# Fostering resilient agro-food futures through a social-ecological systems framework: Public–private partnerships for delivering ecosystem services in Europe

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# FOSTERING RESILIENT AGRO-FOOD FUTURES THROUGH A SOCIAL-ECOLOGICAL SYSTEMS FRAMEWORK: PUBLIC–PRIVATE PARTNERSHIPS FOR DELIVERING ECOSYSTEM SERVICES IN EUROPE

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## Abstract

In recent decades, various public policies have targeted agriculture and forestry's relationship with environmental protection and management. Among environmental policy communities the approach is increasingly framed through the theoretical concepts of ecosystem services (ES) or public goods (PG). Both offer useful perspectives to enhance understanding, but each only partially reflects the complex inter-linkages between productive land management and multiple environmental and social assets (biodiversity, landscapes, water, soil and air quality, rural vitality, culture and heritage), constraining their capacity for effective policy development. The Social-Ecological-Systems framework (SES), considering both natural and socio-economic elements in complex systems and interrogating these joint production relationships, offers added value in this context. The PEGASUS project[1] applied an adapted SES framework to identify the potential complementary and synergistic roles of policy, private and community actors in promoting socially beneficial outcomes, strengthening ecosystem services and sustainability. Two case studies illustrate the analytical process and its ability to connect top-down and bottom-up perspectives. This generated an expanded range of options focused on social processes and market development

[1] The authors gratefully acknowledge project funding from the EU H2020 RTD programme, grant agreement 633814.

facilitated by an enabling, responsive policy framework. Lessons for governance and practice, as well as international relevance, are briefly considered.

*Keywords:*
Ecosystem services; Public goods; Social-ecological systems; Sustainable agriculture; European Union policy; Collective action; Public–private partnerships

# 1. Introduction and context

## 1.1. Conceptual influences upon recent CAP reform in Europe

The development and implementation of public policy has shaped the impact of agriculture and forestry on global and local environmental resources. In that context, and particularly among those working in the ecological policy arena, the Ecosystem Services (ES) concept has emerged as an increasingly influential guide. It has been particularly championed as a tool for sustainability analysis and awareness-raising, as shown in the Millennium Ecosystems Assessment (MEA, 2005) exercise. This has also led to its inclusion in debates concerning reforming or reshaping public policies for farming and forestry. Within the European Union, the ES concept has gained increased prominence in the past decade as a relevant influence on the further development of the Common Agricultural Policy (CAP). It can be seen as a new element within a longer-term process in which the rationale and instruments of EU support to agriculture have been gradually reshaped in a more environmentally-aware direction. Understanding the evolutionary nature of this process is, we argue, central to assessing and promoting its future development.

The term ‘multifunctionality’ was first used in policy discussions in the late 1980s to describe how, in farming or forestry practice, land managers are able to produce or sustain a variety of different outputs including natural and socio cultural ‘benefits’ alongside food and other products for conventional markets. The ‘multifunctional’ view of primary production became a core EU concept in the CAP reforms of 1992 and 2000 (as affirmed in the 1997 Luxembourg Council), and was shared to an extent by other policy stakeholders internationally, some of whom used it to argue for special treatment of agriculture in the WTO-led process of trade liberalization. Thus the concept was popularized, and later somewhat discredited as a protectionist device, in that international context (Lataste, 2014). Subsequently, the concept of public goods (PG) began to gain ground in the CAP debate, promoted as a way of understanding agriculture’s generation of non-marketable environmental goods and externalities as a process of market failure requiring some action to

address it. In a context of budgetary restraint, these discussions and analyses (e.g. Marsh, 1992; Buckwell, 1997) helped to foster a new paradigm for agricultural policy built upon neoclassical economic theory and characterised by the rationale of 'public money for public goods' (Barthelemy and Nieddu, 2003; Laurent, 2001; Pingault, 2001; Massot-Marti, 2003; Bazin, 2003; Gravey, 2011). CAP reform debates since 2000 have increasingly used the PG concept to press for a new orientation of farm support away from the production of food and towards provision of a range of environmental and societal benefits (Berriet-Solliec, 2016). In support of this, various studies at EU level have sought to categorise and examine the nature of public goods from agriculture and forestry and consider how policies can foster socially-optimal levels of their provision (Cooper et al., 2009; ENRD, 2010). It is within this context that Ecosystem Services (ES) have also entered the arena of CAP reform discussion and analysis (EC, 2019).

Fundamentally, the ES concept describes the multiple ways in which modern societies depend upon certain functions of the ecological systems within which they are embedded (Daily, 1997). In doing so it identifies specific components of these systems, such as provisioning', 'regulating' and 'cultural' services, which need to be recognized and valued in decision-making (De Groot et al., 2002). In policy, it is increasingly understood that regulating and cultural ES are rarely recognised and rewarded through commercial market transactions (Ten Brink et al., 2009), leading to an interest in fostering their protection and enhancement through the actions and provisions of governance. For example, in international discussions an interest in policy instruments which offer Payment for Ecosystem Services (PES) has emerged (OECD/World Bank, 2013); mirroring the pattern of recognition and development of the PG concept at this level. In order to achieve this, Haines-Young and Potschin (2010) developed the 'service cascade' model where (natural) assets generate functions, which can provide services to society, which it perceives as beneficial. The notion of environmental assets as the starting point for this chain has resonance with concepts and analytical techniques found also in 'natural capital' social accounting literature (see Helm, 2014).

## 1.2. Ecosystem services and public goods as tools for policy development

Both ES and PG, as conceptual framings for enhanced policy, have important strengths and weaknesses in this context, as revealed through analysis of theory and its application in policy literature and contemporary debate. As discussed by Dwyer et al. (2015), the PG approach captures well the challenge of 'market failure', where economic signals fail sufficiently to represent certain

types of societal value which are not easily captured in the pricing of tradeable commodities. ES emphasise the multiple ways in which society benefits from the maintenance of natural and cultural assets, over and above their role as resources for the production of such commodities. But ecosystem resources, their extent, quality and service provision are affected by agriculture and forestry practices and in turn, these practices are affected by those resources, with knock-on consequences for societal choices both now and into the future. The relationship is neither predominantly unidirectional (Setten and Brown, 2018), nor unavoidably determined by the essentially 'non market' character of natural and cultural resources, as implied by the PG approach. Furthermore, the ES approach does not explain how some key natural assets and functions (e.g. biodiversity, carbon storage) are themselves dependent on the practise of certain socio-economic activities (Jones et al., 2015; Setten and Brown, 2018), in some contexts (e.g. extensive farming or woodland management). Also, it offers few insights into the behaviour of markets and institutions, and thus cannot readily prescribe the scale or nature of policies and actions to meet societal needs. By contrast, the concept of PG provides a useful way of understanding why market behaviour under-represents environmental and social values, but it is less able to explain how the conditions and context of production affect the degree of under-provision that occurs in any particular farming or forestry situation (system-specificity). And PG do not explain the dynamic interaction – including 'jointness' (generating public and private goods simultaneously, see Cahill, 2001), system-dependence and feedback conditions – that exist between natural and socio-economic assets in farming or forestry and that are in turn influenced by governance and property rights. These factors and the resulting 'partial' PG nature of many beneficial environmental and social attributes of farm and forestry practices mean that markets can play a role in supporting ES and PG provision. Moreover, those policies setting the general framework within which markets and businesses operate are a highly relevant consideration for effective policy.

## 1.3. Resilient agro-food futures and ecosystem services

As noted in the introduction to this issue, in Europe today our dominant agricultural and forestry systems are driven primarily by market incentives to produce food and fibre, maximising output whilst minimising financial cost and governed by increasingly global supply chains in which the act of production is often distanced from consumption (Dwyer, 2013). Such systems have traditionally given relatively less emphasis to the social, cultural and environmental benefits and costs of production, such that consumers cannot readily interrogate these aspects when making purchasing choices. In these situations, the supply of all ES, other than provisioning, can be seen as a positive externality, and the benefits of these services characterised as PG, which are largely unrewarded by

the market but nonetheless valued by society (Brouwer et al., 2018). It is a situation lacking in social and environmental resilience which is increasingly recognised as such by producers and consumers in many different situations (Marechal et al., 2018a). In reaction, a wide array of initiatives has arisen where actors aim to recognise and better reward ES provision by farming and forestry (Dwyer et al., 2018). Some of these have been directly stimulated by public policy while others arose from voluntary/private, often collective actions. In all cases, the broader policy framework of market conventions, governance and property rights influences their behaviours and their effectiveness. By focusing research and analysis to better understand the pre-conditions for successful development of such initiatives and the role(s) of public policy and private action in creating and sustaining those conditions, we hoped to generate new ideas for EU policy and practice (Rega et al., 2020; Marechal et al., 2018b).

## 1.4. Adapting and applying the SES framework in action-oriented research

In view of the conceptual and policy challenges described in section 1 above, the core aim of this paper is to present and discuss an approach which unifies the ES and PG concepts and is able to provide a holistic framework to assess the economic, environmental and social resilience of local initiatives. An action-oriented research approach is taken that places farmers, foresters and other stakeholders at the centre of the research (Knickel and Renting, 2002; Fazey et al., 2018), fundamentally because the land management decisions of these actors have a direct impact on the provision of a range of ES and PG. The proposed framework is the Social-Ecological-Systems (SES) concept (McGinnis and Ostrom, 2014). This representation of SES was evaluated and adapted to render it suitable for evaluation and development of case studies across Europe in the 'PEGASUS' project,[2] in order to analyse how provision is fostered by local and/or sector-led action, thus to identify transferable lessons for policy and practice. An action-oriented and participatory, mixed-methods approach, as suggested by McGinness and Ostrom, and based upon wider SES practice, was adopted. Results were recorded, analysed and discussed through a series of interactive events to identify lessons for policy, and transferable advice and guidance for local actors seeking to achieve similar kinds of change in their own situations. In this paper we present examples drawn from contrasting cases to illustrate how the framework supported and directed the analysis, and identify the lessons for policy and practice emerging from the research. We then reflect on the particular

[2] An EU-funded project under the Commission's Horizon2020 framework – see www.ieep-pegasus.net.

value of the SES framework as applied, and offer some ideas for further theoretical and applied development.

The rest of the paper is organised as follows: Section 2 explains the SES concept and the adapted SES framework used for the analysis of diverse initiatives in this research, which operationalized it particularly to support decision-making and enhanced impact among local actors. Section 3 presents analysis and results from the project, illustrated by reference to two detailed case studies and linked to study outputs including recommendations for policy and a toolkit of guidelines for enhanced local action. Section 4 concludes with reflections upon how the adapted SES framework performed in this context and how similar approaches could help enhanced global efforts in this arena, particularly linking to recent CBD and FAO-stimulated initiatives.

# 2. Applying social-ecological systems in agri-policy analysis

## 2.1. Introducing social-ecological systems

Social-Ecological Systems (SES) as a research framework developed as a mechanism to overcome thinking that was judged as too often either people- *or* nature-focused (Berkes and Folke, 1998; Berkes et al., 2002). Its emphasis is that humans must be seen as part of, not apart from, nature. To this end, both socio-economic and ecological elements of ecosystems can be analysed together through an SES framework, emphasising the interdependencies between natural and man-made factors and processes, and their integrated functionality (Berkes et al., 2002; de Groot et al., 2010). Fig. 1 builds on the discussion in the first section and relates the interaction between ES and PG within the agriculture and forestry sectors. The figure illustrates how assets generate services and how governance shapes the determination of how far assets and services are captured as either private or public goods, even in cases where a single process generates joint products. The two main types of driver – societal/personal and market on the one hand, and biophysical on the other – will shape the way in which, and extent to which, these processes operate in any given situation.

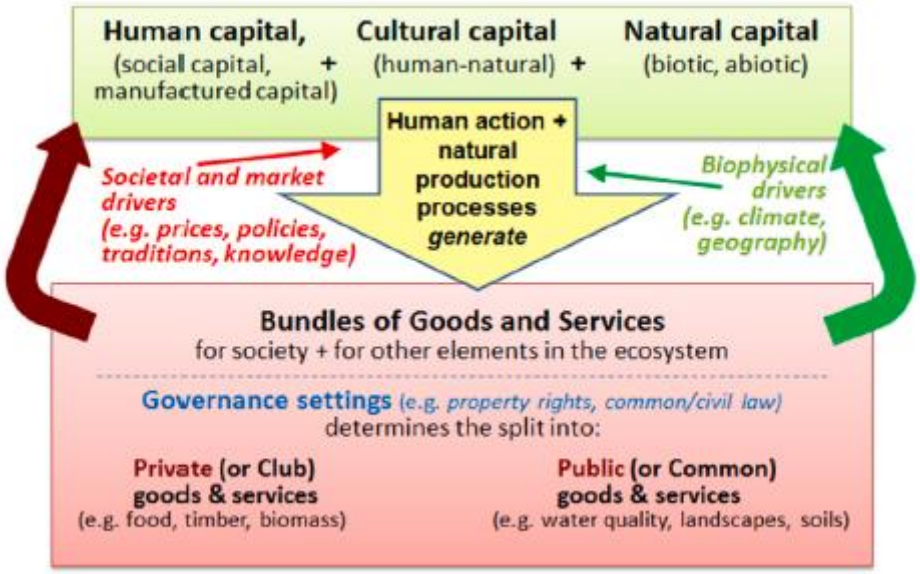


**FIGURE 1 AGRICULTURE AND FORESTRY CONCEIVED AS A SOCIAL-ECOLOGICAL SYSTEM.**

Proponents of SES argue that this enables a direct movement from theory into practice, built on enhanced understanding of the functional and institutional factors influencing the supply and demand of social and environmental benefits. Walker and Salt (2006) highlight four key SES principles that distinguish it conceptually from either PG or ES analytical framings:

(1) social systems are embedded in, and interlocked with, ecological systems;
(2) SES are subject to change in unpredictable, non-linear and transformative ways;
(3) SES are complex, adaptive systems;
(4) SES have varying degrees of 'resilience', and biological, physical and socio-economic factors can enhance (or reduce) this resilience.

The term 'resilience' is central to the SES approach. Here, resilience is taken to mean the ability of the system to undergo change while retaining sufficient functionality to continue to support both livelihoods and the provision of environmental and social benefits (Biggs et al., 2012). This quality is central to planning for sustainability in agriculture and forestry, where both ecological and socio-economic elements in the system are constantly changing in response to both local and global phenomena (van Riper et al., 2017; Pascua et al., 2017).

Anderies et al. (2004) suggest that interactions between different factors determine the robustness of the SES. Others, such as Leach et al. (2010), highlight dynamic relations within SES as critical.

However the approach is an iterative one under active development and thus far, it has not been widely applied in a European policy context. The McGinnis and Ostrom (2014) approach specifically offers a common vocabulary and framework for analysing natural resource management challenges across the globe. It was derived by analysis of a number of case studies, abstracting from them 'common features for analysing, comparing and diagnosing SES' (op.cit.). This allows it to embrace different disciplines (ecology, economics, socio-political and cultural knowledge) within a coherent framework for analysing the dynamics of local systems, which enables both ES and PG assets and attributes to be included and considered, irrespective of how they are interconnected.[3]

## 2.2. Applying SES in a multi-country study

The research outlined in this paper aimed to explore novel and innovative ways to enhance public goods and ecosystem services delivery from farming and forestry, learning from the 'bottom up' by analysing evolving cases *in situ*. The SES framework was used to structure an analysis of how the initiatives functioned, gathering information by reference to a common set of categories and inter-relations. An adapted diagrammatic version of the SES template of McGinnis and Ostrom (2014) was developed (Fig. 2), and comprehensive SES analytical guidance and training was prepared for all project partners (Knickel et al., 2016; PEGASUS, 2017). The SES diagram defines the constituent parts of the SES framework (including where ES and PG sit within the system), and the approach focuses particularly on the nature of their interactions and how different system elements promote, or conversely weaken, ES and PG provision. The analysis is not static: understanding how the system has evolved and is still changing is also key to the identification of opportunities for enhanced provision.

[3] Many ecosystem services relating to farming and forestry are public goods but some can be private goods and some will be attributes or services provided by 'bundles' of goods under particular conditions, rather than associated with single goods in all situations.

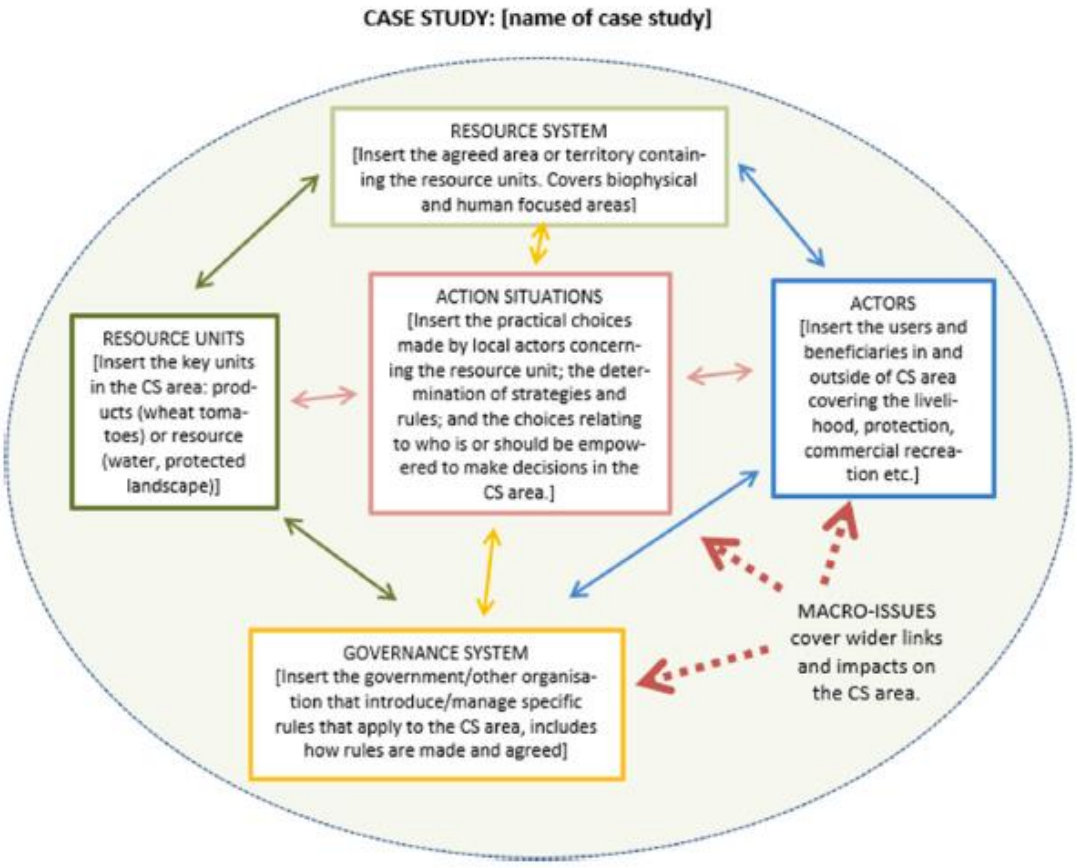


**FIGURE 2 SES FRAMEWORK DEVELOPED FOR PEGASUS (ADAPTED FROM OSTRAM AND COX, 2010; MCGINNIS AND OSTROM, 2014).**

A list of 34 case studies of contrasting local initiatives promoting PG and/or ES was identified by the research partners, covering different kinds of territory, resources and actors, and initiatives in different stages of maturity or development.[4] SES-based evaluation was applied to these cases, in a two-stage process as described here.

In stage 1 a rapid SES evaluation of all 34 cases, identifying the actors, issues and processes relevant to each of the elements depicted in Fig. 2, was used to derive a series of principles concerning how policies and practical actions had supported the development of environmental and social benefits, and to assemble a unifying chronology of such action. Then 12 'in-depth' case studies were selected from among the 34, through a combination of top-down sample stratification and bottom up considerations of feasibility and added value to stakeholders. For stage 2 of the evaluation, in-depth and action-oriented research was undertaken in these 12 cases using the SES diagnostic and applying SES principles to assist with the practical development of enhanced outcomes, in each case. Stage 2

[4] For more details on case studies see http://pegasus.ieep.eu/case-studies/list-of-case-studies.

utilised participatory appraisal, where researchers engaged with and actively involved case study actors and stakeholders, supported by iterative methods tailored to each individual situation (PEGASUS, 2017). Most case study teams facilitated discussions in groups, creating mind maps or developing and applying geographic maps as tools to allow all participants to engage and contribute (Knickel and Renting, 2002), as well as interviews, documentary analysis and participant-observation in events. In a few cases, levels of trust between actors were judged insufficient to deploy explicitly collective methods throughout, so instead sequential interviews and bilateral meetings were used to construct and validate areas of consensus and ideas for enhanced action. In a final phase of study and reflection, common lessons were extracted from all 12 in-depth cases, generating a set of policy recommendations for the future CAP, and a practice-based 'toolkit' of guidance to help stakeholders to initiate new collective actions for environmental and social benefit (Marechal et al., 2018b).

The initial SES 'rapid appraisal' of 34 case studies involved two steps:

1. Identifying and characterising the social-ecological system; and
2. analysing the conditions for successful PG/ES provision within that system.

The in-depth work in 12 cases then involved two further steps:

3. Deeper participatory analysis of SES interactions, including actors' motivations, system trade-offs and an assessment of transformative potential within the system;
4. Activities to build stakeholder consensus for actions designed to deliver an enhanced level of PG/ES, compared to the current situation.

The 34 case studies (See Fig. 3) covered a wide range of situations including private sector and single issue-based projects, as well as territorially-based, multi-actor approaches where a mix of environmental and social benefits was considered and promoted. Some initiatives were relatively new (fewer than 5 years old), while others had been long-established (20+ years).

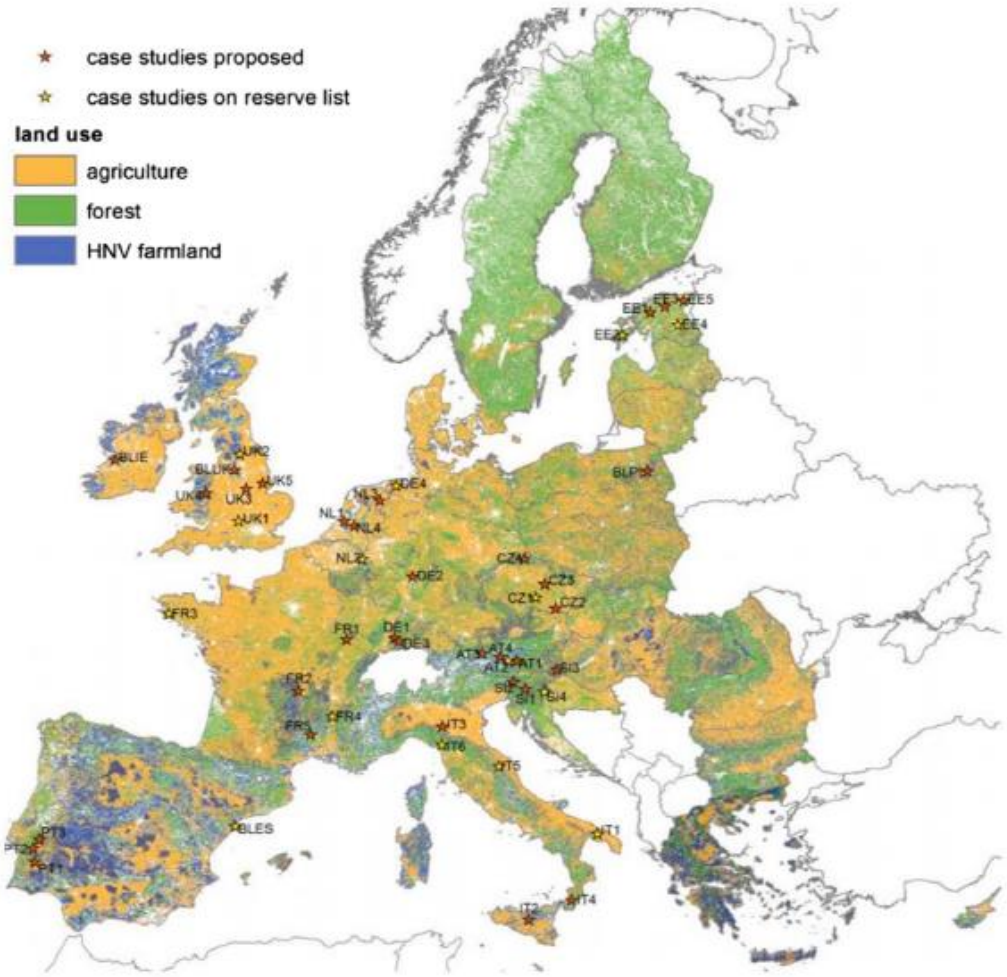


**FIGURE 3 LOCATION OF 34 CASE STUDIES. (SOURCES: BASED ON NUTS3 REGIONS, CORINE LAND-COVER MAP FOR 2006 (AND 2000 DATA FOR GREECE), PARACCHINI ET AL., 2008 HNV DATA.**

Key outcomes from the 34 case studies clarified the drivers of change within the SES, identifying the influence of institutions on provision of goods and services and the role of governance arrangements and institutional change in facilitating enhanced provision (Knickel et al., 2016; Knickel and Marechal, 2018). In sum, they showed how:

- Agricultural policy has been assumed as a key driver over many years but at the local level, many other policies and instruments are also influential;
- Changes are also occurring in markets which are enabling increased opportunities for ES and PG provision within SES. These are in turn influenced by demographic and social trends (e.g. lifestyle choices, patterns of migration)
- Collective action, an enabling or flexible policy framework, effective communication and the confidence and capacity to innovate were key factors for transformative practice in PG and ES provision.

The next section assesses the challenges and benefits provided by the SES framework.

## 2.3. Challenges and benefits of SES framework

The first challenge concerned the placing of ES and PG within the SES. The majority of ES and PG were identified as fitting well in the Resource Unit category. However, some cultural ES, such as public recreation and cultural heritage and broad PG such as rural vitality, fit more appropriately in within Action Situation or Resource System boxes in the diagram. Care had to be taken as the SES encompassed a range of interconnected ES and PG, and were often hard to disentangle. For example, 'landscape character', often cited as part of the Resource System, was strongly linked with 'biodiversity', commonly placed in the Resource Unit category, and this interlinkage needed to be emphasised in the analysis.

Another challenge concerned the dynamic nature of some ES, such as tackling climate change. Here the static depiction of the SES framework in the diagram was overly constraining for describing Action Situations and Macro Issues. It had to be acknowledged that the historical context shapes the Governance System and the Actors involved. Nevertheless, in all cases the approach enabled description of the relationships between assets, services, actors and farming and forestry systems in ways which illuminated their drivers and motivations and suggested how these might be altered to good effect.

The framework was flexible enough to illustrate how Resource Units represent the generated ES, or anticipated PG, through the Resource System and/or Action Situations, and how Governance Systems shape levels and types of provision, in the many cases where a single production process was generating joint or 'bundles' of products (economic, environmental and social) for a range of different Actors.

From this stage it was concluded that the adapted SES framework enabled the identification and analysis of the links between social, economic and ecological factors, and was useful in helping local actors to consider the long-term health of the system as a whole, because of its emphasis upon the linkages between different elements and how these had developed and were evolving, over time. Actors were able to pinpoint vulnerable elements or relationships within the system as a whole, prompting consideration about how they could be strengthened, in all 34 cases.

In the stage 2 in-depth analysis of 12 case studies, the SES further helped to shape and inform the adaptive and participatory methods applied (PEGASUS, 2017). Considering the whole system with stakeholders enabled a deeper analysis of the dynamic interrelations between system elements and the feasibility and desirability of different options for development, generating relevant conclusions and tangible ideas for enhanced future performance. This demonstrated that the it allowed shared understanding to develop in an iterative way. It served as essentially 'a way of seeing things' that allowed the analysis of complex and dynamic relationships between different actors. As a result, the participatory process helped in further mobilising actors to enhance ES and PG provision within the system. The next section reports in detail on two of the 12 in-depth case studies in order to illustrate these qualities of the SES analysis in contrasting situations. In order to reduce the need for lengthy explanations of contrasting institutional and agri-policy contexts, we use two cases from a single EU Member State and region: England.

# 3. Results, illustrated by specific examples

## 3.1. Hope Farm, Cambridgeshire

In this UK case study, researchers were invited to engage with an initiative focused around enhancing the environmental performance of arable agriculture. An environmental NGO (the Royal Society for the Protection of Birds, RSPB) had purchased an 'unremarkable' commercial arable farm in Eastern England in 2000 with the aim of using it as a test-bed to demonstrate how more wildlife- and bird-friendly practices could be integrated into a commercial farming system. The RSPB farm management team and ecologists spent several years in experimentation and analysis, to identify appropriate, transferable management practices and prescriptions that would enhance bird populations on the farm whilst being agronomically and economically compatible with conventional arable cropping. The results, backed by supporting ecological and economic evidence of their feasibility and positive impact, were promoted by the RSPB as new management options for the all-England agri-environment scheme: 'Entry Level Stewardship' (ELS). These options were incorporated into the scheme as items on a menu of management options available to scheme participants. However, the options were very rarely selected by farmers, with only a few instances of uptake in the years following their introduction. With hindsight, this was perhaps to be expected, given the voluntary nature of scheme participation and the ability for farmers freely to choose options that suited them best (subject to meeting a certain 'threshold' level of management action). These arable options required a degree of specific additional action by farmers, which might have appeared to

constrain normal management operations (e.g. creating 'skylark plots' within a cropped field, to enable ground-nesting birds to rear chicks safely). Low uptake of its new options prompted the RSPB to review its strategy for Hope Farm: it was committed to retaining the farm but wished to consider how it might more effectively be used to promote wildlife-friendly arable farming, in light of the lessons of the first decade of ownership.

PEGASUS' rapid analysis of the SES within which Hope Farm was situated enabled its recognition as a farm situated within a challenging landscape and catchment: a low-lying clay basin (the Bedfordshire & Cambridgeshire Claylands National Character Area (NE, 2014) through which streams and small rivers feed into the river Ouse, in which almost all farms are cropping wheat, barley and rape. Interviews and documentary analysis to identify SES elements – *resource units, actors* and the *governance system* – enabled the project to discover a range of wider drivers and issues that could represent important elements in developing a new strategy for the farm. Among the *action situations* emerging from this analysis, the following were especially pertinent.

1. Many neighbouring farmers were becoming concerned about their future ability to continue with established, conventional management practices. This was due to the combined and increasingly apparent risks of climate change, pesticide resistance, price volatility and policy uncertainty. There had been a succession of years with poor conditions for establishing winter cereals; concerns about how to cope with herbicide resistant blackgrass in crops; and the coming to a head of an EU-level debate about whether glyphosate (a key tool in their regular management operations) should be banned or restricted on human health grounds. A local farmers' discussion group was actively considering the options for more resilient and more radical management tactics.
2. In the same locality, the developers of a branding and certification system for 'wildlife-friendly' cereals and other farm produce, established some years earlier, were looking to increase the scale of their operations so as to be able better to negotiate with processors and secure more market opportunities for their small but increasing farmer membership.
3. Local farmers' perceptions of the RSPB farm were quite strongly negative. The purchase was perceived as a whim of a (comparatively) wealthy national NGO, insensitive to local culture (e.g. the farm's longstanding name – Grange farm – was changed, following a national consultation with RSPB's 2,000 members), and 'playing at farming without needing to make a living' from it. Limited outreach from the RSPB towards their farming neighbours had created an impression that they were uninterested in local people and in working with them.

4. Not far from the farm, another large farm owned and managed by a different environmental NGO was implementing a fully organic arable system and the farm manager there had recently been elected Chair of the local National Farmers Union (NFU) branch – demonstrating a potential for close relations between environmental and farming interests, locally. Whilst the RSPB's farm manager attended local NFU meetings, RSPB Headquarters had shown little enthusiasm for Hope Farm engaging with such agri-focused networks.
5. The Environment Agency (EA), a public body, wanted to enhance the regularity of flow and quality of water in the local catchment, to mitigate increasing risk of future floods further down the river basin system, as well as helping protect the internationally-important RAMSAR wetland, the Ouse Washes, into which it flows. However, the EA lacked the resources to sponsor farm outreach activity in this particular area, as it was not designated a 'priority catchment' under the Water Framework Directive (WFD), although it was included in the Catchment Sensitive Farming (CSF) initiative linked to Nitrate Vulnerable Zones.
6. The RSPB team had sub-contracted the cropping and the conservation management activities at Hope Farm to different neighbouring farm businesses. These relationships were subject to regular discussion and review. The conservation management sub-contractor was an enthusiastic, wildlife-friendly farmer, with experience developed on his own farm and working on contract for a number of other, nearby farms.

Considering the *governance system* of the SES, it was clear that the RSPB manager and ecologists working regularly at the farm felt they lacked autonomy to develop their own strategy for the farm, embedded in and informed by local knowledge networks. They were aware of the local tensions and opportunities outlined above and, in discussion with the research team, identified several potential outreach, demonstration and networking activities which could be beneficial to the farm and the local farmed environment. But RSPB Headquarters' consideration of a new management strategy for Hope Farm remained more focused upon national priorities than it was upon what might be valued, and valuable, locally. See Fig. 4 for the SES diagram for Hope Farm.

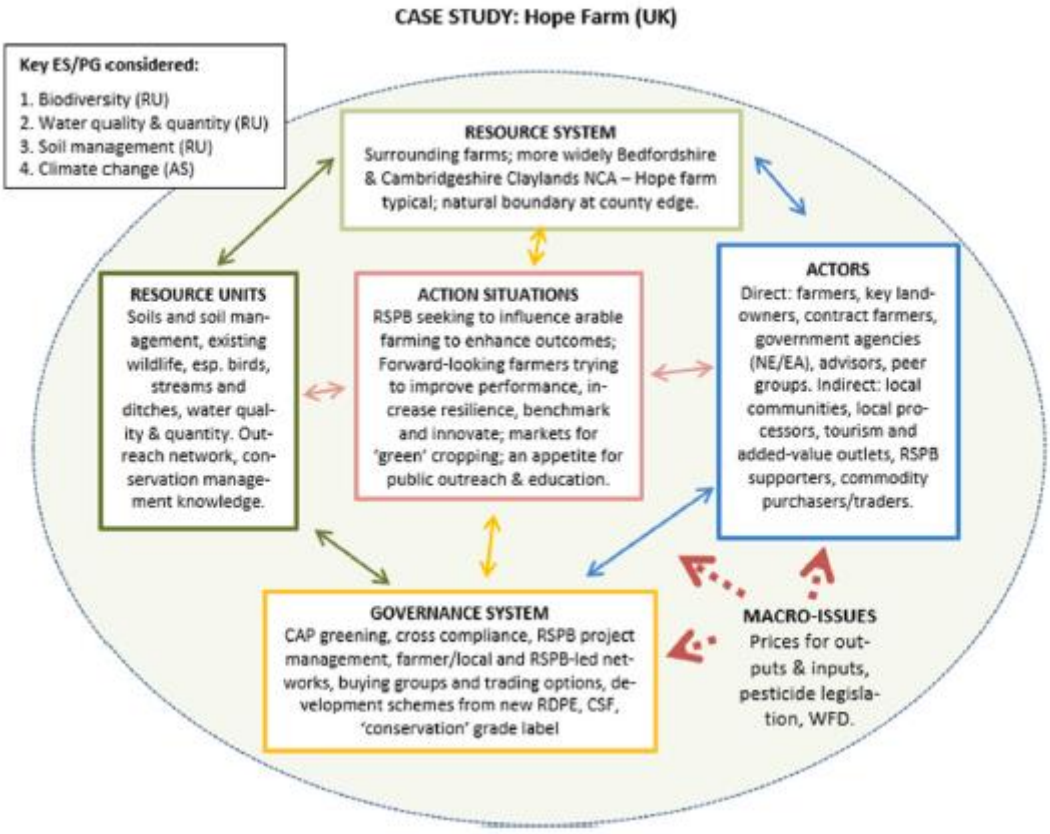


**FIGURE 4 SES DIAGRAM FOR HOPE FARM.**

By developing and presenting the SES analysis to the RSPB, the research team highlighted significant scope to develop a new vision and role for Hope Farm by engaging more in discussion and local partnership action. Using RSPB's financial and research capacity and its facilities to help address neighbouring actors' concerns (farmers, policy agencies and environmental NGOs), could simultaneously promote RSPB goals for sustainable agriculture, demonstrated at a landscape scale, while supporting local needs and opportunities. However, to do this a change in outlook, attitude and modus operandi was required, to overcome mutual suspicion and build new trust between the relevant actors. This would be key to create the conditions to enable local actors and the RSPB to better understand and respect each other's primary motivations and room for manoeuvre, and to foster discussion and open debate, as changes in practice were considered and evaluated.

The SES analysis identified that the weak point in the system was *the lack of a social process* by which farm management decisions across the landscape could be shared and considered together. Farmers were already using a network but the RSPB had not empowered its farm managers to become active participants, partly for fear of diluting the clarity of its environmental message. By identifying potential 'brokers' for the RSPB message among the wider community (actors who

already recognised the commonality of their interests and those of the NGO, to varying degrees), the SES analysis suggested potential ways to bring the parties closer together, to mutual benefit. For example:

- New RSPB effort focused on conservation certification could identify, encourage and help offer a price or market advantage to local farms producing in ways which were known to benefit birdlife, working with the pre-existing local certification initiatives;
- Hope Farm managers could join the existing farmer discussion group with its regular meetings and informal peer-review, offering new opportunities for the group to access experimental and demonstration facilities at the farm. An increased financial 'room for manoeuvre' to experiment and host events at Hope Farm could be a valuable asset for the group as a whole to learn from, in pursuing more sustainable and resilient arable systems. Experienced agronomists (from a national, certified advisory body) were already engaged with the group and could offer useful knowledge to support Hope Farm's work.

The process of brokerage could be fostered by co-ordinated action among policy makers, environmental and agricultural NGOs to create a sufficiently enabling and mutually supportive framework to stimulate positive action.

When our research ended, the RSPB was actively developing the first of these two suggested options by agreeing a new partnership with the conservation certification body. The second option was initially positively received by the farm's Management Committee, but we are not aware of significant change at the time of writing (2019).

## 3.2. Water and integrated local delivery in the Upper Thames

The second UK case study example concerns the 'Water and Integrated Local Delivery' (WILD) project, which covers about 26,000 hectares of land in the higher and central parts of the Upper Thames catchment, within the Thames river basin of Central and Southern England. The catchment includes the source of the Thames, where watercourses rising on the plateau of the Cotswolds join the clay lowlands around Swindon. Three main interconnected issues underpinned the development of the WILD initiative in the years following 2000. The Environment Agency, the public agency responsible for implementing WFD, was concerned about the poor ecological status of water bodies in the area: by 2012, one-third of all rivers in the Upper Thames were classed either as "bad" or "poor". A second issue concerned recent localised flooding from river water or poor drainage, which

was of particular interest to local communities. A third issue was the deteriorating condition of the area's designated nature conservation sites of international importance.

The WILD project aimed to involve local communities, farmers, landowners, nature conservation bodies and local government, increasing their understanding of how these three issues are inter-connected and encouraging and enabling local actors to become actively involved in enhanced ecosystem services management. It pursued this aim via a mix of targeted advice to particular key groups (e.g. farmers, local government), and sustained facilitation to foster new co-operation between different stakeholders, developing shared problem-solving exercises to identify and pursue collective action on common priorities. Through the co-ordinated input of a mix of public and private actors, WILD was able to devise and deliver a plan of specific enhancements to the water environment (covering water quality, water flow, flood protection and amenity); to biodiversity and landscape; and to the local community (including farmers, residents and other local actors).

SES analysis revealed that WILD had developed a powerful and multi-actor dynamic for change over time, which had evolved from an initial focus on meeting the objectives of the WFD, linked to a statutory framework and timetable as set out in the Directive. The Directive also contains a specific objective that encourages the active involvement of stakeholders and communities in planning and action, a trend that is present in planning more generally (Healey, 1998). This goal incentivised institutional change in the governance arrangements for the catchment, which drew in a wider range of stakeholders than previously, emphasising the value of local input for more effective action. Interviews and documentary analysis by the research team highlighted how this had taken effect in WILD, facilitating discussion and debate between many stakeholders and embracing a wide range of ES and environmental assets, reflecting these groups' different interests and knowledge. Project partners and other local actors cited 13 distinct types of environmental and social benefit as assets or services that were considered important to WILD: with water quality, flood protection, rural vitality and soil protection at its core. The SES evaluation (see Fig. 5 for the SES diagram) revealed a number of important *action situations:*

1. The value of activities involving different types of stakeholders, which has allowed local non-farming residents to connect with farmers in new ways which was considered constructive and effective, e.g. taking action to clear key ditches in the catchment, which had not been cleared for many years.

2. A practical, solution-based focus to meetings and discussions had reduced duplication between different actors and saved them money, as well as being a motivational factor in itself (i.e. the project's meetings and events are not just 'talking shops' – they lead to tangible change, which people appreciate).
3. WILD has enabled a shift in local thinking and action away from a sectoral approach covering just technical, hydrological issues – flooding, drinking water, abstraction and irrigation quality – towards one that simultaneously covers many sectors and interests, attracting more people to get involved.
4. The project has built a new willingness to change traditional governance arrangements, enabling more joint working between national and local public agencies and NGOs. As a result, there is increased awareness of the role and remit of all these organisations, locally, and more effective operational practice.
5. Institutional actors' willingness to embed and enable local delivery, so that the protection of water quality and flow becomes self-sustaining over time, has helped communities to become more proactive within WILD, working in a coordinated way with statutory bodies. It is a good example of joint problem-solving on equal terms. The SES analysis revealed increased awareness in local communities of the roles and responsibilities of riparian owners, so that local issues linked to poor land management could be resolved through landowners, agencies and communities working constructively together.

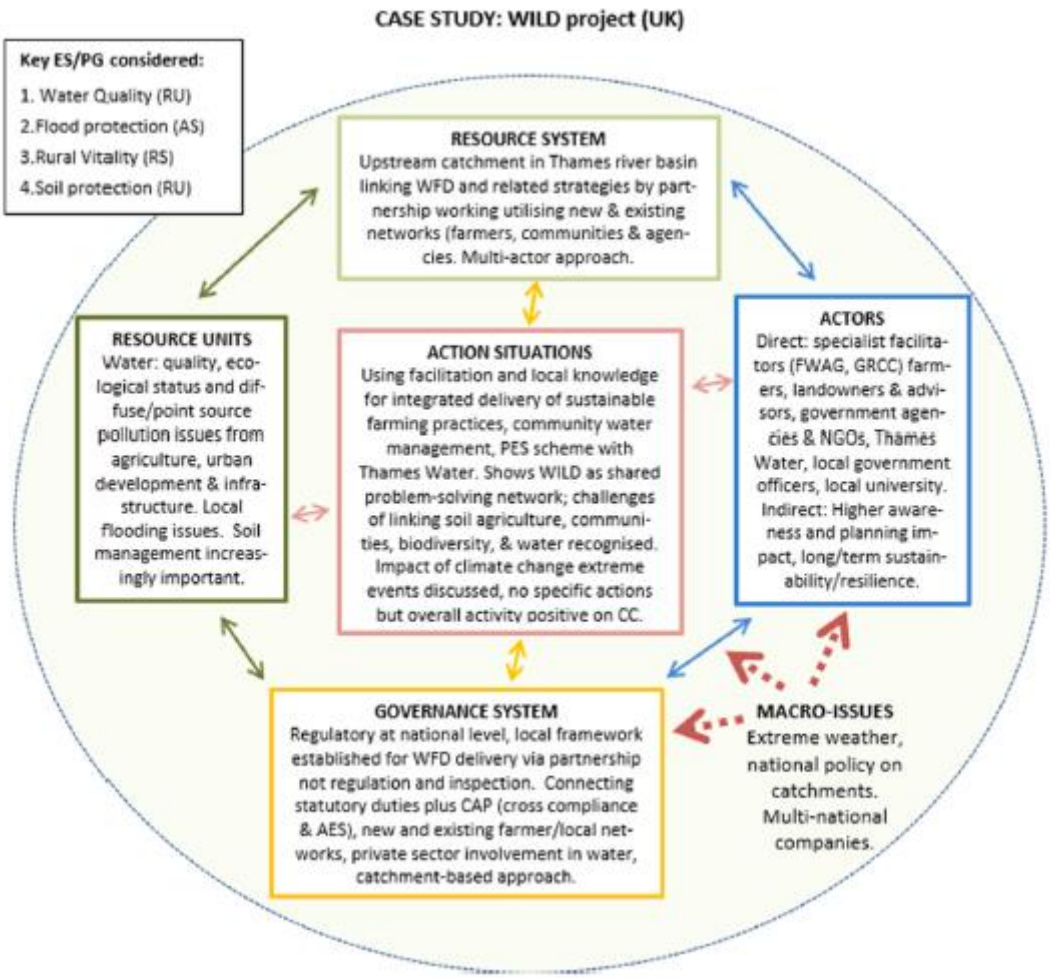


**FIGURE 5 SES DIAGRAM FOR THE WILD PROJECT.**

The project's outputs and impacts were significant: 298 farm visits over 3 years covering 118 farms/estates, and advice provided for 22,692 hectares of land (87% of the project area). 24 'Farmer Guardians' were appointed to act as key contacts in discussions between farmers, the relevant government agencies and Thames Water (the private water company), and 461 farmers adopted new sustainable pesticide management affecting 6 key water bodies. 13 local municipalities were involved developing new parish plans and/or Water Management Plans, and they also published a national 'Community Guide to the Water Environment' in collaboration with the NGO 'Action in Communities of Rural England' (ACRE). 60 km of potential river biodiversity enhancements were identified and promoted with partners; over 300 km ditches were surveyed, leading to 30 km of ditches more sympathetically managed; shade reduction & tree pollarding works were conducted on 8.5 km; large woody debris deflectors and faggots were installed on 5.6 km; new and improved fencing on 5 km; with new stock drinking bays designed to meet WFD and farmers' needs; and 2.7 km of river was treated to control invasive species (Himalayan balsam).

In its lessons for policy and governance, WILD demonstrates how increased integration in the governance of water resources, drawing national policy into direct conversations with local stakeholders (Rijke et al., 2012), resulted in heightened awareness of the goods and services that ecosystems provide for society (Fish, 2011), leading to enhanced provision through effective collective action. The project has secured benefits that will improve the provision of clean water and the regulation of water flow, as identified in the MEA (2005) and the UK's National Ecosystem Assessment (NEA) (NEA, 2014). WILD was also helped by an important enabling factor: the NEA had highlighted the need for a 'systems approach', fostering a Catchment-Based Approach in national policy (Defra, 2013). This territorial approach to planning and action recognised the spatially-distinct links between ecosystems, ES and society and the need for partnership to underpin this.

WILD thus represents an adjustment to the dominant England framework of sector-based policies implemented on the ground by different government agencies, in liaison with their most relevant private sector actors (in this case, the Environment Agency and the commercial company Thames Water). Five new aspects are critical:

- Engagement – WILD only works because of the level of engagement secured, this has been achieved through strong project officer facilitation with farmers and local communities, but also persuading government agencies and the commercial sector to embrace engagement in this way.
- Communication – by accepting facilitation as key for communication, the facilitator has to disseminate exactly what WILD is and what it is aiming to achieve, to as wide a spectrum of relevant actors as possible. Despite marked success in this respect, the research team's SES evaluation revealed continued confusion around how WILD fits with the conventional governance framework for water, land management and biodiversity, including issues of overlap with other initiatives: the governance landscape remains complex.
- Knowledge – it is clear that expert or agency knowledge provides a starting point for discussion, to which the local knowledge of farmers and local communities is added, enriching outcomes in many instances. What happens to this combined and shared knowledge in the coming years will be critical to WILD's continuing success: the research found that it supported a more rounded understanding and widespread stakeholder acceptance of difficult issues than would have been possible without the project's socially innovative approach.

- Consistency – with a wide range of stakeholders engaging over different times and to varying depths, there is a need for a consistent outreach and feedback about changes and developments. WILD's achievements have been celebrated with stakeholders, but challenges remain and progress across all areas is inconsistent. Work is most active on WFD priorities and closely related agri-environment scheme enhancement. Pursuing stakeholders' goals with agencies and authorities more distant from WILD's central aim, for example officials concerned with spatial development and planning control, has been difficult to achieve in its 3-year timeframe. And there is some concern amongst farmers that the integrated process pursues higher environmental standards than necessary, without additional payment.
- Trust – celebrating and sharing positive progress helps the development of trust. There is clear evidence of increased trust and cooperation between formerly separate groups and institutions as a result of WILD, but some scepticism of higher levels of government remains, among local stakeholders.

Overall, the SES analysis helped reveal options for enhanced provision of ecosystem services and SES resilience within WILD, and recognised or confirmed that:

- Agriculture is integral to the provision of the assets and services identified (water quality, flood protection, soil protection, biodiversity and landscape character). It is less universally so for rural vitality, given the many other social and economic activities in the project area, but WILD has helped raise the profile of this goal and its key connection to the different environmental and social assets and services that the project has supported.
- The WFD is WILD's central policy driver, but a wider range of national and European policy goals, both environmental and social, has been embraced within the project through common actions inspired by specialist facilitation to build a shared agenda and targets.
- There is greater appreciation of ecosystem services and public goods as a result of WILD, amongst farmers, communities, local authority staff and national policy officers. However, perhaps more important is the identification of their synergies and also of how co-management – a key social process – can address multiple objectives. Both delivery partners and stakeholders see the social benefits of the project. They recognise that biodiversity benefits will take longer to materialise, but are confident that they will appear.
- To roll out this distinctive ILD approach beyond the boundaries of WILD would require the relevant budgets of appropriate regulatory bodies to be devolved to a local level and shared

amongst the most relevant local delivery partners. Determining which bodies and which budgets to involve in each local area would depend on the mix of local environmental and social assets and priorities for action that would need to be discussed and agreed between national agencies and local actors.

# 4. Discussion and conclusions: project findings and the value of the SES approach

## 4.1. Conclusions – project results

The research across all 34 case studies demonstrated how considerable enhancement of PG and ES was possible in a wide variety of situations, as illustrated in our two contrasting English examples but mirrored across Europe. Common features of progress included the engagement of a variety of different actors in some sort of collective endeavour, frequently bringing together public and private commercial and voluntary interests to identify and work towards a set of shared goals, each contributing different resources to the process (Brouwer et al., 2018). Another important finding was how policy instruments and frameworks were often a key ingredient in facilitating change but they were neither sufficient on their own, nor necessary in all cases, to achieve beneficial changes and complementary market or voluntary mechanisms were equally important (Marechal et al., 2018a). Finally, as illustrated in the 2 detailed examples in England, the research highlighted the value of an explicit emphasis upon social processes, when actors and policy makers are seeking to achieve changes in practice on the ground. These are often the key ingredient for making progress – bringing together actors and interested parties who may not have met or worked together before; sharing and then combining knowledge and ideas for development; and breaking down barriers to action that commonly arise due to lack of awareness and understanding, or suspicion and mistrust, among different players. As both examples illustrate, these take time to develop and bear fruit, but the potential for co-benefits to be realised from the integration of different strategic interests and resources at the local level is recognised.

Based on the examination of all case studies in the PEGASUS project, a set of policy and practice briefings was prepared (Marechal et al., 2018b). They noted that policies seeking to stimulate the provision of environmental and social benefits from agriculture often rely on a relatively narrow, mainly contractual approach to persuade individual farmers to change practices, for a given period of time. The approach is potentially limited by only partial engagement with the specific farmers

who choose to engage, and for just a few years of commitment. When seen from the broader perspective of the SES within which farmers are operating, it is evident that promoting beneficial environmental and social practices and outcomes can be addressed via many more potential drivers and actors working with different elements in the system in a longer-term and more integrated way. The key is to foster collective action via the social processes that can establish and develop it, between land managers and the commercial networks in which they operate, and those with environmental and social goals who can represent the public interest in land and environmental management. Our previous exploration of the situations and opportunities for Hope Farm and WILD present examples of these multiple drivers and actors; in the former case, as opportunities to explore, and in the latter case, coming together in a successful partnership with demonstrable impacts and continuing potential for further development. Among the other case studies in the project, the SES also explored more extensive integration between public environmental goals and market opportunities, for instance promoting grass-fed organic beef to sustain the flower-rich meadows in Estonia which were originally created as pasture for working horses; and securing a new market niche to revitalise the unique cultural landscape of Bergamot orchards in southern Italy, which had almost disappeared through declining appreciation of authentic, natural ingredients in the mass market perfume industry. And a further cluster of SES cases revealed the potential for large-scale corporate actors to be powerful agents of beneficial land management change, including the Heineken brewery in the Netherlands and Volvic in central France, working collectively with farmers. From all aspects of the SES framework, the cases demonstrate significant potential for environmental and social achievements but also emphasise how, to achieve lasting benefits, the social process of engagement, for farmers and other actors, has to become more appealing.

Both the examples from England, in different ways, show the central importance of social processes as an enabler for promoting and generating environmental and social benefits from commercial land management. These can be encouraged by ‘soft’ policy approaches which promote co-ordination, co-operation and advice, and by initiatives (both policy and market-driven) which incentivise different relevant actors to come together to identify common or synergistic goals and work towards them. They can also be stimulated indirectly via a flexible approach to the implementation of policy which ‘frees up’ actors to find their own ways to deliver particular public goods and ecosystem services. Both examples in England, along with others from across Europe, suggest how, by involving local stakeholders, developing local ownership of the environmental agenda and encouraging information exchange and trust between parties, new and effective collective action can be stimulated and sustained.

For practitioners, the research embodied and analysed within the SES case studies enabled the development of a four-stage guidance toolkit (PEGASUS, 2018). This draws lessons from the case studies and refined their common principles, in discussion with a wider range of stakeholders from diverse EU Member States, via workshops held in the final phase of the project. The toolkit can be accessed online by interested parties and was disseminated by all the stakeholders involved in project case studies.

## 4.2. Conclusions – value of the SES approach

The SES framework and methodological process, with its emphasis upon dynamic relations, system-level interactions and key actors and action-situations, revealed the value of looking at both human and nonhuman elements of these systems simultaneously. As a result, it was able to interrogate and analyse the challenges, achievements and potential beneficial developments for cases including Hope Farm and WILD in a broader and more integrated way than might have been possible with either economic or ecological analytical methods, applied separately. This approach was able to highlight the scope for private, voluntary and community actors or institutions, each with their very different motivations and concerns, to do more to promote environmental and social benefits in complementary or synergistic ways.

The SES framework was judged especially useful in the qualitative domain of clarifying the values that specific environmental and social outcomes assume for different stakeholders within a participatory and integrative setting. The critical aspect here, as shown in the WILD project, is the ability to assess whether and how the relevant outcomes influence stakeholders' decision-making processes, as well as stakeholders' understanding. In the absence of the SES approach it could be easy to overlook the particular role of the socio-cultural dimension (e.g. characteristics of actors, levels of trust, a sense of history – as discussed for Hope Farm) in the assessment of reasons for success or failure of a particular action in protecting and enhancing the environmental and social outcomes of agriculture. In both examples, the SES analysis highlights additional factors beyond simple economic calculus, including governance and extant social challenges and opportunities, among the significant influences shaping farming systems and their outcomes. Consequently, it promotes deeper insight into group dynamics, informed by factors such as trustworthiness, compliance with agreed rules and norms of behaviour, which helps to identify what factors could make the collective action more effective.

We conclude that the SES as a conceptual framework for analysis has potential to embrace both PG and ES perspectives but in so doing, it adds a new layer of understanding. As a result of its use in this particular project, practical guidance for successful initiatives was devised which encouraged actors to follow a staged process, based on experiences demonstrated in mature cases including WILD, in which situations could be mapped out and relationships developed and established one step at a time. In addition, the work stimulated discussion among national and EU policy makers about broader, more collective and more context-sensitive, flexible approaches to support for public goods and ecosystem services within the future CAP.

For policy, the SES approach applied in Pegasus across all the case studies suggests benefit in adopting a more polycentric and adaptive approach to the solution of the complex problems of market failure and insufficient ES appreciation, using broad framings, new institutional governance arrangements and a flexible mix of individual tools and measures. As highlighted, the SES framework captures the situation at a given point in time, in analysing situations and processes which are dynamic. Thus, in many cases it would be appropriate to undertake the analysis more than once, to ensure evolving governance and other conditions are examined and taken into account – for example, reviewing Hope Farm's assets and opportunities once a wider group of local actors is engaged; or analysing and developing actions to enhance new environmental and social needs arising from accelerated climate change, in WILD.

## 4.3. Wider considerations

The SES approach as applied in the PEGASUS project seems a potentially powerful framework to identify improved policy and practice for sustainable farming and forestry. This has relevance beyond Europe, as similar challenges arise in many different contexts across the globe. Two particular international initiatives offer examples of situations where SES analysis may be especially pertinent. As host to the 2010 COP on the Convention for Biological Diversity, Japan launched the International Partnership for the Satoyama Initiative (IPSI), promoting its central concept of 'people living in harmony with nature'. IPSI encourages governments and institutions across the world to identify their own 'Social-Ecological Production Landscapes' as a step towards ensuring their protection and continuation into the future. Like the PEGASUS project, the IPSI promotes shared learning between local actors in different countries and has produced a number of online and published resources to assist this process. In 2019, the WILD initiative became an IPSI case study with the aim of pooling learning resources between the PEGASUS project and the IPSI secretariat, which is based at the UN University in Tokyo.

In 2014 the FAO defined ‘Globally Important Agricultural Heritage Systems’ (GIAHS), to describe landscapes shaped by many centuries of active management for food production, in which nature and culture have co-evolved and become highly interdependent. Both IPSI’s Satoyama landscapes and those of the GIAHS initiative demand a continuation or renewal of sensitive management in order to sustain their multiple social and environmental values. This is frequently a significant challenge, as traditional methods and practices are no longer in line with market demands for low cost production, irrespective of its consequences for ES. These complex and important systems can benefit from analyses which can help to identify novel ecologically and culturally-embedded approaches to revitalise management, as was demonstrated for SES in the European context, by PEGASUS. Exploring the similarities of experience and scope for stronger international action to recognise and sustain these systems, using tools such as the SES framework to generate new insights and ideas, appears a fruitful avenue for further research.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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