



**TRANSFORMING APPROACHES TO  
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04/09/2015

**Public Goods and Ecosystem Services from  
Agriculture and Forestry – towards a holistic  
approach: review of theories and concepts**



**Prepared under contract from the European Commission**

Project number: 633814

Collaborative project

Horizon2020

Project acronym: **PEGASUS**  
Project full title: **Public Ecosystem Goods and Services from land management – Unlocking the Synergies**  
Duration: March 2015 – February 2018  
Coordinating organisation: Institute for European Environmental Policy (IEEP)  
Project coordinator: Kaley Hart  
Project manager: Anne Maréchal  
Project website: [www.pegasus.ieep.eu](http://www.pegasus.ieep.eu)

Deliverable title: Public Goods and Ecosystem Services from Agriculture and Forestry – towards a holistic approach: review of theories and concepts  
Deliverable number: D1.1  
Responsible work package: [WP1]  
Authors: Dwyer, J., Short, C., Berriet-Sollicc, M., Gael-Lataste, F., Pham, H-V., Affleck, M., Courtney, P. and Déprès, C.  
Partners involved: CCRI, INRA  
Deliverable status: Final



# Public Goods and Ecosystem Services from Agriculture and Forestry – towards a holistic approach: review of theories and concepts

Janet Dwyer, Chris Short, Marielle Berriet-Sollicec, Francois Gael-Lataste, Hai-Vu Pham, Melissa Affleck, Paul Courtney, and Christophe Déprès

## TABLE OF CONTENTS

<b>TABLE OF CONTENTS</b> .....	<b>i</b>
<b>Executive summary</b> .....	<b>ii</b>
<b>Authors’ acknowledgements</b> .....	<b>ii</b>
1. Introduction .....	1
2. Context.....	2
3. Theoretical groundings .....	3
3.1 Public goods .....	4
3.1.1 <i>A neoclassical economic approach</i> .....	4
3.1.2 <i>A socio-political approach</i> .....	5
3.1.3 <i>Use of ‘public goods’ in the context of the CAP</i> .....	6
3.1.4 <i>Values – public goods</i> .....	8
3.2 Ecosystem services .....	9
3.2.1 <i>ESS in the context of the CAP</i> .....	12
3.2.2 <i>Values – ecosystem services</i> .....	12
4. Combining the Analysis in a farming and forestry context .....	14
4.1 Social-Ecological Systems as a potential unifying approach.....	14
4.2 Distinguishing PG and ESS.....	16
4.3 Discussion of possible integrated framework .....	17
4.4 Particular application within the Pegasus project .....	20
5. References .....	25
<b>Annex 1: An extended examination of the nature of public goods theory, and social PG/ESS aspects of PEGASUS</b> .....	<b>33</b>

## Executive summary

This paper provides a review of theories and concepts in order to identify a holistic approach to serve as a conceptual framework for the PEGASUS project. It reviews the theoretical context, examining the different understandings of public goods and ecosystem services from agriculture and forestry in the scientific and policy literature; bringing them into the more holistic frame of social-ecological systems and using insights from these different understandings to identify key issues, analytical concepts and processes to guide PEGASUS. The findings of this review have shaped subsequent development of the PEGASUS conceptual framework, which is reported in Deliverable 1.2 (D1.2).

Public Goods (PG) has origins in neoclassical economic theory, and in socio-political discourse. In economics it describes goods and services with properties of non-rivalry and non-excludability which explain their often insufficient provision in commercial markets and suggest that some form of collective or public intervention may be needed to correct 'market failure'. In the socio-political literature PG describes goods, services and attributes valued as beneficial to the public, thus a legitimate concern of policy. Both definitions shape the list of farm and forestry PGs in recent studies for the European Commission. However, many are incompletely non-excludable and non-rival. Many are not simple goods or services but complex bundles of attributes whose character and value depend upon context and governance, making socially-optimal provision difficult to determine.

Ecosystem services (ESS) has more recently been applied to farming and forestry in the EU. It describes how 'natural' elements in ecosystems, with or without human influence or management, generate services to society through the functioning of the ecosystems within which they are embedded. It emphasises the dynamic feedback and feed-forward links between farming and forestry and key ecosystem components, including hydrological cycles, ecological climate regulation and soil functioning. It includes a wide range of services, private and public in provision and demand, from food production to amenity, landscape management and pollination. A specific literature on cultural ESS exists, highlighting elements of social as well as environmental value.

PG and ESS are not mutually exclusive – they overlap. But each approach illustrates different and valuable aspects of relations between farming and forestry and their natural and socio-cultural contexts. Both can be considered within the newly-emerging framework of Social-Ecological-Systems (SES) theory, which adds understanding by considering the health, resilience and other attributes of the whole systems – both human and natural, embracing economies and environment – within which EU farming and forestry operate.

PEGASUS will work with all three notions to interrogate PG and ESS from farming and forestry. Conceptually, from PG it recognises the importance of understanding markets, values, drivers of production and levels of societal demand as well as relative under-supply. From ESS it will analyse and increase understanding of dynamic linkages between food or timber production and the condition and provision of regulating and cultural ESS. From SES it will seek to assess the 'health' of whole systems, to determine and develop their potential for sustainability and resilience.

## Authors' acknowledgements

This Deliverable (D1.1) was prepared by the two lead teams for this part of the PEGASUS project, but it was also informed by the results of an expert workshop held in Dijon in June 2015, to which all 14 PEGASUS partners, and a number of external invited experts, made an active contribution. The authors would like to acknowledge the contribution of all workshop participants to the final content and conclusions of the deliverable, which will feed into the PEGASUS conceptual framework as consolidated in D1.2.

## **1. Introduction**

The aim of this paper (Deliverable 1.1) is to provide a holistic approach drawn from previous theoretical and policy literature which can inform and guide the conceptual framework of the PEGASUS project. PEGASUS stands for 'Public and Ecosystem Goods And Services from agriculture and forestry: Unlocking the Synergies'. The project is concerned with achieving a better understanding of the concepts of Public Goods (PG) and EcoSystem Services (ESS) in farming and forestry and their occurrence (state, trends and condition) across rural Europe, and thereby to identify enhanced approaches to ensure a more socially-desirable level and pattern of provision, through policy and markets and the activities of people engaged in these sectors (e.g. farmers, foresters, food companies, rural communities). The emphasis is on exploring joint or co-production, wherein these assets and attributes are generated or modified - consciously or unconsciously - simultaneously during the production of marketed goods and services by farmers and foresters, and seeking to analyse and understand the systems characterising the inter-relationships between resources, actors, outputs and processes. The paper hypothesizes that by an enhanced understanding of synergies, trade-offs and conflicts, both we and the key actors engaged in these systems can learn from these situations and thereby seek to unlock further synergistic and/or more complementary relationships in contrasting situations and contexts, across the EU.

This paper (D1.1) seeks to:

- make an initial review of the theoretical context, examining different understandings of PG and ESS from agriculture and forestry in the scientific and policy literature;
- bring these concepts into a holistic framing within the broader concept of Social-Ecological Systems (S-E-S);
- use the insights from these different understandings to identify key issues, analytical concepts and processes most useful for pursuing the aims of our study;
- thereby inform and guide development of the conceptual framework of PEGASUS, which will be defined within the next Deliverable for the project – D1.2.

Further work in this first Work Package (WP1) will define a typology of Public Goods and EcoSystem Services, and review their appreciation and valorization (- ways in which their value is recognized and enhanced). This will enable the definition of a robust conceptual framework for the project in Deliverable 1.2. PEGASUS will use this to investigate these phenomena in contrasting situations across Europe, testing their condition and potential and learning from existing and developing practice (WPs 2, 3 and 4). In the project's final phase, lessons from the research will be drawn together to develop recommendations for both policy and practice (WP5). The aim is to produce recommendations for the next CAP reform and for enhanced appreciation and monitoring of PG/ESS at EU level, as well as to provide guidance and a learning process which can be applied in different local situations, to help stakeholders, including farmers, foresters and supply chain actors, to improve PG/ESS provision and appreciation 'on the ground'.

The structure of this deliverable is as follows. Section 2 summarises the policy context within which the concepts of PG and ESS have been used to describe aspects of agriculture and forestry, to consider new mechanisms of provision and to analyse their implications for policy. Section 3 examines the theoretical origins of these concepts and considers their particular application to agriculture and forestry. Section 4 introduces the emerging concept of S-E-S and makes a comparative analysis of what each of these three concepts adds to our understanding of effective policies and practices for sustainable land management; and section 5 presents ideas for combining them into a holistic approach.

## **2. Context**

Public goods (PG) and ecosystem services (ESS) linked to agriculture and forestry have emerged as salient considerations both in the EU and internationally during a period of substantial technological and structural change in rural land use, and the ongoing, gradual liberalization of agricultural markets over the past two to three decades. In this context, PG and ESS could be considered as tools of analysis and debate concerning the impacts of these activities upon the natural and cultural environment, as well as a potential means of legitimizing, or at least identifying a new purpose for, support under the Common Agricultural Policy (CAP).

Tracing this process, the environmentally-damaging aspects of modern farming and forestry practice were first identified and described as 'negative externalities' – i.e. practices which led to negative environmental 'side-effects' from modern agriculture and forestry production, largely external to the considerations of those engaged in production. However, in analysing these processes it became apparent that agriculture and forestry could be generators of both negative and positive externalities for the environment – either causing environmental or socio-cultural damage, or conversely, helping to maintain environmental or social assets which had 'co-evolved' with often long-established 'traditional' production systems. Thus the relationship between primary food, fuel and fibre production and environmental or social assets and attributes could vary between conflict and antagonism at one extreme, to synergy at the other, depending upon local circumstances. At the same time, a high level of agricultural support, particularly when coupled to commodity production, has been cast as a contributory factor in the generation of these market failures, notwithstanding the fact that some public and private initiatives may encourage the provision or conservation of goods and services that are not supported by market mechanisms (e.g. the maintenance of High Nature Value farming in economically marginal areas). These questions were examined in some depth by Baldock et al (2002), in which it was concluded that the CAP had both negative and positive effects upon the production or destruction and damage of environmental assets and functions by farming, in particular.

Land management in farming and forestry has a critical influence upon PG/ESS provision beyond the production of private goods, but the extent to which different management systems either recognize or promote these outcomes depends on the combined actions and understandings of the farmers, foresters and others concerned. These actors are all influenced by a variety of market, policy, institutional, behavioural and cultural factors operating at various scales, from global to local. In economic theory, it is because public goods exhibit non-excludable and non-rival properties (see next section) that there is a shortfall in provision through markets, because producers have insufficient incentive to provide them and consumers have insufficient incentive to pay for them, relative to societal demand (see section 3). A beautiful landscape, for example, might have a high societal value but no market price. These conditions, in conjunction with the drive to increase the production of food, feed, timber, energy and other marketed commodities from land over the past half century, have led to significant undersupply and decline in the public goods associated with rural landscapes. This situation is now exacerbated by the challenge of climate change, whereby a critical need to reduce carbon emissions globally, as a long-term public good, finds insufficient expression in conventional markets.

The term 'multifunctionality' was coined in policy discussions in the late 1980s to describe how, in the process of practising either farming or forestry, land managers were able to produce a variety of different outputs including natural and socio-cultural 'benefits' alongside

goods for conventional markets. The ‘multifunctional’ view of primary production became a core EU concept in the reforms to the Common Agricultural Policy of 1992 and 2000, and was shared to an extent by some other countries’ governments across the globe who used it to argue for special treatment of agriculture in the WTO-led process of trade liberalization. Through this process the concept was first popularized, and later somewhat discredited as a simple protectionist device, in that international context (Lataste, 2014).

Following the weakening of multifunctionality as a concept with political influence, the concept of public goods began to gain ground in the CAP debate conceived by some as a new source of legitimacy for public intervention in the agricultural sector, derived from its environmental and social impacts and potential. These discussions helped to foster a new paradigm for agricultural policy built upon neoclassical economic theory (Buckwell et al, 1995; Bathelemy et Nieddu ; 2003; Laurent 2001; Pingault 2001 ; Allaire et Dupeuble 2002 ; Massot-Marti, 2003 ; Bazin 2003; Gravey 2011). It identified public goods from farming and forestry as instances of ‘market failure’ whereby under-provision by the market was likely and public intervention could therefore be justified. The CAP reform debates of the last decade have used the concept of public goods increasingly to argue for a new orientation of farm support away from production of food and towards provision of a range of environmental and social benefits, on the basis that the market could be relied upon to encourage food production, but not to create sufficient incentives to maintain and enhance these wider benefits. A variety of studies at EU level has sought to categorise and examine the nature of public goods from agriculture and forestry and to consider how best policies could foster a socially-optimal level of their generation (Cooper et al, 2009, ENRD, 2010).

Almost in parallel to the development of PGs in agri-political discourse, an approach developed from ecological science to describe the multiple ways in which modern societies depend upon certain functions of the ecological systems within which they are embedded (Daily, 1997). Ecosystem Services (ESS) was coined as a term to describe these functional roles played by components of ecological systems, which need to be recognized and valued (in more or less concrete ways) in decision-making and resource allocation. The approach distinguished between different types of service but importantly, it served to highlight the interdependence of many aspects of society and economic activity with the natural environment, through ‘provisioning’, ‘regulating’ and ‘cultural’ services provided by the latter to the former, and without which a functioning society and economy would be impossible.

Today, both these concepts have been used in discussions about future rationales and directions for agri-rural policy, as well as in research seeking to increase farmers and foresters’ awareness of their role in PG/ESS provision. However, their origins in quite different disciplines and bodies of theory has generated some confusion about how the terms are used and how best to apply them in future policy and practitioner action. There is a need to better link/co-ordinate how they are dealt with in policy and practice, in order to improve common understanding and decision-making for sustainability and resilience.

### **3. Theoretical groundings**

*“There can be no more important aspect of scholarship than the concern for concept and language. If we use the same words or terms to describe fundamentally different fact situations, ideas or phenomena, then progress in understanding is impeded rather than advanced.” Bromley, 1991.*

### **3.1 Public goods**

The concept of public goods was developed in a neoclassical economic theoretical context by Samuelson (1954) and Musgrave (1959). These authors identified the existence of certain goods demanded by society which were not readily traded or exchanged in markets, and linked this phenomenon to specific inherent qualities of these goods – non-excludability and non-rivalry in consumption, as mentioned earlier. These characteristics were identified as contributing to situations of market failure, where despite societal demand for them, provision through the normal market mechanisms was anticipated to be insufficient. Economists and policy analysts have used the (positive) concept of a “public good” within a normative approach, in order to consider when public or state intervention in markets may be justified.

In parallel, public goods is used as a term in socio-political contexts: placing equal emphasis upon ‘goods’ in a normative sense – things which are ‘for the common good’. A potential problem of the PG concept as used in debates about future policy concerns this difference of usage. We therefore examine these two definitions in more depth, below.

#### **3.1.1 A neoclassical economic approach**

A clear exposition of the economic meaning of ‘public goods’ can be found in Cornes and Sandler (2003). These goods share the two key characteristics of non-rivalry and non-excludability, as mentioned earlier. Non-rivalry means that one person’s consumption of the good does not prevent others from consuming it. Non-excludability means that when a good is provided to one, it is automatically provided for all or it is impossible or expensive to exclude non-payers from its consumption (see annex 1). These two characteristics will generally be associated with inappropriate supply and pricing of these goods in conventional markets, and they are often therefore described as leading to market failure. Where markets fail to provide items or attributes sought by people, it is argued that these circumstances justify consideration of some kind of collective action or public intervention, to correct the market failure.

The OECD, in its analysis of public goods in farming and forestry (OECD, 2013), notes that this need not mean public financing as the only way to ensure adequate provision – a range of options is available and choices will depend upon societal norms and the level of private provision already achieved, notwithstanding the predictions of theory that there will be under-provision. Other authors have discussed and differentiated concepts of local and global PGs and noted that PGs, just like private goods, can include both tangible goods and less tangible services demanded by society. Several have covered both social and environmental elements cf. Bureau et Mahé (2008); Bureau (2010), Poux (2012), whilst others have explored the phenomenon of non-profit provision where goals other than profit maximisation drive production choices (e.g. Dwyer and Hodge, 1995), as well as so-called ethical or socially-responsible production where economic and wider social and environmental goals are combined, in specific types of farming and forestry practice (e.g. Grouiez, 2014; SFSCC, 2015). In these situations, actors trading in markets may nonetheless be motivated to generate PGs at levels above what simple profit maximisation would produce, due to the broader mix of drivers to which they respond.

In his discussion of public goods, Musgrave (1959) also explains that the characteristic of non-exclusion gives rise to two problems:

- i) revealing individual preferences for social wants; and
- ii) even if preferences could be known, selecting the desired state of distribution through a social welfare function.



Olson (1965) develops the problems raised by the non-exclusion characteristic through the discussion of ‘free rider’ behaviour. This selfish behaviour – where an individual seeks to gain benefit without paying for it - leads to market failure, both in respect of preference revelation but also in under-payment for the goods. If everyone does the same, rational behaviour to maximize individual utility (why should I pay if I can get the benefit for free?) can produce irrational outcomes at the collective scale (no-one willing to pay, so no incentive to supply).

Whilst economists recognize non-rivalry and non-exclusion as sources of market failure, this diagnosis has stimulated a variety of ideas about how it can be corrected, with much discussion about the type and nature of the collective, public or state involvement that should be applied. Three kinds of recommendation are usually suggested: intervention by the state to provide the goods directly (e.g. compulsory purchase and management of a nature reserve); the use of market instruments to try and internalize costs and benefits so as to move provision closer to a social optimum (e.g. Pigovian tax or incentive payment/subsidy to decrease private generation of public bads or increase private supply of public goods in the production of private goods); or regulation in order to re-define property rights so as to place public duties upon private actors (e.g. prohibition on certain types of land use or management, for sites or assets of specific public value).

Ostrom’s work (e.g. 1990; 2005) has shown through multiple empirical studies that alternative solutions exist once the options for collective decision-making are explored, concerning the governance of common pool resources which also have the characteristics of non-excludability but are mainly rival in consumption (e.g. an aquifer – see figure 1). Hodge, in particular, has written extensively about the potential for non-profit actors in farming and forestry to contribute to the provision of PGs in ways which may move closer to a social optimum (e.g. Hodge, 2009; Hodge and Adams, 2014).

<b>Characteristics of goods</b>	<b>Excludable</b>	<b>Non-excludable</b>
<b>Rival in consumption</b>	Private goods <i>e.g. loaf of bread</i>	Common pool resources <i>e.g. an aquifer</i>
<b>Non-rival in consumption</b>	Club goods or toll goods <i>e.g. a film or music appreciation club</i>	Public goods <i>e.g. a lighthouse</i>

**Figure 1. A classic economic categorisation of types of goods** (after Ostrom, 2005, discussing Samuelson and Musgrave’s work)

### **3.1.2 A socio-political approach**

In political science, and particularly political philosophy, the “public good” refers more to *what is good for people* and *what people want for their collective well-being*. A variety of economists has also used this approach (Harribey 2006;2010; Ballet 2008; Vievard 2009; Dardot et Laval 2010;2014; Cordonnier, 2012; Beitone 2010, Coriat 2010; Lipietz 2010; Viévard 2009, Compagnon 2001; Favereau 2010; Bertrant et Destais 2002; Balet et Mahieu 2003; Bénard 1985; Laville 2003;2008). These writers consider that the *collective* (or *public*) dimension of a good is not necessarily linked to intrinsic characteristics of non-rivalry and non-exclusion, but results from collective and institutional choices about what is considered as a collective issue or benefit. In this sense, a ‘public good’ refers to the public interest or public utility derived from a particular asset, state or service which may merit public

intervention or public oversight, concern and/or governance (Divay, 1980; Coulomb 1991; Foisneau 2007), or perhaps different forms of collective action (Olson, 1965, Ostrom, 1990), simply because it is much valued or demanded by society.

One of the differences between this socio-political approach and the neoclassical economic conception of PGs is the degree of dependence upon the intrinsic qualities of particular goods or services (Dardot, Laval, 2010), where the latter analysis emphasises these qualities while the former emphasises a notion of public value ascribed to certain goods or services. The socio-political approach also highlights the need to consider different degrees of “publicness”, depending on different local contexts. Different public goods can have territorial and social anchoring, depending on place and time, and the same attributes and qualities may be more or less public, depending on the contexts in which they occur (e.g. whether they are associated with clearly-defined property rights, or not). In this perspective, governance and institutions (in the sense of systems of rules and values) can be seen to have a key influence on the nature and definition of PGs, as much as their inherent or intrinsic properties.

In neoclassical economics, the problem of property rights definition is also recognised: by default, public goods cannot be exchanged in a market unless exchangeable property rights are defined for them (in which case they may become private or collective goods), and some authors identify this as the optimal strategy to improve provision. Economists also recognise the partial applicability of non-exclusion and non-rivalry attributes to many ‘public goods and services’ associated with farming and forestry (e.g. as Figure 1 illustrates, different valued goods and services may have different degrees of these characteristics).

An absence of clear rights definition causes difficulty in valuation. However, it also depends on what is considered as appropriable, and this can vary between societies (Chardeau 2006; Godelier 1984;1996; Durkheim, 1950); as well as between the different attributes of a particular asset – e.g. in respect of land, some attributes or types of use of the asset can be owned and traded (e.g. rights to cultivate, to mine or to hunt/harvest) whereas others cannot generally (e.g. rights to the carbon storage function in the soil – although soil carbon could in theory be traded) and others are only partially ownable / tradeable (rights to use, divert or capture the water flowing through the land only up to a level determined by public authorities or other users).

### **3.1.3 Use of ‘public goods’ in the context of the CAP**

The two different approaches to the “public good” concept are exemplified in recent CAP policy debates, with some stakeholders clearly adopting a more socio-political perspective whilst others, notably the European Commission and a group of prominent agricultural economists (Zahrnt et al, 2009), has taken a more neoclassical economic view. The lists of public goods identified by the European Commission and presented in research commissioned by DG Agriculture and Rural Development (Cooper et al, 2009), and the ENRD (2010) seems to have been a kind of trade-off between a “positive” economic approach and a “normative” socio-political one (Lataste, 2014). The first study by Cooper et al (ibid) provided a list of public goods, which includes examples with a range of degrees of non-rivalry and non-excludability, as well as imputed ‘common good’ value (Lataste 2014; Bureau, 2010). The list was slightly amended in the subsequent study by IEEP and others for the European Network for Rural Development, Thematic Working Group 2 (ENRD, 2010), adding one element and amending the description of two others. When the lists are combined, they include the following.

- Farmland and forest biodiversity
- Water quality and availability
- Soil functionality
- Climate stability
- Air quality
- Resilience to flooding & fire
- Agricultural & forest landscapes (meaning landscapes with some normative quality)
- Rural Vitality
- Food Security
- Farm animals' welfare & health

A brief scrutiny of the items on the list suggests that it adopts a hybrid approach to public goods definition, combining elements of both neoclassical-economic and socio-political perspectives, with the latter particularly evident in respect of items such as animal welfare and rural vitality.

However, other challenges are also apparent – for instance, the items on the list are not simple goods and services in the sense of objects, physical entities or specific defined activities which can be exchanged. The classic economic example of a PG used by many authors is a lighthouse, which is readily identifiable as a single entity, providing a specific service to all shipping, for the benefit of wider society. The items on this list, by contrast, include some which are specific attributes and/or 'states' of particular goods or services, while others are 'services or functions' which are dependent on provision by natural and/or cultural or social capital. Some are 'meta-attributes': the cumulative quality achieved by a variety of component parts (a 'bundle') working / taken together. All of these complex items could be excludable and/or rival in some senses, e.g. if separated into constituent parts, and with property rights assigned (e.g. bottled water, or a property with a nice view). Most are probably closer to common pool resources (non-excludable but rival in consumption) than to 'pure' public goods (non-excludable and non-rival).

Biodiversity, for example, is a relative measure of 'the extraordinary variety of ecosystems, species and genes that surround us' (EC biodiversity strategy), often considered as the species-richness (and related populations) of particular systems or assemblages, which must be defined by reference to a specific geographical scale. Its individual elements, namely particular plant or animal species, may be common property, public property or private property, depending upon the nature of landownership prevailing in the places in which they are found. In defining biodiversity as a public good, the socio-political element is evident in the sense that society views ecological richness, at least at the international level, as a benefit with current and future value. And the neoclassical economic element is evident in the sense that many wild assemblages of plants and animals in a particular location are, to an extent, non-rival in that multiple citizens can enjoy their existence at once. They provide a general benefit to the population by their existence and their contribution to quality of life as well as for the ecological services that they perform to the benefit of society (e.g. pollination). But biodiversity is not a simple, exchangeable 'good' or 'service' in a conventional economic sense. By accumulating land with high biodiversity, individuals may 'own' these assets, and they can exclude other people from direct use of these assets for leisure or learning. But they cannot prevent wider societal benefit from conserving the diversity of the ecosystem. Similar analyses could be made of all the elements on the list above.

The complex nature of these 'goods and services' is further confounded by the phenomenon of jointness (annex 1), whereby they are unavoidably affected by farming and forestry's production of marketed goods, in relationships that can be either synergistic or competitive, depending upon the specific systems and contexts considered. Jointness leads to risks of inefficiencies in provision through public policy, if that policy is designed from a simple diagnosis which identifies market failure and seeks to create a quasi-market in which the state henceforth contracts to purchase these goods to a pre-determined level of demand, on behalf of society – as in the case of agri-environment schemes (Rosanvallon 1989). Where there is jointness, some degree of PG provision will occur as a result of market transactions but it may be difficult for policies to recognize and take account of this (e.g. where agri-environment payments 'reward' provision which was already present, resulting in some deadweight or displacement).

In the list, some socio-cultural dimensions of PGs from farming and forestry are included as well as environmental ones, acknowledging the topics that have been most prominent in mainstream policy debates. However, agriculture and forestry practice can be concerned also with other social 'goods and services' such as public health and welfare, and education (e.g. social farming or 'forest schools': see Annex 1 for a more in-depth discussion of these issues). Expanding the portfolio of public goods delivered through agriculture and forestry to encompass a wide range of social and cultural 'goods' suggests that many societal demands may be met, at least in part, by these sectors and equally, that in other contexts these sectors can have negative influences upon social and cultural demands. As Cooper et al (2009) state, a 'second order' of social benefits from the delivery of public goods highlights the wider importance of farming and forestry maintaining the environment not only for its intrinsic value, but also for the incidental values generated through vitality, quality of life and the stimulation of economic activity. Conversely, where agricultural modernisation and increased productivity enable a significant diminution in the agricultural labour force we may identify a conflict between sectoral economic efficiency and 'rural vitality', particularly if this occurs in low-growth economies, creating rural unemployment.

#### **3.1.4 Values – public goods**

Whatever the initial disciplinary approach, the notion of public goods raises questions, usually linked with the governance, allocative and management dimensions of collective goods / services or resources and their collective benefits for the community. For instance, we might ask:

- What is the optimal governance and management approach for collective goods/resources, and at what scale?
- What should be the involvement of the State in the governance or provision of such goods?
- How can we assess the value of collective goods so as to determine what optimal provision would look like, setting costs against benefits?
- How can we assess the value of collective goods/services provided by ecosystems or natural resources?
- How can we identify and assess societal demand for a collective good or service?
- How can we limit the risk of free-rider behaviour in the use and management of a non-excludable good?

Economists try to provide answers to certain of those questions using economic analysis and assessment tools. Many public goods have been subject to a body of applied economic

research to place monetary values on different assets or services. The rationale for valuation can be understood in various ways. In some cases it is argued that by estimating a money value for goods and services not normally traded in markets, economists aid political decision-making because they enable the comparison of these values alongside the values revealed in markets for other goods (e.g. food, fibre, fuels), where optimal resource allocation requires some trade-off between these options. Most obviously, valuation is used in cost-benefit studies that support complex, multi-objective planning decisions where governments are seeking to permit new developments subject to some overarching principles of sustainability or resource protection. In corporate decision-making, valuation may also be used in similar situations. From economic theory, it follows that the most relevant information for decision-making of these kinds should be marginal values rather than total values, as well as marginal costs of provision (i.e. the pros and cons of making changes from the current position). However, in practice many studies seek to assess total value, probably because this is slightly less problematic. The explicit recognition and valorisation of social and cultural goods and services, as well as economic and environmental ones, may also be challenging. The Demos 'Value Triangle', distinguishing between Intrinsic, Instrumental and Institutional value, sought to conceptualise cultural values and raise their profile and legitimacy in policy (Holden, 2006).

Classic valuation techniques include contingent valuation methods, also termed Willingness-To-Pay (WTP) studies, whereby values are assigned by constructing demand curves reflecting survey respondents' reactions in choice experiments where the PGs may be provided, and/or withdrawn, in various scenarios. Alternatively, hedonic pricing approaches may be used, whereby values are inferred from indirect expenditure choices (most commonly travel costs used as a proxy for peoples' valuation of specific sites or locations, or house prices used as reflecting the perceived higher or lower quality of a surrounding environment). In the main, whilst they produce figures for certain kinds of public good in specific local or more general contexts, the results often lack credibility in the eyes of policymakers and many stakeholders on account of the difficulties inherent in applying these techniques and the high sensitivity of results to initial assumptions and the design and conduct of choice experiments (Marsh, 1992; Milanese, 2010). These valuation issues including credibility, data, and methodological challenges have been discussed by many authors (Maitre d'Hôtel and Pelegrin, 2012; Dupraz and Pech, 2009; Desjeux et al, 2012; Ansaloni, 2008; Dupraz et al, 2010; Bonnieux et al, 2006; Baschet 2009; Barbut, 2009; Desjeux et al, 2011; Tempesta and Thiene, 2004; Mollard, 2003).

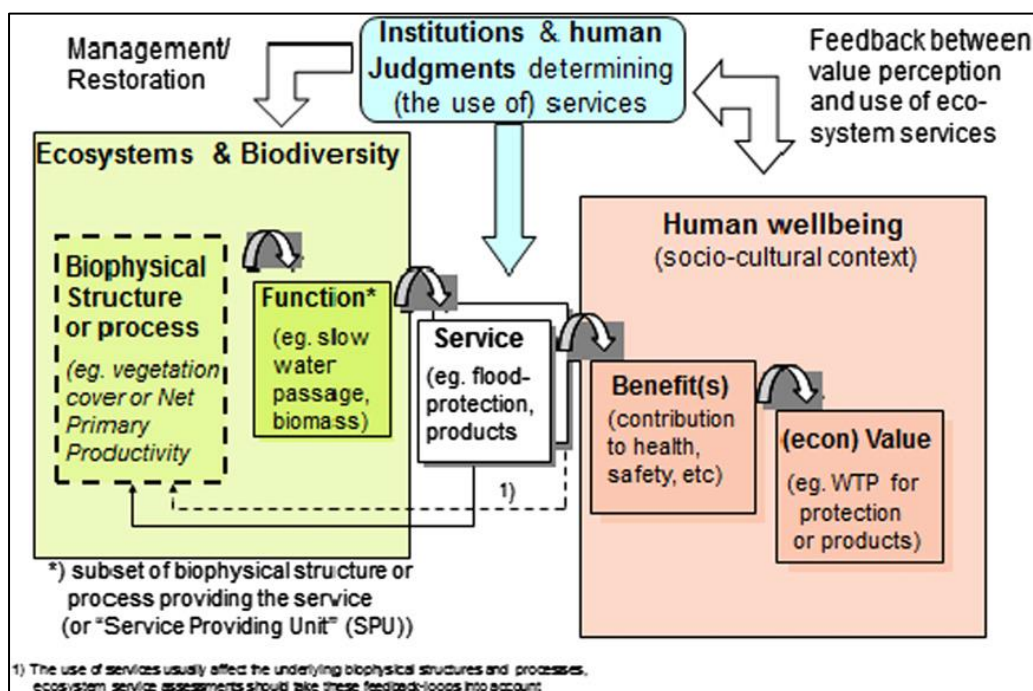
Others question these approaches at a more fundamental level as being anti-democratic, based upon a set of (in their view, incorrect) beliefs or assumptions. These are: that market values represent societal values for traded goods sufficiently well; that the proxy values computed through these various economic techniques are reliable indicators of the values of non-traded goods; and that once both are known, optimal decisions can become largely a matter of technical calculus, rather than an outcome of negotiated compromise between the different value-systems held by different groups such as can be achieved through the political process. The latter is seen by some as a more transparent and acceptable approach for societal decision-making concerning these sensitive issues, notwithstanding its potentially significant resource requirements and the challenges of sufficiently democratic or inclusive process design.

### **3.2 Ecosystem services**

Concepts around ecosystem services can be traced back to Leopold's idea of a land ethic (Leopold, 1949), however, the term was only explicitly coined sometime around the late 1960s (see: King; 1966; Helliwell; 1969; Westman; 1977). Today, as a field of research EcoSystem Services (ESS) is evolving from its original ecological and pedagogic imperatives whereby it was used to raise awareness about human dependence upon ecological systems, to include more economic elements aimed at influencing public policy and particularly environmental regulation. ESS has emerged as a concept used to convey the importance of, and value of, natural systems to society and the economy (Ehrlich et al.; 1977; Ehrlich and Mooney, 1983), embracing the functioning of hydrological, chemical, ecological and other biophysical elements and systems in the environment as well as a range of functions resulting from the combined effect of natural and cultural processes, such as landscape quality. However, current uses and applications of ESS arguably coalesce around the application of valuation as a means to improve decision-making processes, as discussed above (Daily, 1997; Costanza et al., 1997). Along this evolutionary pathway, a variety of different ESS typologies has developed and the concept is still subject to discussion and debate concerning the best ways to characterize and analyse it.

ESS was clearly 'mainstreamed' in the arena of public policy with the publication of the Millennium Ecosystem Assessment (MEA) in 2005. The MEA defines ESS as 'the benefits people directly or indirectly obtain from the environment' (MEA, 2005), and uses the term to include both goods and services that are provided by ecosystems. It classifies ESS into 4 broad types of service to society: provisioning, regulating, supporting, and cultural services. As widely reviewed elsewhere (Lele et al., 2013; Schroter et al., 2014; Fisher et al., 2009) the MEA (2005) has been critiqued (Costanza, 2008) on the basis that it mixes its ends with means: confusing ecosystem functions (i.e. the natural cycling of the system), with services (whereby certain parts of the cycle provide a direct service to society) and benefits (where that service is explicitly valued by society; Boyd and Banzhaf, 2007).

Boyd and Banzhaf (2007) distinguish between final and intermediate ESS (cf. *realised* and *potential* ESS, respectively, in Jones et al., 2015) to clarify ends and means. The 'service cascade' model can be applied to much of the logic that ties this accounting perspective together (Haines-Young, R. and M. Potschin, 2010). A classic cascade model is depicted below, taken from the TEEB study (Figure 2). Other typologies of ESS have been developed including some attempting to capture the spatial relations between the source of the service and the beneficiaries (see Fisher et al., 2008), also the degree to which users can be excluded or compete for services (Costanza, 2008). However, classifications such as TEEB (2010); CICES (Haines-Young, R. and M. Potschin, 2013) and de Groot et al. (2012), all take the functional organisation of the MEA as a basis. In this organisation, as in the TEEB diagram, the concept distinguishes a chain through which (natural) assets generate functions, which can provide services to society, which it perceives as beneficial and which it may or may not explicitly value in various ways. The notion of environmental assets as the starting point for this chain has resonance with concepts and analytical techniques found in the 'natural capital' social accounting literature (for a review see Helm, 2014), which is also relevant to our work and will briefly be considered further below, and in section 4 of this paper.



**Figure 2. The Economics of Ecosystems and Biodiversity (TEEB) overview diagram.**  
Braat and de Groot et al. (2012), adapted from Haines-Young, R. and M. Potschin (2010)

Fisher et al. (2009) provide a useful overview of the main characteristics of ESS, which are pertinent to developing ESS classification, ESS assessment and decision making. ESS research has to navigate factors such as: spatial and temporal dynamism; beneficiary dependency (Boyd and Banzhaf, 2007); complexity (Limburg et al., 2002); jointness or 'bundling' (Fisher et al., 2009; Bennett et al., 2009); and public-private good aspects (Costanza, 2008). The authors posit that, given the complexity of ecosystems and the characteristics of ESS, any attempt to come up with a single classification scheme or utilisation of a single valuation approach should be approached with caution. As many ESS are inherently tied to social systems and social choices, the decision context is crucial for mobilising the ESS concept (Fisher et al., 2009).

The ESS approach also makes explicit reference to socio-cultural aspects and values. Cultural Ecosystem Services (CES) are recognized, defined as the non-material benefits obtained from ecosystems through spiritual enrichment, cognitive development, reflection, aesthetic experience and include things like social relations, aesthetic values and human well-being (Bieling and Plieninger, 2013; Plieninger et al 2012). According De Groot et al (2005), many writers on ESS recognise the legitimacy of socio-cultural services and some (Parachini et al, 2014) have made serious attempts at devising methodologies to capture and value such services within the broader ESS framework, often in a specific landscape context. Conversely, according to Plieninger et al (2012), CES are rarely fully considered in ESS assessments due to methodological challenges.

Mollard (2003) proposed considering the relationship between PGs and ESS described as externalities as a relation between stocks and flows (of utility), as for instance where ecosystems (as an asset or stock) produce a range of ecological/natural services (externalities or flows) to beneficiaries. This approach sought to offer a means of unifying public goods and services with an ecosystem approach providing ESS. However, it uses a

much more narrow definition of both PGs and ESS than that now found in the literature, as already discussed. According to Mollard, the stocks that may be involved in the provision of externalities or services may be natural or cultural, or both. In the separate 'capitals' approach to social accounting (see Helm, 2014), various different kinds of stock are identified including natural, cultural, human and social capitals, and some such taxonomies also extend to embrace manufactured and financial capital, as components of the Social-Ecological System (SES). These approaches highlight the importance of analysing natural and cultural assets and their condition, as well as the wide variety of services that can flow from them.

### **3.2.1 ESS in the context of the CAP**

Turning to its applications and implications for policy, ESS as a concept is part of a wider, integrated 'ecosystem approach', which also includes other key elements of involving people and valuing the natural environment, in decision making. Several authors have developed policy suggestions for land management and planning using principles derived from ecological science and ESS insights, for instance: the dynamic and uncertain behaviour of complex ecosystems, the imperfect knowledge of different experts, and the irreversibility of certain kinds of change. These tend to point towards a need for certain styles of governance (Hodge and Adams, 2014). Thus the broader 'ecosystem approach' within which ESS are discussed, has been characterised as encompassing systemic, participatory and adaptive management (Waylen et al, 2014). In this context, a certain degree of fluidity in the definitions, classifications, valuation and application of ESS is unavoidable. This is captured in the conceptual framework offered by Villamagna et al. (2013) of capacity, pressure, demand and flow (see their figure and table 1, pp.115-116).

Having emerged in policy discussions relatively recently, the explicit use of ESS as a concept or a tool for analysis within the context of the CAP and its reform has so far been relatively minor. However, it has gained increasing prominence in the arena of environmental reporting and state of the environment 'classification' and 'diagnosis' exercises (e.g. Haines-Young, R. and M. Potschin, 2013; Paracchini et al, 2014; Van Oudenhoven, 2012; MAES 2013 and 2014; Snäll et al, 2014). Among environmental agencies and NGOs the concept has also been widely used alongside public goods as a way of seeking to make more tangible, the dependence of various social and economic activities on continued functioning of natural processes and maintenance of environmental assets (Rutz et al, 2014; see also postings on the IEEP CAP2020 website).

### **3.2.2 Values – ecosystem services**

Policy makers are increasingly demanding economic assessments or valuations of how biodiversity and ESS loss may impact upon human well-being (Lele et al., 2013). Payment for ecosystem services (PES) has attracted increasing interest as a mechanism to translate external, non-market values into financial incentives for local actors to provide services (specifically, water quality and quantity; carbon sequestration, and cultural services, including biodiversity), to purchasers who may be either public or private entities benefiting from such provision (Rowcroft et al., 2011).

However, the directness of the PES approach, often singling out a particular service for payment, has caused unease that this undermines one of the basic principles of the ESS approach: that it is the system and the multiple interactions between services that must be understood and acknowledged (CGIAR, 2014). Also, the value of some services appears to be only implicit within some valuations (Robinson et al., 2014). As a result, there is increased



pressure on policymakers to consider the multi-functionality of ESS in their decision-making, and this is especially true of the role played by soil and soil functioning, when using land management to reverse environmental decline (Robinson et al., 2014).

ESS research has undertaken major efforts to quantify and measure ESS (Burkhard et al, 2013). Considerable focus has been placed upon identifying the relevant indicators and how to measure them in order to map quantified ESS at different spatial and temporal scales (Burkhard et al, 2013). This has presented challenges, particularly for cultural services (Kenter et al, 2014; RECare (2014); Schwartz and Bilsky, 1987; Dietz et al, 2005; Van Oudenhoven et al, 2012). Quantifying bundles of ESS and recognizing the interrelations between components of indicator sets, however, remain major challenges to monitoring ESS flows (Muller and Burkhard, 2012; Schwilch et al, 2015). By and large, these valuation efforts have been mostly technical, rather than participatory or deliberative in nature, although they may be embedded within broader and more participatory decision-making processes (such as land-use planning).

Some valuation techniques mirror those used for public goods, with hedonic and contingent valuation methods (CVM). In other cases, proxy measures can be used by considering the actual monetary cost of provision of a specific service via a non-ecosystem route. For instance, if a hydrological system with reedbeds removes nutrients from a water course, its value could be equal to the cost of chemical treatment of the nutrient-rich water to remove the same elements. In overview, valuation remains a challenge. CVM is challenging to apply, as it usually deals with a specific issue and thus cannot easily reflect the complexity attached to ESS. However without the right tools ESS struggles to inform policy as the size of the challenge, the views of society and the potential benefits are difficult to articulate.

Chan et al (2012) argue that the valuation of cultural ecosystem services (CES) is complicated by the properties of intangibility and incommensurability and that the effectiveness of the CES framework is thwarted by the conflation of services, values and benefits. Thus in the context of public goods, integration of CES may be better served by distinguishing the benefits, and their corresponding value, from the goods themselves whilst remaining clear about the difference. Plieninger and Bieling (2012) nevertheless demonstrate that aesthetic values, social relations and educational values are related to individuals' well-being. They also show that such services are not scattered randomly across a landscape but rather follow specific patterns in terms of the intensity, richness and diversity of their provision. This bundled (joint) provision, they argue, can orientate management of CES towards multi-functionality. The review by Daniel et al (2012) also finds that spiritual and religious values can be instrumental in promoting biodiversity conservation, indicating that jointness may equally apply to different regulating and cultural ESS as well as between these and the main provisioning ESS (food, fibre and timber). There are clear parallels here with economists' work on non-profit provision of PGs.

Van Berkel and Verburg (2012) show that there is societal demand for cultural services, again focusing principally on landscape. Recognising that tourism services form an important aspect of amenities in agricultural landscapes, the authors assessed the value of landscape functions including aesthetic beauty, cultural heritage, spirituality and inspiration (on the basis that they are non-material benefits related to land management and therefore non-excludable), using travel cost and WTP estimates. Daniel et al (2012) conclude that non-market valuation methods have shown promise for monetising benefits for some cultural services, although a more refined and inclusive approach is needed to accommodate CES in a broader public good framework.

As mentioned earlier, ESS are situated within the 'ecosystem approach' which includes other key elements (Waylen et al., 2014). The techniques of the approach - participatory learning by stakeholder groups, to facilitate collective decisions - may offer an alternative means to resolve issues of allocation without recourse to monetary valuation, in a variety of local contexts.

#### **4. Combining the Analysis in a farming and forestry context**

##### **4.1 Social-Ecological Systems as a potential unifying approach**

Social-Ecological Systems (SES) are linked systems of people and nature, emphasizing that humans must be seen as a part of, not apart from, nature (Berkes and Folke, 1998; Berkes et al, 2002). Both socio-economic and ecological elements of ecosystems can be analysed together through the concept of SES, emphasising the close interdependencies between natural and man-made factors and processes, and seeking to examine how they function in an integrated way (Berkes et al, 2002; Schouten et al, 2013; de Groot et al., 2012). Proponents of SES argue that this enables a more direct movement from theory into practice, built on a fuller understanding of the functional and institutional factors influencing supply and demand of PG/ESS.

CGIAR's Water, Land and Ecosystems (WLE) programme has applied a SES approach (CGIAR 2014), guided by Walker and Salt (2006) who highlight four key SES principles:

- (1) the social systems are embedded in, and interlocked with, the ecological systems;
- (2) SES are subject to changes 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 use of the term 'resilience' is important as it refers to the ability of the SES to undergo change and retain sufficient functionality to continue to support both livelihoods and the provision of PG/ESS (Biggs et al 2012).

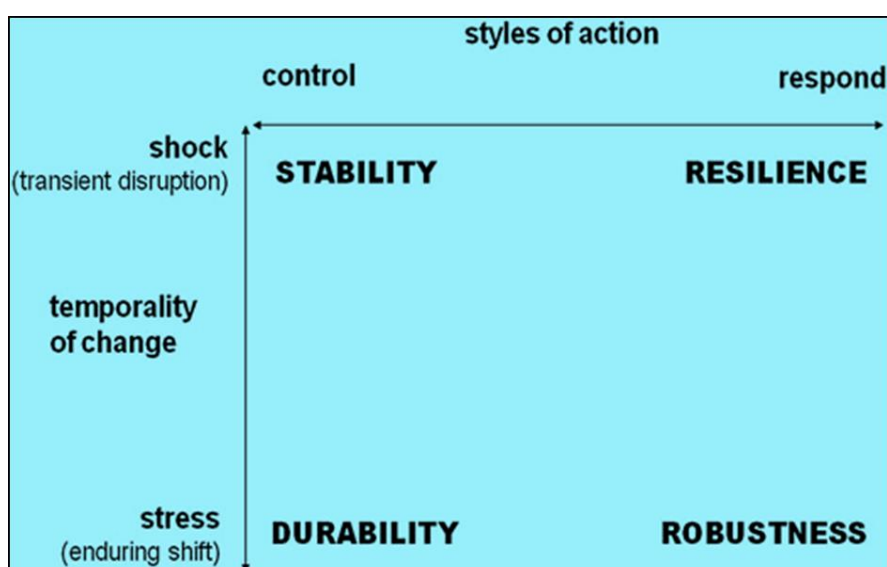
Biggs et al (2012) present a framework for SES incorporating PG/ESS, and suggest that not all PG/ESS behave the same, nor do they indicate the level of resilience within the SES. The authors propose a set of principles which determine resilience, seeking to demonstrate that bringing the social and biophysical aspects of systems together represents a cornerstone for social-ecological thinking (Berkes et al, 2002). The Biggs framework distinguishes between systems and their governance, while at the same time recognizing the difference between governance and management.

**Table 1.** Entities involved in social-ecological systems

Entities	Examples	Potential Problems
A. Resource	Water source Fishery	Uncertainty Complexity / Uncertainty
B. Resource Users	Farmers using irrigation  Fishers harvesting from inshore fishery	Stealing water, getting a free ride on maintenance Overharvesting
C. Public infrastructure providers	Executive and council of local users' association Government bureau	Internal conflict or indecision about which policies to adopt Information loss
D. Public Infrastructure	Engineering works Institutional rules	Wear out over time Memory loss over time, deliberate cheating
External Environment	Weather, economy, political system	Sudden changes as well as slow changes that are not noticed

**Figure 3. Key elements of SES** (from Anderies et al, 2004)

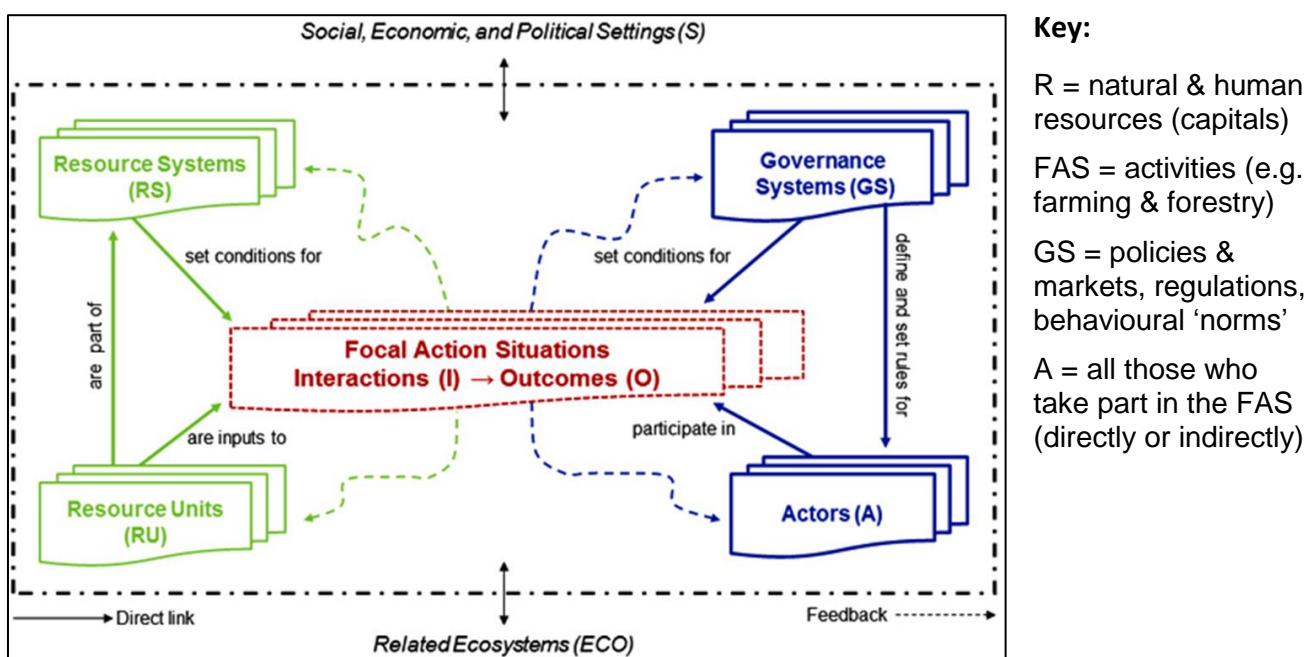
As both PG and ESS approaches recognize, social and ecological factors interact in the production of marketed products from agriculture and forestry. Anderies et al (2004) outline a framework for SES based around four key elements and the external environment (Figure 3), suggesting that interactions between these various factors determine the robustness of the SES. Others highlight dynamic relations within SES as critical (see Figure 4); these suggest some challenges for new policy approaches to resolve.



**Figure 4. Relations between SES properties** (Leach et al, 2010, in Domtail et al, 2015)

The added value of the SES approach is perhaps its ability to embrace different disciplines (ecology, economics, socio-political and cultural knowledge) within a coherent framework for analyzing the dynamics of local SES, identifying their components and explaining important properties of the system including resilience, and recognising the existence of ‘tipping points’

or thresholds at which the system becomes fundamentally transformed in a way which is not easy to reverse (see Holling, 1996 for a useful introduction). However the approach is still under active development and thus far, it has not been widely applied in a policy context. To illustrate the state of the art, a recent example specifically designed to offer a common vocabulary and framework for analysing natural resource management challenges across the globe, is shown (Figure 5). This approach was developed by examining a number of specific cases (all published in a special edition of Ecology and Society – vol.19 issue 2) and seeking to abstract from them ‘common features for analysing, comparing and diagnosing SES’.



Authors’ note: A social-ecological system (SES) framework with multiple first-tier components. Solid boxes denote first-tier variables. Resource Systems, Resource Units, Governance Systems, and Actors are the highest-tier variables that contain multiple variables at lower tiers. Action Situations are where all the action takes place as inputs are transformed by the actions of multiple actors into outcomes. Dashed arrows denote feedback from action situations to each of the top-tier categories. The dotted-and-dashed line that surrounds the interior elements of the figure indicates that the focal SES can be considered as a logical whole, but that exogenous influences from related ecological systems or social-economic-political settings can affect any component of the SES. These exogenous influences might emerge from the dynamic operation of processes at larger or smaller scales than that of the focal SES.

**Figure 5: McGinness and Ostrom’s generalised SES for resource management (2014)**

#### 4.2 Distinguishing PG and ESS

In seeking to understand how PGs and ESS are related, we might ask: are they the “same thing” viewed from a different perspective, or are they “different things” with some interactions? Actually, they largely overlap – many ESS from farming and forestry are PGs but some will be private goods, and some will be attributes or services provided by specific goods or bundles of goods. However, all PGs will be assets or services within a broader SES framework, and all ESS can be generated by such a framework.

A key difference between the PG perspective and the ESS one is the way in which:

- PG as a discourse emphasizes public benefit versus private benefit, highlights the importance of drivers of decision-making, the phenomenon of market failure, and raises the question as to how far provision of a socially-desired level of PG by farming and forestry can be a private, a public or some hybrid form of process (e.g. collective, contractual, deliberative etc.); whereas
- ESS emphasizes the biophysical and broader environmental processes by which natural and human elements of the ecosystem interact, and identifies the dependencies and inter-dependencies involved in these relationships, with feedback loops and complex adaptive or reactive responses. It highlights how those dealing with conventional farming and forestry outputs (producers, supply chain actors, consumers) may be insufficiently aware of these relationships, leading to problems.

Thus ESS adds to our understanding of the nature of these relationships, whilst PG focuses our attention on types of provision/supply, societal demand or need, and how to reconcile these two things effectively in a range of different circumstances. In seeking to foster a more socially-optimal outcome from farming and forestry practice, therefore, both ESS and PG are useful concepts to apply, each with its own added-value for analysis.

When we turn to consider SES, this broader approach adds a further dimension to understanding and potentially addressing a need for more sustainable farming and forestry. It emphasises the value to be gained by seeking to assess both human and non-human elements and relations within a given system defined by reference to a particular sectoral or territorial context, and examining the properties of the system as a whole. It considers system resilience or vulnerability and seeks to identify tipping points or prospects for transformation toward enhanced states, at this more strategic level.

#### **4.3 Discussion of possible integrated framework**

We may consider the assets that generate services and attributes/characteristics that are potentially capturable as various kinds of ‘good’, but with differing levels of incomplete commodification (not all are ‘goods and services’) as well as market failure. When these are framed within SES, we can conceive of ‘market’ and ‘non-market’ spheres, recognizing that many goods in the economic area (i.e. items or services which people seek to use and benefit from) are not taken into account in the market area (Chevassus-au-Louis *et al.* 2009), and that some concepts of valued assets or attributes may not be fully captured in economics (e.g. faith, love or moral principles).

Assets might include a variety of types of capital. ‘Natural capital’ (i.e. the non-human resource within an ecosystem) has various forms with specific characteristics (whose basic quality will be affected by anthropogenic impacts) which vary spatially and temporally. Also, cultural capital, resulting from the interplay of past human effort and natural capital, varies spatially and temporally. Human and social capital, which come more from the anthropogenic sphere, also vary in space and time. Actually many forms of ‘capital’ are hybrid between these ‘ideal types’, and may be more or less replicable. All can represent assets, in both ESS and SES framings. Human and non-human interaction with different forms of capital generates a variety of ‘goods’ and services but many of the things that we commonly call ‘goods’ in this

context are not tangible items or objects, but characteristics or attributes of that capital and its behaviour/activity, as discussed earlier.

Many of these elements are valued by society and by individuals in society. Some come within a 'consumption choice' sphere of activity (e.g. I can choose to go and appreciate a landscape or not); whilst others are unavoidably necessary to a decent quality of life (e.g. unpolluted air and water, pollination for crops, flood regulation/management). Only a proportion of these values is expressed in any market, but many are embraced within different governance structures and policy regimes (Primmer et al, 2015). They are therefore subject to various other non-market allocation processes. Markets exist for multifaceted qualities and many intangible attributes as well as goods and services, but usually these are 'bundled' with specific goods or services, so that they affect market prices for those goods through product attributes, branding or niche-market tactics.

Agriculture and forestry, because they involve managing land and other elements of ecosystems, almost unavoidably have impacts upon natural capital, its characteristics and its ability to provide goods and services. Some impacts are deliberate, i.e. production of food, fuel and fibre; whilst others are incidental or accidental. Different land-based primary producers have different aims in their deliberate activities: some seek to produce maximum profit, others look for income stability, still others wish to steward their assets (land) to pass on to their children; many also pursue a range of environmental and/or social goals, often reflecting different ethical and political viewpoints alongside commercial production, even when their actions apparently focus on economic gains.

Figure 6 (our own) seeks to encapsulate this understanding in a unifying way, indicating how PG, ESS and SES can be accommodated in a holistic approach to describe human and social interaction with the wider environment. This 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 the extent to which, these processes operate in a given situation.

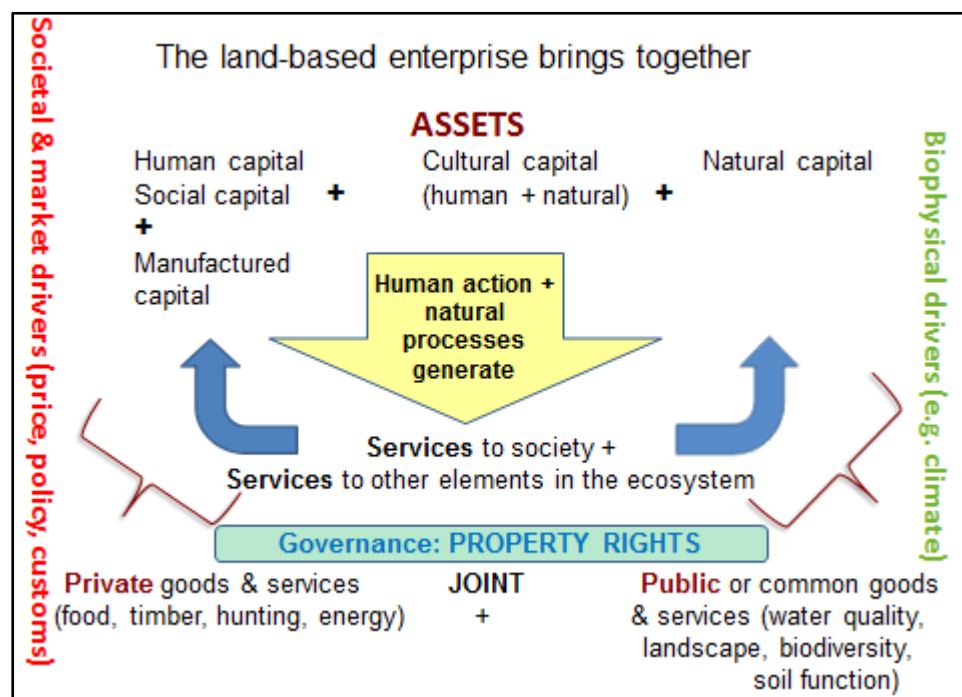


Figure 6: Illustrating relations between PGs, ESS and SES for farming and forestry

This framing of the SES provides a useful way of seeing both the ‘goods’ and the products from the ‘system’ that are being used, directly and indirectly, by a range of beneficiaries. A system-level analysis may also suggest a mechanism for diagnosis where emphasis is placed on considering the ‘health’ of the whole mix (social and ecological as well as economic), relative to long-term issues of supply and survival. Both ESS and SES approaches to analysis enable a realisation that in many situations, the focus of development or change has been on meeting anthropocentric, short-term needs (Braat and de Groot, 2012; Berkes et al, 2002). The result has been a reduction on the robustness and resilience of SES systems from both a social and ecological perspective, with consequent negative impacts for the long-term economic perspective.

Comparing the different approaches in terms of the *prescriptions* that they suggest for action is also interesting. In the public goods analysis, markets under-recognise demand and/or under-appreciated need, so the response can be either to strengthen market recognition, provide quasi-markets or use alternatives to markets, such as regulation or new governance approaches, to influence supply. Within an ESS perspective an improved understanding of how provisioning services of farming and forestry affect many other elements of the system often leads analysts to call for new governance systems which oblige these linkages to be recognised, for example through multi-actor arrangements, adaptive management; collective governance, with an emphasis on the health of the ecosystem and the need to raise awareness of this concept among key actors (notably farmers and foresters but also other stakeholders, e.g. in supply chains). The focus on the system as a whole is most pronounced in the SES approach, in particular; this tends to suggest responses in policy and practice which can act to strengthen the voice of the long-term in decision-making, planning for greater system resilience and durability. For instance SES analysts have discussed designing ‘multi-level institutions’ (e.g. including local, regional and national scales of responsibility) to act and respond for the long-term. A tangible example of such an approach taken at the SES level

could be the new governance and regulations surrounding the protection and use of the Galapagos islands (González, 2008).

Summing up, this analysis recognises the differences between PG and ESS as aids to analyse issues and propose solutions to promote a greater provision of environmental and social benefits from farming and forestry practices. Combining both sets of insights within an overarching framework of Social-Ecological-Systems analysis adds a further layer of understanding which has the potential to emphasize the long-term health of the system as a whole. It is clear that there is considerable overlap in coverage and concerns, between analyses of farming and forestry which use public goods or ecosystem services as conceptual starting points, and that common understanding can be hampered by differences in language and, in some cases, a lack of clarity in definitions. The SES as a concept has potential to embrace both PG and ESS perspectives but in so doing it appears unlikely to replicate their insights; rather, it may add a new layer of understanding to the analysis. It therefore seems important to draw from all three approaches, in seeking improved policy and practice for sustainable farming and forestry.

#### **4.4 Particular application within the Pegasus project**

For PEGASUS, it is important for the project to adopt a relatively broad, systemic and socio-political approach to the concepts of public goods and (especially non-provisioning) ecosystem services as societal benefits, as well as focusing upon those goods and services which are intimately connected to farming and forestry activities across Europe.

From our consideration of the PG concept, it is clear that the project is concerned with analysing particularly those social and environmental goods, services and attributes associated with farming and forestry which are under-provided relative to societal appreciation and demand or unexpressed functional need (as in an ecological life-support system like pollination, or a 'global good' such as the property of food security). At the same time, it will be very important to focus upon the drivers which underlie situations of greater or lesser provision; embracing market, individual and social drivers including key actors' awareness, knowledge and attitudes towards these benefits, as well as economic, regulatory, institutional and structural incentives and barriers. And we must seek to understand the extent to which jointness, in these contexts, exists and can be harnessed as a positive influence upon provision.

From the ESS and SES perspectives we may divide the environmental and social benefits into different categories: assets (stocks); and attributes of assets; as well as functions generating services (flows) between natural and socio-cultural assets and society, sometimes but not always as a result of management processes designed for the central purposes of producing food, fibre and fuel. And we must seek to understand the feedback and feed-forward loops in the systems within which these assets, attributes and functions occur, identifying where and under what conditions things work synergistically and/or antagonistically.

From the SES analytical approach, it will be important to recognise and seek to understand the overall 'health' of the different systems that we analyse, identifying indicators of relative



resilience or vulnerability and the presence of characteristics such as tipping-points or threshold values above or below which the system could undergo radical transformation to quite different states with different values and functioning. We must also consider the appropriate scale of the systems that we analyse – for example, looking beyond the farm level to include supply chains, particularly where the production system is embedded within, and closely dependent upon, characteristics and specificities operating at a higher level.

In sum, the project must be concerned with understanding the reasons for an insufficient (and declining) provision of these benefits from farming and forestry across Europe as a whole, and identifying the multiple ways in which systems could be transformed towards a state of greater provision of environmental and social benefits, more in line with societal demand or need. For this aspect, a SES framework offers an approach that both PG and ESS concepts and analyses can feed into, and suggests a scale of operation for the case studies that should be meaningful to those with whom we will collaborate, in that process.

It was also the intention that this paper would help to define the analytical framework for the selection of PEGASUS case studies. So, the following are suggested as key points:

- **we can select examples from each of the main types of PGs/ESS (i.e. whether assets, attributes, flows) operating at the scale of a SES**, to see if differences in their nature affect aspects of their current or potential provision, relative to societal demand/appreciation or need;
- **we can examine contrasting models and methods of provision** which range from almost entirely private (generated by private individuals or groups as part of 'commercial' activity to produce food, fuel or fibre) to predominantly public (generated directly by state action for public benefit), and include a range of hybrid models of provision (e.g. collective provision by non-profit organisations or groups; contract-based provision by private actors responding to government financial incentives; or negotiated forms of 'partnership' provision by private and public actors, with or without a financial element), looking to understand drivers, the role of knowledge, attitudes and learning, and the potential for enhanced performance; also
- **we can seek to include contrasting states of the systems that we examine (e.g. good provision and resilient, increasing or in decline; versus poor provision increasing or not)**, including some which are close to thresholds of positive or negative transformation.

It is also clear that we should use methods to identify and characterize PGs and ESS which explicitly acknowledge both environmental and social elements, and seek to integrate them into our analysis of the SES, to better understand how ecological and social attributes and values, and their provision in farming and forestry alongside the production of food, fuel or fibre, interconnect. This will enable an understanding of any link between differences in the nature of goods and the types of provision found, as well as clarifying key factors which help to determine types and extent of provision, relative to societal demand.

In pursuit of the first of these points, WP1.2 will clarify a typology of PG/ESS for using within PEGASUS to help select case studies, and the process will be extended in WP2 to produce characterisations and mapping. As a starting point, Table 1 makes an attempt to link a broad categorisation of these benefits to examples that are directly relevant to EU agriculture and forestry. To make our choice of cases to study in more depth, we could seek a range of examples covering all of the categories in the left-hand column of the table, as well as

*Public Goods and Ecosystem Services from Agriculture and Forestry – towards a holistic approach: review of theories and concepts*

different or characteristic types of farming and forestry; producing food, fibre, fuel and other private goods from commercial land management, such as tourism and leisure services.

**Table 1: Initial categorisation of public and ecosystem goods and services from farming and forestry, for PEGASUS (our own)**

<b>Main categories of environmental and social benefit</b>	<b>As affected by farming and forestry</b>	<b>Possible examples of PG and ESS delivering these benefits</b>
High water quality (drinking water, healthy rivers and other water bodies).	Positive: Dilutes pollution, remediation, purifies. Negative: diffuse or point source pollution, loss of top soil into water bodies	Water quality (PG), Water quality regulation (ESS)
Regular flow of water (reducing likelihood of flooding, maintaining supply)	Positive: regulating water flow, 'holding water back'. Negative: surface water run-off, irregular water flow (peaks and troughs), depletion of aquifers.	Water availability (PG), Hydrological cycle and water flow maintenance (ESS)
Healthy soils (providing environment for food production, biodiversity, water regulation and water quality)	Positive: high levels of OM and biodiversity. Negative: soil erosion, desertification, compaction, loss of OM, contamination, salinisation.	Soil functionality (PG), Soil formation, composition and fixing processes (ESS)
Carbon sequestration (locking up carbon so it is not released into the atmosphere)	Positive: Ability to lock up carbon for the long term through sustainable management. Negative: release of carbon through management activities	Climate stability – carbon storage (PG), Atmospheric composition and climate regulation: carbon sequestration by terrestrial ecosystems (ESS)
Reduction of greenhouse gas (GHG) emissions	Positive: Ability to reduce GHG emissions through sustainable management. Negative: release of GHG through management activities	Climate stability – emissions (PG), Atmospheric composition & climate regulation: reduction of GHG concentrations (ESS)
High air quality (low levels of pollutants, low impact on human health)	Positive: Ability to reduce air pollution and improve air quality. Negative: contribute to pollution through management practices	Air quality (PG, Atmospheric composition and climate regulation (ESS)
Flood protection (reduced likelihood of flooding)	Positive: management practices contribute to flood alleviation Negative: management practices (or lack of management) reduce flood alleviation	Resilience to flooding (PG), Liquid flows: Flood protection (ESS)
Fire protection (reduced likelihood of fire)	Positive: management practices contribute to reduction of fire risk Negative: management practices (or lack of management) reduce resilience to fire risk	Resilience to fire (PG), Atmospheric composition and climate regulation (ESS)
Vibrant rural communities	Positive: contribution to sense of community and quality of life Negative: no contribution to sense of community	Rural vitality (PG), public and private health and wellbeing (ESS)
Wildlife (species, habitats)	Positive: management practices can maintain existing, enhance and restore habitats and species Negative: management practices can destroy habitats and species.	Biodiversity (PG), Does not feature as an ESS as it is considered to underpin the delivery of most ESS. Note: Viewing wildlife is a cultural ESS
Pollination	Positive: certain management can benefit pollinators Negative: lack of positive management can reduce opportunities for pollinators	To some extent covered by Biodiversity (PG), Pollination (ESS)

*Public Goods and Ecosystem Services from Agriculture and Forestry – towards a holistic approach: review of theories and concepts*

<b>Main categories of environmental and social benefit</b>	<b>As affected by farming and forestry</b>	<b>Possible examples of PG and ESS delivering these benefits</b>
Biological pest and disease control	Positive: certain management practices will encourage natural predators and reduce the need for artificial control of pest and disease Negative: lack of suitable management can significantly reduce presence of natural predators	To some extent covered by Biodiversity (PG), Biological control mechanisms (ESS)
High levels of genetic diversity	Positive: encourages high levels of plant and animal diversity (both breeds of livestock, crops, trees as well as wildlife), which ensure greater resilience to pest/disease/climatic changes etc Negative: low levels of diversity in terms of livestock, crop, tree species and wildlife	To some extent covered by Biodiversity (PG), Genetic resources, medicinal resources (ESS)
Landscape character	Positive: contributes to the diversity of landscape features, field patterns etc. which contribute to the distinctiveness of the area Negative: Removal of distinctive features leads to a more homogenous landscape	Agriculture and forest landscapes (PG) Landscape character, cultural landscapes (ESS)
Public enjoyment	Positive: encouragement of access to farmland and woodland for people to experience and enjoy the countryside and being outdoors Negative: making farmland and woodland inhospitable to people	Health and wellbeing (PG) Spiritual, symbolic and other interactions with biota, ecosystems and landscapes (ESS)
Food security	Positive: management practices can provide achieving healthy soils, carbon sequestration, flood and fire protection Negative: increase, soil erosion, release of carbon, diffuse pollution, and risk of flooding and fires.	Unclear with the PG (Rural Vitality?) and ESS are in conjunction with Food Security but it was agreed at Dijon that this should be on the list.

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## **Annex 1: An extended examination of the nature of public goods theory, and social PG/ESS aspects of PEGASUS**

### **Public goods' characteristics: non-rivalry (Samuelson, 1954) and non-exclusion (Musgrave, 1959)**

**Non-rivalry**. In his founding article, Samuelson (1954) distinguishes “ordinary *private consumption goods* which can be parcelled out among different individuals [...] and *collective consumption goods* which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good”.

Through that definition, Samuelson demonstrates that this characteristic prevents optimum price and quantity adjustment of collective goods in the market. Under those conditions, “no decentralized pricing system can serve to determine optimally these levels of collective consumption”.

The author concludes that “the *external economies or jointness of demand* intrinsic to the very concept of collective goods and governmental activities makes it impossible for the grand ensemble of optimizing equations to have that special pattern of zeros which makes *laissez-faire* competition even *theoretically possible*”. In those conditions, some economists consider that public intervention in markets is justified. Thus, because of market failure, these collective goods will become *public goods* or *merit goods*, in the sense that the State has to determine and/or provide the optimal level of consumption on behalf of society.

**Non-exclusion**: According to Musgrave (1959), the other key factor that leads some goods/services to become public, is the impossibility of applying the exclusion principle because it is too costly or difficult. This exclusion principle postulates that an individual should be “excluded from the enjoyment of any particular commodity or service unless he is willing to pay the stipulated price to the owner” (Musgrave, 1959). In his *theory of public finance*, Musgrave (1959) considers that the *allocation branch* has to satisfy *public wants* which are of two kinds: *social wants* and *merit wants*. Social wants are defined as “those satisfied by services that must be consumed in equal amount by all. People who do not pay for the services cannot be excluded from the benefits that result; and since they cannot be excluded from the benefits, they will not engage in voluntary payments”. Under those conditions, Musgrave considers “such wants cannot be satisfied through the mechanism of the market because their enjoyment cannot be made subject to price payment”. This appears as the cause of market failure, “hence the market cannot satisfy such wants. Budgetary provision is needed if they are to be satisfied at all” (*ibid.*).

According to these characteristics, economists recognize that there are relatively few examples of pure public goods in the neoclassical sense – very few assets or services are fully non-rival as well as fully non-excludable. Many of the attributes that are commonly discussed as ‘public goods’ are in fact common pool resources, such that their consumption is rival to an extent (e.g. water sources, which are often non-excludable); while others may be club goods in that it is possible to exclude certain groups from enjoying the good (e.g. a beautiful view, which is clearly non-rival but can be hidden from those who do not pay for access to see it). These varying qualities or degrees of ‘publicness’ in respect of the neoclassical definition can be illustrated by the classic four-cell table as used by many authors, shown below (a simpler version is also in the main text of the paper).

	<b>Non-rival goods and services (indivisible)</b>	<b>Rival goods and services (divisible)</b>
<b>Impossibility of exclusion</b>	(1) Pure public goods Stable climate, cultural heritage, Peace, public TV	(2) Common goods (common pool resources) ground and surface water, fish in the ocean, rivers and canals, wildlife,
<b>Possibility of exclusion</b>	(3) Quasi public goods (club goods) Nature reserves, toll roads, libraries, golf clubs	(4) Pure private goods agricultural products, timber, agri-tourism, hunting, [social farms?]

Sources: adapted from Jongeneel et al (2009); Ostrom (2005)

Notwithstanding their ‘impure’ nature in this respect, it is clear that many examples of goods and services provided in the table share at least some degree of either non-rival or non-excludable character, which would tend to suggest issues of under-provision relative to societal demand.

The notion of ‘goods’ itself can be somewhat malleable in this context. Generally speaking, goods are items which can be exchanged; and ‘goods’ is often used as a short-hand term to cover both goods and services which can be exchanged. In the case of public goods and services, however, the ability to exchange is frequently partial or imperfect and depends critically upon the judicial system governing property rights. In many instances around the world, agriculture and forestry are associated with common property which is held collectively and cannot readily be exchanged. Further, the natural assets or capital upon which these production activities rely, and which they also affect, have various attributes associated with their particular uses and/or ‘services’, many of which are held in common rather than privately owned. Ostrom’s insights from work on commons has particular relevance to this arena (Chanteau et al, 2013).

When considering more socio-political concepts of ‘public goods provided by farming and forestry’, it is also possible to identify examples of goods and services which can be both rival and excludable but which nonetheless provide wider societal benefits.

For instance, in the case of social farms; the direct provision of therapy or rehabilitation for patients with mental or behavioural needs can be offered as a private benefit which is paid for by the healthcare provider to the farm at which the patients are received. This transaction itself is therefore clearly a private one. However, the society gains wider benefits from the therapeutic effects of such arrangements which may reduce the costs of more conventional treatments or care provision through another route. In that wider sense, therefore, social farms can be defined offering a public good, in the same way that schools and hospitals would generally be considered as providing public goods. This broader concept reflects the fact that services such as healthcare and education are frequently provided by governments as universal benefits accessible to all, even though this public-funded provision may sit alongside private provision for which some people choose to pay.

## **Socio-cultural aspects of public goods and ecosystem services**

Expanding the portfolio of public goods delivered through agriculture and forestry to encompass a wider range of social and cultural 'goods' may in fact show that societal demand can be met more than policy makers currently recognize. As Cooper et al (2009) state, a second order of social benefits from the delivery of public goods highlights the wider importance of maintaining the environment not only for its intrinsic value, but also for the incidental values generated through vitality, quality of life and the stimulation of economic activity. And of course for agriculture and forestry to be truly sustainable evidenced based policy needs to support the capture and valuation of social and cultural goods and services, as well as economic and environmental.

What is required therefore is not only a re-conceptualisation of public goods to embrace more explicitly these incidental social and cultural benefits, but alongside this, a wider conceptualisation of value in the assessment of public goods. By distinguishing between Intrinsic, Instrumental and Institutional value, the Demos 'Value Triangle', designed originally to conceptualise cultural values and raise their profile and legitimacy in public policy (Holden, 2006) can help to provide a broader framework whereby one may consider the outcome or benefits that are revealed for individuals and society through access to public goods. In simple terms these three forms of value constitute the following:

- Intrinsic Value - based on subjective experience intellectually, emotionally and spiritually
- Instrumental value - Incidental or ancillary effects of culture or heritage which is used to achieve a social or economic purpose
- Institutional value - How organisations create value for the public, based principally around their engagement with the public

Explicitly recognising the intrinsic and instrumental values associated with agriculture and forestry, and the various ways they might be delivered, provides a useful foundation for how consideration of socio-cultural goods can move beyond the fairly limited scope of food security, rural vitality and animal welfare towards more meaningful assessments not constrained by the notion of property rights or by traditional approaches to public goods.

It is acknowledged that economic and institutional approaches to public goods pay little attention to socio-cultural aspects, or at least to the detail of them. Socio-political approaches may take a broader view, encompassing things like democracy, social responsibility, freedom and equality within a public good framework. Nevertheless, the 'real' public good remains something that is "consumed" as a service, not a set of outcomes that are revealed for individuals and society through that consumption.

The political approach highlights the role of institutions that manage relations with beneficiaries of public goods by assuring equal access to use. However, existing frameworks fall short of understanding the nature and extent of socio-cultural benefits from the consumption of public goods, and from socio-cultural attributes which themselves may be considered as public goods in their own right. There are many reasons for this, not least the problem of how to capture, measure and value socio-cultural 'goods' within existing, predominantly economic, frameworks. What is required therefore is a social-ecological framework to conceptualise public goods. And a useful starting point for this is to consider the relevance of Cultural Ecosystem Services (CES) and the role they might play in redefining the public goods of agriculture and forestry.

## **Cultural Ecosystem Services (CES) – a short critique**

The ESS approach can help us take a step towards such a framework as more explicit reference is made to socio-cultural aspects than is the case in the wider public goods literature. A number of authors advocate the legitimacy of CES which are defined as the nonmaterial benefits obtained from ecosystems through spiritual enrichment, cognitive development, reflection, aesthetic experience and include things like social relations, aesthetic values and human well being (Bieling and Plieninger, 2013; Plieninger et al 2012).

According De Groot et al (2005), CES comprise six main subsets:

1. Cultural identity – focusing on the cultural linkage between humans and their environment, and connected to knowledge systems and language;
2. Heritage values - encompassing memories related historically valuable land use practices;
3. Spiritual services – sacred, religious or other forms of spiritual inspiration derived from ecosystems;
4. Inspiration - which might be expressed through artifacts the arts or folklore;
5. Aesthetic appreciation of landscapes; and
6. Recreation and tourism.

Many of these writers recognise the legitimacy of socio-cultural services and some have made serious attempts at devising methodologies to capture and value such services within the broader ES framework, often in a landscape context. According to Plieninger et al (2012), CES are rarely fully considered in ecosystem services assessments due to methodological challenges. Chan et al (2012) argue that the valuation of CES is complicated by the properties of intangibility and incommensurability and that the effectiveness of the CES framework is further thwarted by the conflation of services, values and benefits. Thus in the context of public goods, integration of CES may be better served by distinguishing the benefits, and their corresponding value, from the goods themselves whilst remaining clear about the difference.

Problems of appropriate measurement and in particular, valuation methods, to legitimise CES alongside the more conventional economic and environmental services have evidently prevented socio-cultural measures achieving the same level of recognition. Nevertheless, the review by Daniel et al (2012) demonstrates opportunities for operationally defining cultural services in terms of social-ecological models which explicitly link ecological structures and functions with cultural values and benefits.

## **Towards a new conceptual framework**

There is clearly some promise in integrating a fuller appreciation of CES into a public goods framework for agriculture and forestry, although they need to be more clearly defined and understood, whilst at the same time relieving the framework of the constraints of conventional analyses which cannot reconcile the intangible nature of such 'goods' with appropriate economic valuation techniques.

There are two aspects to resolving these issues, and in turn to devising a social-ecological goods framework which is more relevant to how society derives benefits from agriculture and forestry. The first is to conceptualise socio-cultural public goods as having two tiers, or orders: one where social and cultural provision is derived directly from agriculture and forestry, and a second tier where socio-cultural outcomes, benefits, are derived indirectly from tangible services such as recreation, education and landscape attributes. This finer-grained approach



to understanding socio-cultural aspects should help to overcome the constraints of previous approaches to PGs with respect to socio-cultural constituents.

The second is to undertake a more broad-based review of methodologies for capturing and valuing socio-cultural public goods afforded by a new Social-Ecological conceptual framework. Outcomes-based and contemporary valuation approaches offered through social accounting and social cost-benefit analysis should help to overcome the methodological barriers currently experienced by advocates of socio-cultural aspects with the ecosystem services paradigm.

### **Reframing socio-cultural public goods of agriculture and forestry**

Given the limited scope of socio-cultural public goods already acknowledged in relation to agriculture and forestry, simply combining these with relevant elements of CES is likely to be unsatisfactory. Except for rural vitality (itself ambiguous and in need of refinement), food security, animal welfare and landscape, only a few socio-cultural dimensions of PG from farming and forestry have been recognised. However by extension, agriculture and forestry can be concerned also with social ‘goods’ such as public health and welfare, and education.

Aligning the recognised public goods of agriculture and forestry with the European priorities for 2020 is one way in which socio-cultural ‘goods’ might be reframed, building in CES to illustrate how these might be organised around two tiers. The four most relevant priorities to the case of socio-cultural goods are used to illustrate how this re-framing might work, drawing also on recent work which has sought to conceptualise the social characteristics of farming systems (Reed and Courtney, 2013).

	<b>Agriculture and Forestry Public Goods and Benefits</b>	
<b>EU priority</b>	<b>Tier One (First order)</b>	<b>Tier two (Second order)</b>
Cohesion	Community vibrancy and cohesion through integration and governance Formal and informal networks (sectoral/kinship)	Community cohesion Trust and reciprocity  Bridging and Bonding Social capital
Health	Countryside access and recreation Social prescribing Care farms and deliberative therapy	Mental and physical health Emotional well-being Life satisfaction
Cultural heritage	Landscape quality and historic features Rural skills and customs	Inspiration and spirituality Cultural identity
Knowledge	Farm and forest schools Study sites /reserves	Education Lifelong learning

The tier two, or second order, list essentially comprises benefits that arise through the provision of public goods such as quality landscape or the availability of farm and forest resources for social prescribing. This helps overcome the limitations of conflating the values/services/benefits of CES mentioned above, and can more directly frame the societal impact of agricultural and forestry activities. It also recognises the opportunity for establishing the intrinsic and instrumental values of agricultural and forestry activities, an approach which has proved useful in the context of wider societal and cultural issues. The above list currently excludes food security and animal welfare, and there may be scope to further disaggregate the notion of rural vitality to capture additional benefits.

*Note: References given in this annex can be found in full in section 5 of the main paper.*