



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

Papers downloaded from AgEcon Search may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

Thilo NIGMANN*, Thomas DAX* and Gerhard HOVORKA*

Applying a social-ecological approach to enhancing provision of public goods through agriculture and forestry activities across the European Union

Public goods provided by different land management practices in European regions have increasingly attained attention in agricultural policy debates. By focusing on the social-ecological systems (SES) framework, the systemic interrelations (e.g. drivers, resources, actors, governance regimes and policy impact) in land management across several case studies in various topographical and climatic conditions across ten European Union Member States are provided. The analysis of agricultural and forestry systems reveals a wide range of factors that drive the provision of 'ecologically and socially beneficial outcomes' (ESBOS). The respective influencing aspects cannot be reduced to market forces and policy support, but have to address simultaneously the pivotal role of social, cultural and institutional drivers as well. In particular, the tight interplay between public policies and private initiatives, and market mechanisms and societal appreciation of public goods delivery have shown to be the indispensable clue for understanding the relationship shaping the level of provision of public goods. Comparative analyses support the strong reliance on context, history, types of regions and differentiation of management systems which might be used for recommendations in the current debate on the future Common Agricultural Policy.

Keywords: agricultural policy, rural development, mountain farming, public goods, valuation

JEL classifications: H41, O13, O35, Q18, Q57, R11, R52

* Bundesanstalt für Bergbauernfragen, Marxergasse 2, A-1030 Wien, Austria. Corresponding author: thomas.dax@berggebiete.at; <http://orcid.org/0000-0002-0281-0926>

Received 1 December 2017; accepted 6 March 2018.

Introduction

Land use and land management are increasingly analysed as activities that include functions that go well beyond their primary objectives and economic focus. It has been widely acknowledged for several decades that agricultural and forestry systems 'produce', in addition to food, timber and fibre, a great variety of public goods and ecosystem services. These joint products are of particular relevance for many rural regions, and positively contribute to rural vitality.

While the production function is seen as a result of individual firm business decisions, the latter functions increasingly attract public attention, manifested in discussions surrounding the provision of social and ecological goods and services from land management such as biodiversity, climate change mitigation, water management, soil erosion, rural vitality and rural depopulation, as well as animal welfare objectives among many others (Randal, 2002; Cooper *et al.*, 2009; Renting *et al.*, 2009; Dwyer and Hodge, 2016). Public goods and ecosystem services have increasingly gained attention in agricultural policy evolution and reform considerations as a result of the public demand expressed by this debate. In particular, the recent reform of the Common Agricultural Policy (CAP) (Erjavec and Erjavec, 2009) and the current preparation of shaping the CAP for the period after 2020 (Matthews, 2016; Buckwell *et al.*, 2017) take legitimacy from linking land management types and management intensity with resulting levels of public goods and ecosystem service provision. Instruments of the agri-environmental programmes are the most direct expression of these relationships (OECD, 2013). Despite the commonly-acknowledged high public value and the elaboration of a set of policy interventions to secure public goods, there is increasing concern of a potential undersupply of crucial public goods with

regard to current and future societal demand (Cooper *et al.*, 2009; Stoate *et al.*, 2009; Maréchal *et al.*, 2017; Nilsson *et al.*, 2017), and inherent limited impact of policy intervention (Westhoek *et al.*, 2013).

Considering the wide variety of different landscape types as well as the variance in the effects of different management systems in the European Union (EU), the importance of better understanding how agriculture and forestry contribute to the provision of public goods becomes evident (van Zanten *et al.*, 2014; Lefebvre *et al.*, 2015). Yet, previous research mostly addresses this issue from an agricultural landscape perspective. The EU's Horizon 2020 Framework Programme commissioned, through a targeted call (ISIB-1-2014), two respective European research projects (PEGASUS and PROVIDE) to investigate the provision of public goods and ecosystem services from agriculture and forestry activities in the EU, and to formulate recommendations how to secure beneficial outcomes from and target policies at supporting sufficient levels of appropriate land management systems. This paper draws on the work of the PEGASUS ('Public Ecosystem Goods and Services from land management – Unlocking the Synergies') project, which focuses on the assessment of drivers that stimulate and/or hinder the service provision.

The project's approach does not only take into account land use and resource systems, but also integrates the actors' perspective, the organisation and effectiveness of governance regimes and institutional settings and place-specific dynamics (Dwyer *et al.*, 2015). In analysing the wide scope of influences on how land management adopts effective strategies to provide such services, a social-ecological system based approach has been selected. This paper provides a synthesis of the comparative analysis of a range of case studies across EU Member States and regions, and summarises the emerging findings of the project work (Maréchal and Baldock, 2017; Sterly *et al.*, 2017).

To display the relevance of this approach, the paper starts by presenting the theoretical concept and the methodological background of the project. It continues by discussing the main results of the selected in-depth case studies. The research goal is to develop a knowledge base regarding the role of these factors in provisioning beneficial outcomes to society in order to develop guidance and recommendations for both policy design and practice. The summary of findings in the following section thus highlights the main common findings, which intend to be a source for practitioners' action and policy considerations.

Theory and methodological background

The underlying theoretical concepts behind public goods and ecosystem services respectively are rooted in different disciplines but at the same time share much in common. The former looks through the lens of (neoclassical) economics while the latter provides an environmental science-based point of view (MEA, 2005; Dwyer *et al.*, 2015). In order to capture both social and environmental aspects in an integrated way, the project elaborated a working concept that emphasises the intended 'positive' outcomes by the term 'environmentally and socially beneficial outcomes' (ESBOs) (Maréchal *et al.*, 2016). Acknowledging the vast spatial differences in the environmental and socio-cultural context (van Zanten *et al.*, 2014), as well as the differences in pan-European land use history and institutional settings, the project bases its empirical evidence on a set of 34 case studies in varied topographical and climatic conditions across ten EU Member States (Figure 1) (Maréchal *et al.*, 2016). These are not only characterised by their spatial variation, but reflect also the important variability in land management systems across Europe. Out of these, a subset of twelve case studies was selected for in-depth analysis (Table 1). The selection was particularly based on the significance of empirical findings as well as access to stakeholders. Each case study represents some specific initiative or other forms of collective action at local, regional or territorial level.

The empirical findings of each case study are based on local, regional and national data sets, a range of semi-structured stakeholder interviews, focus groups and workshop sessions. In order to illustrate the systemic interrelations between natural resources, cultural aspects, governance regimes, drivers and actors which all impact on the provision of ESBOs to different degrees, a social-ecological system framework was applied for each case study (Figure 2). The SES framework is seen as instructive in sharpening the analysis on key influences, interrelations and acting persons as well as diverse policy and external inputs. It is particularly important to view this concept not as a static one, but rather as a structure that focuses analysis on the area observed. The interlinkages beyond the studied area are very important and (increasingly) affect the provision of ESBOs and the effectiveness of regional action.

While it is already a challenge to evaluate the impact of a certain driver on the provision of a single ESBO, it is even



Figure 1: Locations of all 34 case study areas in the PEGASUS H2020 research project. The circles indicate the twelve in-depth case studies listed in Table 1.

Source: Maréchal and Baldock (2017)

Table 1: The twelve in-depth case studies and related environmentally and socially beneficial outcome (ESBO) provision.

No.	Study topic	Key ESBOs ¹
1	Organic farming label in the mountain Murau region	8, 10
2	Birds and amphibians support on wet meadows	8, 10, 12
3	Traditional orchard meadows in Hessen/Baden-Württemberg	8, 9, 10, 13
4	Grass-fed beef	4, 8, 10, 11, 12
5	Volvic water company, management agreements and agri-forestry	1, 2
6	Processed tomato supply chain in the Tomato District of northern Italy	1, 2, 6, 7
7	Bergamot, niche and organic products in Calabria	8, 10, 12
8	Outdoor-grazing payments in dairy farming	6, 8, 10, 11
9	Skylark foundation, a farmers' association for sustainable arable farming	1, 6
10	Small-scale peri-urban mosaic in Montemor-o-Novo	12
11	Agri-forestry in sub-alpine Slovenia (Upper Savinja Valley)	8, 10
12	WILD river basin management initiative	1, 5, 12

¹(1) water quality; (2) water availability; (3) air quality; (4) climate change mitigation; (5) flood protection; (6) soil functionality; (7) soil protection; (8) species and habitats; (9) pollination; (10) landscape character and cultural heritage; (11) farm animal welfare; (12) rural vitality; (13) educational activities

See Figure 1 for the geographical locations of the case studies

Source: IfLS/CCRI (2017)

more challenging to evaluate how they interact synergistically in a social-ecological system on multiple ESBOs. In order to reduce the complexity and in an attempt to increase the significance of the findings, the case studies focus on key ESBOs which are primarily impacted by the case study initiatives. Yet, it is acknowledged that the analysed cases have an impact on a cascade of ESBOs. In Figure 2, the different clusters of the social-ecological system framework represent the variables involved in provisioning public goods while the arrows showcase the interactions between these clusters.

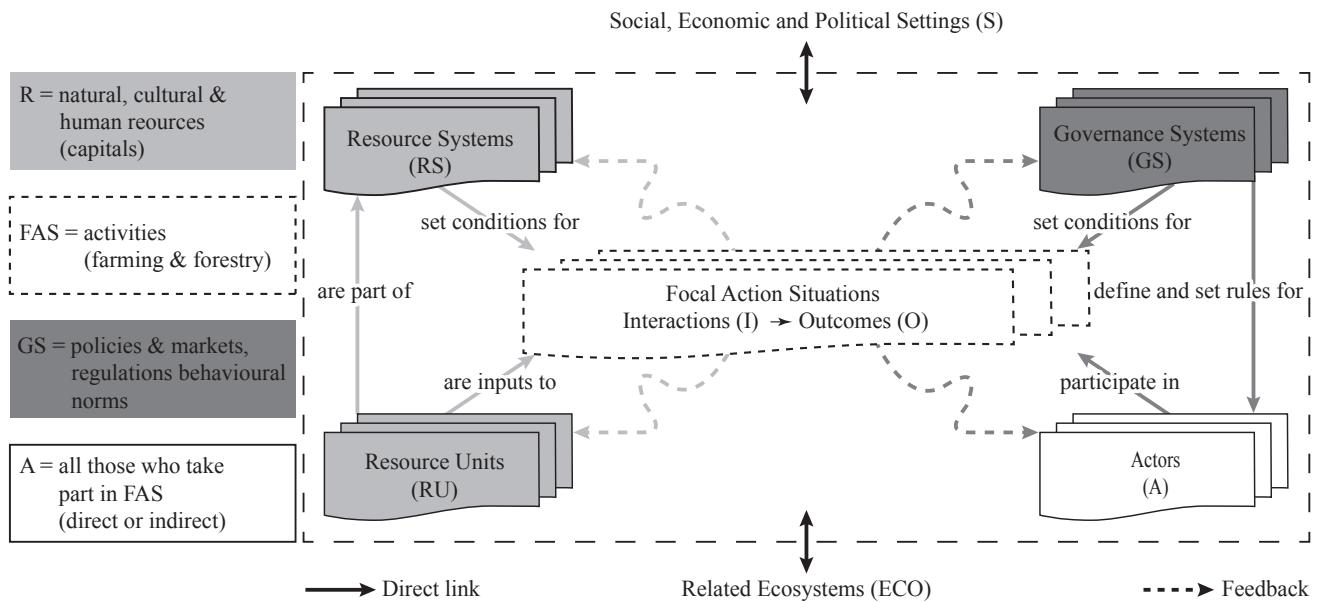


Figure 2: Illustration of a social-ecological system.

Source: adapted from McGinnis and Ostrom (2014)

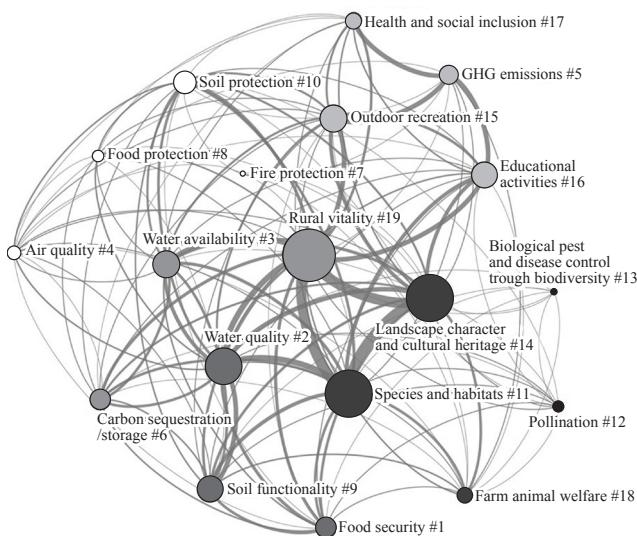


Figure 3: Distribution of environmentally and socially beneficial outcomes (ESBOs) among the case studies in the PEGASUS H2020 research project.

Source: Sterly *et al.* (2017)

In terms of ESBOs addressed within the case study areas, Figure 3 provides an indication of the main scope of relevance of the ESBOs. The case studies predominantly focus on species and habitats (#11), rural vitality (#19), and landscape character and cultural heritage (#14). It seems important that there is great interrelation between these three ESBOs (co-production) which mutually strengthen each other. The distribution of the frequency of ESBOs is also due to the choice of case studies which indirectly were selected to support analysis in those areas which are most severely affected by ‘negative’ trends and threats of land abandonment and neglect of public goods provision. This leads also to the overall picture that the following important aspects are covered only to a limited extent: greenhouse gas emissions

(#5), pollination (#12), fire protection (#7), and biological pest and disease control (#13). The presentation is not meant to make any allusion of the representativeness of the ESBOs across Europe; for such an analysis a comparative selection process of a wide larger number of areas would be required.

Emerging findings

In the analysis of the PEGASUS project, the project teams investigated a variety of approaches to providing public goods by a wide range of stakeholders, including in particular farmers, local administration, environmental bodies, local and national and international enterprises, and regional and national authorities. These actors aim in the analysed case studies to enhance the provision of public goods and ecosystem services in rural areas. In view of the wide range of these actors it was particularly important to capture their myriad intentions, views and experiences, and include alternative and effective governance systems (Rounsevell *et al.*, 2012). The following findings are derived from the common analysis of all the case studies and the project analysis, aiming at recommendations for future policy adaptation and suggestions for practical work in relation to ESBO provision (Maréchal and Baldock, 2017).

All cases showed that the provision of ESBOs is driven by a wide range of different mechanisms that show overlapping and controversial features. It is evident that changes in ESBO provision are tied to a variety of social, cultural and institutional drivers (Mantino *et al.*, 2016), which in some cases are also complemented by market forces and/or structural changes. Societal trends and aspirations of local actors are also decisive incentives in ESBOs appreciation, but quite often this becomes visible only through product and market differentiation strategies, market development, creation of higher value added as well as various forms of collective action (Knickel *et al.*, 2017).

Table 2: Land use / management practices and associated provisioning mechanisms in the twelve in-depth case studies.

No.	Prevailing / concerned land use and management practices	Main mechanisms of initiatives	Additional aspects
1	Pastures (combined with dairy or meat production): Extensive, organic production, hay farming, dairy farming, cattle breeding, also forestry.	Private actor initiative built on consumer concern: Price premium for high quality milk from specific and localised production system as well as CAP payments.	
2	Pastures (combined with dairy or meat production): Irrigated (extensive) grassland for hay production, hunting.	Consumer/citizen concerns: Ecological enrichment of managed grassland through modified irrigation system and nature-friendly agriculture on a private reserve 'for birds and for the people' (purchase of land).	NGO-driven.
3	Permanent crops: Traditional orchard meadows, very extensive, organic production.	Consumer/citizen concerns: Crop surcharge initiative; creation of a new branding/labels, and of alternative supply chains / new product lines that can be connected back to traditional orchards and the related ecological benefits.	Private – citizens collaboration.
4	Pastures (combined with dairy or meat production): Grass-fed organic beef production.	Private actor initiative built on consumer concern: Whole value chain approach (production-processing-marketing) of grass-fed organic beef led by farmers' NGO Liivimaa Livaheis.	
5	Mixed land use systems: Mixed forest (53 per cent), mainly unmanaged; dominant agricultural land use: pasture, beef production, some (limited crop area).	Private actor led - territorial: The main strategy is to motivate appropriate land management and technical innovations by farmers/foresters via the provision of subsidies to land users to manage the risk of water contamination effectively.	Private sector water supplier with extensive interests in catchment.
6	Focus on tomato production (IPM and micro-irrigation introduction), in general: agriculture, mostly arable crops (wheat, maize) and forage. But also significant livestock farming.	Private actor initiative built on consumer concern: Interregional large-scale supply chain; innovative agricultural practices (integrated production, controlled irrigation and environmental certification) to reduce costs and increase crop competitiveness.	
7	Permanent crops: Citrus production, conventional and organic; irrigated, fertilising not so relevant, larger- and smaller-scale producers, intensification generally linked to landscape; water saving methods; rising share of organic production.	Private actor initiative built on consumer concern: Consortia trying to maintain the economic viability of distinctive bergamot production through market integration and cooperation in the food chain as well as CAP-derived aid.	
8	Pastures (combined with dairy or meat production): Grazing of dairy cows, manure management; rather intensive, but trend towards more animal welfare: trade-off between manure legislation and outdoor grazing; increasing the scale of production tends to be more efficient with in-house production systems.	Private actor initiative built on consumer concern: Branded cheese 'Beemsterkaas' is produced from defined outdoor-grazing systems.	
9	Arable crops and horticulture: Arable farms, with irrigation, some livestock keeping; intensive, innovations towards sustainable principles.	Private actor led - other: Sector-based funding mechanism (farmers and production related companies) to improve management in intensive systems e.g. to support buffer strips along field margins in return for land to be leased elsewhere.	
10	Mixed land use systems: Mixed small-scale land use: olives, sheep, vegetables, fruits; gravity irrigation; some beekeeping, hunting.	Private actor initiative built on consumer concern: Collective action by farmers and the linkage with other actors; Raising awareness about the value of rural life and increasing appreciation of aspects of it. Reviving/re-establishing local supply chains and more direct connections between smaller-scale producers and consumers.	Consumer concern.
11	Forestry: Mostly mountain forests, scattered rather large farms: ruminants, dairy and meat (sheep, cattle), managed forests.	Private actor initiative built on consumer concern: Private initiatives connecting producers and consumers (re. mountain wood).	
12	Mixed land use systems: Agriculture mostly commercial arable agriculture with some grazing land, small amounts of private woodland; major shifts from cattle production, increasing sheep counts; introducing herb-al lay, increased arable land.	Consumer/citizen concerns: The strategy is to involve farmers and local communities in developing the understanding and commitment to the actions needed and sustained effort.	NGO and public body partnership.

See Table 1 for the topic of each case study
 Source: adopted from Sterly *et al.* (2017)

Table 2 highlights the identified mechanisms of the selected in-depth case studies, which are closely associated with fostering provision. These mechanisms range from public sector governance-driven factors through consumer and citizen concerns-driven aspects to private actors-led initiatives at local or regional level. The case studies provide evidence that ESBOs are more effectively delivered when the initiative arises as a collective effort and trust relationships exist among regional or supply chain actors. This suggests that ESBOs are more effectively delivered when the mechanisms driving the provision are more strongly rooted in the respective territories, landscapes and supply chains, allowing institutions and governance regimes to work jointly towards desired outcomes. Critical success factors for building initiatives were identified as social capital, trust, transparent and inclusive communication, and cooperation. The following triggers were most frequently mentioned as being responsible for setting up collective initiatives: economic opportunities as well as the need to react to economic pressure was a prominent incentive of the analysed initiatives. The response to this was often to supply a premium market in connection with quality- and origin-centred marketing schemes. Examples for this approach are the case study on premium haymilk labelling in Austria (CS1; Nigmann *et al.*, 2017) as well as organic grass-fed beef in Estonia (CS4). Regulations designed to stimulate or maintain certain land use practices and agricultural activities in certain areas were another powerful trigger. These may range from agri-environmental measures through Natura 2000 payments to payments associated with Areas of Natural Constraints. Environmental challenges may also stimulate collective action as in the case of UK catchment management (CS12). However, an important underlying factor for the creation and success of collective initiative is societal appreciation ultimately responsible for the protection and enhancement of ESBOs.

In many cases, the success of a certain initiative was based on an interplay between private and public actors. These relationships can take up different forms, ranging from purely public entity-driven, to mainly private commercial-driven over to voluntary- and civil society-driven and, most often, a combination of all of them. The way these interactions work depends strongly on local governance regimes and the respective collective initiative. The case studies suggest that taking into account these governance and institutional aspects also at a local level provides a better understanding of how collective initiatives and effective provision of ESBOs can be incentivised and maintained. Also in this sense, trust between actors including public officials and commercial actors acts as a vehicle for enabling the emergence of collective action.

Besides the supply of ESBOs, it is also relevant to understand the demand side. Therefore, all case studies engaged in a qualitative assessment of the appreciation of ESBOs by different actors. The development of causal linkages between the actions within initiatives and the level of provision and related demand is in most cases characterised by complex linkages and, quite often, substantial changes over time. As such, it is hardly feasible to delineate explicit causality.

Complex interlinkages suggest the need to focus on direct or indirect indicators for levels of appreciation as, for example, the level of consumer demand and willingness to pay premia for certain product or service attributes, the level of farmer or NGO engagement as well as wider political discourse around certain types of management practices related to ESBO provision. Some cases showed how the 'value' of an ESBO can become either directly or indirectly part of agri-food products or services and how related costs for ESBO provision can partially be recovered via the value chain.

Beyond these direct and immediate market relationships, a more long-term perspective on the shaping of values and the underlying 'cultural' recognition of valorisation of products and activities that include the provision of public goods is crucial. This refers to the basic prerequisite of the existence of public appreciation (within a specific area and/or in the greater regional/national and societal context). Activities that increase public appreciation of ESBOs (specified for the context and particular topic) and which are conceived in a way so that they are able to transform this into demand seem particularly promising. This demand can either be directly expressed in pecuniary terms but may also take up different forms such as the creation of initiatives that sustain rural identity, which indirectly can be supportive to agro-tourism activities and regional competitiveness. In general, increasing the public's appreciation of environmental and social goods and services from agriculture and forestry systems could therefore contribute to transform this into an articulated demand and, consequently, would contribute to an increased provision.

In the current policy debates (see in particular the present discussion on the CAP post-2020 reform; Dax and Copus, 2016; EC, 2017), the proof of legitimacy of public funding is a 'hot' topic which centres increasingly on verifying and achieving the intended impact. The linkages from project analyses towards policy conclusions is rendered difficult as causal relationships between land management (both agricultural and forest management) and related ESBOs can hardly be delivered due to their complexity. At most, specific parts and immediate effects are analysed and described with sufficient accuracy. To some extent, the 'weakness' of this approach is due to the short timescale of studies and evaluation of programmes. The PEGASUS case studies and the project's mapping work underscore the difficulties in finding definite answers for closing these gaps.

In analysing the current provision and the potential to increase ESBOs, the involvement of local actors is indispensable if realisation of the concept and effectiveness is sought. The highly participatory approach applied in the PEGASUS study proved to be a useful method to capture some of the multiple interactions taking place between drivers, actors, practices and the outcomes delivered. It seems the most interesting way to detect and follow local application and relationships between different types of ESBOs and different types of land management. However, there are important limitations to this approach as it risks some environmental or social needs being overlooked (especially when these are more difficult to address such as climate issues). For the conclusive recommendations at the various scales this would mean that policy and practice should be

informed by a bottom-up/collective approach in combination with well-informed guidance from higher levels and regulatory schemes.

Conclusions

The observations across the diverse rural regions covered by the PEGASUS project revealed the presence of and the need to shape further and enhance ESBO provision through a place-based approach. This involves particular care in linking to local conditions, without neglecting the decisive national and European influences on local developments.

The high recognition of the topic in the CAP, but also in the demand for many of the public goods, is already ‘translated’ into market relationships. Many cases showed how markets for primary products and in particular how product differentiation and demand for quality regional products impact land use decisions and management practices. Hence, the private sector can be an important stimulus and agent of change. However, there is evidence that regional ‘markets’ are insufficient and market mechanisms alone are inadequate to secure appropriate provision of ESBOs.

The policy context and relevant regulations must not be neglected in any case, with the CAP having a core role through its interpretation and implementation at Member State level for the provision of ESBOs. While policies and instruments focusing directly on ESBOs, such as the agri-environmental scheme and nature protection measures, are significant, the indirect impact of other CAP measures and other EU and national policies are also critically important.

The interplay between public policies, private initiatives and market mechanisms have been shown to be the clue for understanding the relationship between land management and shaping the level of provision of public goods. Comparative analysis supports the strong reliance on context, history and evolution, recognition and demand, and differentiation by types of regions, institutional settings and land management systems. These findings hold a series of important lessons and conclusions for the discussion on the reform of the future CAP.

They indicate the serious need for incorporating a systems perspective in policy assessment and conceptualisation that addresses the multitude of triggers and drivers for land management. Spatial variance and differentiation of land management types is crucial for a proper understanding of relationships of land management practices to beneficial outcomes and for shaping policies that pay attention to the large scope of differentiation across EU regions and land management activities.

Acknowledgements

This work was partly funded by the EU Horizon 2020 Programme within the Project PEGASUS grant number 633814. The opinions expressed in this paper are not necessarily those of the EU.

References

Buckwell, A., Matthews, A., Baldock, D. and Mathijs, E. (2017): CAP - Thinking Out of the Box: Further modernisation of the CAP – why, what and how? Brussel: RISE Foundation.

Cooper, T., Hart, K. and Baldock, D. (2009): Provision of Public Goods through Agriculture in the European Union, Report Prepared for DG Agriculture and Rural Development. London: Institute for European Environmental Policy.

Dax, T. and Copus, A. (2016): The Future of Rural Development, in Research for AGRI Committee – CAP Reform Post-2020 – Challenges in Agriculture, Workshop Documentation. Brussel: European Parliament, 221-303.

Dwyer, J. and Hodge, I. (2016): Governance structures for social-ecological systems: Assessing institutional options against a social residual claimant. *Environmental Science and Policy* **66**, 1-10. <https://doi.org/10.1016/j.envsci.2016.07.017>

Dwyer, J., Short, C., Berriet-Solliec, M., Gael-Lataste, F., Pham, H-V., Affleck, M., Courtney, P. and Déprés, C. (2015): Public Goods and Ecosystem Services from Agriculture and Forestry – a conceptual approach. Deliverable 1.1. of the EU H2020 project PEGASUS.

EC (2017): The Future of Food and Farming. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the regions. COM(2017) 713 final. Brussel: European Commission.

Erjavec, K. and Erjavec, E. (2015): ‘Greening the CAP’ – Just a fashionable justification? A discourse analysis of the 2014–2020 CAP reform documents. *Food Policy* **51**, 53-62. <https://doi.org/10.1016/j.foodpol.2014.12.006>

IfLS/CCRI (2017): Case study reports – Step 3-4. Developing innovative and participatory approaches for PG/ESS delivery. Deliverable 4.3. of the EU H2020 project PEGASUS.

Knickel, K., Dwyer, J., Baldock, D., Hülemeyer, K., Dax, T., Westerink, J., Peepson, A., Rac, I., Short, C., Polman, N. and Brouwer, F. (2017): Approaches to an enhanced provision of environmental and social benefits from agriculture and forestry. Synthesis of Deliverable 4.3. of the EU H2020 project PEGASUS.

Lefebvre, M., Espinosa, M., Gomez y Paloma, S., Paracchini, M.L., Piort, A. and Zasada, I. (2015): Agricultural landscapes as multi-scale public good and the role of the Common Agricultural Policy. *Journal of Environmental Planning and Management* **58** (12), 2088-2112. <https://doi.org/10.1080/09640568.2014.891975>

Mantino, F., Vanni, F. and Forcina, B. (2016): Socio-political, economic and institutional drivers. A cross-country comparative analysis. Synthesis report. Deliverable 3.3. of the EU H2020 project PEGASUS.

Maréchal, A. and Baldock, D. (2017): Key emerging findings from the PEGASUS project. Report published as part of the EU H2020 project PEGASUS.

Maréchal, A., Baldock, D., Hart, K., Dwyer, J., Short, C., Pérez-Soba, M., Paracchini, M.L., Barredo, J.I., Brouwer, F. and Polman, N. (2016): The PEGASUS conceptual framework. Synthesis report. Deliverable 1.2. of the EU H2020 project PEGASUS.

Matthews, A. (2016): The Future of Direct Payments, in Research for AGRI Committee – CAP Reform Post-2020 – Challenges in Agriculture, Workshop Documentation. Brussel: European Parliament, 3-86.

McGinnis, M.D. and Ostrom, E. (2014): Social-Ecological System Framework: Initial Changes and Continuing Challenges. *Ecology and Society* **19** (2), article 30. <https://doi.org/10.5751/ES-06387-190230>

MEA (2005): *Ecosystems and Human Well-being: Synthesis. A Report of the Millennium Ecosystem Assessment*. Washington DC: Island Press.

Nigmann, T., Hovorka, G. and Dax, T. (2017): Organic farming in the mountain region Murau. National report Austria. Deliverable 4.3. of the EU H2020 project PEGASUS.

Nilsson, L., Andersson, G.K.S., Birkhofer, K. and Smith, H.G. (2017): Ignoring ecosystem-service cascades undermines policy for multifunctional agricultural landscapes. *Frontiers in Ecology and Evolution* **5**, article 109. <https://doi.org/10.3389/fevo.2017.00109>

OECD (2013): *Providing Agri-environmental Public Goods through Collective Action*. Paris: OECD Publishing.

Randal, A. (2002): Valuing the outputs of multifunctional agriculture. *European Review of Agricultural Economics* **29** (3), 289-307. <https://doi.org/10.1093/eurrag/29.3.289>

Renting, H., Rossing, W.A., Groot, J.C., Van der Ploeg, J.D., Laurent, C., Perraud, D., Stobbelaar, D.J. and Van Ittersum, M.K. (2009): Exploring multifunctional agriculture. A review of conceptual approaches and prospects for an integrative transitional framework. *Journal of Environmental Management* **90** (2), S112-S123. <https://doi.org/10.1016/j.jenvman.2008.11.014>

Rounsevell, M.D.A., Robinson, D.T. and Murray-Rust, D. (2012): From actors to agents in socio-ecological systems models. *Philosophical Transactions of the Royal Society B* **367** (1586), 259-269. <https://doi.org/10.1098/rstb.2011.0187>

Stoate, C., Baldi, A., Beja, P., Boatman, N.D., Herzon, I., van Doorn, A., de Snoo, G.R., Rakosy, L. and Ramwell, C. (2009): Ecological impacts of early 21st century agricultural change in Europe – a review. *Journal of Environmental Management* **91**, 22-46. <https://doi.org/10.1016/j.jenvman.2009.07.005>

Sterly, S., Baldock, D., Dwyer, J., Hart, K. and Short, C. (2017): Synthesis report on cross-cutting analysis from WPs 1-4. Deliverable 5.1. of the EU H2020 project PEGASUS.

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, S., Targetti, S., Zasada, I. and Viaggi, D. (2014): European agricultural landscapes, common agricultural policy and ecosystem services: a review. *Agronomy for Sustainable Development* **34** (2), 309-325. <https://doi.org/10.1007/s13593-013-0183-4>

Westhoek, H.J., Overmars, K.P. and van Zeijts, H. (2013): The provision of public goods by agriculture: Critical questions for effective and efficient policy making. *Environmental Science & Policy* **32**, 5-13. <https://doi.org/10.1016/j.envsci.2012.06.015>