082
	Tourism	0.025	0.031	0.025	0.022	0.014	0.022	0.024	0.025	0.020	0.024
	Trade/Services	0.021	0.037	0.043	0.049	0.021	0.028	0.033	0.026	0.021	0.032
	Population	0.036	0.032	0.030	0.035	0.062	0.028	0.039	0.023	0.029	0.034
Private good-type services	Food	0.108	0.079	0.071	0.125	0.171	0.173	0.142	0.122	0.113	0.119
	Raw materials	0.061	0.099	0.075	0.075	0.027	0.035	0.039	0.061	0.066	0.062
Public good-type services	Prot. function	0.048	0.028	0.031	0.021	0.041	0.047	0.016	0.026	0.031	0.032
	Nat. Processes	0.029	0.026	0.033	0.011	0.011	0.022	0.017	0.020	0.030	0.022
	Biodiversity	0.038	0.042	0.042	0.024	0.017	0.021	0.033	0.031	0.038	0.033
	Cultural Services	0.048	0.065	0.066	0.044	0.037	0.035	0.063	0.080	0.086	0.059
Socio-economic benefits	Jobs	0.093	0.082	0.075	0.088	0.074	0.101	0.085	0.106	0.063	0.085
	Added value	0.076	0.068	0.087	0.076	0.079	0.085	0.081	0.073	0.121	0.082
	Rural population	0.081	0.075	0.063	0.061	0.090	0.055	0.045	0.057	0.059	0.065
	Investment	0.084	0.115	0.093	0.077	0.064	0.091	0.103	0.105	0.121	0.096
Welfare/competitive-ness	Econ. competitiveness	0.084	0.104	0.108	0.123	0.126	0.107	0.111	0.105	0.100	0.107
	Social competitiveness	0.083	0.057	0.074	0.077	0.069	0.061	0.077	0.055	0.036	0.066

*AT: Austria; BG: Bulgaria; DE: Germany; FR: France; IT: Italy; NL: Netherlands; PL: Poland; ES: Spain; TR: Turkey.

Table B2
Descriptive statistics (horizontal results across all case studies).

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Mini-mum	Maxi-mum
					Lower Bound	Upper Bound		
Agriculture & Forestry	85	0.0825	0.0355	0.0039	0.0743	0.0903	0.004	0.156
Tourism	85	0.0238	0.0121	0.0013	0.0213	0.0264	0.003	0.055
Trade/Services	85	0.0317	0.0207	0.0022	0.0279	0.0365	0.003	0.134
Local Population	85	0.0343	0.0198	0.0021	0.0300	0.0386	0.003	0.102
Food	85	0.1192	0.0748	0.0081	0.1031	0.1348	0.006	0.339
Raw Materials	85	0.0620	0.0469	0.0051	0.0523	0.0724	0.007	0.208
Protection function	85	0.0315	0.0261	0.0028	0.0262	0.0372	0.003	0.098
Natural processes	85	0.0225	0.0211	0.0023	0.0183	0.0273	0.001	0.106
Biodiversity	85	0.0327	0.0248	0.0027	0.0279	0.0381	0.001	0.120
Cultural Services	85	0.0595	0.0454	0.0049	0.0504	0.0696	0.002	0.219
Jobs	85	0.0854	0.0368	0.0040	0.0771	0.0930	0.005	0.168
Creation of Added value	85	0.0822	0.0409	0.0044	0.0734	0.0909	0.010	0.195
Stability of rural populations	85	0.0646	0.0325	0.0035	0.0578	0.0721	0.012	0.195
Creation of investment	85	0.0957	0.0405	0.0044	0.0877	0.1043	0.021	0.243
Economic competitiveness	85	0.1070	0.0466	0.0051	0.0976	0.1173	0.020	0.199
Social competitiveness	85	0.0657	0.0361	0.0039	0.0584	0.0736	0.003	0.216

Land Use Policy 76 (2018) 735–745

Table B3
Differences in average weights of the elements of the network clusters and statistical significance using ANOVA post-hoc (Scheffe) (*significant difference at 95% level).

	Agriculture	Tourism	Trade/ services	Local population	Food	Raw materials	Protection function	Natural processes	Biodiversity	Cultural services	Jobs	Added value	Rural populations	Investment	Economic competitiveness	Social competitiveness
Agriculture & Forestry		0.059*	0.050*	0.048*												
Tourism	−0.059*		−0.008	−0.011												
Trade/services	−0.050*	0.008		−0.003												
Local population	−0.048*	0.011	0.003													
Food						0.057*	0.088*	0.067*	0.087*	0.060*						
Raw materials					−0.057*		0.030*	0.040*	0.029*	0.002						
Protection function					−0.088*	−0.030*		0.009	−0.001	−0.028						
Natural processes					−0.097*	−0.040*	−0.009		−0.010	−0.037*						
Biodiversity					−0.087*	−0.030*	0.001	0.010		−0.027						
Cultural services					−0.060*	−0.002	0.028	0.037*	0.027							
Jobs												0.003	0.021	−0.010		
Added value											−0.003		0.018	−0.013		
Rural populations											−0.021	−0.018		−0.031*		
Investment											0.010	0.013	0.031*			
Economic competitiveness																0.041*
Social competitiveness															−0.041*	

References

Aragonés-Beltrán, P., Pastor-Ferrando, J.P., García-García, F., Pascual-Agulló, A., 2010. An Analytic Network Process approach for siting a municipal solid waste plant in the Metropolitan Area of Valencia (Spain). J. Environ. Manage. 91, 1071–1086.

Bürgi, M., Silbernagel, J., Wu, J., Kienast, F., 2015. Linking ecosystem services with landscape history. Landscape Ecol. 30, 11–20.

Carmona-Torres, C., Parra-López, C., Sayadi, S., Chirosa-Ríos, M., 2016. A public/private benefits framework for the design of polices oriented to sustainability in agriculture: an application to olive growing. Land Use Policy 58, 54–69.

Costanza, R., d'Arge, R., Groot, R.d., Farberk, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Suttonkk, P., Belt, M.v.d., 1997. The value of the world's ecosystem services and natural capital. Nature 387, 253–260.

Debolini, M., Marraccini, E., Dubeuf, J.P., Geijzendorffer, I.R., Guerra, C., Simon, M., Targetti, S., Napoléone, C., 2018. Land and farming system dynamics and their drivers in the Mediterranean Basin. Land Use Policy. http://dx.doi.org/10.1016/j.landusepol.2017.07.010.

Dissart, J.-C., Vollet, D., 2011. Landscapes and territory-specific economic bases. Land Use Policy 28, 563–573.

Duke, J.M., Aull-Hyde, R., 2002. Identifying public preferences for land preservation using the analytic hierarchy process. Ecol. Econ. 42, 131–145.

Eakin, H., Bojórquez-Tapia, L.A., Monterde Diaz, R., Castellanos, E., Haggar, J., 2011. Adaptive capacity and social-environmental change: theoretical and operational modeling of smallholder coffee systems response in Mesoamerican Pacific Rim. Environ. Manage. 47 (3), 352–367.

Erdoğmuş, Ş., Aras, H., Koç, E., 2006. Evaluation of alternative fuels for residential heating in Turkey using analytic network process (ANP) with group decision-making. Renew. Sustain. Energy Rev. 10, 269–279.

Ferguson, M., Ali, K., Olfert, M.R., Partridge, M., 2007. Voting with their feet: jobs versus amenities. Growth Change 38, 77–110.

Finn, J.A., Bartolini, F., Bourke, D., Kurz, I., Viaggi, D., 2009. Ex post environmental evaluation of agri-environment schemes using experts' judgements and multicriteria analysis. J. Environ. Plann. Manage. 52, 717–737.

Gómez-Navarro, T., García-Melón, M., Acuña-Dutra, S., Díaz-Martín, D., 2009. An environmental pressure index proposal for urban development planning based on the analytic network process. Environ. Impact Assess. Rev. 29, 319–329.

García-Melón, M., Ferrís-Oñate, J., Aznar-Bellver, J., Aragonés-Beltrán, P., Poveda-Bautista, R., 2008. Farmland appraisal based on the analytic network process. J. Glob. Optim. 42, 143–155.

García-Melón, M., Gómez-Navarro, T., Acuña-Dutra, S., 2010. An ANP approach to assess the sustainability of tourist strategies for the coastal national parks of Venezuela. Ukio Technologinis ir Ekonominis Vystymas 16, 672–689.

Gasparatos, A., Scolobig, A., 2012. Choosing the most appropriate sustainability assessment tool. Ecol. Econ. 80, 1–7.

Haines-Young, R., Potschin, M., 2010. The Links Between Biodiversity, Ecosystem Services and Human Well-Being. Cambridge University Press, Cambridge.

Harker, P.T., Vargas, V.G., 1987. The theory of ratio scale estimation: saaty's analytic hierarchy process. Manage. Sci. 33, 1383–1403.

Hein, L., van Koppen, K., de Groot, R.S., van Ierland, E.C., 2006. Spatial scales, stakeholders and the valuation of ecosystem services. Ecol. Econ. 57, 209–228.

Heringa, P.W., van der Heide, C.M., Heijman, W.J.M., 2013. The economic impact of multifunctional agriculture in Dutch regions: an input-output model. NJAS Wageningen J. Life Sci. 64–65, 59–66.

Huang, J., Tichit, M., Poulot, M., Darly, S., Li, S., Petit, C., Aubry, C., 2015. Comparative review of multifunctionality and ecosystem services in sustainable agriculture. J. Environ. Manage. 149, 138–147.

Huylenbroeck, G.V., Vandermeulen, V., Mettepenningen, E., Verspecht, A., 2007. Multifunctionality of agriculture: a review of definitions, evidence and instruments. Living Rev. Landscape Res. 1.

Jongman, R.H.G., 2002. Homogenisation and fragmentation of the European landscape: ecological consequences and solutions. Landscape Urban Plann. 58, 211–221.

Kim, Y.-S., Johnson, R.L., 2002. The impact of forests and forest management on neighboring property values. Soc. Nat. Resour. 15, 887–901.

LaNotte, A., D'Amato, D., Mäkinen, H., Paracchini, M.L., Liquete, C., Egoh, B., Geneletti, D., Crossman, N., 2017. Ecosystem services classification: a systems ecology perspective of the cascade framework. Ecol. Indic. 74, 392–402.

Maes, J., Jacobs, S., 2017. Nature-based solutions for Europe's sustainable development. Conserv. Lett. J. Soc. Conserv. Biol. 10, 121–124.

Manrique, R., Viaggi, D., Raggi, M., 2015. A Bayesian network highlighting the linkages between landscape structure and the local economy: the case of agritourism in lowland areas of Northern Italy. J. Environ. Plann. Manage. 58, 2137–2158.

McVittie, A., Moran, D., Thomson, S., 2009. A review of literature on the value of public goods from agriculture and the production impacts of the single farm payment scheme. Report Prepared for the Scottish Government's Rural and Environment Research and Analysis Directorate (RERAD/004/09).

Meade, L.M., Sarkis, J., 1999. Analyzing organizational project alternatives for agile manufacturing processes: an analytical network approach. Int. J. Prod. Res. 37, 241–261.

Neaupane, K.M., Piantanakulchai, M., 2006. Analytic network process model for landslide hazard zonation. Eng. Geol. 85, 281–294.

Nekhay, O., Arriaza, M., Boerboom, L., 2009. Evaluation of soil erosion risk using Analytic Network Process and GIS: a case study from Spanish mountain olive plantations. J. Environ. Manage. 90, 3091–3104.

Parks, S., Gowdy, J., 2013. What have economists learned about valuing nature? A review

essay. Ecosyst. Serv. 3, e1–e10.
Parra-López, C., Calatrava-Requena, J., de-Haro-Giménez, T., 2008. A systemic comparative assessment of the multifunctional performance of alternative olive systems in Spain within an AHP-extended framework. Ecol. Econ. 64, 820–834.
Partridge, M.D., Rickman, D.S., Ali, K., Olfert, M.R., 2008. The geographic diversity of U.S. nonmetropolitan growth dynamics: a geographically weighted regression approach. Land Econ. 84, 241–266.
Pedroli, B., Pinto Correia, T., Primdahl, J., 2016. Challenges for a shared European countryside of uncertain future: towards a modern community-based landscape perspective. Landscape Res. 41, 450–460.
Rodríguez-Entrena, M., Colombo, S., Arriaza, M., 2017. The landscape of olive groves as a driver of the rural economy. Land Use Policy 65, 164–175. http://dx.doi.org/10.1016/j.landusepol.2017.03.017.
SEGIRA, 2010. 'Study on Employment, Growth and Innovation in Rural Areas: Main Report', Report Prepared for DG Agriculture and Rural Development.
Saaty, T.L., Shih, H.-S., 2009. Structures in decision making: on the subjective geometry of hierarchies and networks. Eur. J. Oper. Res. 199, 867–872.
Saaty, T.L., 1980. The Analytic Hierarchy Process. McGraw-Hill, New York.
Saaty, T.L., 1996. Decision Making with Dependence and Feedback: The Analytic Network Process. RWS publications, Pittsburgh.
Saaty, T.L., 2005. Theory and Applications of the Analytic Network Process: Decision Making With Benefits, Opportunities, Costs, and Risks. RWS publications, Pittsburgh.
Saaty, T.L., 2008. Decision making with the analytic hierarchy process. Int. J. Serv. Sci. 1, 83–98.
Saaty, T.L., 2013. The modern science of multicriteria decision making and its practical applications: the AHP/ANP approach. Oper. Res. 61, 1101–1118.
Sharpley, R., Vass, A., 2006. Tourism, farming and diversification: an attitudinal study. Tour. Manage. 27, 1040–1052.
Spangenberg, J.H., Settele, J., 2010. Precisely incorrect? Monetising the value of ecosystem services. Ecol. Complexity 7, 327–337.
TEEB, 2010. The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB.
Tempesta, T., Giancristofaro, R.A., Corain, L., Salmaso, L., Tomasi, D., Boatto, V., 2010. The importance of landscape in wine quality perception: an integrated approach using choice-based conjoint analysis and combination-based permutation tests. Food Qual. Preference 21, 827–836.
Turner, R.K., Paavola, J., Cooper, P., Farber, S., Jessamy, V., Georgiou, S., 2003. Valuing nature: lessons learned and future research directions. Ecol. Econ. 46, 493–510.
van Vliet, J., de Groot, H.L.F., Rietveld, P., Verburg, P.H., 2015. Manifestations and underlying drivers of agricultural land use change in Europe. Landscape Urban Plann. 133, 24–36.
van Zanten, B., Verburg, P., Espinosa, M., Gomez-y-Paloma, S., Galimberti, G., Kantelhardt, J., Kapfer, M., Lefebvre, M., Manrique, R., Piorr, A., Raggi, M., Schaller, L., Targetti, S., Zasada, I., Viaggi, D., 2014. European agricultural landscapes, common agricultural policy and ecosystem services: a review. Agron. Sustain. Dev. 34, 309–325.
Vandermeulen, V., Verspecht, A., Vermeire, B., Van Huylenbroeck, G., Gellynck, X., 2011. The use of economic valuation to create public support for green infrastructure investments in urban areas. Landscape Urban Plann. 103, 198–206.
Villanueva, A.J., Gómez-Limón, J.A., Arriaza, M., Nekhay, O., 2014. Analysing the provision of agricultural public goods: the case of irrigated olive groves in Southern Spain. Land Use Policy 38, 300–313.
Villanueva, A.J., Targetti, S., Schaller, L., Arriaza, M., Kantelhardt, J., Rodriguez-Entrena, M., Bossi-Fedrigotti, V., Viaggi, D., 2015. Assessing the role of economic actors in the production of private and public goods in three EU agricultural landscapes. J. Environ. Plann. Manage. 58, 2113–2136.
Wilson, G.A., 2010. Multifunctional quality and rural community resilience. Trans. Inst. Br. Geogr. 35, 364–381.
Wolfslehner, B., Vacik, H., Lexer, M.J., 2005. Application of the analytic network process in multi-criteria analysis of sustainable forest management. For. Ecol. Manage. 207, 157–170.
Zasada, I., Piorr, A., 2015. The role of local framework conditions for the adoption of rural development policy: an example of diversification, tourism development and village renewal in Brandenburg, Germany. Ecol. Indic. 59, 82–93.
Zasada, I., Häfner, K., Schaller, L., van Zanten, B.T., Lefebvre, M., Malak-Rawlikowska, A., Nikolov, D., Rodríguez-Entrena, M., Manrique, R., Ungaro, F., Zavalloni, M., Delattre, L., Piorr, A., Kantelhardt, J., Verburg, P.H., Viaggi, D., 2017. A conceptual model to integrate the regional context in landscape policy, management and contribution to rural development: literature review and European case study evidence. Geoforum 82, 1–12.